



~~OFFICIAL USE ONLY - SECURITY RELATED INFORMATION~~

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

June 28, 2010

Christopher L. Burton, Vice President
Shearon Harris Nuclear Power Plant
Carolina Power & Light Company
Post Office Box 165, Mail Zone 1
New Hill, North Carolina 27562-0165

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 – ISSUANCE OF AMENDMENT REGARDING ADOPTION OF NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805, "PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS" (TAC NO. MD8807)

Dear Mr. Burton:

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 133 to Renewed Facility Operating License No. NPF-63 for the Shearon Harris Nuclear Power Plant, Unit 1, in response to your application dated May 29, 2008, as supplemented by letters dated November 14, 2008, December 11, 2008, August 13, 2009, August 28, 2009, October 9, 2009, February 4, 2010, and April 5, 2010.

The proposed amendment transitions the existing fire protection program to a risk-informed, performance-based program based on National Fire Protection Association Standard 805 (NFPA 805), "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, in accordance with Title 10 of the *Code of Federal Regulations*, Paragraph 50.48(c). NFPA 805 allows the use of performance-based methods, such as fire modeling and fire risk evaluations, to demonstrate compliance with the nuclear safety performance criteria.

A copy of the related NRC staff safety evaluation is also enclosed. A publicly accessible version of the attachments to the safety evaluation will be made available by July 23, 2010, at ADAMS Accession No. ML101750604. The Commission's regular biweekly *Federal Register* notice will include the Notice of Issuance of this amendment.

Sincerely,

/RA/

Marlayna Vaaler, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosures:

1. Amendment No.133 to NPF-63
2. Safety Evaluation (~~Official Use Only - Security Related Information~~)

cc w/o attachments to Enclosure 2: Distribution via Listserv

~~OFFICIAL USE ONLY - SECURITY RELATED INFORMATION~~

Christopher L. Burton, Vice President
Shearon Harris Nuclear Power Plant
Carolina Power & Light Company
Post Office Box 165, Mail Zone 1
New Hill, North Carolina 27562-0165

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 – ISSUANCE OF AMENDMENT REGARDING ADOPTION OF NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805, “PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS” (TAC NO. MD8807)

Dear Mr. Burton:

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 133 to Renewed Facility Operating License No. NPF-63 for the Shearon Harris Nuclear Power Plant, Unit 1, in response to your application dated May 29, 2008, as supplemented by letters dated November 14, 2008, December 11, 2008, August 13, 2009, August 28, 2009, October 9, 2009, February 4, 2010, and April 5, 2010.

The proposed amendment transitions the existing fire protection program to a risk-informed, performance-based program based on National Fire Protection Association Standard 805 (NFPA 805), “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants,” 2001 Edition, in accordance with Title 10 of the *Code of Federal Regulations*, Paragraph 50.48(c). NFPA 805 allows the use of performance-based methods, such as fire modeling and fire risk evaluations, to demonstrate compliance with the nuclear safety performance criteria.

A copy of the related NRC staff safety evaluation is also enclosed. A publicly accessible version of the attachments to the safety evaluation will be made available by July 23, 2010, at ADAMS Accession No. ML101750604. The Commission’s regular biweekly *Federal Register* notice will include the Notice of Issuance of this amendment.

Sincerely,

Marlayna Vaaler, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosures:

1. Amendment No. 133 to NPF-63
2. Safety Evaluation (~~Official Use Only - Security Related Information~~)

cc w/o attachments to Enclosure 2: Distribution via Listserv

DISTRIBUTION:

PUBLIC LPL2-2 R/F
RidsAcrsAcnw_MailCTR
RidsNrrDorlLpl2-2
RidsOgcRp

RidsNrrPMShearonHarris
RidsNrrDorlDpr
RidsNrrDraApla
SWeerakkody, NRR

RidsNrrDraAfpb
RidsNrrLACSola
RidsRgn2MailCenter
SLaur, NRR

HBarrett, NRR
PLain, NRR
SShort, PNNL
CMoulton, NRR

ADAMS Accession Number: ML101750602

*by memo

OFFICE	LPL2-2/PM	ADM/QTE	AFPB/BC	APLA/BC	ITSB/BC	OGC	LPL2-2/BC
NAME	MVaaler	Tech. Editor*	AKlein*	DHarrison*	RElliott	DRoth (NLO)	DBroaddus
DATE	4/28/2010	4/21/2010	3/23/2010	3/23/2010	5/10/2010	5/28/2010	6/28/2010

OFFICIAL RECORD COPY



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

CAROLINA POWER & LIGHT COMPANY, et al.

DOCKET NO. 50-400

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 133
Renewed License No. NPF-63

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Carolina Power & Light Company (the licensee), dated May 29, 2008, as supplemented by letters dated November 14, 2008, December 11, 2008, August 13, 2009, August 28, 2009, October 9, 2009, February 4, 2010, and April 5, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," of the Commission's regulations and all applicable requirements have been satisfied.

- 2 -

2. Accordingly, the license is amended by changes to the Renewed Operating License and the Technical Specifications, as indicated in the attachment to this license amendment; paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-63 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, as revised through Amendment No. 133, are hereby incorporated into this license. Carolina Power & Light Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 180 days of issuance, contingent upon completion of the items identified in Section 2.9 of the associated NRC Safety Evaluation.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Douglas A. Broaddus, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to Renewed Facility
Operating License No. NPF-63
and the Technical Specifications

Date of Issuance: June 28, 2010

ATTACHMENT TO LICENSE AMENDMENT NO. 133

RENEWED FACILITY OPERATING LICENSE NO. NPF-63

DOCKET NO. 50-400

Replace the following pages of Renewed Operating License No. NPF-63 with the attached revised pages. This represents the replacement of Renewed Operating License No. NPF-63 Condition 2.F with the revised License Condition 2.F contained in Section 4.0 of the associated Safety Evaluation.

Remove Page

4
8
9

Insert Page

4
8
9
10
11
12

Replace the following page of Appendix A, "Technical Specifications," to Renewed Facility Operating License No. NPF-63 with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove Page

6-17

Insert Page

6-17

- C. This license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect, and is subject to the additional conditions specified or incorporated below.

(1) Maximum Power Level

Carolina Power & Light Company is authorized to operate the facility at reactor core power levels not in excess of 2900 megawatts thermal (100 percent rated core power) in accordance with the conditions specified herein.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, as revised through Amendment No. 133, are hereby incorporated into this license. Carolina Power & Light Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

(3) Antitrust Conditions

Carolina Power & Light Company shall comply with the antitrust conditions delineated in Appendix C to this license.

(4) Initial Startup Test Program (Section 14)¹

Any changes to the Initial Test Program described in Section 14 of the FSAR made in accordance with the provisions of 10 CFR 50.59 shall be reported in accordance with 50.59(b) within one month of such change.

(5) Steam Generator Tube Rupture (Section 15.6.3)

Prior to startup following the first refueling outage, Carolina Power & Light Company shall submit for NRC review and receive approval if a steam generator tube rupture analysis, including the assumed operator actions, which demonstrates that the consequences of the design basis steam generator tube rupture event for the Shearon Harris Nuclear Power Plant are less than the acceptance criteria specified in the Standard Review Plan, NUREG-0800, at §15.6.3 Subparts II(1) and (2) for calculated doses from radiological releases. In preparing their analysis Carolina Power & Light Company will not assume that operators will complete corrective actions within the first thirty minutes after a steam generator tube rupture.

¹The parenthetical notation following the title of many license conditions denotes the section of the Safety Evaluation Report and/or its supplements wherein the license condition is discussed.

E. Physical Security (Section 13.6.2.10)

The licensee 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 the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Guard Training and Qualification Plan" submitted by letter dated October 19, 2004, "Physical Security Plan" and "Safeguards Contingency Plan" submitted by letter dated October 19, 2004 as supplemented by letter dated May 16, 2006.

F. Fire Protection Program

Carolina Power & Light Company 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 revised license amendment request dated October 9, 2009, supplemented by letters dated February 4, 2010, and April 5, 2010, and approved in the associated safety evaluation dated June 28, 2010. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c) and NFPA 805, 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.

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

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the proposed change may include methods that have been used in 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.

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

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

(2) Other Criteria for Changes that May Be Made to the NFPA 805 Fire Protection Program Without Prior NRC Approval

- (a) Changes to NFPA 805 Chapter 3, Fundamental Fire Protection Program Elements and Design Requirements

Prior NRC review and approval is not required for changes to the NFPA 805 Chapter 3 fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard.

The licensee may use an engineering evaluation to demonstrate that a change to an NFPA 805 Chapter 3 element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

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

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

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

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

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

Prior NRC review and approval is not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process, as approved in the NRC safety evaluation dated June 28, 2010, to determine that certain fire protection program changes meet the minimal risk criterion. The licensee shall in all cases ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

(c) Unless License Condition F.(2)(b) is met, risk-informed changes to the licensee's fire protection program which involve fire areas that credit incipient detection may not be made without prior NRC review and approval until the Harris Fire PRA model has been modified to incorporate an NRC-accepted method for modeling incipient detection.

(3) Transition License Conditions

(a) Before achieving full compliance with 10 CFR 50.48(c), as specified by Transition License Condition F.(3)(b), 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 License Condition F.(2)(b) above.

(b) The licensee shall implement the following modifications to its facility in order to complete the transition to full compliance with 10 CFR 50.48(c) by December 31, 2010 (note that each modification is listed by Engineering Change (EC) Number, as described in Attachment S of the Shearon Harris NFPA 805 License Amendment Request Transition Report, and outlined in Table 2.8.1-2 of the associated NRC safety evaluation):

- | | |
|------------|------------|
| • EC 62343 | • EC 69501 |
| • EC 62820 | • EC 69764 |
| • EC 68645 | • EC 69765 |
| • EC 68646 | • EC 70027 |
| • EC 68648 | • EC 70350 |
| • EC 68658 | • EC 70895 |
| • EC 68769 | • EC 71147 |

- (c) The licensee shall maintain appropriate compensatory measures in place until completion of the modifications delineated above.

G. Reporting to the Commission

Except as otherwise provided in the Technical Specifications or Environmental Protection Plan, Carolina Power & Light Company shall report any violations of the requirements contained in Section 2.C of this license in the following manner: initial notification shall be made within twenty-four (24) hours to the NRC Operations Center via the Emergency Notification System with written follow-up within 30 days in accordance with the procedures described in 10 CFR 50.73 (b), (c) and (e).

- H. The licensees shall have and maintain financial protection of such type and in such amounts as the Commission shall require in accordance with Section 170 of the Atomic Energy Act of 1954, as amended, to cover public liability claims.
- I. The Updated Safety Analysis Report supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the Updated Safety Analysis Report required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, CP&L may make changes to the programs and activities described in the supplement without prior Commission approval, provided that CP&L evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.
- J. The Updated Safety Analysis Report supplement, as revised, describes certain future activities to be completed prior to the period of extended operation. Carolina Power & Light Company shall complete these activities no later than October 24, 2026, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.
- K. All capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of American Society for Testing and Materials E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. All capsules placed in storage must be maintained for future inspection. Any changes to storage requirements must be approved by the NRC, as required by 10 CFR Part 50, Appendix H.

- L. This license is effective as of the date of issuance and shall expire at midnight on October 24, 2046.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

Attachments/Appendices:

1. Attachment 1 – TDI Diesel Engine Requirements
2. Appendix A – Technical Specifications
3. Appendix B – Environmental Protection Plan
4. Appendix C – Antitrust Conditions

Date of Issuance: December 17, 2008

ADMINISTRATIVE CONTROLS

PROCEDURES AND PROGRAMS (Continued)

- g. Quality Assurance Program for effluent and environmental monitoring; and
- h. Deleted.
- i. Technical Specification Equipment List Program.

6.8.2 DELETED

6.8.3 DELETED

6.8.4 The following programs shall be established, implemented, and maintained:

a. Primary Coolant Sources Outside Containment

A program to reduce leakage, to as low as practical levels, from those portions of systems outside containment that could contain highly radioactive fluids during a serious transient or accident. The systems include:

- 1. Residual Heat Removal System and Containment Spray System, except spray additive subsystem and RWST,
- 2. Safety Injection System, except boron injection recirculation subsystem and accumulator,
- 3. Portions of the Chemical and Volume Control System:
 - a. Letdown subsystem, including demineralizers,
 - b. Boron re-cycle holdup tanks, and
 - c. Charging/safety injection pumps,
- 4. Post-Accident Sample System (until such time as a modification eliminates the Post-Accident Sample System as a potential leakage path),



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 133 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF- 63

TRANSITION TO A RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION

PROGRAM IN ACCORDANCE WITH 10 CFR 50.48(c)

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

EXECUTIVE SUMMARY

This safety evaluation describes the results of a review by the U.S. Nuclear Regulatory Commission (NRC) staff of a license amendment request (LAR) for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP), to adopt a risk-informed, performance-based (RI/PB) fire protection program (FPP) in accordance with Title 10 of the *Code of Federal Regulations*, Part 50, Section 48, Paragraph (c) [10 CFR 50.48(c)], which incorporates by reference, with some exceptions, modifications, and supplementations, National Fire Protection Association Standard 805 (NFPA 805), "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition.

By letter dated May 29, 2008, as updated on October 9, 2009, and supplemented by letters dated November 14, 2008, December 11, 2008, August 13, 2009, August 28, 2009, February 4, 2010, and April 5, 2010, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc. (PEC or the licensee), submitted the LAR in accordance with 10 CFR 50.48(c). The licensee is requesting a license amendment to establish and maintain a RI/PB FPP for HNP in accordance with the guidelines described in NFPA 805.

NFPA 805 is a national consensus standard that allows reactor owners and operators to utilize engineering analyses to demonstrate that the installed fire protection systems and features are sufficient to meet specific fire protection and nuclear safety goals, objectives, and performance criteria. Specifically, the NFPA 805 Nuclear Safety Goals, Objectives, and Performance Criteria fall into two categories, nuclear safety related and radioactive release related, as follows:

1. Nuclear Safety
 - a. 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.

Enclosure

- b. The nuclear safety objectives state that in the event of a fire during any operational mode and plant configuration, the plant shall be capable of (1) rapidly achieving and maintaining subcritical conditions (i.e., reactivity control); (2) achieving and maintaining decay heat removal and inventory functions (i.e., fuel cooling); and (3) preventing fuel clad damage so that the primary containment boundary is not challenged (i.e., fission product boundary).
- c. The nuclear safety performance criteria state 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.

2. Radioactive Release

- a. 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.
- b. The radioactive release objective states that during all operational modes and plant configurations, either the containment integrity must be capable of being maintained, or the source term must be capable of being limited.
- c. The radioactive release performance criteria state 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.

Additional important considerations regarding NFPA 805 include the following:

- NFPA 805 requirements are applied during all phases of plant operation.
- NFPA 805 establishes fundamental fire protection program elements and design requirements for fire protection systems and features.
- NFPA 805 allows the nuclear safety performance criteria to be satisfied by complying with either the deterministic or performance-based approach, considering the following:
 - The performance-based approach can use fire modeling or fire risk evaluations.
 - Implementation of the fire risk evaluation performance-based approach (and plant change evaluations) includes an integrated assessment of fire risk, fire protection defense-in-depth, and safety margins.
 - Fire protection systems and features required to meet the nuclear safety performance criteria must be monitored to ensure that adequate levels of performance are maintained.

The following discussion provides a high level description of the major steps taken to perform the transition to a performance-based FPP in accordance with NFPA 805. To transition to a FPP in accordance with NFPA 805, the licensee must take the following four steps:

1. Adopt the Nuclear Safety Goals, Objectives, and Performance Criteria provided in NFPA 805, as incorporated by reference into 10 CFR 50.48(c).
2. Ensure that fire protection systems, structures, and components (SSCs) meet the fundamental fire protection program elements and design requirements of NFPA 805; including documenting previous NRC staff approval of existing configurations for fire protection systems, structures, and components.
3. Perform engineering analyses as necessary to demonstrate that fire protection systems, structures, and components provide sufficient capability to meet the nuclear safety performance criteria of NFPA 805, as follows:
 - a. Identify the fire areas and associated fire hazards.
 - b. Identify the performance criteria that apply to each fire area.
 - c. Identify SSCs in each fire area to which the performance criteria apply.
 - d. Select, on a fire area basis, either a deterministic or performance-based approach to meet the performance criteria.
 - e. When using the deterministic approach, demonstrate compliance with the deterministic criteria.
 - f. When using the performance-based approach, perform engineering analyses to demonstrate that performance based requirements are satisfied. NFPA 805 defines two analysis methods for demonstrating compliance – fire modeling and fire risk evaluation – as described below:
 - (i) Fire modeling involves developing detailed fire models that verify that the maximum expected fire scenario is significantly smaller than the limiting fire scenario, such that the analysis demonstrates that the same fire can not damage sufficient equipment to prevent achieving the nuclear safety performance criteria.
 - (ii) Fire risk evaluation involves developing a fire probabilistic risk assessment (Fire PRA) in accordance with NRC and industry standards that models the fire protection and safe shutdown features of the plant such that the risk of fires can be predicted.
 - g. Perform fire risk evaluations which demonstrate that variations from the deterministic requirements are acceptable with regard to risk, defense-in-depth, and safety margins.
 - h. Propose and commit to install plant modifications as necessary to provide additional fire protection capability or additional SSCs, or both, to ensure the ability to meet the nuclear safety performance criteria.

- i. Perform evaluations of non-power operational fire risk during various plant operating states, which includes the following actions:
 - (i) Identify equipment and systems necessary to provide key safety functions (KSFs).
 - (ii) Perform circuit and cable routing analyses to identify and locate cables associated with the KSF equipment and systems.
 - (iii) Perform fire area analyses to identify important areas of the plant where a single fire could prevent meeting one or more of the KSFs.
 - (iv) Define actions to be taken to reduce fire risk during times when the consequences of losing these KSFs is highest.
 - j. Perform analyses to ensure that any fire fighting activities will not result in radioactive releases greater than the limits specified in NRC regulations and associated environmental standards.
 - k. Develop a program to monitor plant performance in order to ensure that the nuclear safety performance criteria are achieved and maintained. The monitoring program should provide feedback for adjusting the fire protection program as necessary to achieve maximum performance and continued conformance with NFPA 805.
 - l. Provide adequate documentation, ensure adequate quality of the analyses, and maintain configuration control of the resulting plant design and operation in order to ensure continued conformance with NFPA 805.
4. Submit a LAR for NRC staff approval (i.e., this licensing action), which fully documents the transition such that the NRC staff may conclude that the licensee's performance-based FPP meets the regulatory requirements of 10 CFR 50.48(c). The LAR should include a process to allow self-approval of certain future risk-informed, performance-based changes to selected portions of the FPP, provided that the requirements of NFPA 805 continue to be met and the established risk thresholds are not exceeded.

HNP is one of two NFPA 805 pilot plants. The NRC recognized the first two licensees that filed a letter of intent to adopt NFPA 805 as NFPA 805 pilot plants. On June 10, 2007, Carolina Power & Light Company filed the second letter of intent to transition to NFPA 805, requesting that the Shearon Harris Nuclear Power Plant be granted pilot plant status. On September 19, 2005, the NRC granted pilot plant status to HNP.

The pilot plant reviews have been conducted in parallel, with many opportunities for the NRC, industry, the Nuclear Energy Institute (NEI), members of the public, and other interested stakeholders to provide feedback and gain insight to the NFPA 805 transition process via public interactions, fire protection workshops, and various fire protection forums.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	 i
ABBREVIATIONS	 viii
1.0 INTRODUCTION	_____ - 1 -
1.1 Background	_____ - 1 -
1.2 Requested Licensing Action	_____ - 1 -
2.0 REGULATORY EVALUATION	_____ - 2 -
2.1 Applicable Regulations	_____ - 4 -
2.2 Applicable Staff Guidance	_____ - 5 -
2.3 Interim Staff Positions (NFPA 805 Frequently Asked Questions Process)	_____ - 6 -
2.4 Orders, License Conditions, and Technical Specifications	_____ - 7 -
2.4.1 Orders	_____ - 7 -
2.4.2 License Conditions	_____ - 8 -
2.4.3 Technical Specifications	_____ - 8 -
2.5 Final Safety Analysis Report	_____ - 9 -
2.6 Rescission of Exemptions	_____ - 10 -
2.7 Self Approval Process for Post-Transition Fire Protection Program Changes	_ - 11 -
2.7.1 Risk-Informed Plant Change Evaluation Process	_____ - 12 -
2.7.2 Risk-Informed Self Approval Process Regarding Plant Changes	_____ - 13 -
2.7.3 Qualitative Self Approval Process Regarding Plant Changes	_____ - 14 -
2.8 Implementation	_____ - 16 -
2.8.1 Modifications	_____ - 16 -
2.8.2 Schedule	_____ - 22 -
2.9 Summary of Implementation Items	_____ - 22 -

3.0	TECHNICAL EVALUATION	- 27 -
3.1	NFPA 805 Fundamental FPP Elements and Minimum Design Requirements	- 28 -
3.1.1	Compliance with NFPA 805 Chapter 3 Requirements	- 28 -
3.1.2	Identification of the Power Block	- 32 -
3.1.3	Electrical Raceway Fire Barrier Systems (HEMYC™ and MT™)	- 32 -
3.1.4	Performance-Based Methods for NFPA 805 Chapter 3 Elements	- 33 -
3.2	NFPA 805 Nuclear Safety Capability Assessment Methods	- 35 -
3.2.1	Compliance with Nuclear Safety Capability Assessment Methods	- 36 -
3.2.2	Applicability of Feed and Bleed	- 40 -
3.2.3	Assessment of Multiple Spurious Operations	- 40 -
3.2.4	Transition of Operator Manual Actions to Recovery Actions	- 42 -
3.2.5	Installation of Incipient Fire Detection Systems	- 45 -
3.2.6	Conclusion for Section 3.2	- 48 -
3.3	Fire Modeling	- 49 -
3.4	Fire Risk Assessments	- 50 -
3.4.1	Quality of the Fire Probabilistic Risk Assessment	- 50 -
3.4.2	Maintaining Defense-in-Depth and Safety Margins	- 59 -
3.4.3	Fire Risk Evaluations	- 63 -
3.4.4	Additional Risk Presented by Recovery Actions	- 64 -
3.4.5	Risk-Informed or Performance-Based Alternatives to Compliance	- 66 -
3.4.6	Cumulative Risk and Combined Changes	- 66 -
3.4.7	Uncertainty and Sensitivity Analyses	- 68 -
3.4.8	Conclusion for Section 3.4	- 69 -
3.5	Nuclear Safety Capability Assessment Results	- 70 -
3.5.1	Nuclear Safety Capability Assessment Results by Fire Area	- 71 -
3.5.2	Fire Protection During Non-Power Operational Modes	- 76 -
3.5.3	Conclusion for Section 3.5	- 82 -
3.6	Radioactive Release Performance Criteria	- 83 -
3.7	NFPA 805 Monitoring Program	- 86 -

3.8	Program Documentation, Configuration Control, and Quality Assurance	- 88 -
3.8.1	Documentation	- 89 -
3.8.2	Configuration Control	- 90 -
3.8.3	Quality	- 91 -
3.8.4	Fire Protection Quality Assurance Program	- 93 -
3.8.5	Conclusion for Section 3.8	- 94 -
4.0	FIRE PROTECTION LICENSE CONDITION	- 94 -
5.0	FINAL NO SIGNIFICANT HAZARDS CONSIDERATION	- 97 -
6.0	STATE CONSULTATION	- 100 -
7.0	ENVIRONMENTAL CONSIDERATION	- 100 -
8.0	CONCLUSION	- 101 -
9.0	REFERENCES	- 102 -

ABBREVIATIONS

ac	alternating current
ACP	auxiliary control panel
ADAMS	Agencywide Document Access and Management System
AFW	auxiliary feedwater
AHJ	Authority Having Jurisdiction
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOV	air operated valve
ARP	auxiliary relay panel
ASD	alternative shutdown
ASME	American Society of Mechanical Engineers
BTP	branch technical position
BWR	boiling water reactor
CC	capability category
CCDP	conditional core damage probability
CCW	component cooling water
CDF	core damage frequency
CFAST	Collaborative Force Analysis, Sustainment, and Transportation
CFR	<i>Code of Federal Regulations</i>
CSIP	charging/safety injection pump
CRS	control room supervisor
CVCS	chemical and volume control system
dc	direct current
DG	diesel generator
DID	defense-in-depth
DID-RA	defense-in-depth recovery action
EC	engineering change
EEEE	existing engineering equivalency evaluations
EPRI	Electric Power Research Institute
ERFBS	electrical raceway fire barrier system
ESFAS	engineered safety features actuation system
F&Os	facts/findings and observations
FACP	fire alarm control panel
FAQ	frequently asked question
FPP	fire protection program
FPRA	fire probabilistic risk assessment
FR	<i>Federal Register</i>
FSA	fire safety analyses
FSAR	final safety analysis report
FSSPMD	Fire Safe Shutdown Program Manager Database
GDC	general design criterion/criteria
GL	generic letter
gpm	gallons per minute
HEAF	high energy arcing fault
HEP	human error probability
HGL	hot gas layer
HNP	Shearon Harris Nuclear Power Plant, Unit 1
HRE	higher risk evolution
HRR	heat release rate
HVAC	heating, ventilation, and air conditioning
IMC	Inspection Manual Chapter
IN	information notice

KSF	key safety function
LAR	license amendment request (in most cases, this specifically refers to HNP's NFPA 805 License Amendment Request Transition Report)
LERF	large early release frequency
MCB	main control board
MCC	motor control center
MCR	main control room
MGR	multiple Greek letter
MOV	motor operated valve
MSO	multiple spurious operation
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NPO	non-power operation
NRC	U.S. Nuclear Regulatory Commission
OMA	operator manual action
PB	performance-based
PCS	primary control station
PEC	Progress Energy Carolinas, Inc.
PIC	process instrumentation cabinet
PMG	performance monitoring group
POS	plant operational state
PORV	power-operated relief valve
PRA	probabilistic risk assessment
PSA	probabilistic safety assessment
PWR	pressurized water reactor
QA	quality assurance
RAB	reactor auxiliary building
RAI	request for additional information
RAW	risk achievement worth
RCP	reactor coolant pump
RCS	reactor coolant system
RG	regulatory guide
RHR	residual heat removal
RI	risk-informed
RI/PB	risk-informed, performance-based
RIS	regulatory issue/information summary
RWST	refueling water storage tank
SE	safety evaluation
SER	safety evaluation report
SFPE	Society of Fire Protection Engineers
SG	steam generator
SI	safety injection
SSC	systems, structures, and components
SSPS	solid state protection system
T-H	thermal-hydraulic
TS	technical specifications
UFSAR	updated final safety analysis report
V&V	verification and validation
VAC	volts alternating current
VCT	volume control tank
VEWFDS	very early warning fire detection system
VFDR	variation from deterministic requirements
yr	year
ZOI	zone of influence

1.0 INTRODUCTION

1.1 Background

On June 16, 2004, the U.S. Nuclear Regulatory Commission (NRC or the Commission) revised Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, "Domestic Licensing of Production and Utilization Facilities," to include Paragraph 50.48(c). Section 48, "Fire protection," Paragraph 50.48(c), "National Fire Protection Association Standard NFPA 805," incorporates by reference NFPA 805, "Performance Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition (Reference 1), hereafter referred to as NFPA 805. This change to the NRC's fire protection regulations provides licensees with the opportunity to adopt a performance-based fire protection program (FPP) as an alternative to the existing prescriptive, deterministic fire protection regulations. Specifically, NFPA 805 allows the use of performance-based methods, such as fire modeling and fire risk evaluations, to demonstrate compliance with the nuclear safety performance criteria.

Accordingly, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc. (PEC or the licensee), requested a license amendment to allow the licensee to maintain the Shearon Harris Nuclear Power Plant, Unit 1 (HNP), fire protection program in accordance with 10 CFR 50.48(c). In the related license amendment request (LAR) and this safety evaluation (SE), extensive reference is made to NFPA 805. In particular, when this safety evaluation refers to a fire protection program element as being in compliance with, or meeting the requirements of, NFPA 805, the NRC staff intends this to indicate that the element is in compliance with 10 CFR 50.48(c) as well as the applicable portions of NFPA 805.

1.2 Requested Licensing Action

PEC submitted its original application for transition to NFPA 805 by letter dated May 29, 2008 (Reference 2), which requested to change the renewed operating license and technical specifications (TSs) for HNP in order to adopt a new fire protection program. The licensee supplemented the application by letters dated November 14, 2008, December 11, 2008, August 13, 2009, and August 28, 2009 (References 3, 4, 5, and 6, respectively), completely updated the application (including a complete revision to the HNP NFPA 805 Transition Report and all attachments, which replaced the information contained in previous submittals) by letter dated October 9, 2009 (Reference 7), and again supplemented the application by letters dated February 4, 2010, and April 5, 2010 (References 8 and 9, respectively).

The licensee is requesting an amendment to the HNP renewed operating license and TSs to establish and maintain a performance-based fire protection program in accordance with the requirements of 10 CFR 50.48(c). Specifically, the licensee requests to transition from the existing deterministic fire protection licensing basis established in accordance with Section 9.5.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light Water Reactor Edition" (Reference 10), to a performance-based fire protection program in accordance with 10 CFR 50.48(c) that uses risk information, in part, to demonstrate compliance with the fire protection and nuclear safety goals, objectives, and performance criteria of NFPA 805. As such, the proposed fire protection program at HNP is referred to as risk-informed, performance-based (RI/PB) throughout this safety evaluation.

The licensee has proposed a new fire protection license condition reflecting the new RI/PB FPP licensing basis, as well as revisions to the Technical Specifications that address this change to

the current fire protection program licensing basis. Section 2.4.2 and Section 4.0 of this safety evaluation discuss in detail the license condition, and Section 2.4.3 discusses the TS changes.

As part of the implementation of the RI/PB FPP in conformance with NFPA 805, the licensee is also resolving several technical and regulatory issues associated with its HEMYC™ and MT™ electrical raceway fire barrier systems (ERFBS). Accordingly, this safety evaluation documents final resolution for the HEMYC™ and MT™ ERFBS issues as proposed in the licensee's June 9, 2006, response to NRC Generic Letter (GL) 2006-03, "Potentially Nonconforming HEMYC™ and MT™ Fire Barrier Configurations" (Reference 11).

The supplemental letters dated November 14, 2008, December 11, 2008, August 13, 2009, and August 28, 2009, the revised application dated October 9, 2009, and the supplements dated February 4, 2010, and April 5, 2010, provided additional information that clarified the application, but did not expand the overall scope of the application as originally noticed and did not change the NRC staff's original proposed opportunity for a hearing on the initial application as published in the *Federal Register* on June 19, 2009 (74 FR 29241).

2.0 REGULATORY EVALUATION

Section 50.48, "Fire Protection," of 10 CFR provides the NRC requirements for nuclear power plant fire protection. Paragraph 50.48(c) of 10 CFR outlines the NRC requirements applicable to licensees that choose to adopt a performance-based fire protection program (i.e., NFPA 805) as an alternative to meeting the requirements of 10 CFR 50.48(b) (i.e., conformance with Appendix R to 10 CFR Part 50) for plants licensed to operate before January 1, 1979, or the approved fire protection license conditions for plants licensed to operate after January 1, 1979.

The NRC regulations include specific procedural requirements for implementing a RI/PB FPP based on the provisions of NFPA 805. In particular, 10 CFR 50.48(c)(3)(i) requires licensees which choose to adopt a RI/PB FPP in compliance with NFPA 805 to submit a LAR to the NRC that identifies 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.

Paragraph 50.48(c)(3)(i) of 10 CFR also states 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 for plants licensed to operate before January 1979, or the fire protection license conditions for plants licensed to operate after January 1, 1979." HNP was licensed to operate after January 1, 1979, and the license condition issued with this safety evaluation will supersede the current fire protection license condition with a condition that allows implementation of a fire protection program in accordance with NFPA 805.

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 this paragraph is given in the statement of considerations for the final rule, which was published in the *Federal Register* (FR) on June 16, 2004 (69 FR 33536). The statement of considerations states:

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).

The evaluations and analyses process in Chapter 2 of NFPA 805 provides for the establishment of the fundamental fire protection program, identification of fire area boundaries and fire hazards, determination by analysis that the plant design satisfies the performance criteria, identification of the structures, systems and components (SSCs) required to achieve the performance criteria, conduct of plant change evaluations, establishment of a monitoring program, development of documentation, and configuration control. Chapter 2 of NFPA 805 also provides for the use of a deterministic or performance-based approach to determine that the performance criteria are satisfied and provides for the use of tools such as engineering analyses, fire models, nuclear safety capability assessments, and fire risk evaluations to support development of these approaches. The methodology for the use of these tools is established in Chapter 4 of NFPA 805 (69 FR 33548).

In its LAR, the licensee has provided a description of the revised fire protection plan it is requesting NRC approval to implement, a description of the fire protection program 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 safety evaluation documents the NRC staff's evaluation of the licensee's amendment request and concludes that:

- (1) The licensee has identified any orders and license conditions that must be revised or superseded, and provided the necessary revisions to the plant's technical specifications and bases, as required by 10 CFR 50.48(c)(3)(i). The NRC staff finds this adequate.
- (2) The licensee has completed its implementation of the methodology in Chapter 2, "Methodology," of NFPA 805, including completion of all the required evaluations and analyses outlined by the statement of considerations, and the NRC staff has approved the licensee's modified fire protection plan, which reflects the decision to comply with NFPA 805, consistent with 10 CFR 50.48(c)(3)(ii).

Since items (1) and (2) satisfy the requirements of 10 CFR 50.48(c)(3), the staff concludes that the licensee's implementation of the modified fire protection program that aligns with NFPA 805, including physical plant modifications as described in the LAR, in accordance with the implementation schedule set forth in this safety evaluation and the accompanying license condition, is sufficient to demonstrate compliance with 10 CFR 50.48(c).

The regulations also allow for flexibility that was not originally included in the NFPA 805 standard. Licensees that choose to adopt 10 CFR 50.48(c), but wish to use the performance-based 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 a LAR in accordance with 10 CFR 50.48(c)(2)(vii). Alternatively, licensees may choose to use risk-informed or performance-based alternatives to comply with NFPA 805 by submitting a LAR in accordance with 10 CFR 50.48(c)(4).

In addition to the conditions outlined by the rule that require licensees to submit a LAR for NRC review and approval in order to adopt a RI/PB FPP, licensees may also submit additional elements of their fire protection program for which they wish to receive specific NRC review and approval, as set forth in Regulatory Guide (RG) 1.205, “Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants,” Revision 1, Regulatory Position C.2.2.1, issued on December 18, 2009 (74 FR 67253; Reference 12). Inclusion of these elements in the NFPA 805 LAR is meant to alleviate uncertainty in portions of the current fire protection program licensing bases as a result of the lack of specific NRC approval of these elements. However, any submittal addressing these additional fire protection program elements should 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 fire protection program established by NFPA 805 is to provide assurance, through a defense-in-depth philosophy, that the fire protection objectives are satisfied.

NFPA 805, Section 1.2, “Defense-in-Depth,” states the following:

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 and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage
- (3) Providing an adequate level of fire protection for SSCs important to safety, so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed

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

2.1 Applicable Regulations

The licensee’s fire protection program will generally be considered acceptable if it meets the applicable regulatory criteria established by the following regulations:

- 10 CFR Part 50, Appendix A, GDC 3, “Fire protection,” establishes the general criteria for fire and explosion protection of SSCs important to safety.

- 5 -

- 10 CFR Part 50, Appendix A, GDC 5, "Sharing of Systems, Structures, and Components," relates to shared fire protection systems and potential fire impacts on shared SSCs important to safety.
- 10 CFR 50.48(a), requires that each operating nuclear power plant have a fire protection plan that meets the requirements of GDC 3.
- 10 CFR 50.48(c), incorporates NFPA 805 (2001 Edition) by reference, with certain exceptions, modifications, and supplementation. This regulation establishes the requirements for using a performance-based 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 license condition(s) related to fire protection. Because NFPA 805 was incorporated by reference into 10 CFR, all requirements of the endorsed standard must be met, unless otherwise excepted by the NRC.
- 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 Staff Guidance

The NRC staff review also utilized the following additional staff guidance:

- RG 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1, issued December 2009, which provides guidance to licensees for implementing a RI/PB FPP in compliance with 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 1, issued November 2002 (Reference 13), which provides guidance to licensees on acceptability limits for risk-informed changes to the licensing basis.
- 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 14), which provides guidance to licensees on methods for determining the technical adequacy of probabilistic risk assessment (PRA) results when used for risk-informed changes to the licensing basis.
- RG 1.189, "Fire Protection for Operating Nuclear Power Plants," Revision 2, issued October 2009 (Reference 15), which provides guidance to licensees on the proper content and quality of engineering equivalency evaluations used to support the fire protection program.
- NUREG-0800, Section 9.5.1.2, "Risk-Informed, Performance-Based Fire Protection Program," Revision 0, issued December 2009 (Reference 16), which provides the NRC staff with guidance for evaluating license amendment requests that seek to implement a RI/PB FPP in accordance with 10 CFR 50.48(c).

- NUREG-0800, Section 19.1, "Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, issued June 2007 (Reference 17), which provides the NRC staff with guidance for evaluating the technical adequacy of a licensee's PRA results when used to request risk-informed 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 18), which provides the NRC staff with guidance for evaluating the risk information used by a licensee to support permanent, risk-informed changes to the licensing basis for the plant.

It should be noted that during the course of the review of the HNP NFPA 805 LAR, several of the above guidance documents were revised to incorporate updated information and lessons learned during the course of the pilot process. As such, the original HNP NFPA 805 LAR was submitted against earlier revisions of some of these documents (e.g., RG 1.205). However, as the LAR was supplemented by various letters, many of the positions in the new document revisions were incorporated into the application. Accordingly, the NRC staff considers that the NFPA 805 LAR meets the intent of the current document revisions, and was reviewed as such, except where otherwise noted in the safety evaluation.

2.3 Interim Staff Positions (NFPA 805 Frequently Asked Questions Process)

During the ongoing NFPA 805 pilot transition process, as well as throughout the subsequent non-pilot reviews, the NRC staff, industry, and other interested stakeholders expect to gain experience and develop lessons learned during the submission and subsequent review of each license amendment request to transition a licensee to a RI/PB FPP. The lessons learned are often converted into interim staff positions, which apply to the ongoing review until they can be formally incorporated into the NFPA 805 guidance documents such as Nuclear Energy Institute (NEI) document NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)" (Reference 19), as endorsed, and RG 1.205.

The lessons learned and interim staff positions address the NRC's performance goals of maintaining safety, improving effectiveness and efficiency, reducing regulatory burden, and increasing public confidence. In most cases, the meetings and other interactions involved in promulgating interim staff positions are open to the public and feedback is welcomed. With respect to the NFPA 805 LARs, the NRC established the frequently asked questions (FAQ) process as described in Regulatory Information Summary (RIS) 2007-19, "Process for Communicating Clarifications of Staff Positions Provided in Regulatory Guide 1.205 Concerning Issues Identified during the Pilot Application of National Fire Protection Association Standard 805" (Reference 20), to clarify issues encountered during the pilot transition process.

The FAQ process provides a means for the NRC staff to establish and communicate interim positions on technical and regulatory issues that emerge as experience is gained during review of the NFPA 805 LARs. Approved interim staff positions documented through the FAQ process are used where applicable in reviewing those portions of the LAR to which they apply.

The following table provides the current set of FAQs the NRC staff used in the preparation of this safety evaluation, as well as the safety evaluation section to which the FAQ was applied.

Table 2.3-1: Applicable NFPA 805 Frequently Asked Questions

FAQ #	Rev.	FAQ Title	Closure Memo ML#	SE Section
06-0008	9	Fire Protection Engineering Evaluations	ML073380976	4.0
06-0022	2	Acceptable Electrical Cable Construction Tests	ML091240278	3.2
07-0032	2	10 CFR 50.48(a) and GDC Clarification	ML081400292	2.0
07-0035	1	Bus Duct Counting Guidance for High Energy Arcing Faults	ML091620572	3.5
07-0039	2	Provide Update for NEI 04-02, Table B-2	ML091320068	3.2
07-0040	4	Non-Power Operations Clarification	ML082200528	3.4
08-0042	0	Fire Propagation from Electrical Cabinets	ML092110537	3.5
08-0046	0	Incipient Fire Detection Systems	ML093220426	3.5
08-0047	1	Spurious Operation Probability	ML082950750	3.5
08-0052	0	Transient Fire Size	ML092120501	3.5

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 technical specifications and the bases thereof.”

2.4.1 Orders

The NRC staff reviewed Section 5.2.3, “Orders and Exemptions,” and Attachment O, “Orders and Exemptions,” of HNP's NFPA 805 License Amendment Request Transition Report, as revised on October 9, 2009 (Reference 7), hereafter referred to simply as the LAR, with regard to NRC-issued Orders pertinent to HNP that are being revised or superseded by the NFPA 805 transition process. The licensee determined that no Orders need to be superseded or revised to implement a fire protection program at HNP that complies with 10 CFR 50.48(c).

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

In addition, a specific review was performed of the license amendment that incorporated the mitigation strategies required by Section B.5.b of Commission Order EA-02-026 (Reference 21) to ensure that any changes being made in order to comply with 10 CFR 50.48(c) do not invalidate existing commitments applicable to HNP.

The licensee's review of this Order and the related license amendment demonstrated that changes to the fire protection program during transition to NFPA 805 will not affect the mitigation measures required by Section B.5.b. The NRC staff accepts the licensee's determination concerning Section B.5.b of Order EA-02-026.

2.4.2 License Conditions

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

The staff reviewed the revised license condition the licensee requested, which supersedes the current HNP fire protection License Condition 2.F, for consistency with the content guidance outlined by Regulatory Position C.3.1 of RG 1.205, Revision 1. This section of RG 1.205 outlines an approach acceptable to the NRC staff for promulgating a fire protection license condition in accordance with the requirements of NFPA 805. Overall, the licensee's replacement license condition conforms to the guidance in RG 1.205, Revision 1.

Furthermore, the revised license condition, as specified by the sample license condition, identifies the plant-specific modifications outlined in the LAR, and associated implementation schedules, which must be accomplished at HNP to complete transition to NFPA 805. In addition, the revised license condition includes a requirement that appropriate compensatory measures will remain in place until implementation of the specified plant modifications is completed. The modifications, implementation schedules, and compensatory measures ensure that completion of the transition to NFPA 805 at HNP will be orderly and conducted in accordance with the applicable regulations and license conditions.

Once these and other implementation issues are completed, NFPA 805 will be fully in effect at HNP, and provided that the licensee implements the RI/PB FPP as described in the LAR, as supplemented, PEC will be in full compliance with 10 CFR 50.48(c). These modifications and implementation schedules are identical to those identified in the LAR, as discussed in Sections 2.8.1 and 2.8.2, and explicitly reviewed in Section 3.0, of this safety evaluation.

Because (1) the licensee's revised license condition is consistent with the content and format of the sample license condition in RG 1.205, Revision 1, considering that the plant-specific modifications identified in the license condition are identical to those reviewed in this safety evaluation, and (2) the revised license condition and this safety evaluation supersede all existing fire protection license condition(s) and previous fire protection program safety evaluation reports, the NRC staff finds the revised license condition acceptable. Section 4.0 of this safety evaluation provides the revised HNP fire protection program license condition.

2.4.3 Technical Specifications

The NRC staff reviewed LAR Section 5.2.2, "Technical Specifications," and Attachment N, "Technical Specification Changes," with regard to proposed changes to the HNP TSs that are being revised or superseded during the NFPA 805 transition process. According to the LAR, the licensee conducted a review of the HNP TSs, including proposed TS changes that have been submitted to the NRC for approval, to determine which TS sections will be impacted by the transition to a RI/PB FPP based on 10 CFR 50.48(c), and identified two changes.

The first change is to delete HNP TS Section 6.8.1.h. TS 6.8.1.h currently states that written procedures shall be established, implemented, and maintained covering activities that include fire protection program implementation. As discussed in the LAR, TS 6.8.1.h is being deleted

because, after completion of the transition to NFPA 805, the requirement for establishing, implementing, and maintaining fire protection procedures will be contained in 10 CFR 50.48(a) and 10 CFR 50.48(c), as specifically outlined in Section 3.2.3, "Procedures," of NFPA 805. Since the licensee has stated that the RI/PB FPP at HNP complies with the requirements of NFPA 805, Section 3.2.3 (see portions of Section 3.1 of this safety evaluation), the NRC staff finds the deletion of HNP Technical Specification Section 6.8.1.h acceptable.

The second change is to revise the bases of HNP Technical Specification 3/4.3.3.5, "Remote Shutdown System," to refer to 10 CFR 50.48(a) and 10 CFR 50.48(c) rather than to Appendix R of 10 CFR Part 50. The bases for TS 3/4.3.3.5 currently states that "this capability is consistent with General Design Criterion 3 and Appendix R to 10 CFR Part 50."

The bases for TS 3/4.3.3.5 are being changed since 10 CFR Part 50, Appendix R, was never the appropriate licensing basis for the HNP fire protection program. The more appropriate reference would have been NUREG-0800, Section 9.5.1, "Fire Protection Program," Branch Technical Position (BTP) CMEB [Chemical Engineering Branch] 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants" (Reference 10). Under the new RI/PB FPP at HNP, 10 CFR 50.48(a) and 10 CFR 50.48(c) are the appropriate references and will be inserted accordingly. Because this change to the TS bases is consistent with the HNP transition to NFPA 805, in accordance with 10 CFR 50.48(c), the NRC staff finds this change in the bases for HNP TS 3/4.3.3.5 acceptable.

2.5 Final Safety Analysis Report

The NRC staff reviewed LAR Attachment R, "Updated Final Safety Analysis Report (UFSAR) Changes," with regard to the proposed changes to the UFSAR as a result of transitioning to NFPA 805. Attachment R states that these changes will be made in accordance with 10 CFR 50.71(e) by applying the HNP procedures for updating the final safety analysis report.

The NRC does not typically review proposed changes to a licensee's UFSAR for prior approval. However, because HNP's transition to NFPA 805 represents a complete change in the licensing basis for the fire protection program, the NRC staff performed a review in order to determine that the licensee's proposed UFSAR changes are in accordance with the applicable guidance and regulations, as described below.

As part of the transition to a fire protection program in compliance with 10 CFR 50.48(c), the licensee completely revised UFSAR Section 9.5.1, "Fire Protection Program," to provide a general description of the HNP NFPA 805 RI/PB FPP and fire protection systems. The major sections of the HNP UFSAR revision include:

- A summary of the design basis, which the licensee stated is based on the nuclear safety performance criteria, performance objectives, and defense-in-depth requirements from NFPA 805 Chapter 1, and identifies the codes, standards, and guidelines used for the design and implementation of the HNP fire protection systems.
- A brief system description that points to LAR Attachment A, "NEI 04-02 Table B-1 – Transition of Fundamental Fire Protection Program and Design Elements (NFPA 805 Chapter 3)," which defines the fire protection program systems and features needed to

- 10 -

meet the requirements of NFPA 805 Chapter 3, and identifies the HNP structures included within the power block.

- An overview of the fire hazard safety analyses, which are design-basis documents that provide the fire safety analysis (FSA) compliance strategies for each HNP fire area.
- A general discussion of the inspection and testing program, surveillance requirements, and monitoring program for the fire protection program systems and features that are governed by the requirements of NFPA 805.
- A summary of the HNP fire protection program management policy and direction, a discussion of the responsibilities and qualifications of the HNP staff responsible for fire protection program implementation, and an outline of the training necessary for HNP fire brigade members.

The NRC staff reviewed the proposed UFSAR revisions using guidance on the level-of-detail appropriate for updating UFSARs contained in NEI 98-03, "Guidelines for Updating Final Safety Analysis Reports" (Reference 22), which the NRC endorsed in RG 1.181, "Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71(e)" (Reference 23).

According to this guidance, licensees may simplify their UFSARs by removing information that is duplicated in separate, controlling program documents (such as the Fire Protection Plan) so long as the controlling program documents are referenced. Accordingly, although the licensee's proposed UFSAR revision only provides a general description of the HNP RI/PB FPP, it does conform with the guidance in that it references Attachment A, Section 4.0, "Compliance with NFPA 805 Requirements," and Attachment E, "NEI 04-02 Table G-1, Radioactive Release Transition," of the HNP NFPA 805 LAR Transition Report as sources for detailed descriptions of fire protection program systems, the fire safety analyses, and the monitoring program.

Since the proposed UFSAR revision references appropriate HNP documents that provide a more detailed description and basis for the RI/PB FPP, and because the licensee commits to submit the final changes to the UFSAR to the NRC in accordance with the requirements of 10 CFR 50.71(e), the NRC staff finds that the proposed general approach and level of detail for the HNP UFSAR revisions satisfy the applicable guidance and regulations for both the UFSAR and a fire protection program based on NFPA 805.

2.6 Rescission of Exemptions

The NRC staff reviewed LAR Section 5.2.3, "Orders and Exemptions," Attachment O, "Orders and Exemptions," and 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 fire protection program licensing basis in conformance with NFPA 805 will supersede. The licensee determined that no exemptions to 10 CFR Part 50, Appendix R, need to be superseded to implement a fire protection program at HNP that complies with 10 CFR 50.48(c).

Note that the licensee requested and received NRC approval for numerous deviations from the deterministic attributes of NUREG-0800, Section 9.5.1, BTP CMEB 9.5-1. The NRC staff individually addresses the applicability and continuing validity of these deviations as

incorporated into the NFPA 805 fire protection program as part of the staff's review of the appropriate section or fire area involved.

2.7 Self Approval Process for Post-Transition Fire Protection Program Changes

Upon completion of the implementation of the RI/PB FPP based on NFPA 805 and issuance of the license condition provided in Section 4.0 of this safety evaluation, changes to the approved fire protection program must be evaluated to ensure that they are acceptable.

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

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:

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.

NFPA 805, Section 2.4.4, outlines a process that allows licensees to make changes to the fire protection program. The process envisioned by the NRC staff when 10 CFR 50.48(c) was promulgated included provisions to allow certain risk-informed and/or performance-based changes to the FPP be made by the licensee without prior NRC review and approval, provided that the processes and methods used meet the regulatory requirements. The specific implementation guidance documents associated with NFPA 805 (NEI 04-02, Section 5.3, and RG 1.205, Regulatory Position C.3.2) address the screening process and other requirements necessary to allow self approval of plant changes with the potential to impact the RI/PB FPP.

RG 1.205, Regulatory Position C.3.2.3, "NRC Approval of Fire Protection Program Changes," provides the following examples of fire protection program changes that licensees must submit for NRC review and approval through a license amendment request before implementation:

- Changes that do not meet the acceptance criteria of the approved license condition.
- Changes to the fundamental fire protection program elements and design requirements of NFPA 805 Chapter 3 that utilize performance-based methods, unless otherwise specified in the fire protection license condition for the plant.
- Changes that have been evaluated using risk-informed or performance-based alternatives to compliance with NFPA 805, where the alternatives have not been approved for use by a license amendment, as required by 10 CFR 50.48(c)(4).
- Combined changes where any individual change would not meet the risk acceptance criteria of the approved license condition.

2.7.1 Risk-Informed Plant Change Evaluation Process

The NRC staff reviewed LAR Section 4.5.3, “NFWA 805 Risk-Informed, Performance-Based Change Evaluation Process,” for compliance with the NFWA 805 plant change evaluation process requirements. To address potential changes to the NFWA 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 1, Section 4.4, “Licensing Basis Transition – Change Evaluations,” and Section 5.3, “Plant Change Process,” as well as Appendices B, I, and J (Reference 24), as modified by RG 1.205, Revision 0, Regulatory Position C.3.2 (Reference 25). However, as a result of the incorporation of lessons learned through the NFWA 805 pilot program, updated versions of these guidance documents became available during the subsequent NRC review of the proposed transition to a RI/PB FPP at HNP.

Accordingly, although the NFWA 805 plant change evaluation process originally developed at HNP relied upon the earlier guidance, the NRC staff utilized the most recent approved documents (see References 12 and 19) to conduct its review, as described below.

LAR Section 4.5.3 states that the plant change process consists of four subtasks:

- defining the change
- preliminary risk review
- risk evaluation
- acceptability determination

The licensee’s change evaluation process starts with definition of the change or altered condition to be evaluated (i.e., the variance from the deterministic requirements) and a review of the baseline configuration as defined by the existing licensing basis (i.e., the previously approved fire protection program element).

Once the change has been defined, along with its relationship to the deterministically compliant condition, a preliminary risk review is performed. This review is implemented as a multi-step screening process to evaluate minor program changes that do not involve the need for detailed fire protection or risk analyses. Forms have been developed by the licensee in accordance with NEI 04-02 guidance that lead the practitioner through a series of questions intended to ensure that plant or procedure changes do not adversely impact the fire protection program, the ability to achieve and maintain the nuclear safety performance criteria, or erode the margin of safety contained in the performance-based analyses performed to date for the RI/PB FPP.

If the preliminary risk review does not screen out the change to be evaluated, a more detailed risk evaluation is performed. The licensee has stated that it will evaluate post-transition (to NFWA 805) plant changes requiring a detailed risk evaluation using a fire probabilistic risk assessment (Fire PRA). The licensee has also stated that the Fire PRA currently meets, and will continue to meet, the required PRA quality standards in accordance with endorsed industry standards and the applicable regulatory guidelines.

The risk evaluation will involve detailed risk calculations (either limiting or bounding risk analyses or a detailed integrated risk analysis) for both core damage frequency (CDF) and large early release frequency (LERF), which will be used to model the proposed change and calculate the change in risk (delta risk) associated with the potential variations from the deterministic

requirements (VFDRs). Delta risk numbers (i.e., ΔCDF and $\Delta LERF$) will be calculated to address VFDRs in accordance with NFPA 805, Section 4.2.4.2, "Use of Fire Risk Evaluation," and the additional risk associated with the implementation of recovery actions required to demonstrate the availability of a success path for achieving the nuclear safety performance criteria will be calculated in accordance with NFPA 805, Section 4.2.4, "Performance-Based Approach." The detailed risk evaluation will also include performance of any uncertainty analyses as required by NFPA 805 (see NFPA 805, Section 2.7.3.5, "Uncertainty Analysis").

2.7.2 Guidelines for the Risk-Informed Self Approval Process Regarding Plant Changes

Once the delta risk numbers have been calculated, the final step in the plant change evaluation process involves determining whether the proposed change is acceptable with respect to risk, defense-in-depth, and safety margins, such that prior NRC review and approval is not required to implement the change. This step utilizes the guidance provided in NEI 04-02 and RG 1.205, Revision 1 (note that both NEI 04-02 and RG 1.205, Revision 1, reference RG 1.174, Revision 1, as part of the basis for this determination of acceptability), which generally outline that prior NRC review and approval is not required for changes that represent a decrease in risk or which result in a risk increase less than 1×10^{-7} per year (/yr) for core damage frequency and less than 1×10^{-8} per year for large early release frequency.

The acceptable risk thresholds were chosen an order of magnitude below "very small" as defined in RG 1.174. This provides reasonable assurance that (1) the actual risk increase from a change that does not require prior NRC review and approval remains acceptable even considering uncertainty, and (2) cumulative risk increases associated with these changes will not be unacceptable. NFPA 805 requires evaluation of cumulative risk when more than one change to a fire protection program is made. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. Implementation of the licensee's proposed plant change evaluation process will be governed by the requirements in the license condition issued with this safety evaluation.

Risk assessments performed to evaluate plant change evaluations 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.

According to the LAR, the licensee intends to use a Fire PRA to evaluate the risk of proposed future plant changes. Section 3.4.1 of this safety evaluation discusses the technical adequacy of the Fire PRA, including the licensee's process to ensure that the Fire PRA remains current. Because (1) the NFPA 805 license condition includes the acceptance criteria and other attributes from the sample license condition contained in RG 1.205, Revision 1, and (2) the NRC staff determined that the quality of the licensee's Fire PRA and associated administrative controls and processes for maintaining the quality of the PRA model is sufficient to support self-approval of future risk-informed changes to the fire protection program under the NFPA 805 license condition, the staff finds that the licensee's process for self-approving future fire protection program changes is acceptable.

However, it should be noted that unless a proposed change to the licensee's fire protection program has been demonstrated to have no more than a minimal risk impact using the approved screening method, risk-informed changes to the RI/PB FPP which involve fire areas that credit incipient detection may not be made without prior NRC review and approval until the HNP Fire PRA model has been modified to incorporate an NRC-accepted method for modeling incipient detection. This is in accordance with HNP's plant-specific NFPA 805 license condition and is further discussed in Section 3.4.1 of this safety evaluation.

Based on the information provided by the licensee in the LAR, the screening process established to evaluate post-transition plant changes meets the guidance in NEI 04-02, Revision 2, as well as RG 1.205, Revision 1. The NRC staff finds that the proposed plant change evaluation process at HNP, which includes a multi-step screening process, is acceptable because it addresses the required delta risk calculations, utilizes 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, defense-in-depth, and safety margins.

However, before achieving full compliance with 10 CFR 50.48(c) by implementing the plant modifications listed in Section 2.8.1 of this safety evaluation (i.e., during full implementation of the transition to NFPA 805), 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 using the multi-step screening process discussed above. In addition, the licensee is required to ensure that fire protection defense-in-depth and safety margins are maintained during the transition process. The Transition License Conditions in the 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, with respect to the requirements for fire protection program changes during transition, and therefore demonstrate compliance with 10 CFR 50.48(c).

The NRC staff also finds that the fire risk evaluation methods used at HNP 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 3.4.1, "Fire PRA Quality"). Accordingly, these cause and effect relationship models may be used after transition to NFPA 805 as a part of the fire risk evaluations conducted to determine the change in risk associated with proposed plant changes.

2.7.3 Guidelines for the Qualitative Self Approval Process Regarding Plant Changes

The NFPA 805 license condition also includes a provision for self approval of changes to the fire protection program that may be made on a qualitative, rather than risk-informed, basis. Specifically, the license condition states that 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 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.

The licensee has requested the ability to utilize fire protection engineering evaluations to demonstrate that minor deviations in the systems, methods, or devices used to comply with the fundamental fire protection program elements and design requirements of NFPA 805 Chapter 3 are “functionally equivalent” to the standard element. These fire protection engineering evaluations utilize a qualitative analysis conducted by a qualified fire protection engineer to determine that the condition does not affect the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard. The basis of approval for a functionally equivalent evaluation is that it achieves the desired result, which is maintaining the function of the NFPA 805 requirement. As such, determination that the condition is functionally equivalent means that the evaluated condition complies with the code.

Use of this approach does not fall under NFPA 805, Section 1.7, “Equivalency,” because the condition can be shown to meet the NFPA 805 Chapter 3 requirement. Section 1.7 of NFPA 805 is a standard format used throughout NFPA standards. It is intended to allow owner/operators to utilize 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 authority having jurisdiction 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 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 (with respect to the ability to meet the nuclear safety and radioactive release performance criteria), using a relevant technical requirement or standard.

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 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).

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, while not exceeding 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 Section 3.8 of this safety evaluation.

2.8 Implementation

Regulatory Position C.3.1 of RG 1.205, Revision 1, provides guidance that the NFPA 805 license condition presented in the LAR should include the following: (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 commitment to maintain appropriate compensatory measures in place until implementation of the modifications is completed.

2.8.1 Modifications

The NRC staff reviewed LAR Attachment S, “Plant Modifications,” which describes the HNP plant modifications necessary to implement the NFPA 805 licensing basis as proposed. These modifications are identified in the LAR as necessary to bring HNP into compliance with either the deterministic or performance-based requirements of NFPA 805. LAR Table S-1 in Attachment S provides a description of each of the proposed plant modifications, presents the problem statement explaining why the modification is needed, and identifies the compensatory actions required to be in place pending completion/implementation of the modification.

The NRC staff’s review confirmed that the modifications identified in LAR Table S-1 are the same as those identified in LAR Table B-3, “Fire Area Transition,” on a fire area basis, as the modifications being credited in the proposed NFPA 805 plant configuration and licensing basis. The staff also confirmed that the LAR Table S-1 modifications and associated implementation schedule are the same as those provided in the NFPA 805 license condition, and for which the licensee has committed to keep the appropriate compensatory measures in place until the modifications have been completed. LAR Attachment S also provides a listing of the modifications the licensee indicated it has already completed at HNP as a part of the NFPA 805 transition (note that these were not independently verified by the NRC staff). Table 2.8.1-1 provides a summary of these completed changes.

Table 2.8.1-1: Completed Plant Modifications

Engineering Change No.	Completed Plant Modification
48802	Removed a Thermo-lag wall and replaced it with Interam™ wrap in the auxiliary control panel (ACP) room.
52769	Established the volume control tank (VCT) valve gallery as a separate Fire Area and installed fire rated cable for the VCT outlet valves (1CS-165 and 1CS-166).

- 17 -

Engineering Change No.	Completed Plant Modification
53878	De-energized the charging pump discharge header cross connect valves (1CS-217, 1CS-218, 1CS-219, and 1CS-220).
54065	Reduced the possibility of spurious operation of the containment spray pump suction valves (1CT-102 and 1CT-105) by replacing existing cable with fire rated Meggitt™ cable.
55938	Eliminated a non-feasible manual action for the electrical equipment room ventilation system dampers (CZ-D73 and CZ-D74).
56427	Re-powered the component cooling water (CCW) system supply to and return from the reactor coolant pump (RCP) seals and motor cooler containment isolation valves (1CC-208 and 1CC-251) from an alternate motor control center (MCC).
56428	Provided an alternate power supply for the “B” essential services chilled water system chiller (WC-2B), which provides cooling for the “B” train safety related equipment in the reactor auxiliary building (RAB). Provided an alternate power supply for the turbine driven auxiliary feedwater (AFW) pump discharge valve (1AF-130) to the “B” steam generator (SG).
58008	Installed a refueling water storage tank level indicator at the ACP.
58779	Provided emergency lighting for the main control room (MCR) and the ACP. Diesel backed lighting using alternating current (AC) electrical power is available in the MCR for all scenarios and is being credited. Also added two 8 hour direct current (DC) emergency lights to the ACP room.
59104 & 60257	Installed a manual transfer switch for the “C” charging/safety injection pump (CSIP).
60435	Provided cable protection for the air handling unit (12 1A-SA) essential services chilled water system temperature control valve (1CH-279) cables in Fire Area 1-A-CSR.B.
60436	Re-powered the RCP thermal barrier flow control valve (CCW system valve 1CC-252) from an alternate MCC and provided cable protection for that valve’s associated cables.
60828	Racked-out the power supply circuit breaker for the CSIP cross-tie valves (1CS-167, 1CS-168, 1CS-169, and 1CS-170) for power operating conditions.

- 18 -

Engineering Change No.	Completed Plant Modification
64641	Modified the transfer and power supply scheme for the service water outlet valve from the 1B-SB essential services chiller (1SW-1208) to meet the requirements of the Safe Shutdown Program.
67742	Placed circuit breakers 1D21-6C:002 and 1E21-6A:002 in the pre-fire rack out position to de-energize the control room smoke purge interlock on the exhaust fans (ES-1 (1A-NNS) and/or ES-1 (1B-NNS)) by preventing spurious starting in the event of a fire.
67743	Precluded the impact of the identified spurious valve misalignments by disabling the boric acid filter valves (1CS-559, 1CS-563, 1NI-117, and PM-103) and RCP seal injection filter valves (1FB-7, 1FB-8, 1NI-107, 1NI-109, 1PM-87 and 1PM-92) by changing the normal position as well as depowering the valves.
67772	Prevented the safety injection discharge valves (1SI-107, 1SI-52, 1SI-86, 1SI-3, and 1SI-4) from spuriously opening because of a fire-induced fault by installing fire rated Meggitt™ cable for the associated valves.
68656	Modified the control wiring circuit for the emergency service water makeup valve (1SW-1204) to eliminate the possibility of a hot short maintaining the valve open following transfer by rerouting a conductor through a normally closed contact of a transfer relay. This was done by modifying the transfer switch wiring, such that upon transfer to the ACP, the valve will fail closed.
68660	Removed an air handling unit (AH-6B) cable from Fire Area 12-A-CR and rerouted it to a cabinet in Fire Area 1-A-SWGRB, where the cable already terminates, to prevent fire impacts.
68768	Added a transient exclusion zone from elevation 261 feet of the RAB to the main corridor near the “B” essential services chilled water system chiller.
70028	Installed dedicated ladders throughout the RAB to support recovery actions for safe shutdown equipment. Relocated two existing general purpose ladders in the RAB that were a possible hazard to Meggitt™ cable located in close proximity to them. Installed two “door-stays” in the RAB to support defense-in-depth recovery actions for safe shutdown equipment.

LAR Table S-1 provides a detailed listing of the committed plant modifications that must be completed in order for HNP to be fully in accordance with NFPA 805, implement many of the

- 19 -

attributes upon which this safety evaluation is based, and thereby meet the requirements of 10 CFR 50.48(c). As discussed above, these modifications will be implemented in accordance with the schedule provided in the NFPA 805 license condition, which states that all modifications will be in place by December 31, 2010.

In addition, the licensee has committed to keep the appropriate compensatory measures in place until the modifications have been fully implemented. Table 2.8.1-2 presents a simplified version of LAR Table S-1.

Table 2.8.1-2: Committed Plant Modifications

Engineering Change No.	Problem Statement	Modification Description
62343	Mitigate the consequences of spuriously opening main steam power operated relief valve (PORV) 1MS-62 due to a fire-induced fault.	Protect 1MS-62, a "C" SG PORV, from damage in Fire Area [REDACTED] and Fire Area [REDACTED] by installing a kill switch on the ACP so the valve can be failed shut.
62820	Upgrade the reliability of the safe shutdown communications for a postulated fire.	Perform modification actions to ensure adequate communications for necessary plant areas.
68645	Prevent AFW system valve 1AF-74 fire damage in Fire Area [REDACTED]. This valve isolates flow from the "A" and "B" motor driven AFW pumps to the "C" SG.	Protect AFW system valve 1AF-74 from fire damage by re-routing cables outside Fire Area [REDACTED] and Fire Area [REDACTED].
68646	Prevent high energy arcing fault (HEAF) damage.	Add thermal shields over electrical switchgear units 1B-SB, 1B-NNS, 1E-NNS, and 1B1-NNS in switchgear room 1B to prevent HEAF damage. Alternatively, provide HEMYC™ fire wrap around the nearest cable tray to prevent vertical flame propagation and damage from a HEAF source fire.
68648	Protect cable 0988B to prevent the AFW isolation signal from being received due to spurious cable interactions in Fire Area [REDACTED].	Reroute existing cable out of Fire Area [REDACTED].

- 20 -

Engineering Change No.	Problem Statement	Modification Description
68658	Prevent CCW valves 1CC-147 and 1CC-167 from spurious operation as a result of a postulated fire in Fire Area [REDACTED]. The spurious opening of two of these valves would cause the running CCW pump to run out due to excessive CCW flow through both residual heat removal (RHR) heat exchangers.	Install fuses in the control circuit to prevent fire-induced spurious opening of these valves.
68769	Address generic NRC Information Notice (IN) 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire" (Reference 26), in regard to motor operated valve (MOV) safe shutdown and fire protection issues.	Resolve generic IN 92-18 MOV safe shutdown and fire protection issues as required.
69501	Reduce risk as necessary in the following Fire Areas: [REDACTED]	Add a very early warning fire detection system (VEWFDS) to the following Fire Areas in the cabinets indicated: [REDACTED] termination cabinets; inverters; [REDACTED] [REDACTED] – high risk process instrumentation cabinets (PIC); isolation cabinets; solid state protection system (SSPS) cabinets in the [REDACTED] [REDACTED] – high risk auxiliary relay panels (ARPs) [REDACTED] [REDACTED] [REDACTED]

Engineering Change No.	Problem Statement	Modification Description
69764	Upgrade existing credited HEMYC™ applications.	Modify electrical raceway fire barrier systems (ERFBS) consistent with the tested configuration for fire resistance assumed (25 minutes minimum).
69765	Upgrade existing credited MT™ applications.	Modify ERFBS consistent with the tested configuration for the fire resistance assumed (115 minutes minimum).
70027	Provide additional cooling for the [REDACTED] room and the [REDACTED] room during a postulated fire.	Add 480 Volt AC power outlets to supply compensatory fans for cooling the [REDACTED] room and the [REDACTED] room; these are to have diesel backed AC power. This supports defense-in-depth since the alternate seal injection pump modification will be installed, and this modification supports going to cold shutdown. Note that the licensee has identified hot standby as the safe and stable condition to achieve the NFPA 805 nuclear safety performance criteria.
70350	Supply RCP seal injection during a postulated fire.	Install a new diesel generator and dedicated charging pump to supply RCP seal injection (automatic start), with the additional ability to power essential battery chargers for new diesel output.
70895	Protect turbine driven AFW MOVs 1AF-137, 1AF-143, and 1AF-149 from fire damage in Fire Area [REDACTED]; these valves could isolate AFW to SGs "A," "B," and "C" from the turbine driven AFW pump.	Provide additional isolation of the circuit via the transfer switch on transfer to the ACP.
71147	Correct multiple spurious conditions inside MCCs (e.g., a situation in which two high head safety injection valves could spuriously open due to a fire in a single MCC).	Relocate breaker cubicles to minimize the potential for internal cabinet fire exposure damage, and limit fire-induced damage to relevant control cables via the use of fire rated cable for internal cable runs in areas subject to fire damage.

2.8.2 Schedule

LAR Section 5.4 provides the overall schedule for completing the NFPA 805 transition at HNP. The licensee stated that it will complete the implementation of the new program, including any necessary reviews, procedure changes, process updates, and training for affected plant personnel to implement the NFPA 805 fire protection program, within 180 days after NRC approval, as conveyed by the date of issuance of this safety evaluation.

LAR Section 5.4 also states that all modifications necessary for HNP to fully implement the transition to NFPA 805 will be completed by the end of the fourth quarter of 2010. In addition, the revised license condition includes a statement that appropriate compensatory measures will remain in place until implementation of these modifications is complete (see Section 4.0 of this safety evaluation). In most cases, these compensatory measures involve maintaining hourly fire watches in the areas where modifications have not yet been completed.

2.9 Summary of Implementation Items

Implementation items are items that the licensee has not fully completed or implemented as of the issuance date of the safety evaluation, 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, NFPA 805 programs that have not been fully implemented, personnel training that is still underway, etc.). These items do not impact the bases for the safety conclusions made by the NRC staff in the associated safety evaluation.

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. In addition, the licensee has provided a commitment and a date by which each implementation item will be completed.

Per this commitment from the licensee (Reference 27), 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 amended license (i.e., 180 days from the issuance date of the safety evaluation).

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 dispositioned appropriately under the licensee's corrective action program.

As a result of its review of the HNP NFPA 805 LAR, the NRC staff identified the implementation items contained in Table 2.9-1. For tracking purposes, the staff has assigned a unique identifying number to each implementation item.

The table also specifies the associated section of the safety evaluation in which the implementation item is identified, as well as the appropriate licensee document which denotes that the action associated with the implementation item is still ongoing and provides some additional level of detail regarding what the change will entail.

Table 2.9-1: NFPA 805 Implementation Items

#	SE Section	Implementation Item Description	HNP Document
1	Section 3.2.1: Compliance with NFPA 805 Nuclear Safety Capability Assessment Methods	The licensee stated that LAR Table B-2, “Nuclear Safety Capability Assessment,” refers to the appropriate circuit coordination studies, and that, with the exception of backfeed, all other non-power operation (NPO) concerns are bounded by the safe shutdown analysis. The updating / completion of the coordination study for the backfeed configuration is an implementation item.	Letter dated August 13, 2009 (HNP-09-084): HNP Request for Additional Information (RAI) Response 3-64
2	Section 3.5.2: Fire Protection During Non-Power Operational Modes	Providing additional procedural guidance related to RHR flow control recovery actions is an implementation item.	Letter dated August 13, 2009 (HNP-09-084): HNP RAI Response 3-47
3	Section 3.5.2: Fire Protection During Non-Power Operational Modes	Providing procedural changes to address the 20 generic pinch points identified during the NPO review is an implementation item.	Letter dated August 13, 2009 (HNP-09-084): HNP RAI Response 3-48
4	Section 3.5.2: Fire Protection during Non-Power Operational Modes	Providing procedural changes to address potential spurious valve operations identified during the NPO review is an implementation item.	Letter dated August 13, 2009 (HNP-09-084): HNP RAI Response 3-66
5	Section 3.7: Monitoring Program	Completion of the NFPA 805 Monitoring Program at HNP is an implementation item. Successful completion/implementation of the monitoring program includes: • defining availability, reliability, and performance parameters to be measured for each performance monitoring group • identifying action levels for availability, reliability, and performance parameters • identifying corrective actions to be taken when action levels have been exceeded	Letter dated August 13, 2009 (HNP-09-084): HNP RAI Response 6-1

- 24 -

#	SE Section	Implementation Item Description	HNP Document
6	Section 3.8.2: Configuration Control	Completion of the necessary changes to the HNP Fire Protection Program Manual is an implementation item.	Letter dated August 13, 2009 (HNP-09-084): HNP RAI Response 7-2
7	Section 3.8.3: Quality	Revision of post-transition processes and procedures to include NFPA 805 requirements for verification and validation is an implementation item.	LAR Section 4.7.3
8	Section 3.8.3: Quality	Revision of post-transition processes and procedures to include NFPA 805 requirements for limitations of use is an implementation item.	LAR Section 4.7.3
9	Section 3.8.3: Quality	The licensee stated that a fire modeling qualification and training program would be developed to ensure that personnel performing future modeling activities will meet the requirements for qualification of use identified in NFPA 805, Section 2.7.3.4. The establishment of this fire modeling qualification program and associated training is an implementation item.	Letter dated February 4, 2010 (HNP-10-008): HNP RAI Response 5-4.1
10	Section 3.8.3: Quality	Revision of post-transition processes and procedures to include NFPA 805 requirements for uncertainty analyses is an implementation item.	LAR Section 4.7.3
11	Section 3.8.4: Fire Protection Quality Assurance Program	Expansion of the Fire Protection Quality Assurance (QA) Program to include systems in the power block that were not previously included in the scope of the QA Program, but which are required by NFPA 805 Chapter 4, is an implementation item. Specifically, the addition to the QA Program of certain fire protection and safe shutdown systems in the waste processing building, fuel handling building, and the turbine building that are required by NFPA 805 Chapter 4, as identified in LAR Tables 4-8-1 and 4-8-2.	Letter dated August 13, 2009 (HNP-09-084): HNP RAI Response 7-3 & Revised LAR Tables 4-8-1 and 4-8-2 provided in the letter dated February 4, 2010 (HNP-10-008)

#	SE Section	Implementation Item Description	HNP Document
12	Attachment A: NFPA 805 Chapter 3 Fundamental Elements Compliance Matrix, Section 3.2.3, Procedures, Subsection 3.2.3.(1)	The licensee stated that during the implementation of the NFPA 805 licensing basis, performance-based surveillance frequencies will be established as described in Electric Power Research Institute (EPRI) Technical Report (TR) 1006756, "Fire Protection Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features" (Reference 28). The performance-based surveillance frequencies will be evaluated in calculation HNP-M/BMRK-0015. Establishment of the appropriate performance-based surveillance frequency process is an implementation item.	LAR Attachment A, Subsection 3.2.3 Procedures (1)
13	Attachment A: Section 3.3.10, Hot Pipes and Surfaces	Appropriate modification of plant procedures to meet the requirements of the NFPA 805 Chapter 3 element (3.3.10) regarding hot pipes and surfaces is an implementation item.	Letter dated February 4, 2010 (HNP-10-008): HNP RAI Response 2-17f
14	Attachment A: Section 3.4.2, Pre-Fire Plans	The development and implementation of an outside yard pre-fire plan to address radioactive materials areas and Sea-Land type container storage is an implementation item.	Letter dated February 4, 2010 (HNP-10-008): HNP RAI Response 2-17h
15	Attachment D: Nuclear Safety Capability Assessment Results by Fire Area, Fire Area 12-A-CR	Completion of the revisions to calculation HNP-M/MECH-1127 and other affected fire safety analysis calculations to clearly state how the delta risks were determined is an implementation item.	Letter dated October 9, 2009 (HNP-09-094): HNP RAI Response 3-23n
16	Attachment D: Fire Area 1-A-ACP	Completion of the revisions to calculation HNP-M/MECH-1124 to incorporate the revised change evaluations documenting that conduit 14449T and cable 0153E are not within the zone of influence (ZOI) of a significant ignition source once the VEWFDs is installed is an implementation item.	LAR Attachment C, Fire Area 1-A-ACP

#	SE Section	Implementation Item Description	HNP Document
17	Attachment D: Fire Area 1-A-BAL-B	Completion of the updates to the appropriate change evaluation in order to address the relationship of cables 0955C and 0970E to the ignition source ZOIs in Fire Area 1-A-BAL-B is an implementation item.	LAR Attachment C, Fire Area 1-A-BAL-B2
18	Attachment D: Fire Area 1-A-BAL-B	Completion of the updates to the appropriate change evaluation in order to document that cable 2608C is not within the ZOI of a significant ignition source, and revising the compliance strategy and associated operator procedure, is an implementation item.	LAR Attachment C, Fire Area 1-A-BAL-B3
19	Attachment D: Fire Area 1-A-BAL-B	Completion of the updates to the appropriate change evaluation in order to document that cable 0245B is not within the ZOI of a significant ignition source is an implementation item.	LAR Attachment C, Fire Area 1-A-BAL-B3
20	Attachment D: Fire Area 1-A-BAL-B	Completion of the updates to the appropriate change evaluation for Fire Area 1-A-BAL-B in order to document that the new configuration (i.e., installation of fire rated Meggitt™ cable and associated analyses, as well as the commitment to install an alternate seal injection system) provides adequate defense-in-depth and safety margin is an implementation item.	LAR Attachment C, Fire Area 1-A-BAL-B4
21	Attachment D: Fire Area 1-A-BAL-B	Completion of the updates to the appropriate change evaluation in order to document that cable 0270C is not within the ZOI of a significant ignition source is an implementation item.	LAR Attachment C, Fire Area 1-A-BAL-B5
22	Attachment D: Fire Area 1-A-BAL-C	Completion of the updates to the appropriate change evaluation in order to document that cable 0153E is not within the ZOI of a significant ignition source is an implementation item.	LAR Attachment C, Fire Area 1-A-BAL-C
23	Attachment D: Fire Area 1-F-FPP	Removing credit for the ionization detection system in Fire Zones 5-F-2-FPV1 and FPV2 will be reflected in calculation HNP-M/ MECH-1188. Completion of the revisions to this calculation is an implementation item.	Letter dated April 5, 2010 (HNP-10-040): HNP RAI Response 2-2

3.0 TECHNICAL EVALUATION

The following sections evaluate the technical aspects of the requested license amendment to transition the fire protection program at HNP to one based on NFPA 805 in accordance with 10 CFR 50.48(c). While performing the technical evaluation of the licensee's submittal, the NRC staff utilized the guidance provided in NUREG-0800, Section 9.5.1.2, "Risk-Informed, Performance-Based Fire Protection" (Reference 16), 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. Specifically:

- Section 3.1 provides the results of the NRC staff review of the licensee's transition of the fire protection program 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 nuclear safety performance criteria.
- Section 3.3 provides the results of the NRC staff review of the fire modeling methods used by the licensee to demonstrate the ability to meet the nuclear safety performance criteria using a fire modeling performance-based approach.
- Section 3.4 provides the results of the NRC staff review of the fire risk assessments used by the licensee to demonstrate the ability to meet the nuclear safety performance criteria using a fire risk evaluation performance-based approach.
- Section 3.5 provides the results of the NRC staff review of the licensee's nuclear safety capability assessment results by fire area.
- Section 3.6 provides the results of the NRC staff review of the methods used by the licensee to demonstrate the 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 the a RI/PB FPP based on NFPA 805.
- Section 3.8 provides the results of the NRC staff review of the licensee's approach to program documentation, quality assurance, and configuration management.

Most of the above sections (including the associated subsections) are preceded by additional regulatory criteria from the NFPA 805 standard that is meant to establish a clear basis for the NRC staff review described in each section. This information is intended to be used in conjunction with the associated overarching regulations and guidance documents discussed in Section 2.0 of this safety evaluation to determine whether the appropriate acceptance criteria have been met for the use of a RI/PB FPP in accordance with NFPA 805.

In addition, Attachments A - E to this safety evaluation provide additional detailed information that was evaluated and/or dispositioned by the NRC staff to support the licensee's request to transition to a RI/PB FPP in accordance with NFPA 805 (i.e., 10 CFR 50.48(c)). These attachments are discussed as appropriate in the associated section of the safety evaluation.

3.1 NFPA 805 Fundamental FPP Elements and Minimum Design Requirements

NFPA 805 Chapter 3 contains the fundamental elements of a fire protection program and specifies the minimum design requirements for fire protection systems and features that are necessary to meet the standard. The fundamental fire protection program elements and minimum design requirements include necessary attributes pertaining to the fire protection plan and procedures, the fire prevention program and design controls, internal and external industrial fire brigades, and fire protection SSCs. However, 10 CFR 50.48(c) takes exception to three specific requirements of NFPA 805 Chapter 3, and provides alternative requirements 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, regarding an allowance for existing cable in place prior to the adoption of NFPA 805 to remain as is, 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, regarding provisions for restoring water supply and distribution for manual fire fighting purposes, 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 performance-based 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 evaluated in accordance with the performance-based methods permitted in the standard.

Furthermore, Section 3.1 of NFPA 805 specifically allows the use of alternatives to the NFPA 805 Chapter 3 fundamental fire protection program requirements that have been previously approved by the NRC (which is the authority having jurisdiction (AHJ), as denoted in NFPA 805), and are contained in the currently approved fire protection program 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 19), as endorsed by the NRC in RG 1.205, Revision 1 (Reference 12), to assess the proposed HNP fire protection program against the NFPA 805 Chapter 3 requirements. The NEI 04-02 based approach was modified in regard to existing HNP fire protection program elements that comply via previous approval, as described in the licensee's supplemental letter dated August 28, 2009 (Reference 6; see response to RAI 2-8). For these elements, rather than providing excerpts from both the associated submittal and approval documents, as outlined in Appendix B, "Detailed Transition Assessment of Fire Protection Program," of NEI 04-02, the licensee provided only an excerpt from the NRC approval document as a part of the compliance basis statement, on the condition that the excerpt included sufficient information to fully understand the basis for previous approval without the need for additional information from the submittal document. The NRC staff has determined that, taken together, this constitutes an acceptable approach for documenting compliance with the NFPA 805 Chapter 3 requirements.

As part of the assessment, the licensee reviewed each section and subsection of NFPA 805 Chapter 3 against the existing HNP fire protection program and provided specific compliance statements for each NFPA 805 Chapter 3 attribute that contained applicable requirements. As discussed below, some subsections of NFPA 805 Chapter 3 do not contain requirements, or are otherwise not applicable to HNP.

The methods used by HNP for demonstrating compliance with the NFPA 805 Chapter 3 fundamental fire protection program elements and minimum design requirements are as follows:

1. The existing fire protection program element directly complies with the requirement; noted in LAR Attachment A, "NEI 04-02 Table B-1, Transition of Fundamental Fire Protection Program and Design Elements (NFPA 805 Chapter 3)," also called the B-1 Table, as "Complies."
2. The existing fire protection program element complies through the use of an explanation or clarification; noted in the B-1 Table as "Complies with Clarification."
3. The existing fire protection program element complies with the requirement based on prior NRC approval of an alternative to the fundamental fire protection program attribute and the bases for the NRC approval remain valid; noted in the B-1 Table as "Complies Via Previous NRC Approval."
4. The existing fire protection program element complies through the use of existing engineering equivalency evaluations (EEEEEs) whose bases remain valid and are of sufficient quality; noted in the B-1 Table as "Complies with the Use of EEEEEs."
5. The existing fire protection program element does not comply with the requirement, but the licensee is requesting approval for a performance-based method in accordance with 10 CFR 50.48(c)(2)(vii); noted in the B-1 Table as "License Amendment Required."

The licensee stated in LAR Section 4.2.2.2.1, "Results of the Existing Engineering Equivalency Evaluation Review," that it had evaluated the EEEEEEs used to demonstrate compliance with the NFPA 805 Chapter 3 requirements in order to ensure continued appropriateness, quality, and applicability to the current HNP plant configuration. Additionally, the licensee stated in LAR Section 4.2.2.2.2, "Results of the Licensing Action Review," that the existing licensing actions used to demonstrate compliance have been evaluated to ensure that their bases remain valid.

Table 3.1-1, "NFPA 805 Chapter 3 Fundamental Elements Compliance Matrix," in Attachment A to this safety evaluation, provides the specific fire protection program elements and minimum design requirements from NFPA 805 Chapter 3, as appropriately modified by 10 CFR 50.48(c). In addition, the table describes each fundamental fire protection program element from NFPA 805 Chapter 3 and identifies which of the methods listed above the licensee used as the means for demonstrating compliance with the requirement.

SE Table 3.1-1 also provides the results of the NRC staff's evaluation of the licensee's compliance statement for each FPP element. LAR Attachment A (the NEI 04-02 B-1 Table) provides further details regarding the licensee's compliance strategy for specific NFPA 805 Chapter 3 requirements, including references to where compliance is documented.

- 30 -

For approximately 60 percent 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 fire protection program element using the existing fire protection program element. In these instances, based on the validity of the licensee's statements, the NRC staff finds the licensee's statements of compliance acceptable.

For approximately 12 percent of the NFPA 805 Chapter 3 requirements, the licensee provided additional clarification when describing its means for compliance with the fundamental fire protection program element. In these instances, the NRC staff reviewed the additional clarifications and concludes that the licensee will meet the underlying requirement for the fire protection program element as clarified.

For approximately 7 percent of the NFPA 805 Chapter 3 requirements, the licensee demonstrated compliance with the fundamental fire protection program element through the use of EEEEs. The NRC staff reviewed the licensee's statement of continued validity for the EEEEs, as well as a statement on the quality and appropriateness of the evaluations, and finds the licensee's statements of compliance in these instances acceptable.

Approximately 13 percent of the NFPA 805 Chapter 3 requirements were supplanted by an alternative that was previously approved by the NRC. In all but one instance, NRC approval was documented in the original 1983 Safety Evaluation Report (Reference 29), or in Supplements 2, 3, or 4 (References 30, 31, and 32, respectively) to the original report, which were issued between 1985 and 1986. The one additional previously approved alternative is a 2006 license amendment approving the use of fire rated cable in lieu of 3-hour rated electrical raceway fire barriers (Reference 33).

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

In the compliance statements for approximately 8 percent of the NFPA 805 Chapter 3 requirements, the licensee used more than one of the above strategies to demonstrate compliance with aspects of the fundamental fire protection program element. In each of these cases, the staff found the compliance statements acceptable, for the reasons outlined above.

In one instance, the licensee requested approval for the use of a performance-based method to demonstrate compliance with a fundamental fire protection program element. In accordance with 10 CFR 50.48(c)(2)(vii), the licensee requested specific approval be included in the license amendment approving the transition to NFPA 805 at HNP. The requested performance-based method pertains to the requirement contained in NFPA 805 Chapter 3, Section 3.5.16, which concerns the non-fire protection use of fire protection water supplies. As discussed in SE Section 3.1.4 below, the NRC staff finds the use of a performance-based method to demonstrate compliance with this fundamental fire protection program element acceptable.

- 31 -

Some NFPA 805 Chapter 3 sections either do not apply to the transition to a RI/PB FPP at HNP, or have no technical requirements. Accordingly, the NRC staff did not review these sections for acceptability. The unreviewed sections fall into one of four categories:

- Sections that do not contain any technical requirements (e.g., NFPA 805 Chapter 3, Section 3.4.5 and Section 3.11).
- Sections that are not applicable to HNP because of the following:
 - The licensee states that HNP does not have systems of this type installed (e.g., the NFPA 805 Chapter 3, Section 3.9.1 (3) requirements for water mist systems, the Section 3.9.1 (4) requirements for water foam systems, and the Section 3.10 requirements for gaseous suppression systems).
 - The type of system, while installed at HNP, is not required under the RI/PB FPP (e.g., NFPA 805 Chapter 3, Section 3.9.1 (2), which contains requirements for fixed water spray systems).
 - The requirements are structured with an applicability statement (e.g., NFPA 805 Chapter 3, Section 3.4.1(a)(2) and Section 3.4.1(a)(3), wherein the determination of which NFPA code(s) apply to the fire brigade depends on the type of brigade specified in the fire protection program).

In Table 3.1-1 of Attachment A to this safety evaluation, the unreviewed sections are shaded.

As documented in SE Table 3.1-1 and discussed above, the NRC staff evaluated the results of the licensee's assessment of the proposed HNP RI/PB FPP against the NFPA 805 Chapter 3 fundamental fire protection program 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 by various letters, the NRC staff finds the RI/PB FPP acceptable with respect to the fundamental fire protection program elements and minimum design requirements of NFPA 805 Chapter 3, as modified by 10 CFR 50.48(c)(2), because the licensee accomplished the following:

- Used an overall process consistent with NRC staff approved guidance to determine the state of compliance with each of the applicable NFPA 805 Chapter 3 requirements.
- Provided appropriate documentation of HNP'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.
 - 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.

- 32 -

- Through the use of a combination of the above methods.
- Through the use of a performance-based method that the NRC staff has specifically approved in accordance with 10 CFR 50.48(c)(2)(vii).

3.1.2 Identification of the Power Block

The NRC staff reviewed the HNP structures identified in LAR Table I-1, "HNP 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 HNP RI/PB FPP that have additional requirements in accordance with 10 CFR 50.48(c) and NFPA 805. As stated in the LAR, power block equipment includes all the SSCs required for the safe and reliable operation of the station. It includes all safety-related and balance-of-plant systems and components required for operation, including radioactive waste processing and storage, and switchyard equipment maintained by the station. The staff finds that the licensee has appropriately evaluated the structures and equipment at HNP, and adequately documented a list of those structures that fall under the definition of "power block" in NFPA 805.

3.1.3 Electrical Raceway Fire Barrier Systems (HEMYC™ and MT™)

NFPA 805, Section 3.11.5, "Electrical Raceway Fire Barrier Systems (ERFBS)," requires that ERFBS be capable of resisting the fire effects of the hazards in the area. The ERFBS must also be tested in accordance with, and meet the acceptance criteria of Supplement 1, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Trains Within the Same Fire Area," to GL 1986-10, "Implementation of Fire Protection Requirements" (Reference 34). HNP relies on HEMYC™ and MT™ fire wraps in the ERFBS as identified in LAR Attachment A, Section 3.11.5, and detailed in the HNP response to GL 2006-03 (Reference 11). However, in light of recent findings associated with the accuracy of the fire resistive ratings of HEMYC™ and MT™ installations, the licensee implemented compensatory measures to provide protection and maintain the safe shutdown function of affected areas in the plant. The licensee also proposed to resolve the issues related to the HEMYC™ and MT™ fire wrap installations at HNP during transition to the RI/PB FPP.

The first step was to establish the HEMYC™ and MT™ ERFBS fire barrier worth through plant-specific fire testing and evaluation of the installed fire wrap configurations. Next, the performance-based plant change/fire risk evaluation process was used to evaluate the acceptability of the ERFBS installations credited to meet the NFPA 805 nuclear safety performance criteria. Finally, HNP committed to perform modifications to those HEMYC™ and MT™ installations that are credited to meet the nuclear safety performance criteria requirements of NFPA 805 Chapter 4, but do not currently meet the fire resistance rating required by the deterministic criteria in NFPA 805, Section 4.2.3, "Deterministic Approach." The testing and evaluation of the installed ERFBS configurations at HNP is described in LAR Attachment A, Section 3.11.5. The NRC staff's review of the performance-based evaluations performed for each fire area, which incorporate these results, is discussed in Attachment D, "Nuclear Safety Capability Assessment Results by Fire Area," of this safety evaluation.

As described in LAR Attachment S, two committed plant modifications (EC 69764 and EC 69765) involve changes that will make the installed HNP HEMYC™ and MT™ configurations

- 33 -

consistent with the tested configurations. According to the licensee's letter dated August 13, 2009 (Reference 5), these modifications include:

- The installation of termination collars or pads where the HEMYC™ and MT™ ERFBS meet a fire barrier.
- The installation of larger joint collars on the HEMYC™ ERFBS installed on conduits.
- The reworking of MT™ ERFBS on junction boxes to provide adequate blanket overlaps.
- The addition of insulation blankets to thermal shorts (supports).

In addition, the licensee stated that the compensatory measures described in the HNP response to GL 2006-03 (i.e., fire watch patrols and controls on transient combustible materials in the areas where HEMYC™ and MT™ ERFBS are credited with providing protection for required safe shutdown circuits) will remain in effect until the modifications under EC 69764 and EC 69765 are completed and the RI/PB FPP has been approved.

Based on the above discussion, the NRC staff concludes that the combination of plant-specific fire testing and evaluation of the installed ERFBS configurations, the appropriate use of performance-based plant change and fire risk evaluations, and the commitment to implement the proposed plant modifications while maintaining compensatory measures as necessary, is an adequate means for resolving the remaining GL 2006-03 issues regarding HEMYC™ and MT™ fire barrier configurations at HNP. Once the committed modifications are complete, the licensee's fire risk evaluations related to the RI/PB FPP demonstrate that those fire areas that credit the use of HEMYC™ and MT™ ERFBS will meet the nuclear safety performance criteria using a performance-based analysis, and are therefore acceptable.

3.1.4 Performance-Based Methods for NFPA 805 Chapter 3 Elements

In accordance with 10 CFR 50.48(c)(2)(vii), a licensee may request NRC approval for use of the performance-based methods permitted elsewhere in the standard as a means of demonstrating compliance with the prescriptive fire protection program fundamental elements and minimum design requirements of NFPA 805 Chapter 3. Paragraph 50.48(c)(2)(vii) of 10 CFR requires that an acceptable performance-based 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 defense-in-depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability).

In LAR Attachment L, "NFPA 805 Chapter 3 Requirements for Approval," provided in the supplemental letter dated February 4, 2010 (Reference 8), the licensee requested NRC staff review and approval of a performance-based method to demonstrate an equivalent level of fire

protection for the requirement of NFPA 805, Section 3.5.16 regarding the fire protection water supply system. Specifically, the licensee has requested approval of a performance-based method to justify the use of fire protection water supplies for non-fire protection uses.

As described by the licensee, this usage would consist of the control room supervisor (CRS) approving use of fire protection system water for plant evolutions other than fire protection under the following conditions: (1) CRS approval is obtained and documented, (2) controls or communications, or both, are in place to ensure the non-fire protection system water demand can be secured immediately if a fire occurs, and (3) the non-fire protection system water demand must be less than 250 gallons per minute (gpm).

The licensee stated that the use of fire protection water for these non-fire protection system water demands would have no adverse impact on the ability of the fire protection water supply system to provide required flow and pressure based on the following: (1) the 250 gpm demand allowed by the proposed change is less than the hose stream demand (500 gpm) currently postulated in determining suppression water flow requirements in accordance with NFPA 805 Chapter 3, and (2) the personnel utilizing the fire protection water are in contact with the control room, therefore ensuring the ability to secure the non-fire protection system water demand before hose streams are used should a fire occur. The licensee concluded that neither the flow and pressure available to any automatic water based suppression system, nor the manual fire suppression demands when needed, will be adversely impacted by the proposed change since the non-fire protection water demand would be secured before hose streams were used.

The NRC staff finds that there is no impact on the NFPA 805 nuclear safety performance measures (goals, objectives, and performance criteria) because the flow restrictions ensure that there is no impact on the ability of the automatic suppression systems to perform their function. Furthermore, the ability to isolate the non-fire protection system water flow ensures that there is no impact on manual fire suppression efforts. Similarly, the NRC staff finds that this alternative will have no effect on the NFPA 805 radiological release performance measures, since there will be no impact on fire suppression activities.

The proposed change may result in more frequent demands on the fire pumps, possibly resulting in the need for more frequent maintenance (with a corresponding reduction in fire pump reliability). While this may be true, the licensee is required to perform periodic surveillance testing of the fire pumps in accordance with NFPA 805, Section 3.2.3, "Procedures." In addition, the fire pumps fall under the requirements of the NFPA 805 Monitoring Program, which directs the licensee to establish acceptable levels of performance and to develop methods to monitor that performance, such that if performance of a component is not acceptable, proper corrective action will be taken to restore it to acceptable levels.

The NRC staff also finds that the proposed alternative maintains the safety margins of the licensee's analyses related to fire suppression functions, based on the licensee's statements that the proposed alternative did not alter the methods, input parameters, and acceptance criteria used to calculate flow requirements for the automatic and manual suppression systems. The staff also finds that any increased use of the fire pumps to support this change will be monitored and appropriate corrective actions taken before fire pump performance is adversely impacted. Finally, the NRC staff finds that fire protection defense-in-depth is maintained, since both the automatic and manual fire suppression functions are maintained.

In accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff finds the proposed performance-based method acceptable for application in lieu of 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 sufficient safety margin, and maintains adequate fire protection defense-in-depth.

3.2 NFPA 805 Nuclear Safety Capability Assessment Methods

NFPA 805 is a performance-based standard that allows engineering analyses to be used to show that FPP features and systems provide sufficient capability to meet the requirements.

NFPA 805, Section 2.4, "Engineering Analyses," states the following:

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.

NFPA 805 Chapter 1 defines the goals, objectives, and performance criteria that the fire protection program must meet in order to be in accordance with NFPA 805.

Nuclear Safety Goal

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.

Nuclear Safety Objectives

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.

Nuclear Safety Performance Criteria

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.

- 36 -

- (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 [pressurized water reactor] (PWR) and shall be capable of maintaining or rapidly restoring reactor water level above top of active fuel for a [boiling water reactor] (BWR) such that fuel clad damage as a result of a fire is prevented.
- (c) *Decay Heat Removal.* Decay heat removal shall be capable of removing sufficient heat from the reactor core or spent fuel such that fuel is maintained in a safe and stable condition.
- (d) *Vital Auxiliaries.* Vital auxiliaries shall be capable of providing the necessary auxiliary support equipment and systems to assure that the systems required under (a), (b), (c), and (e) are capable of performing their required nuclear safety function.
- (e) *Process Monitoring.* Process monitoring shall be capable of providing the necessary indication to assure the criteria addressed in (a) through (d) have been achieved and are being maintained.

3.2.1 Compliance with NFPA 805 Nuclear Safety Capability Assessment Methods

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

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 section of the safety evaluation evaluates the first three of the above-listed topics. Section 3.5 of this safety evaluation addresses the assessment of the fourth topic.

Regulatory Guide 1.205, Revision 1 (Reference 12), endorses NEI 04-02, Revision 2 (Reference 19), and Chapter 3 of NEI 00-01, Revision 2, "Guidance for Post-Fire Safe

Shutdown Circuit Analysis” (Reference 35), and promulgates the method outlined in NEI 04-02 for conducting a nuclear safety capability assessment. This NRC endorsed method documents in a table format (i.e., NEI 04-02 Table B-2, “NFPA 805 Chapter 2 – Nuclear Safety Transition – Methodology Review”) the licensee’s comparison of its post-fire safe shutdown analyses to the guidance in NEI 00-01 Chapter 3, which 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 Review,” and Attachment B, “NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment – Methodology Review,” against these guidelines.

It should be noted that the licensee developed the original HNP NFPA 805 LAR application (Reference 2) based on the guidelines provided in earlier versions of the three guidance documents cited above. At the time the licensee performed the majority of the engineering analyses necessary to meet the requirements being discussed in this section, the NRC endorsed guidance was found in RG 1.205, Revision 0; NEI 04-02, Revision 1; and NEI 00-01, Revision 1 (References 25, 24, and 36, respectively). However, the NRC staff utilized the most recent approved guidance (i.e., RG 1.205, Revision 1; NEI 04-02, Revision 2; and NEI 00-01, Revision 2) during the review of the licensee’s submittal. When there were differences between the currently approved guidance and the earlier revision, the staff generated requests for additional information (RAIs) to address any inconsistencies with the most recent approved guidance. Based on the information provided in the licensee’s submittal, as supplemented, PEC used a systematic process to evaluate the HNP post-fire safe shutdown analysis against the requirements of NFPA 805, Section 2.4.2, Subsections (1), (2), and (3), which meets the methodology outlined in the latest NRC endorsed industry guidance.

For the majority of the NEI 00-01 attributes listed in LAR Attachment B, the licensee stated that the approach used to conduct the post-fire safe shutdown analyses aligns with the NEI 00-01 guidance. However, there were several attributes for which the licensee stated that it aligns only with the intent of the NEI 00-01 guidance. Table 3.2-1, “Nuclear Safety Capability Assessment Method Review,” in Attachment B to this safety evaluation, identifies each applicable NEI 00-01 guidance section, documents whether the licensee stated that it met the NEI 00-01 guidance or provided justification for meeting the intent of that guidance, and presents the NRC staff’s evaluation of the acceptability of the licensee’s justification.

Because the NEI 00-01 guidance is only one acceptable means to demonstrate compliance, the NRC staff reviewed the instances where the licensee deviated from the guidance against the requirements of the NFPA 805 standard and determined that in all cases the alternative methodology used by the licensee was an acceptable means to meet the requirement. For instance, for several of the NEI 00-01 guidance attributes that deal with establishing safe shutdown paths, the licensee stated that they based their analysis on the concept of safe shutdown divisions rather than safe shutdown paths. This is acceptable to the staff because safe shutdown paths only address how the analysis is organized, hence their use has no impact on the results of the evaluation, making the use of safe shutdown divisions rather than safe shutdown paths a matter of preference rather than substance.

While performing the review of the licensee’s nuclear safety capability assessment method, the NRC staff identified several issues that required the licensee to provide additional information in order to adequately demonstrate compliance with specific NFPA 805, Section 2.4.2 requirements. By letter dated August 6, 2009 (Reference 37), the staff requested additional information regarding a number of regulatory and technical issues pertaining to the methodology

used to perform the nuclear safety capability assessment at HNP, specifically in regard to demonstrating compliance with common enclosure and circuit coordination requirements (in particular, RAI 3-18, RAI 3-64, and RAI 3-65 of the associated letter address these concerns).

In its letter dated August 13, 2009 (Reference 5), the licensee verified that the requirements of NFPA 805, Section 2.4.2.2.2, "Other Required Circuits," Subsection (a), regarding common power supply circuits, have been met for all operational conditions. The licensee stated that LAR Attachment B (the NEI 04-02 B-2 Table) refers to the appropriate circuit coordination studies. In addition, with the exception of backfeed, all other non-power operation circuit coordination concerns are bounded by the safe shutdown analysis. Finally, the licensee committed to update the coordination study as appropriate prior to implementation to incorporate the results of the backfeed evaluation. Based on the information provided in the August 13, 2009, submittal, the NRC staff finds that with the exception of the backfeed configuration at HNP, the licensee completed circuit coordination studies which demonstrate adequate breaker/fuse coordination. Completion of the coordination study for the backfeed configuration is considered an implementation item (SE Section 2.9; Item 1).

The NRC staff expressed a concern that fire-induced loss of DC control power to switchgear required for safe shutdown could cause a situation that does not meet the common enclosure requirements of NFPA 805. NFPA 805, Section 2.4.2.2.2, Subsection (b), requires that a common enclosure analysis be performed in order to verify that the effects of a fire will not extend outside of the immediate fire area due to fire-induced electrical faults on inadequately protected cables or via inadequately sealed fire area boundaries. In its letter dated August 13, 2009, the licensee stated that there are no associated circuits by common enclosure that create a compliance issue in regard to fire-induced damage to DC control power. In addition, the licensee has included the DC control power circuits as a part of the support equipment for the required switchgear, such that any fire damage to the DC control power cables will result in the switchgear and its associated protective devices being considered failed in the relevant safe shutdown analysis scenario. Based on the information provided in the August 13, 2009, submittal, the NRC staff finds that the licensee has adequately addressed the issue of fire damage to DC control power for switchgear units required for safe shutdown.

In its letter dated August 13, 2009, the licensee also provided a supplemental discussion regarding how HNP met the requirements for a common enclosure analysis. The licensee stated that the plant was originally designed with general coordination to ensure that a fault at the load or anywhere on the cable supplying the load would not damage the cable. In addition, the plant has in place an administrative process for controlling fuses. Subsequent to receiving this supplemental discussion, the staff requested additional information related to the fuse control program in a letter dated January 14, 2010 (Reference 38). In its letter dated February 4, 2010 (Reference 8), the licensee stated that HNP instituted a fuse program in 1987 because of problems with fuse coordination at different plants, as well as other fuse concerns. Accordingly, while the fuse program has not been in place since construction, it has been in place since 1987 (the date of initial fuel load), and the licensee also cited four different initiatives that address some portion of the fuse control issue. These initiatives verified a substantial number of the fuses at HNP, including all safety-related fuses in the plant.

Based on the information provided in the LAR and supplemental submittals, the licensee has taken appropriate actions to ensure that the fuses installed in circuits that have the potential to

- 39 -

adversely impact additional circuits required to meet the nuclear safety performance criteria will provide the required electrical protection under NFPA 805, Section 2.4.2.2.2. The licensee makes this claim based on the following actions taken in response to fuse control issues:

- The licensee undertook a significant baseline verification effort to physically inspect as high a percentage of installed fuses as possible.
- The licensee performed several followup verifications with different circuit populations to physically inspect additional installed fuses.
- All verification efforts have indicated that oversize fuses have not been a problem with respect to post-fire safe shutdown.
- A fuse control program has been in place since initial fuel load to verify that fuses installed in equipment are in accordance with the design requirements.
- On a continuing basis, as maintenance is performed on equipment, proper fuse sizing is verified as a matter of course via a standard plant procedure.

Given the above information, the NRC staff concludes that the licensee has taken appropriate actions to maintain the fuses installed in the plant consistent with the approved design at HNP.

Finally, the nuclear safety goals, objectives, and performance criteria of NFPA 805 allow more flexibility than the previous deterministic fire protection programs based on Appendix R to 10 CFR Part 50 and NUREG-0800, Section 9.5-1 (Reference 10), as well as, in part, NEI 00-01 Chapter 3, since NFPA 805 only requires the licensee to maintain the fuel in a safe and stable condition rather than achieve and maintain cold shutdown. The licensee stated that the NFPA 805 licensing basis for HNP will be to achieve and maintain safe and stable hot standby conditions. However, although the licensing basis going forward for HNP is to be able to achieve and maintain hot standby, the analyses previously performed to meet the deterministic fire protection criteria included actions and equipment to achieve cold shutdown. The licensee has made a decision to keep these analysis attributes, SSCs, and associated procedural actions within the RI/PB FPP in an effort to improve defense-in-depth. The NRC staff finds this acceptable because these actions are not required to meet the nuclear safety performance criteria, but do provide additional capability that adds to both fire protection defense-in-depth and nuclear safety defense-in-depth.

The NRC staff reviewed the documentation provided by the licensee describing the process used to perform the nuclear safety capability assessment required by NFPA 805, Section 2.4.2. The licensee performed this evaluation by comparing the HNP post-fire safe shutdown analysis against the NFPA 805 nuclear safety capability assessment requirements using the NRC endorsed process in Chapter 3 of NEI 00-01, Revision 1, and documenting the results of the review in the B-2 Table in accordance with NEI 04-02, Revision 1. Based on the information provided in the licensee's submittal, as supplemented, the NRC staff accepts the method the licensee used to perform the nuclear safety capability assessment 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, because the method

used either met the NRC endorsed guidance directly or met the intent of the endorsed guidance with adequate justification, as documented in SE Table 3.2-1.

3.2.2 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 PWRs is not permitted.

The NRC staff reviewed LAR Table 5-3, “10 CFR 50.48(c) – Applicability/Compliance References,” and Attachment C, “NEI 04-02 Table B-3 – Fire Area Transition,” to evaluate whether HNP meets the feed and bleed requirements. The licensee stated in LAR Table 5-3 that feed and bleed is not utilized as the sole fire-protected safe shutdown path at HNP for any scenario. The staff verified this by reviewing the designated safe shutdown path listed in LAR Attachment C for each fire area. This review confirmed that all fire area analyses include the safe shutdown equipment necessary to provide decay heat removal without relying on feed and bleed. In addition, all fire areas either met the deterministic requirements of NFPA 805, Section 4.2.3; or the performance-based evaluation performed in accordance with NFPA 805, Section 4.2.4, demonstrated that the integrated assessment of risk, defense-in-depth, and safety margin for the fire area was acceptable. Therefore, the staff determined that based on the information provided in LAR Table 5-3, as well as the fire area analyses documented in LAR Attachment D, 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 path at HNP.

3.2.3 Assessment of Multiple Spurious Operations

NFPA 805, Section 2.4.2.2.1, “Circuits Required in Nuclear Safety Functions,” states that:

Circuits required for the nuclear safety functions shall be identified. This includes circuits that are required for operation, that could prevent the operation, or that result in the maloperation of the equipment identified in 2.4.2.1, [“Nuclear Safety Capability Systems and Equipment Selection”]. This evaluation shall consider fire-induced failure modes such as hot shorts (external and internal), open circuits, and shorts to ground, to identify circuits that are required to support the proper operation of components required to achieve the nuclear safety performance criteria, including spurious operation and signals.

In addition, NFPA 805, Section 2.4.3.2, states that the probabilistic safety assessment (PSA) evaluation shall address the risk contribution associated with all potentially risk significant fire scenarios. Because the performance-based approach taken at HNP was to utilize fire risk evaluations in accordance with NFPA 805, Section 4.2.4.2, “Use of Fire Risk Evaluation,” adequately identifying and including potential multiple spurious operation (MSO) combinations is required to ensure that all potentially risk significant fire scenarios have been evaluated.

- 41 -

Accordingly, the NRC staff reviewed LAR Section 4.8.2.1, "Fire-Induced Multiple Spurious Operations Resolution," and Attachment F, "Fire-Induced Multiple Spurious Operations Resolution," to determine whether the licensee has adequately addressed MSO concerns at HNP. The licensee's chosen approach used an expert panel to identify potential MSO combinations that needed to be considered in the nuclear safety capability assessment, as well as to assess the plant-specific vulnerabilities associated with these MSO combinations.

The expert panels consisted of a diversified group of subject matter experts in the following:

- operations
- systems engineering
- fire protection
- post-fire safe shutdown (SSD) analysis
- probabilistic risk assessment
- fire protection and post-fire SSD consultants

The expert panels utilized guidance provided in Section 4.2, "Expert Panel Review," of Appendix F to NEI 00-01, Revision 1. Two MSO expert panels were performed for HNP.

The first expert panel, conducted in 2005, considered the post-fire safe shutdown analysis for HNP, the self assessment process identified in NEI 04-06, "Guidance for Self-Assessment of Circuit Failure Issues" (Reference 39), insights provided by the internal events PRA for HNP, industry and plant-specific operating experience, and a line-by-line review of the HNP piping and instrumentation drawings.

The first expert panel also generated a list of paired MSOs (two components spuriously actuated simultaneously) in an effort to reflect the intent of the guidance provided in RIS 2004-03, "Risk-Informed Approach for Post-Fire Safe-Shutdown Circuit Inspections," Revision 1 (Reference 40), regarding characterization of MSO combinations which could adversely affect the ability to safely shut down the plant.

A second expert panel, conducted in March 2008, considered all of the information available from the first expert panel as well as the generic list of MSOs provided by the Pressurized Water Reactor Owners Group as part of the update process for NEI 00-01, Revision 2. The second expert panel considered all possible spurious actuation combinations (i.e., they did not limit the assumption to two spuriously actuated components). The results of both expert panels were incorporated into the nuclear safety capability assessment as well as the Fire PRA for HNP.

The MSO combinations included in the nuclear safety capability assessment were evaluated with respect to compliance with the deterministic requirements of NFPA 805, as discussed in Section 4.2.3, "Deterministic Approach." For those situations in which the MSO combination did not meet the deterministic requirements of NFPA 805, the components and associated cables were added to the scope of the plant change evaluations performed for the associated fire area.

The NRC staff reviewed the licensee's expert panel process for identifying circuits susceptible to multiple spurious operations, as described above, and concludes that the licensee adopted a systematic and comprehensive process for identifying MSOs to be analyzed utilizing available industry guidance. Furthermore, the process used provides reasonable assurance that the fire risk evaluation appropriately identifies and includes risk-significant MSO combinations. Based on these conclusions, the NRC staff finds the licensee's approach for assessing the potential for multiple spurious operation combinations, acceptable for use at HNP.

3.2.4 Transition of Operator Manual Actions to Recovery Actions

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

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

NFPA 805, Section 4.2.3.1, states that:

One success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria without the use of recovery actions shall be protected by the requirements specified in either 4.2.3.2, 4.2.3.3, or 4.2.3.4, as applicable. Use of recovery actions to demonstrate availability of a success path for the nuclear safety performance criteria automatically shall imply use of the performance-based approach as outlined in 4.2.4.

NFPA 805, Section 4.2.4, "Performance-Based Approach," states the following:

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 4.8.2.2, "Operator Manual Actions Transition," and Attachment G, "Operator Manual Actions – Transition to Recovery Actions," to evaluate whether the licensee meets the associated requirements for the use of recovery actions per NFPA 805.

The licensee based its approach for transitioning operator manual actions (OMAs) into the 10 CFR 50.48(c) RI/PB FPP as recovery actions on NEI 04-02, Revision 1, Section 4.6, "Regulatory Submittal and Transition Documentation," as endorsed with exceptions by RG 1.205, Revision 0. However, as a result of lessons learned through the NFPA 805 pilot transition process, updated versions of these guidance documents became available during the NRC staff review of the HNP RI/PB FPP. As a result, although the program developed at HNP was based on the earlier guidance, the NRC staff utilized the most recent approved documents (see References 12 and 19) to conduct its review, as described below.

The population of OMAs addressed during the NFPA 805 transition process at HNP included the existing OMAs in the deterministic fire protection program, as well as those being added during the NFPA 805 transition to address MSOs and as a result of development of the Fire PRA. OMAs meeting the definition of a recovery action 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 the defense-in-depth considerations described in Section 1.2 of NFPA 805. Accordingly, the licensee defined a defense-in-depth recovery action as an action that is not needed to meet the nuclear safety performance criteria, but has been retained to provide defense-in-depth. In each instance, the licensee determined whether a transitioning OMA was a recovery action, a defense-in-depth recovery action, or not necessary for the post-transition RI/PB FPP.

While performing the review of the licensee's treatment of the transition of OMAs to recovery actions, the NRC staff identified several issues that required the licensee to provide additional information in order to adequately demonstrate compliance with specific portions of the applicable NFPA 805 requirements. By letter dated August 6, 2009, the staff requested additional information regarding a number of regulatory and technical issues pertaining to the methodology used to transition OMAs into NFPA 805 compliant recovery actions at HNP, specifically in regard to demonstrating the feasibility of recovery actions and the means for determining their risk impact (in particular, RAI 3-31, RAI 3-52, RAI 3-55, RAI 3-67, and RAI 3-68 of the associated letter address these concerns).

In the August 6, 2009, letter, the NRC staff requested the licensee provide additional information regarding the use of a 10 minute window for completion of control transfer from the control room to the auxiliary control panel (ACP) in the event of a control room fire. The staff requested that this include a performance-based analysis to justify the use of the 10 minute operator time window during alternate shutdown (ASD) wherein no spurious equipment actuations are postulated to occur. In its letter dated August 28, 2009 (Reference 6), the licensee responded that the 10 minute operator window for completion of control transfer from the control room to the ACP with no spurious actuations was not assumed or credited in the Fire PRA.

Instead, the Fire PRA analysis relied solely on the fire growth and suppression methods to identify SSCs that would be damaged by a fire. In addition, component failures or spurious actuations caused by any fire-induced damage were not subsequently credited as recovered by an OMA in the associated PSA. The Fire PRA also did not credit ASD for fires that originate in areas other than the main control board itself, and functional failures postulated as part of the Fire PRA were not recovered by OMAs in the associated PSA for any ASD fire scenarios. Accordingly, the risk in the applicable areas impacted by ASD provides a bounding assessment. The NRC staff finds this approach acceptable because fire-induced functional failures were not recovered in the Fire PRA, which resulted in a conservative assessment of the OMA risk.

The NRC staff also asked the licensee to explain how the use of defense-in-depth recovery actions that are not modeled in the Fire PRA meet the requirements of NFPA 805, Section 2.4.3.3, which requires the risk analysis to be based on the as-built, as-operated and maintained plant. In its letter dated October 9, 2009 (Reference 7), the licensee stated that it had reviewed all defense-in-depth recovery actions to verify that they could not have adverse consequences that would increase risk. The licensee also stated that it either revised any actions that could have adverse consequences to eliminate the adverse consequence, or planned modifications to eliminate the need for the recovery action.

In addition, the licensee stated that the circuits associated with all defense-in-depth recovery actions (except those associated with the engineered safety features actuation system (ESFAS) and cold shutdown actions) were modeled in the Fire PRA and treated as VFDRs, thus providing a conservative assessment of the defense-in-depth recovery action risk. A conservative estimate of the change in risk associated with a risk-informed change is acceptable, as described in RG 1.174 (Reference 13). Therefore, the staff accepts this approach as satisfying the risk-informed comparison between the deterministic and proposed performance-based requirements described in NFPA 805, Section 4.2.4.2.

- 44 -

The licensee stated that it subjected all recovery actions (including defense-in-depth recovery actions) to a feasibility review. In accordance with the NRC endorsed guidance in NEI 04-02, the feasibility criteria used were based on the nine attributes provided in Section B.5.2, "Methodology Success Path Resolution Considerations," of Appendix B, "Nuclear Safety Analysis," to NFPA 805. LAR Attachment G includes Table G-1, "Feasibility Criteria – Recovery Actions and defense-in-depth Recovery Actions (Based on NFPA 805 Appendix B.5.2(e) and NEI 04-02 Revision 1)," which lists the nine attributes used to assess recovery action feasibility. Four of those nine feasibility attributes (emergency lighting, tools-equipment, actions in the fire area, and time) reference a footnote in the submittal which states that the feasibility criterion will be utilized only for time critical recovery actions and defense-in-depth recovery actions that must be completed within two hours of an event.

Subsequently, the NRC staff asked the licensee to provide justification that it is not necessary for recovery actions and defense-in-depth recovery actions that must be completed after two hours to meet each of these four feasibility criteria. In its letter dated August 28, 2009, the licensee responded that following the completion of planned plant modifications, all recovery actions must be completed within two hours of an event, resulting in the application of all nine feasibility criteria for all scenarios.

The licensee also stated that defense-in-depth recovery actions required to be performed within two hours must meet all nine feasibility criteria, and those taken after two hours solely support cold shutdown, so were evaluated for feasibility against only the remaining five criteria. The licensee's evaluations for cold shutdown actions assumed the availability of adequate time to complete the action and obtain tools or supporting equipment since the plant can continue to be maintained in a safe and stable condition at hot standby. The NRC staff finds that the licensee's application of feasibility criteria for recovery actions, including defense-in-depth recovery actions, is consistent with the endorsed guidance found in NEI 04-02, Revision 2, regarding Appendix B.5.2(e) to NFPA 805, and is therefore acceptable.

In addition, the NRC staff requested that the licensee provide additional information regarding how it used thermal-hydraulic (T-H) analyses in the feasibility evaluations for recovery actions. In its letter dated August 28, 2009, the licensee stated that T-H analyses were used in manual action feasibility assessments to determine whether adequate time was available to complete the action before unrecoverable plant conditions or equipment damage could occur. Where adequate time and margin could not be demonstrated, the action was not credited as a recovery action or a defense-in-depth recovery action. The variance was then addressed through the modification process, a different compliance strategy, or via a risk-informed, performance-based evaluation. The NRC staff finds this approach acceptable based on the licensee's statements that (1) all circuit issues, except for ESFAS actuation and cold shutdown actions, were treated as VFDRs that were subsequently evaluated to have low risk, and (2) T-H analyses were used to verify that adequate time was available to perform the action.

The licensee was asked to provide the basis for the statement from LAR Section G.5.3.1.2, "Non-Alternative Shutdown Actions – Other Actions," which states that "due to the low risk benefit of performance of defense-in-depth actions, the additional effort per NUREG-1852 does not add measurable benefit." The NRC staff also requested that the licensee clarify whether the feasibility criteria in the LAR align with those from NUREG-1852, "Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire" (Reference 41).

In its letter dated October 9, 2009, the licensee responded that the risk analysts did not model the human error probabilities (HEPs) or perform a human reliability analysis (HRA) for the non-ASD defense-in-depth recovery actions in the Fire PRA. Instead, the unprotected cables that prompted the associated defense-in-depth recovery actions were included as VFDRs, with the exception of potential ESFAS and cold shutdown actions. Therefore, the risk of the VFDRs includes or bounds the risk of the defense-in-depth recovery actions. The licensee further stated that based on the acceptably low risk of the VFDRs without crediting completion of the defense-in-depth recovery actions, further reductions possible by calculating HEPs, performing HRAs, and modeling the defense-in-depth recovery actions in the Fire PRA would not be expected to change the conclusions made in the applicable LAR sections.

The licensee did not consider ESFAS and cold shutdown defense-in-depth recovery actions as VFDRs because (1) the spurious signal could be mitigated with control room or ACP actions, (2) spurious ESFAS actuations provide additional success paths beyond the designated success path, (3) ESFAS actuations do not directly result in the inability to meet the nuclear safety performance criteria, and (4) protection of ESFAS actuation logic is not required if the individual component controls are available and free from fire damage. Additionally, in the case of cold shutdown defense-in-depth recovery actions, they are not time critical. The licensee also provided a table of the feasibility criteria used at HNP and compared them to the criteria in NUREG-1852; the table indicated general alignment between the two. The NRC staff finds the above approach acceptable for the following reasons:

- The unprotected cables of concern that prompted the need for defense-in-depth recovery actions were included and evaluated as VFDRs whose risk was found to be acceptably low.
- The ESFAS actuations can be mitigated from the control room or ACP, and actions to address ESFAS actuations are not considered to be recovery actions.
- Cold shutdown defense-in-depth recovery actions are not time critical.

Based on the above considerations, the NRC staff finds that the licensee has followed the endorsed guidance of NEI 04-02 and RG 1.205 regarding the transition of OMAs to recovery actions in accordance with NPFA 805, thereby meeting the regulatory requirements of 10 CFR 50.48(c). The staff concludes that the feasibility criteria applied to recovery actions are acceptable based on conformance with the endorsed guidance contained in NEI 04-02 and the distinction regarding defense-in-depth actions that are necessary solely for cold shutdown conditions, where the NFPA 805 required end state is only hot standby.

It should be noted that the NRC staff does not accept the licensee's definition of time critical recovery actions based on an arbitrary two hour period; however, this criterion will not be applicable to the recovery actions that are retained after transition to NFPA 805, and is therefore acceptable for use within the specified attributes of the HNP RI/PB FPP (i.e., in regard to cold shutdown defense-in-depth recovery actions only).

3.2.5 Installation of Incipient Fire Detection Systems

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

cabinets at HNP during the incipient stage of a fire. The following discussion is based on the information provided by the licensee in LAR Section 4.8.2.4, "Incipient Fire Detection System."

The licensee selected the specific plant electrical cabinets to be monitored by the VEWFDS based on risk insights gained while developing the HNP Fire PRA. The VEWFDS are being provided as an enhancement to the existing plant fire protection program and are intended to either assist in preventing multiple spurious actuations that could result from fire damage within the cabinets, or prevent a fire within the cabinet from progressing to the point at which it could ignite overhead cables, resulting in the development of a hot gas layer (HGL) in the room. The VEWFDS accomplishes the first goal by detecting a fire before it has the opportunity to progress beyond the smoldering incipient stage, thereby preventing damage to more than the initial degrading component or subcomponent.

The code of record for the new VEWFDS detection system is NFPA 72, "National Fire Alarm and Signaling Code," 2010 Edition (Reference 42). NFPA 76, "Standard for the Fire Protection of Telecommunications Facilities" (Reference 43), is also being used as a part of the design basis with respect to transport time in order to ensure that the VEWFDS meets the performance goals for proper credit in the Fire PRA. Specifically, the maximum transport time of 60 seconds for the VEWFDS from NFPA 76 is being used as a design basis rather than the less conservative 120 second time requirement from NFPA 72 for air sampling detection systems.

The VEWFDS is an air sampling type fire detection system that utilizes "cloud chamber" detection technology to continually sample air from different zones. The detector is designed to identify submicrometer, precombustion particles at the earliest state of a fire (incipient stage) before the visible or smoldering smoke stage. According to statements made by the VEWFDS manufacturer for HNP, the cloud chamber design provides high sensitivity, while simultaneously maintaining a high level of discrimination with respect to false alarms. The VEWFDS is intended to detect the incipient stage of a fire and provide an alarm to operations personnel at the very earliest warning levels, before any resulting damage to the surrounding components.

Each individual detection zone layout connected to the VEWFDS (four zones maximum at HNP) will be designed specifically for that zone configuration, with each air sampling piping/tubing layout designed based on the requirements and limitations from the vendor's hydraulic calculations for air flow requirements. This will assure balanced air flow and adequate air transport times in accordance with the design requirements.

During initial setup, the licensee will determine the system alert and alarm settings for each detection zone as part of the installation and pre-operational testing of the VEWFDS. Guidance from NFPA 72 and the VEWFDS equipment manufacturer will be used to establish the alert and alarm thresholds during final commissioning of the system. Once established, the licensee will maintain the alert and alarm settings under the existing plant configuration control process (i.e., the engineering change process), which nominally includes all program change controls in addition to the engineering calculation justification process.

The licensee stated that the VEWFDS detectors will all be connected to a new fire alarm control panel (FACP) located in the auxiliary relay room adjacent to the main control room (MCR). The new FACP will be connected to the MCR annunciators such that indications of problems with the detection system, very early warning alerts, and actual fire condition alarms will be identified and available to the operators in the control room. Control room operators will respond to the

- 47 -

indications in accordance with the applicable plant operating procedures. In addition, any VEWFDS detector or system fault condition would be annunciated, investigated immediately, and appropriate compensatory measures implemented until the fault condition is corrected.

In response to VEWFDS alert and alarm indications, qualified plant operators or maintenance personnel will respond to investigate alert and alarm indications without delay, and will provide continuous attendance to the affected area until the condition is resolved. By letter dated August 28, 2009, the licensee provided supplemental information describing the qualifications that will be required for the initial responders to a VEWFDS alert or alarm. The licensee stated that responding personnel will have basic training in the use of a fire extinguisher, with the expectation that, if a developing fire is discovered by the responder, there will be an immediate action taken to suppress or control the fire. Additional indication of a fire will initiate an appropriate response by the HNP site fire brigade.

The VEWFDS has been designed to provide addressable alert signals that identify a specific zone (bank of cabinets) that is generating the alert/alarm signal. Responding personnel will then utilize portable equipment (either a handheld VEWFDS or a thermal imaging device) to locate the specific cabinet with the alert/alarm condition. The cabinet will be continuously monitored until the degrading component is repaired, the cabinet is de-energized, or the alarm is satisfactorily reset. The portable air sampling fire detection device will be provided for use by on-shift personnel as part of the VEWFDS modification. The portable VEWFDS will receive regularly scheduled surveillance, and preventive maintenance will ensure that the equipment is available and functional at all times. Thermal imaging camera equipment is also maintained and available for use as part of the existing HNP fire brigade equipment and tools complement.

The licensee stated that the VEWFDS will be installed and tested in accordance with the manufacturer's requirements and the code of record (i.e., NFPA 72). In addition, regular and preventive maintenance will be conducted in accordance with the recommendations of the VEWFDS equipment manufacturer, the provisions of NFPA 72, and the requirements of the HNP preventive maintenance program. The VEWFDS will also receive quarterly surveillance testing and annual maintenance as recommended by the original equipment manufacturer. During the quarterly system surveillance testing, the annunciation function of the control room annunciator light board will be exercised to verify the functionality of the unsupervised circuit utilized for the VEWFDS annunciator(s) on the main control board.

Performance monitoring and testing of the VEWFDS will become a part of the plant surveillance program and subject to all requirements of the program. Any changes to the established performance monitoring and testing requirements will be processed through the HNP configuration and design control process, which includes fire protection engineer review.

The NRC staff finds the fire protection aspects related to the proposed installation of the VEWFDS at HNP acceptable for the following reasons:

- The installation of the VEWFDS at HNP will be performed in accordance with the appropriate NFPA codes and the equipment manufacturers' requirements.
- The VEWFDS will be properly tested during commissioning such that the alert and alarm triggers will be set to provide an appropriate level of sensitivity without unnecessary nuisance or spurious alarms.

- The HNP configuration and design control process will control and maintain the setpoints for both alert and alarm functions from the VEWFDS.
- The VEWFDS equipment will be periodically tested and maintained in accordance with the original equipment manufacturers' requirements.
- First responders to VEWFDS indications will be trained in the use of fire extinguishers and instructed to suppress or control a fire that breaks out in the alarming cabinet.
- The licensee's procedure will require the first responders to remain in place until the degrading component is repaired, the cabinet is de-energized, or the alarm is satisfactorily reset.

In addition, the HNP Fire PRA modeled the installation of the VEWFDS and took credit for its use in assessing the risk of various fire areas during certain scenarios. Section 3.4 of this safety evaluation addresses the technical review of the treatment of the VEWFDS in the HNP Fire PRA, as well as the acceptability of the risk credit taken for the associated fire areas.

3.2.6 Conclusion for Section 3.2

The NRC staff reviewed the licensee's LAR, as supplemented, for conformity with the requirements contained NFPA 805, Section 2.4.2, regarding the process used to perform the nuclear safety capability assessment at HNP. The staff found 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 nuclear safety performance criteria of NFPA 805, Section 1.5.

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

The staff reviewed the licensee's process to identify and analyze MSOs. Based on the information provided in the LAR, as supplemented, the process used to identify and analyze MSOs at HNP is considered comprehensive and thorough. Through the use of an expert panel, potential MSO combinations were identified and included as necessary into the nuclear safety capability assessment as well as the applicable fire risk evaluations. The staff also considers the licensee's approach for assessing the potential for multiple spurious operation combinations to be acceptable because it was performed in accordance with NRC endorsed guidance.

The staff found that, based on the information provided in the LAR, as supplemented, the process used by the licensee to review, categorize, and address recovery actions during the transition from the existing deterministic fire protection licensing basis to a risk-informed, performance-based fire protection program is consistent with the NRC endorsed guidance contained in NEI 04-02 and RG 1.205 regarding the transition of OMAs to recovery actions and other actions required to be taken at a primary control station. Therefore, this process meets the regulatory requirements of 10 CFR 50.48(c) and the guidelines of NFPA 805.

The licensee has proposed the installation of a VEWFDS to monitor conditions in certain key electrical cabinets at HNP. Based on the information provided in the LAR, as supplemented,

the staff found that the fire protection aspects of the proposed VEWFDS installation are acceptable because the installation will be done in accordance with appropriate NFPA codes, the VEWFDS will be properly tested during commissioning, the setpoints for alert and alarm levels will be controlled through the HNP configuration and design control process, the VEWFDS will be periodically tested and maintained, and the first responders will be trained in the use of fire extinguishers. In addition, first responders will remain in place until the component is repaired, the cabinet is de-energized, or the alarm is satisfactorily reset.

3.3 Fire Modeling

NFPA 805 allows the use of fire modeling as a performance-based alternative to the deterministic approach outlined in the standard. 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.”

NFPA 805, Section 2.4.1, “Fire Modeling Calculations,” specifically addresses the application requirements for using performance-based fire models as follows:

- NFPA 805, Section 2.4.1.2.1, “Acceptable Models,” states the following:

Only fire models that are acceptable to the authority having jurisdiction shall be used in fire modeling calculations.

- NFPA 805, Section 2.4.1.2.2, “Limitations of Use,” states the following:

Fire models shall only be applied within the limitations of that fire model.

- NFPA 805, Section 2.4.1.2.3, “Validation of Models,” states the following:

The fire models shall be verified and validated.

NFPA 805, Section 4.2.4.1, “Use of Fire Modeling,” identifies the specific approach for use of fire modeling as a performance-based method, including the following required aspects: identify targets, establish damage thresholds, determine limiting condition(s), establish fire scenarios, protection of required nuclear safety success path(s), and operations guidance.

In addition, RG 1.205, Revision 1 (Reference 12), Regulatory Position C.4.2, and NEI 04-02, Revision 2 (Reference 19), Section 5.1.2, “Fire Modeling Considerations,” provide guidance by identifying fire models that are considered acceptable for use by the NRC for plants transitioning to a performance-based FPP in accordance with NFPA 805 and 10 CFR 50.48(c).

The NRC staff reviewed LAR Section 4.5.2, “Fire Modeling,” which describes how the licensee used fire modeling as a part of the transition to NFPA 805 at HNP, and LAR Section 4.7.3, “Compliance with Quality Requirements in Section 2.7.3 of NFPA 805,” which describes how the licensee performed fire modeling calculations in compliance with the NFPA 805 performance-based evaluation quality requirements for fire protection systems and features at HNP, to determine whether the fire modeling used to support transition to NFPA 805 is acceptable.

In LAR Section 4.5.2, the licensee stated that fire modeling analyses were used only to support development of the HNP Fire PRA for use in performing fire risk evaluations (i.e., in accordance with NFPA 805, Section 4.2.4.2, “Use of Fire Risk Evaluations”), and were not intended to solely constitute a performance-based method for demonstrating compliance with the nuclear safety performance criteria in accordance with NFPA 805, Section 4.2.4.1. Since the licensee did not use fire modeling as a performance-based method, but rather used only the fire risk evaluation performance-based method (i.e., Fire PRA) with fire modeling analyses input, the NRC staff reviewed the technical adequacy of the HNP Fire PRA, including the supporting fire modeling analyses, as documented in Section 3.4.1 of this safety evaluation, to evaluate compliance with the nuclear safety performance criteria.

The licensee did not propose any fire modeling methods to support performance-based evaluations in accordance with NFPA 805, Section 4.2.4.1, as the sole means for demonstrating compliance with the nuclear safety performance criteria. Therefore, the NRC staff has not reviewed any such methods for acceptability in that context. Since the staff has not reviewed any such fire modeling methods, the staff does not find any plant-specific fire modeling methods acceptable for use to support compliance with NFPA 805, Section 4.2.4.1, as a part of this licensing action supporting transition to NFPA 805 at HNP.

3.4 Fire Risk Assessments

This section addresses the licensee’s fire risk evaluation performance-based method, which is based on NFPA 805, Section 4.2.4.2. The licensee chose to use only the fire risk evaluation performance-based method in accordance with NFPA 805, Section 4.2.4.2. The fire modeling performance-based 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 the following:

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.

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 Quality of the Fire Probabilistic Risk Assessment

In reviewing a risk-informed LAR, the NRC staff evaluates the validity of the plant-specific PRA models and their application as proposed in the LAR. The objective of the PRA quality review is to determine whether the plant-specific PRA used in evaluating the proposed LAR is of sufficient scope, level of detail, and technical adequacy for the application. The staff evaluated the PRA quality information provided by the licensee in its NFPA 805 submittal, as supplemented, including industry peer review results and self assessments performed by the licensee. The staff reviewed LAR Section 4.5.1, “Fire PRA Development and Assessment,” Attachment C, “NEI 04-02 Table B-3 – Fire Area Transition,” Attachment W, “Internal Events PRA Quality,” Attachment X, “Fire PRA Quality,” Attachment Y, “Fire PRA Insights,” and Attachment Z, “Fire PRA Quality Post-Transition Process,” in order to assess the quality of the HNP Fire PRA.

In addition, as discussed in more detail below, because the HNP application is an NFPA 805 pilot application, consistent with Regulatory Position C.4.3 of RG 1.205, Revision 0 (Reference 25), the NRC staff performed a pre-submittal audit of the licensee's Fire PRA model since an industry peer review of the HNP Fire PRA had not yet been performed (a focused scope industry peer review was performed subsequent to the NRC audit).

Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (Reference 14), states that "when used in support of an application, this regulatory guide will obviate the need for an in-depth review of the base PRA by NRC reviewers, allowing them to focus their review on key assumptions and areas identified by peer reviewers as being of concern and relevant to the application."

Because an industry peer review of the HNP Fire PRA was not performed, the NRC staff performed an in-depth review of the base Fire PRA model, as described in detail below. The need for the NRC staff to perform an in-depth review of the base PRA model for the NFPA 805 pilot plants was recognized when the pilot process was initiated. Regulatory Guide 1.205, Revision 0, stated that "the fire PSAs developed by the licensees that participate in the NFPA 805 Pilot Program will be reviewed by the NRC over the course of the program, such that a separate peer review of the fire PSA will not be required." This statement was removed from RG 1.205, Revision 1 (Reference 12), because the NRC staff expects that all licensees requesting to transition to NFPA 805 after completion of the pilot process will conduct an industry peer review of their Fire PRA models in accordance with RG 1.200.

The licensee developed its Fire PRA model using the guidance of NUREG/CR-6850, "EPRI/NRC-RES, Fire PRA Methodology for Nuclear Power Facilities" (Reference 44). The model addresses both Level 1 (core damage frequency) and partial Level 2 (i.e., large early release frequency only) PRA during at-power conditions. The licensee modified its internal events PRA model to capture the effects of fire, both as the initiator of an event and to characterize the subsequent potential failure modes for affected circuits or individual plant SSCs (targets), including fire-affected human actions.

The licensee did not identify any (1) known outstanding plant changes that would require a change to the Fire PRA model or (2) any planned plant changes that would significantly impact the PRA model, beyond those identified and scheduled to be implemented as part of the transition to a fire protection program based on NFPA 805. Therefore, the NRC staff finds that the Fire PRA model for HNP represents the as-built, as-operated and maintained plant as it will be configured after full implementation of NFPA 805.

The licensee identified administrative controls and processes used to maintain the Fire PRA model current with plant changes and to evaluate any outstanding changes not yet incorporated into the PRA model for potential risk impact as a part of the routine change evaluation process. Further, as described in Section 3.8.3 of this safety evaluation, the licensee has a program for ensuring that developers and users of these models are appropriately trained and qualified.

Internal Events PRA Model

The licensee evaluated the technical adequacy of the portions of its internal events PRA model used to support development of the Fire PRA model by first performing a peer review of the

HNP internal events PRA model, followed by a self assessment gap analysis for the model, and finally a focused scope peer review of the internal events PRA.

During the initial peer review, the PRA model was evaluated using the American Society of Mechanical Engineers (ASME) RA-S-2002 version of the PRA standard, as endorsed by RG 1.200, Revision 0, which was issued for trial use in 2004 as a part of NUREG-0800, Section 19.1 (Reference 17). The licensee stated that all findings and observations (F&Os) from this peer review have been resolved.

The self assessment gap analysis was performed using the ASME RA-Sb-2005 version of the PRA standard, as endorsed by RG 1.200, Revision 1, to identify any gaps in meeting Capability Category II for each of the supporting requirements. The licensee stated that the additional scope of work identified by the self assessment has also been completed.

The concluding focused scope peer review was conducted using the ASME RA-Sb-2005 version of the PRA standard, as endorsed by RG 1.200, Revision 1, as well as the draft American National Standards Institute/American Nuclear Society Fire PRA Standard (ANSI/ANS 58.23; see Reference 54). The focused scope peer review addressed those technical elements of the PRA standard that could impact the quality of the Fire PRA, and for which the HNP internal events PRA was assigned either Capability Category I or a determination of "Not Met."

The focused scope peer review identified additional F&Os to be resolved. The licensee identified the resolution of the F&Os from the focused scope peer review in LAR Attachment W. The licensee addressed all of the remaining F&Os through either a PRA model change or a specific disposition applicable to this licensing action. Table 3.4-1, "Internal Events PRA Findings and Observations Resolution," in Attachment C, "Fire Risk Evaluation Tables," to this safety evaluation summarizes the NRC staff's review of the licensee's resolution of the F&Os.

Based on its review of the licensee's disposition of the F&Os identified in the focused scope peer review, the NRC staff found all but one of the licensee's dispositions acceptable. The licensee did not adequately disposition internal events peer review F&O DA-C1-01, in which the licensee used a value of 0.33 for generic data sources with zero failures.

However, the NRC staff concludes that the use of a more accepted value in these circumstances would not impact the conclusions drawn from the results associated with this application. Accordingly, considering the minimal impact reasonably expected from changes to the PRA associated with addressing this single item, the staff concludes that the licensee has demonstrated that the internal events PRA model is technically adequate to support the NFPA 805 risk calculations necessary for this license amendment.

Notwithstanding the technical adequacy of the HNP internal events PRA model at Capability Category II, the licensee presented a table of required PRA capability categories for Fire PRA evaluations in LAR Attachment W. This table states, in part, that Capability Category I is acceptable for all supporting requirements within the technical element "Data." In addition, LAR Attachment X proposes a justification which states, in part, that "fire failures dominate equipment failures." The NRC staff does not accept this general conclusion or its proposed basis. Consistent with RG 1.200, Revision 2, data used in the internal events PRA model should meet Capability Category II for use in a Fire PRA, unless acceptable specific justification for each individual supporting requirement is provided.

Fire PRA Model

Since HNP is an industry pilot for NFPA 805, consistent with RG 1.205, Revision 0, the NRC staff performed the review of the licensee's Fire PRA model to determine its technical adequacy because an industry peer review of the HNP Fire PRA model had not yet been performed. The NRC staff conducted its review of the HNP Fire PRA model in February 2008 during a pre-submittal audit, the results of which are documented in an audit report (Reference 45).

The NRC staff review compared the licensee's Fire PRA characteristics against the supporting requirements of Part 3, "Internal Fires at Power Probabilistic Risk Assessment Requirements," of the draft standard ASME/ANS RA-S-2007, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Reference 46). The review also used the guidance set forth in NEI 07-12, "Fire Probabilistic Risk Assessment Peer Review Process Guidance" (Reference 47). As noted in the audit report, the Fire PRA was not complete at the time of the staff's review, and further work was ongoing by the licensee to finalize the Fire PRA results. Therefore, the NRC staff concluded that (1) the review could not be regarded as sufficient for a determination of the technical adequacy of the licensee's PRA to support risk-informed applications and (2) an additional review of the completed HNP Fire PRA would be necessary.

The licensee provided a summary level description of changes made to the PRA subsequent to the NRC staff audit. These changes consisted primarily of enhancements to the documentation, data updates, and increased detail in assessing risk significant sources and scenarios. The licensee stated that none of the changes made by the licensee to the HNP Fire PRA since the NRC staff's audit represented a change in the methodology of the PRA that was reviewed during the audit. The licensee also concluded that the scope of these changes would not invalidate any of the prior reviews conducted. The NRC staff reviewed the revision summaries and the licensee's conclusions regarding the impact of the changes and determined that the NRC's prior audit results provide an acceptable basis to conclude that the portions of the Fire PRA previously determined to be acceptable during the staff audit remain acceptable.

Upon completion of the HNP Fire PRA, the industry conducted a peer review of the licensee's model. This review consisted of a focused scope review, evaluating areas previously identified by the NRC as (1) not complete, (2) having findings or suggestions, or (3) assigned a Capability Category I. This review generated additional findings and suggestions, which the licensee then dispositioned. In addition, because a full-scope industry peer review of the HNP Fire PRA was not performed, the NRC staff reviewed a number of aspects of the Fire PRA model in detail.

Table 3.4-2, "Fire PRA Findings and Observations Resolution," in Attachment C to this safety evaluation summarizes the staff review of the licensee's resolution for findings from the NRC staff audit (including both F&Os as well as supporting requirements evaluated as less than Capability Category II without any specific F&O) and the focused scope peer review. As a result of this review and the supplemental information provided, the NRC staff concludes that the HNP Fire PRA meets the PRA standard at the capability categories stated by the licensee.

Fire Modeling in Support of the Development of a Fire PRA

Typically, the technical adequacy of the fire modeling that supports development of the base Fire PRA for a risk-informed license application is determined by the PRA standards and associated peer review activities, with the NRC staff review focused primarily on the licensee's

resolution of peer review findings and the actual use of (changes made to) the PRA to address the risk impacts of the proposed LAR, as described above. However, since this LAR was a pilot application of the new 10 CFR 50.48(c) requirements, the staff performed additional detailed reviews of the specific fire modeling used to support the HNP Fire PRA in order to gain further assurance that the methods and approaches used for the application to transition to NFPA 805 were technically adequate. The following paragraphs discuss the staff's additional review of the licensee's fire modeling that was used in support of the development of the HNP Fire PRA.

According to LAR Section 4.5.2, "Fire Modeling," the application of fire modeling was intended to develop the zone of influence (ZOI) around ignition sources in order to determine the thresholds at which a target would exceed the critical temperature or radiant heat flux. This approach provides a basis for the scoping or screening evaluation as part of the HNP Fire PRA.

The licensee's ZOI approach applied a generic fire modeling methodology (a screening tool) to distinguish between fire scenarios that required further evaluation and those that did not require further evaluation. A collection of pre-solved empirical correlation solution methodologies was also presented. In general, this methodology developed generalized ZOIs for different target classes around the types of ignition sources that would be expected to be present in a nuclear power plant fire scenario as a means for performing a fire hazard analysis. The screening tool and associated methods involved the use of one or more empirical correlations or computer zone models. Spreadsheet programs were used to manage the calculations and data in the empirical screening tool methodology.

The licensee also developed screening approaches for the evaluation of ignition sources to determine the potential for the generation of an HGL in the compartment or fire area being analyzed. The Fire PRA used these HGL screening approaches to further screen ignition sources, scenarios, and compartments that would not be expected to generate an HGL, and to identify the ignition sources that have the potential to generate an HGL for further analysis.

Qualified personnel performed a plant walk-down to identify ignition sources and surrounding targets or SSCs in compartments and applied the pre-solved empirical correlation screening tool to assess whether the SSCs were within the ZOI of the ignition source. Based on the fire hazard present, these generalized ZOIs were used to screen from further consideration those HNP-specific ignition sources that did not adversely affect the operation of credited SSCs, or targets, following a fire. The licensee's screening was based on the 98th percentile fire heat release rate (HRR) from the NUREG/CR-6850 methodology.

The detailed Fire PRA submitted in support of the licensee's application further evaluated the ignition sources determined to adversely affect the operation of credited SSCs. The licensee adjusted the HRR values for a limited number of ignition sources (i.e., cabinets) based on fire modeling insights. Transient fire HRRs were also adjusted in areas with stricter transient controls. In addition, the licensee used the 75th percentile HRR for high energy arcing faults (HEAFs). Ignition sources determined to adversely affect the operation of credited SSCs were further evaluated in the detailed Fire PRA to support the NFPA 805 transition request.

NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications" (Reference 48), documents the verification and validation (V&V) of five selected fire models commonly used to support applications of risk-informed, performance-based fire protection at nuclear power plants. The seven volumes of this NUREG-series report provide

- 55 -

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 nuclear power plant 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 fire modeling elements performed by the licensee using the V&V applications contained in NUREG-1824 to support the transition to NFPA 805 at HNP, the NRC approves the use of these models, provided that the intended application is within the appropriate limitations, as identified in NUREG-1824.

In LAR Section 4.5.2, the licensee also identified the use of several empirical correlations that are not addressed in NUREG-1824. The NRC staff reviewed the empirical correlation screening tool methodology, as well as the related material provided in the LAR, as supplemented by letter dated August 13, 2009 (Reference 5), in order to determine whether the licensee adequately demonstrated alignment with specific portions of the applicable NUREG-1824 guidance.

By letter dated August 6, 2009 (Reference 37), the NRC staff sought additional information related to the fire modeling used in support of the HNP Fire PRA in regard to: (1) identification of the specific fire models, tools, and correlations used at HNP, including the specific version of any fire modeling software used; (2) assurance that the fire models and empirical correlations used in the associated analyses were applied within their appropriate scopes and limitations; (3) providing a detailed description of the V&V status for the applied models and correlations; and (4) providing the methods, input data, models, and V&V used for special purposes to analyze seven different compartments and fire areas at HNP (in particular, RAI 5-2, RAI 5-3, and RAI 5-6 of the associated letter address these concerns).

In its August 13, 2009, letter the licensee provided a detailed listing of the fire models and empirical correlations used in the screening tool, including the specific versions of the software packages used. Included in this information was a method for calculating the temperature of the exposing vent plume from select electrical cabinets originally presented by S. Yokoi in 1960 (Reference 49). Additional data from NUREG/CR-6850 for solid bottom cable trays and cable soak time were also incorporated into the fire models, where appropriate.

In addition, the licensee provided detailed information regarding the correlations and fire models used to support implementation of NFPA 805 at HNP, as well as a cross reference between major sections of American Society for Testing and Materials (ASTM) guidance document ASTM E 1355-05a, "Standard Guide for Evaluating Predictive Capability of Deterministic Fire Models" (Reference 50), and the associated correlations in terms of their applicability and validation. Included in the discussion was a summary of the treatment of the ZOI for electrical panels with vertical vents based on the paper by Yokoi.

Finally, the licensee described in detail the models and correlations used in the seven compartments and fire areas identified at HNP where fire models were identified as having been used for special purposes. Included in these descriptions was an empirical method/correlation for calculating flame spread rate along a cable tray, a motor control center fire analysis, a cable damage calculation that calculated the time required to damage to a cable above an electrical cabinet based on the method presented in Appendix H of NUREG/CR-6850, and a calculation that determined the HRR necessary to generate an HGL sufficient to damage cable.

The screening tool described in the LAR, as supplemented, constitutes a technical reference guide, a user's guide, and the V&V basis. Table 3.4-3, "V&V Basis for Fire Modeling Correlations Used at HNP," in Attachment C to this safety evaluation identifies these empirical correlations and models for the screening tool.

For the fire modeling screening tool and other approaches documented in the LAR, as supplemented, the NRC staff reviewed the quality assurance process requirements of NFPA 805, Section 2.7.3, "Quality," for performing V&V, limiting the application of acceptable methods and models to within prescribed boundaries, ensuring that personnel applying acceptable methods are qualified, and performing uncertainty analyses. The staff assessed the acceptability of the application of each empirical correlation based on the adequacy of the V&V documentation and the correlation's applicability within its limits. Specifically, the staff used the following criteria in assessing the acceptability of each empirical correlation:

- The empirical correlation is included in a fire model for which verification and validation has been completed and documented in NUREG-1824, and the correlation is applied within the limits of its applicability;
- The empirical correlation is widely accepted and utilized by fire protection engineering professionals, is documented in an authoritative publication of the Society of Fire Protection Engineers (SFPE) (e.g., *The SFPE Handbook of Fire Protection Engineering*), and is applied within the limits of its applicability; or
- The empirical correlation has been subjected to a peer review, is published in a widely recognized peer-reviewed journal article or in a conference report (e.g., *Fire Safety Journal*), and is applied within the limits of its applicability.

Based on the empirical correlations meeting one or more of these criteria, the NRC staff finds the application of each of the correlations used in the HNP Fire PRA to support transition to NFPA 805, acceptable. SE Table 3.4-3 summarizes the empirical correlations used, how each was applied in the HNP Fire PRA, the V&V basis for each, and the staff evaluation for each.

In general, the criteria and modeling techniques referenced in NUREG/CR-6850 and the empirical correlation screening tool were the primary tools used for fire modeling in the development of the HNP Fire PRA. However, some of the fire modeling used for determining the ZOI of postulated fire scenarios, as well as for determination of the critical fire size needed for HGL formation in the compartments of interest, differed from those methods referenced in NUREG/CR-6850. SE Table 3.4-3 also summarizes these additional fire models, and the NRC staff's evaluation of the acceptability of each of the additional methods.

Table 3.4-4, "V&V Basis for Fire Model Correlations of Other Models Used at HNP," in Attachment C to this safety evaluation identifies the other fire modeling calculations used in the development of the HNP Fire PRA. For each of these additional methods, the NRC staff reviewed the fire protection program quality assurance process requirements of NFPA 805, Section 2.7.3, for performing V&V, limiting the application of acceptable methods and models to within prescribed boundaries, ensuring that personnel applying acceptable methods are qualified, and performing uncertainty analyses.

The NRC staff found that the theoretical bases of the models and empirical correlations used in the fire modeling calculations that were not addressed in NUREG-1824 were identified and submitted to peer reviewed journals, authoritative publications such as *The SFPE Handbook of Fire Protection Engineering*, and SFPE engineering guides. In addition, all models and empirical correlations were subjected to review by recognized experts fully conversant with the fire phenomena, but not involved with the production of the fire model.

This approach is consistent with Section 8, "Theoretical Basis for the Model," of ASTM E 1355-05a. Specifically, Section 8.1 states that "the theoretical basis of the model should be reviewed by one or more recognized experts fully conversant with the chemistry and physics of fire phenomenon but not involved with the production of the model." Accordingly, publication of the theoretical basis of the additional fire models used at HNP in authoritative materials, such as those identified above, is sufficient to fulfill this review requirement.

As reflected in Table 3.4-3 and Table 3.4-4 of Attachment C to this safety evaluation, the fire modeling employed by the licensee in the development of the HNP Fire PRA utilized either (1) empirical correlations that provide bounding solutions for the ZOI, or (2) conservative input parameters in the application of the empirical correlation, which produced conservative results for the ZOI. Based on the above, the NRC staff finds that this approach provides reasonable assurance that the fire modeling used in the development of the fire scenarios for the HNP Fire PRA is appropriate, and thus acceptable for use in this application (i.e., transition to NFPA 805).

Incipient Fire Detection Credit

In its February 4, 2010, letter (Reference 8), as part of a response to a request for additional information, the licensee provided a description of the event tree approach used to estimate the credit taken for the VEWFDS at HNP, including a comparison against two other approaches: one based on EPRI Technical Report 1016735, "Fire PRA Methods Enhancements: Additions, Clarifications, and Refinements to EPRI 1011989 (NUREG/CR-6850)," and the other based on "Closure of National Fire Protection Association 805 Frequently Asked Question 08-0046 – Incipient Fire Detection Systems" (References 51 and 52, respectively). In its response, the licensee indicated that the approach employed for the HNP Fire PRA model was developed prior to publication of either of these approaches.

The licensee described the correspondence between the event trees for VEWFDS credit from the three approaches as being essentially equivalent in concept. However, the NRC staff does not accept that the approach used in the HNP Fire PRA model is equivalent in concept to the approaches described in EPRI 1016735 and the NRC memo documenting closure of FAQ 08-0046. To the contrary, the approach used by the licensee adjusts the time available for suppression, whereas both the EPRI and the approved FAQ 08-0046 methods consider the realistic effect of incipient detection on fire ignition frequency and other factors.

As discussed in Section 3.4.7 of this safety evaluation, this discrepancy is overcome by the sensitivity analysis the licensee has performed in regard to this method, which demonstrates that the resulting risk calculations would not significantly change for the NFPA 805 LAR if one of the above approaches were used at HNP.

However, because the method employed in the HNP Fire PRA is not an appropriate physical representation of incipient detection, the NRC staff concludes that the licensee may not make

more than minimal risk-informed changes without prior NRC review and approval for those fire areas that credit incipient detection until the incipient detection modeling in the HNP Fire PRA is modified to be consistent with the approved methods. This restriction has been included in the fire protection license condition in Section 4.0 of this safety evaluation.

The licensee also quantified the sensitivity of the VEWFDS credit estimated from its approach when using a range of values for the input parameters corresponding to those used for the other approaches, in particular those associated with FAQ 08-0046. The results indicated approximately a 33 percent increase in both the total fire CDF and the change in CDF associated with VFDRs (VFDR- Δ -CDF). However, in neither case was the increase of a magnitude that would impact the decisions for transition that were associated with the results. In addition, the licensee provided a table showing the CDF and VFDR- Δ -CDF increases from the base to the most representative sensitivity case for each fire compartment. None of these increases would affect the decisions for transition to NFPA 805 based on the results.

The licensee also stated the following:

The post-transition monitoring program will ensure that the VEWFDS unreliability will be kept below a level needed to assure the effectiveness being credited by maintaining the system according to both NFPA 72 and the manufacturer's maintenance and testing schedule. Additionally, the system is self monitoring and will alert the plant to system faults or precursors to a fault.

Based on the anticipated level of monitoring and maintenance, the manufacturer has provided reliability estimates that are better than those currently used in the associated PRA analysis. Accordingly, the NRC staff finds the licensee's approach used to estimate the credit taken for the VEWFDS at HNP acceptable for use as a part of the NFPA 805 transition application, subject to the limitations included in the associated license condition.

Conclusions Regarding Fire PRA Quality

Because: (1) the PRA models conform to the applicable industry PRA standards for internal events and fires at an appropriate capability category, considering the acceptable disposition of the peer and NRC staff review findings; (2) the fire modeling used to support the development of the HNP Fire PRA has been confirmed as appropriate and acceptable, and (3) the PRA models represent the as-built, as-operated and maintained plant as it will be configured at full implementation of NFPA 805, the NRC staff finds that the technical adequacy and quality of the HNP PRA is sufficient for the fire risk evaluations that support the proposed license amendment.

In addition, the licensee's PRA satisfies the guidance in RG 1.174, Sections 2.2.3 and 2.5 (Reference 13), regarding quality of the PRA analysis and quality assurance; RG 1.205, Section 4.3, regarding fire probabilistic risk assessment; and NUREG-0800, Section 19.2 (Reference 18), regarding the review of risk information used to support permanent plant-specific changes to the licensing basis, which further supports the NRC staff's conclusion that the HNP PRA is technically adequate and of sufficient quality to allow transition to NFPA 805.

Finally, based on the licensee's administrative controls to maintain the PRA models current and assure continued quality, using only qualified staff and contractors (as described in Section 3.8.3 of this safety evaluation), the NRC staff finds that the quality of the HNP PRA is

sufficient to support self-approval of future risk-informed changes to the fire protection program under the NFPA 805 license condition following implementation of the PRA-credited plant modifications (the license condition includes the plant modifications credited in the HNP PRA).

However, until the incipient detection modeling in the HNP Fire PRA is modified to be consistent with the approved methods, the licensee may not make more than minimal risk-informed changes without prior NRC review and approval for those fire areas crediting incipient detection, as discussed above and included as a restriction in the HNP NFPA 805 license condition.

3.4.2 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.”

Defense-in-Depth

As a supplement to the definition of defense-in-depth provided in NFPA 805, Section 1.2, the NRC-endorsed guidance in NEI 04-02, Revision 2 (Reference 19), states the following:

In general, the defense-in-depth requirement is satisfied if the proposed change does not result in a substantial imbalance in:

- Preventing fires from starting
- Detecting fires quickly and extinguishing those that occur, thereby limiting 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

In addition, NEI 00-01, Revision 2 (Reference 35), provides the following guidance with respect to maintaining defense-in-depth:

Consistency with the defense-in-depth philosophy is maintained if the following acceptance guidelines, or their equivalent, are met:

1. A reasonable balance is preserved among 10 CFR 50 Appendix R defense-in-depth elements.
2. Over-reliance on, and permitting increased length of time or risk when performing programmatic activities to compensate for weaknesses in plant design is avoided.
3. Pre-fire nuclear safety system redundancy, independence, and diversity are preserved commensurate with the expected frequency and consequences of challenges to the system and uncertainties (e.g., no risk

- 60 -

outliers). (This should not be construed to mean that more than one safe shutdown train must be maintained free of fire damage.)

4. Independence of defense-in-depth elements is not degraded.
5. Defenses against human errors are preserved.
6. The intent of the General Design Criteria in Appendix A to 10 CFR Part 50 is maintained.

The NRC staff reviewed LAR Section 4.8.4, "Required Systems and Features," Table 4-6, "Considerations for Defense-in-Depth Determination," Table 4-7, which shows the approach to address the term "required" system per the NFPA 805 requirements, Table 4-8-1, "Required Suppression Systems," and Table 4-8-2, "Required Detection Systems," as well as the associated supplemental information, in order to determine whether the principles of defense-in-depth were maintained in regard to the planned transition to NFPA 805 at HNP.

When implementing the performance-based approach, the licensee followed the guidance contained in Section 5.3, "Plant Change Process," of NEI 04-02, which includes a detailed consideration of defense-in-depth and safety margins as part of the change process. The licensee documented the method used to meet the defense-in-depth requirements of NFPA 805 in LAR Table 4-6. For each of the major fire protection defense-in-depth attributes, the licensee provided several examples of how that attribute was addressed, along with a discussion of the considerations used in evaluating the element. Most of these attributes are required to be in place in order to demonstrate compliance with the fundamental fire protection program and design elements of NFPA 805 Chapter 3. However, some of the defense-in-depth elements are variable, depending upon the results of the performance-based analyses conducted during the NFPA 805 transition (e.g., ERFBS, use of fire rated cable, use of recovery actions, etc.). In addition, identification of the required automatic fire suppression and fire detection systems was performed during the plant change process.

As part of the plant change process, this method for addressing defense-in-depth was implemented in the fire safety analyses (FSAs) which involve change evaluations performed to evaluate VFDRs. Accordingly, each performance-based FSA includes a table documenting the review of defense-in-depth, as well as a discussion of how the proposed change maintains adequate safety margins. The table (1) documents the existing balance of defense-in-depth and states whether or not specific elements of defense-in-depth were reduced by the VFDR (and whether or not the element was acceptable based on being adequate for the hazard), (2) notes whether or not the element needs to be strengthened by modifications (such as the installation of a VEWFDs or other fire protection modification), and (3) documents the presence of automatic fire detection and suppression systems. As such, the table in the FSA is the licensee's internal record of the systems required to meet the nuclear safety performance criteria and defense-in-depth requirements of NFPA 805.

The licensee's process for evaluating fire suppression and detection systems also incorporated a review of those suppression and detection systems credited to meet the NFPA 805 deterministic requirements. This review included the identification of suppression and detection systems credited in the NRC staff approved deviations from the existing fire protection licensing basis, as well as those credited by the licensee in engineering equivalency evaluations.

In addition to the defense-in-depth review conducted as part of the plant change process, the licensee also performed a review with regard to risk. A key step in the establishment of the licensee's NFPA 805 Monitoring Program is the review performed during the NFPA 805 expert panel process. One of the tasks assigned to the expert panel was to identify those fire protection systems and features that are considered to be of "higher significance." The licensee designated any automatic fire suppression or detection systems considered to be of higher significance as required to meet defense-in-depth.

LAR Tables 4-8-1 and 4-8-2 document the results of the licensee's review of fire suppression and fire detection systems at HNP.

Safety Margins

Although not a part of the regulations, Section A.2.4.4.3 of Appendix A to NFPA 805 provides the following background related to the meaning of the term "safety margins:"

An example of maintaining sufficient safety margins occurs when the existing calculated margin between the analysis and the performance criteria compensates for the uncertainties associated with the analysis and data. Another way that safety margins are maintained is through the application of codes and standards. Consensus codes and standards are typically designed to ensure such margins exist.

LAR Section 4.5.3.4, "Acceptability Determination," and Section 4.5.4, "NFPA 805 Risk-Informed, Performance-Based Change Evaluation Results," both state that safety margins were considered as part of the change evaluation process. Specifically, LAR Section 4.5.4 states that the licensee evaluated each variation from the deterministic requirements against the safety margin criteria contained in NEI 04-02 and RG 1.205.

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

- Codes and Standards or their alternatives accepted for use by the NRC are met, and
- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses, etc.) are met, or the change provides sufficient margin to account for analysis and data uncertainty.

The site-specific FSA calculations contain the details of the licensee's review of safety margins for each performance-based fire area.

During its audit of the HNP NFPA 805 transition, the NRC staff reviewed the licensee's FSAs and associated calculations to determine the extent to which defense-in-depth and the safety margins for each fire area had been documented (see Reference 53). The FSAs contain a detailed listing of the safety margin attributes for the specific fire area, as well as the applicable calculations performed. The safety margin attributes listed included the following:

- The risk-informed, performance-based processes utilized are based upon NFPA 805, 2001 Edition, which was incorporated by reference in 10 CFR 50.48(c).

- 62 -

- The change evaluation process is conducted in accordance with NEI 04-02, Revision 1, which is endorsed by the NRC in RG 1.205, Revision 0.
- The Fire PRA was developed in accordance with NUREG/CR-6850, which the NRC and EPRI developed jointly.
- The NRC has reviewed the HNP Fire PRA as part of the pilot plant observation process, in lieu of a full-scope industry peer review, in order to ensure that the Fire PRA meets the appropriate quality guidelines of ANS standard, BSR/ANS-58.23, "Fire Probabilistic Risk Assessment Methodology Standard" (Reference 54), subsequently incorporated as Part 3 (Internal Fires) in ASME/ANS RA-Sa-2009, "Standard for Level 1 / Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Reference 55). An additional formal industry focused-scope Fire PRA peer review based on the NEI guidelines was performed in April 2008 to address the NRC findings, including supporting requirements that were not reviewed or not met.
- The HNP internal events PRA model received a formal industry PRA peer review based on the applicable NEI guidelines in June 2002. The Westinghouse Owners Group (WOG) peer review of the HNP PRA model was conducted by a diverse group of PRA engineers from other PWR plants and throughout the industry.
- Those fire protection systems and features determined to be required by NFPA 805 Chapter 4 have been confirmed to meet the requirements of NFPA 805 Chapter 3, and its associated referenced codes and listings, or provided with acceptable alternatives using processes accepted for use by the NRC.
- Fire modeling performed in support of the change evaluations is performed using heat release rates that are based upon Task 8, "Scoping Fire Modeling," of NUREG/CR-6850. These heat release rates are conservative and represent values used to screen out fixed ignition sources that do not pose a threat to the targets within specific fire compartments, as well as to assign severity factors to unscreened fixed ignition sources.

Based on the statements provided in LAR Sections 4.5.3.4 and 4.5.4, and on the NRC staff observations related to the detailed implementation of the actions described in these sections, the staff finds that the licensee has adequately addressed the issue of safety margins in the plant change and fire risk evaluation process. The licensee either used appropriate codes and standards (or NRC approved alternatives), met the safety analyses acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses, etc.), or provided sufficient margin to account for analysis and data uncertainty.

Based on the information provided by the licensee in the LAR, the plant change process includes a detailed review of fire protection defense-in-depth and safety margins. The individual FSAs, which include change evaluations, and LAR Tables 4-8-1 and 4-8-2 document the results of the defense-in-depth and safety margin review. The NRC staff finds the licensee's documentation in regard to defense-in-depth and safety margins to be acceptable because the licensee's process and results follow the endorsed guidance contained in NEI 04-02, Revision 2, and are consistent with the staff guidance found in RG 1.205, Revision 1.

Section 3.5 of this safety evaluation discusses the results of the individual fire area reviews, including the documentation of the required fire suppression and detection systems.

3.4.3 Fire Risk Evaluations

The staff reviewed the following information during its evaluation of HNP's fire risk evaluations:

- LAR Section 4.5.3, "NFPA 805 Risk-Informed, Performance-Based Change Evaluation Process"
- LAR Section 4.5.4, "NFPA 805 Risk-Informed, Performance-Based Change Evaluation Results"
- LAR Attachment Y, "NFPA 805 Transition Risk Insights"
- LAR Enclosure 4, "HNP Responses to 'Technical Acceptance Issues' and 'Review Checklist' per NRC Letter dated September 26, 2008"

In addition, the NRC staff reviewed the following material provided by the licensee during the NFPA 805 pilot program regulatory audits:

- HNP-F/PSA-0079, "Harris Fire PRA – Quantification Calculation," Revision 1, issued January 2009
- HNP-F/PSA-0081, "Harris Fire PRA – Support for NFPA 805 Transition," Revision 1, issued January 2009
- HNP-M/MECH-1126, "NFPA 805 Transition – Fire Area 12-A-CRC1 Fire Safety Analysis," Revision 1, issued January 2009
- HNP-M/MECH-1123, "NFPA 805 Transition – Fire Area 1-A-SWGRB Fire Safety Analysis," Revision 1, issued January 2009
- HNP-F/PSA-0071, "Harris Fire PRA – Fire Ignition Frequency Calculation," Revision 2, issued January 2009
- HNP-F/PSA-0077, "Harris Fire PRA – Fire PRA Component Selection and Fire-Induced Model Calculation," Revision 0 (excluding the attachments)

The licensee identified the following four types of VFDRs that it does not intend to bring into deterministic compliance under NFPA 805, but for which the licensee performed evaluations using the risk-informed approach, in accordance with NFPA 805, Section 4.2.4.2, to address fire protection program non-compliances and demonstrate that the VFDRs are acceptable:

- unprotected cable
- cable protected by HEMYC™ wrap
- cable protected by MT™ wrap
- cable installed in embedded conduit that is less than the required fire rating

In addition to the above, the licensee also identified separation issues associated with spurious ESFAS signals that do not meet the deterministic requirements of NFPA 805. However, as discussed in Section 3.2.4 of this safety evaluation, issues related to spurious ESFAS signals were determined to not constitute VFDRs since (1) the spurious signal(s) could be mitigated with control room and/or ACP actions, and (2) actions required to address ESFAS actuations are not considered recovery actions. Accordingly, the NRC staff finds the licensee's disposition of the issues associated with spurious ESFAS signals acceptable.

Evaluations of the VFDRs associated with the use of HEMYCTM, MTTM, and cables embedded in concrete address the fact that the separation afforded by the wrap or concrete is less than that required by NFPA 805, Section 4.2.3. The change in risk is based on the actual rating of the protection available for wrapped or embedded cables compared to the required rating, rather than on the difference in failure versus non-failure of the cables. The change in probability of core damage between these two scenarios is based on the difference in probability of fire nonsuppression for the actual barrier capability compared to the required barrier capability. Since the probability of nonsuppression decreases with longer durations, fire barriers that provide less protection have higher nonsuppression probabilities and increased risk.

The NRC staff finds that the licensee's methods for calculating the change in risk associated with unprotected cables, or due to HEMYCTM, MTTM, or embedded cables that do not satisfy the deterministic requirements of NFPA 805, are acceptable because they correctly model the physical configuration of the plant and the impact on fire risk due to inadequate separation. In addition, the results of these calculations demonstrate that the difference between the risk associated with implementation of the deterministic requirements and that of the VFDRs meets the risk acceptance criteria described in NFPA 805, Section 2.4.4.1, which is acceptable.

3.4.4 Additional Risk Presented by Recovery Actions

The NRC staff reviewed LAR Attachment C, "NEI 04-02 Table B-3 – Transition," Attachment G, "Operator Manual Actions Transition," and Attachment K, "Licensing Action Transition," during its evaluation of the additional risk presented by the NFPA 805 recovery actions at HNP. Section 3.2.4 of this safety evaluation describes the transition of OMAs to recovery actions.

For those fire areas for which the licensee used a performance-based approach to meet the nuclear safety performance criteria, the licensee used fire risk evaluations in accordance with Section 4.2.4.2 of NFPA 805 to demonstrate the acceptability of the plant configuration. Plant configurations that did not meet the separation requirements of NFPA 805, Section 4.2.3.1 were considered VFDRs. The licensee evaluated each VFDR for risk impact by comparing it to a hypothetically compliant plant configuration, and the additional risk was summed for each fire area and compared to the acceptance criteria contained in RG 1.174.

With the exception of the plant fire areas that used an alternative safe shutdown strategy (e.g., the main control room and the control complex), the additional risk associated with VFDRs is conservatively calculated in that no credit is taken in the PRA for any recovery actions. A conservative estimate of the change in risk associated with a risk-informed change is acceptable as described in RG 1.174. Therefore, the NRC staff accepts this approach for conducting the risk-informed comparison between the deterministic and proposed performance-based requirements, as described in Section 4.2.4.2 of NFPA 805.

- 65 -

The licensee addressed those fire areas that utilized a previously approved ASD strategy differently. For these areas, the licensee utilized the guidance in RG 1.205, Revision 1, for addressing recovery actions. This included consideration of the primary control station (PCS) and the definition of a recovery action as clarified in RG 1.205, Revision 1. Accordingly, any actions required to transfer control to, or operate equipment from, the PCS, while required as part of the RI/PB FPP, were not considered recovery actions per the RG 1.205 guidance and in accordance with NFPA 805. Alternatively, any OMAs required to be performed outside the control room and not at the PCS were considered recovery actions.

The licensee addressed the additional risk of the recovery actions associated with an approved ASD strategy, which take place in response to fire-induced failures for three fire areas, using bounding calculations. These three fire areas are the [REDACTED] (Fire Area [REDACTED]), the [REDACTED] (Fire Area [REDACTED]), and the [REDACTED] room (Fire Area [REDACTED]). Specifically, the licensee took the following approach:

- The additional risk associated with recovery actions being taken as a result of postulated fire damage in Fire Area [REDACTED] was determined using a bounding approach by assessing the risk of the fire area assuming the associated component cables were protected in accordance with the deterministic requirements (resulting in no damage in any of the scenarios), and then subtracting this from the risk of the fire area assuming that the component cables were not protected and the recovery action always failed. This calculation conservatively bounds the additional risk of the recovery actions.
- The additional risk associated with recovery actions being taken for fires which result in [REDACTED] (Fire Area [REDACTED]) [REDACTED] was evaluated using a bounding approach. The total risk associated with the [REDACTED] scenarios was used as a bounding number for the recovery action risk associated with those scenarios.

In its letter dated February 4, 2010 (see response to RAI 3-72 on the risk of recovery actions), the licensee listed the total risk associated with control room abandonment to be $4.99\text{E-}07$ for CDF and $4.99\text{E-}08$ for LERF. As described in response to the NRC staff's request regarding the basis for these numbers, the licensee assumed a single value of 0.10 for the conditional core damage probability (CCDP) associated with shutdown from [REDACTED], which represents the combination of the HEP and random failures associated with the remaining plant capability.

This assumption was applied to three fire scenarios in the [REDACTED].¹ The licensee provided a list describing the specific human actions and corresponding equipment involved in the three scenarios. For each, an estimate of the joint probability of random, fire-induced, and human failures was provided, including multiple spurious operations where applicable. For each human action, a human error probability equal to 0.10 was assumed as a screening value.

¹ (1) Scenario 1 for Panel [REDACTED]: fire-induced station blackout, with power recoverable via outside control post-fire safe shutdown strategies; (2) Scenario 1 for Panel [REDACTED]: postulated fire at any location except Panel [REDACTED], with failure to suppress before the control room abandonment criteria are exceeded (including transient combustible contribution); and (3) Scenario 3 for [REDACTED]: postulated fire at panel [REDACTED], which results in the loss of the main control room ventilation system.

Aggregated, the licensee's joint probabilities for each combination of failures in the three [REDACTED] fire scenarios total 0.006. When combined with the minimal set of failures for any additional mitigation capability (all such failures are assumed to have a probability equal to 1.0), the resultant CCDP is 0.006. Since each failure combination contains one HEP at a value of 0.10, a sensitivity analysis using an HEP equal to 1.0 (i.e., assuming all of the human actions fail) would increase the CCDP to 0.06.

Because this result is still less than the assumed CCDP of 0.10 from HNP-F/PSA-0079, "Harris Fire PRA – Quantification Calculation," the NRC staff finds the licensee's original analysis acceptable since even if the recovery actions are all assumed to fail (i.e., the HEP is equal to 1.0) the total CCDP remains bounded by the originally assumed value.

- The additional risk associated with recovery actions being taken as a result of postulated fire damage in Fire Area [REDACTED] was assessed qualitatively since the success or failure of recovery actions in this area only impacts ventilation to the control room. The licensee's assessment indicated that the time available to transfer control to the ACP greatly exceeded the time required to cause equipment operability (i.e., ventilation) concerns within the control room. The licensee's qualitative assessment indicated that the additional risk of recovery actions associated with this scenario was essentially zero.

Section 3.5 of this safety evaluation discusses and evaluates each individual recovery action. In addition, the NRC staff has reviewed the results of the licensee's calculations associated with the additional risk of recovery actions and finds that the approaches applied are acceptable because they conservatively estimate this risk.

3.4.5 Risk-Informed or Performance-Based Alternatives to Compliance with NFPA 805

The licensee did not utilize any risk-informed or performance-based alternatives to compliance with NFPA 805 which fall under the requirements of 10 CFR 50.48(c)(4) at HNP.

3.4.6 Cumulative Risk and Combined Changes

The licensee identified the planned NFPA 805 transition modifications which decrease risk as being credited during the assessment of the cumulative risk impact of transition to NFPA 805 at HNP. LAR Attachment S, as summarized in SE Section 2.8.1, indicates that these modifications will be complete by the end of Refueling Outage 16, which is currently scheduled to begin on November 5, 2010. The licensee will maintain appropriate compensatory measures as necessary for any outstanding modifications related to NFPA 805 until completion of all of the NFPA 805 transition modifications.

The licensee credited the risk reductions that will be afforded by these modifications in its evaluation of the total change in risk associated with transitioning to NFPA 805. In addition, the new diesel generator and dedicated charging pump provide risk reductions for internal events as well as for fires; this risk reduction is included in the total internal events risk reported below.

While performing its review of the licensee's fire risk evaluations, the NRC staff identified several issues that required the licensee to provide additional information in order to demonstrate that it had adequately evaluated the cumulative change in risk associated with transition to NFPA 805. By letter dated August 6, 2009, the staff requested additional

- 67 -

information regarding a number of regulatory and technical issues pertaining to the fire risk evaluations. Table 3.4-5, "Resolution of Fire Risk Assessment Requests for Additional Information," in Attachment C to this safety evaluation provides a summary of these RAls, the licensee's response, and the NRC staff's evaluation of the licensee's response.

As an outcome of the risk assessments performed in the LAR, as supplemented, the licensee reported the total CDF and total LERF estimated by adding the risk results for internal events and fire. (Note that neither seismic risk, nor other external hazards risk are significant for HNP, and are therefore not addressed in the individual risk assessments or the associated totals.) The CDF and LERF results are summarized in Table 3.4.6-1.

Table 3.4.6-1: CDF and LERF for HNP After Transition to NFPA 805

Hazard Group	CDF	LERF
Internal Events	5.37E-6	1.51E-6
Fires	3.06E-5	3.48E-6
TOTAL	3.63E-5	4.99E-6

The total CDF after implementation of NFPA 805 remains below 1E-4/yr, and the total LERF below 1E-5/yr, which is within the risk acceptance guidelines of RG 1.174.

The licensee also provided the Δ CDF and Δ LERF estimated for each fire area at HNP that is not deterministically compliant in accordance with NFPA 805, Section 4.2.3, "Deterministic Approach." The risk estimates for these fire areas result from the completed and planned modifications that will be implemented as part of the transition to NFPA 805 at HNP. The Δ CDF and Δ LERF results by fire area are summarized in Table 3.4.6-2.

Table 3.4.6-2: Δ CDF and Δ LERF for HNP After Transition to NFPA 805

Fire Area	Δ CDF (/year)	Δ LERF (/year)
██████████	0	0
██████████	4.99E-07	4.99E-08
██████████	5.09E-08	6.19E-08
██████████	0	0
██████████	0	0
██████████	1.57E-9	<1E-10
██████████	6.45E-8	5.41E-9
██████████	0	0
██████████	<1E-9	<1E-10
██████████	0	0

Fire Area	Δ CDF (/year)	Δ LERF (/year)
██████████	<1E-9	<1E-10
██████████	2.07E-9	<1E-10
██████████	1.05E-8	2.23E-10
██████████	0	0
██████████	0	0
██████████	0	0
██████████	1.05E-6	4.78E-8
TOTAL	1.68E-6	1.66E-7

* For conservatism, total risk is reported for all control room abandonment scenarios instead of the change in risk.

Each of the individual fire area changes in risk for CDF and LERF fall into Region III (very small change) of the RG 1.174 acceptance guidelines, except for the Δ CDF for Fire Area ██████████ (██████████), which is just slightly above the threshold for entering Region II (small change). The risk associated with control room abandonment for Fire Area ██████████ is reported as the total risk, and still falls within Region III (very small change).

Based on the results of the licensee's fire risk assessments, as summarized above, the risk increase for each fire area associated with transition to NFPA 805 at HNP, as well as the cumulative change in risk for all fire areas subject to a performance-based approach, is within the RG 1.174 risk acceptance guidelines of 1E-5/yr for Δ CDF and 1E-6/yr for Δ LERF for small changes. In addition, the total CDF will remain below 1E-4/yr and total LERF will remain below 1E-5/yr. Therefore, the NRC staff finds the risk associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 acceptable for the purposes of this application, in accordance with NFPA 805, Section 2.4.4.1, and that the licensee has satisfied the guidance contained in RG 1.174, Sections 2.2.4 and 2.2.5, and NUREG-0800, Section 19.2, regarding acceptable risk.

3.4.7 Uncertainty and Sensitivity Analyses

The licensee identified the key assumptions and sources of uncertainty that could potentially impact the risk analyses which support its LAR to transition to NFPA 805, and provided its evaluation of the sensitivity of the risk results to these issues. Table 3.4-6, "Uncertainty and Sensitivity Issues," in Attachment C to this safety evaluation provides a summary of the issues identified and the NRC staff's evaluation of the impact on the associated risk analyses.

Of specific interest to the NRC staff was the potential sensitivity of risk results to the assumption that arcing in motor control center (MCC) cabinets does not result in damage outside of the MCC cabinet. The licensee used the assumption that MCCs are closed cabinets, meaning that fires internal to an MCC do not result in damage outside the MCC cabinet itself. The licensee performed two risk sensitivity calculations regarding this assumption.

The first sensitivity was a bounding analysis, which assumed that MCC fires always result in damage beyond the MCC cabinet. The results of this sensitivity analysis indicated that the Fire PRA and the delta risk calculations performed for the change evaluations are both sensitive to the assumption regarding damage caused by MCC fires. In its letter dated October 9, 2009 (Reference 7; see response to RAI 5-32), the licensee provided a second sensitivity analysis using more realistic assumptions (i.e., 10 percent of the fires result in damage beyond the MCC cabinet), which were based on an analysis of the MCC events documented in the fire events database contained in EPRI Technical Report 1003111, "Fire Event Database and Generic Ignition Frequency Model for U.S. Nuclear Power Plants," (Reference 56). The results of the second sensitivity analysis indicate that the Fire PRA and change evaluation delta risk calculations are relatively insensitive to this assumption.

The NRC staff has reviewed the licensee's assumptions for the second sensitivity analysis from a fire protection engineering standpoint and finds that based on (1) the licensee's assessment of the physical design of HNP's MCCs, particularly the fact that the MCCs use molded case circuit breakers that are not subject to high energy arcing faults (in accordance with the guidance provided in NEI 04-02), (2) the licensee's fire modeling calculations which demonstrate that non-arcing fault fires originating in MCCs will quickly become oxygen limited, and (3) the fact that the second sensitivity assumed a small percentage of fires will cause damage outside the MCC cabinet, the second sensitivity analysis forms a reasonable basis for considering the HNP MCCs as closed cabinets. This conclusion has also been documented in SE Table 3.4-6.

Overall, the licensee has applied a reasonable approach for identification of key assumptions and sources of uncertainty that could potentially impact the NFPA 805 related risk analyses. Most assumptions are demonstrated to be conservative, thereby ensuring that the existing risk analyses reasonably bound any uncertainty. In addition, more realistic assumptions are applied appropriately when justified by plant-specific configurations and available data. Accordingly, the NRC staff concludes that the licensee has demonstrated that its risk evaluations are reasonable and conservative, and not significantly impacted by the specific modeling assumptions made.

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 HNP, the NRC staff finds the following:

- The licensee's PRA used to perform the risk assessments in accordance with NFPA 805, Section 2.4.4 (plant change evaluations), and Section 4.2.4.2 (fire risk evaluations), is of sufficient quality to support the application (i.e., transition of the HNP fire protection program to NFPA 805). In accordance with NFPA 805, Section 2.4.3.3, the NRC staff finds the PRA approach, methods, tools, and data acceptable. In addition, the underlying PRA (i.e., the baseline model) is technically sound, and the analyses, assumptions, and approximations used to map the cause-effect relationship associated with the application are technically adequate.
- The transition process included a detailed review of fire protection defense-in-depth and safety margins as required by NFPA 805. The staff finds the licensee's documentation on defense-in-depth and safety margins to be acceptable. The licensee's process followed the NRC endorsed guidance in NEI 04-02, Revision 2, and is consistent with

the approved staff guidance in RG 1.205, Revision 1, which provide an acceptable approach for meeting the requirements of 10 CFR 50.48(c).

- The changes in risk (i.e., Δ CDF and Δ LERF) associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 (i.e., fire risk evaluations) are acceptable for the purposes of this application. In addition, the licensee has satisfied the guidance contained in RG 1.205, Revision 1, RG 1.174, Sections 2.2.4 and 2.2.5, and NUREG-0800, Section 19.2, regarding acceptable risk. By meeting the guidance contained in these approved regulatory documents, the changes in risk have been found to be acceptable to the AHJ, and therefore meet the requirements of NFPA 805.
- The licensee's process to identify recovery actions required to demonstrate the availability of a success path necessary to meet the nuclear safety performance criteria is acceptable. The risk presented by the use of these recovery actions was determined and provided in accordance with the guidance in RG 1.205, Revision 1, and NFPA 805, Section 4.2.4. The staff found the risk of the NFPA 805 recovery actions acceptable because it was below the acceptance criteria in RG 1.205, Revision 1, and RG 1.174.
- The licensee did not utilize any risk-informed or performance-based alternatives to compliance with NFPA 805 which fall under the requirements of 10 CFR 50.48(c)(4).
- The licensee's application to transition to NFPA 805 is a combined change, as defined by RG 1.205, Revision 1, which combines the risk increases identified in the fire risk evaluations with the risk decreases resulting from modifications that include reductions in risk associated with the internal events PRA. Based on the combination of these risk values, the changes associated with NFPA 805 meet the guidance contained in RG 1.205, Regulatory Position C.3.2.5, related to meeting the requirements for cumulative risk and combined plant changes.

3.5 Nuclear Safety Capability Assessment Results

NFPA 805, Section 2.2.3, "Evaluating Performance Criteria," states the following:

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

NFPA 805, Section 2.2.4, "Performance Criteria," states the following:

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

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

When applying a deterministic approach, the user shall be permitted to demonstrate compliance with specific deterministic fire protection design

requirements in Chapter 4 for existing configurations with an engineering equivalency evaluation. These existing engineering evaluations shall clearly demonstrate an equivalent level of fire protection compared to the deterministic requirements.

3.5.1 Nuclear Safety Capability Assessment Results by Fire Area

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

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 section of the safety evaluation addresses the last topic regarding the ability of each fire area to meet the nuclear safety performance criteria of NFPA 805. Section 3.2.1 of this safety evaluation addressed the first three topics.

NFPA 805, Section 2.4.2.4, "Fire Area Assessment," also states the following:

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 performance-based approach for meeting the nuclear safety performance criteria. Within each of these approaches, additional requirements and guidance provide the information necessary for the licensee to perform the engineering analyses needed to determine which fire protection systems and features are required to meet the nuclear safety performance criteria of NFPA 805.

NFPA 805, Section 4.2.2, "Selection of Approach," states the following:

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 section of the safety evaluation evaluates the approach used to meet the nuclear safety performance criteria on a fire area basis, as well as what fire protection features and systems are required to meet the nuclear safety performance criteria.

The NRC staff reviewed LAR Section 4.2.2, "Fire Area-by-Fire Area Transition," Section 4.8.4, "Required Systems and Features," Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition," Attachment G, "Operator Manual Actions – Transition to Recovery Actions," Attachment S, "Plant Modifications," and Attachment Y, "Fire PRA Insights," during its evaluation of the ability of each fire area to meet the nuclear safety performance criteria of NFPA 805.

HNP is divided into 42 fire areas. Based on the information provided by the licensee in the LAR, as supplemented, the licensee performed the nuclear safety capability assessment on a fire area basis for each of the 42 fire areas. LAR Attachment C provides the results of these analyses on a fire area basis. For each fire area, the licensee documented the following:

- The approach used in accordance with NFPA 805 (i.e., the deterministic approach in accordance with NFPA 805, Section 4.2.3, or the performance-based approach in accordance with NFPA 805, Section 4.2.4).
- The SSCs required in order to meet the nuclear safety performance criteria.
- An evaluation of the effects of fire suppression activities on the ability to achieve the nuclear safety performance criteria.
- The disposition of each VFDR using either modifications (completed or committed) or the performance of a fire risk evaluation in accordance with NFPA 805, Section 4.2.4.2.

The licensee also performed a detailed analysis of fire protection defense-in-depth with respect to fire detection and fire suppression systems for each fire area. LAR Section 4.8.4 includes a detailed listing of the fire areas, fire zones, and fire protection features necessary to meet the requirements of NFPA 805. LAR Table 4-8-1, "Required Automatic Suppression Systems," from the licensee's supplemental letter dated February 4, 2010 (Reference 8), provides a detailed listing of the fire areas and fire zones at HNP, as well as an indication of whether automatic fire suppression systems are installed in these areas. LAR Table 4-8-2, "Required Automatic Fire Detection Systems," provides a detailed listing of the fire areas and fire zones at HNP, as well as an indication of whether automatic fire detection systems are installed in these areas. The tables identify those fire areas/zones where automatic suppression and detection systems are required and list the regulatory and/or technical issue that makes the system required.

Table 3.5.1-1 of this safety evaluation identifies and briefly describes each fire area at HNP. SE Table 3.5.1-1 is based on LAR Table 4-5, "Fire Area Compliance Summary," which was provided by the licensee in LAR Section 4.8, "Summary of Engineering Analysis Results."

SE Table 3.5.1-1 also identifies the NFPA 805 compliance basis for each fire area, as well as the change in risk associated with CDF and LERF, as identified by the licensee. The detailed discussion for each fire area, including the NRC staff's evaluation of the licensee's compliance with the applicable requirements, is contained in Attachment D, "Nuclear Safety Capability Assessment Results by Fire Area," to this safety evaluation.

Table 3.5.1-1: HNP Fire Area and Compliance Strategy Summary

Fire Area	Fire Area Description	Licensing Actions Credited?	NFPA 805 Compliance Basis	Fire Area Delta Risk	
				Δ CDF	Δ LERF
[REDACTED]	[REDACTED]	Yes	4.2.4	0	0
[REDACTED]	[REDACTED]	Yes	4.2.4	4.99E-07	4.99E-08
[REDACTED]	[REDACTED]	Yes	4.2.4	5.09E-08	6.19E-08
[REDACTED]	[REDACTED]	Yes	4.2.4	0	0
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.4	0	0
[REDACTED]	[REDACTED]	Yes	4.2.4	1.57E-9	<1E-10
[REDACTED]	[REDACTED]	Yes	4.2.4	6.45E-08	5.41E-09
[REDACTED]	[REDACTED]	Yes	4.2.4	0	0
[REDACTED]	[REDACTED]	No	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	No	4.2.4	<1E-09	<1E-10
[REDACTED]	[REDACTED]	No	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	No	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	No	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.4	0	0
[REDACTED]	[REDACTED]	Yes	4.2.4	<1E-09	<1E-10
[REDACTED]	[REDACTED]	No	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	No	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.4	2.07E-09	<1E-10
[REDACTED]	[REDACTED]	Yes	4.2.4	1.05E-08	2.23E-10
[REDACTED]	[REDACTED]	No	4.2.4	0	0
[REDACTED]	[REDACTED]	No	4.2.4	0	0
[REDACTED]	[REDACTED]	Yes	4.2.4	0	0
[REDACTED]	[REDACTED]	Yes	4.2.4	1.05E-06	4.78E-08
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
[REDACTED]	[REDACTED]	Yes	4.2.3.2	N/A	N/A
Total				1.68E-6	1.66E-7

Note: Not Applicable (N/A) applies to those fire areas that are deterministically compliant in accordance with NFPA 805, Section 4.2.3.

Attachment D of this safety evaluation is broken down into those fire areas that were analyzed using the deterministic approach in accordance with NFPA 805, Section 4.2.3, and those using the performance-based approach in accordance with NFPA 805, Section 4.2.4. Each fire area includes a discussion of how the licensee met the requirement to evaluate the fire suppression effects on the ability to meet the nuclear safety performance criteria.

SE Attachment D also addresses those NRC approved deviations from the existing deterministic licensing basis that the licensee desires to incorporate into the RI/PB FPP, as allowed by NFPA 805, Section 2.2.7. The attachment includes a description of the previously approved deviation from the deterministic requirements, the basis for and continuing validity of the deviation, and the NRC staff's evaluation of that deviation. The licensee stated in LAR Section 4.2.2.2.2, "Results of the Licensing Action Review," 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.

The NRC staff identified one previously approved deviation from the deterministic requirements that contains a condition for approval which does not appear to be valid. On August 25, 1986 (Reference 57), the licensee requested a deviation from the guidance in NUREG-0800, Section 9.5-1, BTP CMEB C.6.c.(4) (Reference 10), related to installing seismic hose stations in several safety related areas. The licensee justified the deviation by stating that (1) redundant safety related equipment in the affected rooms was separated by 3-hour rated, seismic Category I fire barriers, (2) the areas were provided with non-seismic fire protection systems, and (3) the combustible loading in these areas was considered low, except in the case of the diesel oil day tanks and the diesel oil storage tanks, where the enclosures are seismic Category I or meet the requirements delineated in Section III of the ASME Code.

The safety evaluation report that approved the deviation cited all of the information provided by the licensee, but also included the presence of "an alternate means of fire fighting" that the licensee did not include in its justification for the deviation. The NRC staff has reviewed the basis for the original deviation request and concludes that, based on the existing separation between redundant trains, the presence of the non-seismic fire protection systems, the combustible loading in the areas, and the seismically designed equipment and enclosures, no alternative fire fighting means is required in the safety related areas where a deviation to the NUREG-0800 guidance regarding the installation of seismic hose stations is in effect. In addition, the NRC staff finds that the deviation remains valid under the new RI/PB FPP.

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 nuclear safety performance criteria.

Four sections of NFPA 805 Chapter 3 have requirements dependent upon the results of the engineering analyses performed in accordance with NFPA 805 Chapter 4: (1) fire detection systems, in accordance with Section 3.8.2; (2) automatic water-based fire suppression systems, in accordance with Section 3.9.1; (3) gaseous fire suppression systems, in accordance with Section 3.10.1; and (4) passive fire protection features, in accordance with Section 3.11. The features and systems addressed in these sections are only required when the analyses

performed in accordance with NFPA 805 Chapter 4 indicate that the features and systems are required to meet the nuclear safety performance criteria.

With the exception of ERFBS, passive fire protection features address the fire barriers used to form fire area boundaries (and barriers separating safe shutdown trains) that were previously reviewed and approved in accordance with HNP's existing deterministic fire protection program. For its transition to NFPA 805, the licensee decided to retain the previously approved fire area boundaries as a part of the RI/PB FPP.

The fire barrier fire resistance rating necessary for separation between fire areas under NFPA 805 (i.e., 3 hours) is the same as that necessary under the plant's existing licensing basis, which for HNP is NUREG-0800 (i.e., 3 hours). Accordingly, based on the previously approved fire area boundaries continuing to meet the NFPA 805 fire barrier acceptance criteria, the staff finds retaining these passive fire protection features acceptable.

The ERFBS used at HNP have all been analyzed using the performance-based approach in accordance with NFPA 805, Section 4.2.4. In SE Attachment D, each fire area utilizing ERFBS includes a discussion of the VFDR analysis used to evaluate the acceptability of this feature.

In addition to the above, SE Attachment D provides an evaluation of the defense-in-depth recovery actions for each applicable fire area. As discussed in SE Section 3.2.4, the licensee created a class of recovery actions that are not needed to maintain the availability of a success path and do not adversely impact risk, but which are being credited to enhance defense-in-depth for the fire area. Because the licensee has identified these recovery actions as being necessary to provide adequate defense-in-depth, the NRC staff has evaluated them as a part of the RI/PB FPP. As such, future removal of these defense-in-depth recovery actions would require a plant change evaluation in accordance with NFPA 805, Section 2.4.4.

Finally, as a part of the nuclear safety capability assessment, the licensee evaluated fire detection and suppression systems on a fire area basis. In SE Attachment D, the evaluation of each fire area includes a table that documents the licensee's review of these fire detection and suppression systems, as well as the NRC staff's evaluation of the review and its results.

As documented in SE Attachment D, for those fire areas that utilized a deterministic approach in accordance with NFPA 805, Section 4.2.3, the NRC staff finds that each of the fire areas analyzed using the deterministic approach meet the associated criteria of NFPA 805, Section 4.2.3.2. This conclusion is based on (1) the licensee's documented compliance with NFPA 805, Section 4.2.3.2; (2) the licensee's assertion that the success path will be free of fire damage without reliance on recovery actions; (3) an assessment that the suppression systems in the fire area will have no impact on the ability to meet the nuclear safety performance criteria; and (4) the licensee's appropriate determination of the automatic fire suppression and detection systems required to meet the nuclear safety performance criteria.

In addition, for those fire areas that utilized the performance-based approach in accordance with NFPA 805, Section 4.2.4, the NRC staff finds that that each fire area has been properly analyzed, and compliance with the NFPA 805 requirements demonstrated as follows:

- Deviations from the existing fire protection licensing basis were reviewed for applicability, as well as continued validity, and found acceptable.

- 76 -

- VFDRs were either evaluated and found to be acceptable based on an integrated assessment of risk, defense-in-depth, and safety margins, or modifications were planned/implemented to address the issue.
- Recovery actions used to demonstrate the availability of a success path to achieve the nuclear safety performance criteria 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 nuclear safety performance criteria, including:
 - Fire suppression and detection systems.
 - Fire area boundaries (ceilings, walls, and floors), such as fire barriers, fire barrier penetrations, and through penetration fire stops.
- ERFBS credited were documented on a fire area basis, verified to be installed consistent with tested configurations and rated accordingly, and evaluated using a fire risk evaluation that demonstrated the ability to meet the applicable acceptance criteria for risk, defense-in-depth, and safety margins.

Accordingly, each fire area utilizing the performance-based approach was able to achieve and maintain the nuclear safety performance criteria, and the associated fire risk evaluations meet the applicable NFPA 805 requirements for risk, defense-in-depth, and safety margins.

3.5.2 Fire Protection During Non-Power Operational Modes

NFPA 805, Section 1.1, "Scope," states the following:

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

NFPA 805, Section 1.3.1, "Nuclear Safety Goal," states the following:

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 Attachment D, "NEI 04-02 Table F-1 – Non-Power Operational Modes Transition," to evaluate the licensee's treatment of potential fire impacts during non-power operations. HNP used the process provided in NEI 04-02, Revision 2 (Reference 19), for demonstrating that the nuclear safety performance criteria are met for higher risk evolutions (HREs) during NPO modes.

The NRC staff endorsed FAQ 07-0040, "Non-Power Operations Clarification," Revision 4, to clarify the guidance from NEI 04-02 regarding providing "reasonable assurance that a fire during

- 77 -

non-power operations will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition.” Specifically, FAQ 07-0040 clarifies the following:

- The process for selecting equipment and cabling to evaluate during NPO modes.
- Evaluation of HREs during NPO modes.
- The process for analyzing key safety functions (KSFs) in different plant operational states (POSSs).
- The actions taken beyond the normal fire protection program defense-in-depth actions when a specific KSF could be lost as a direct result of fire damage.

In LAR Section 4.3, the licensee stated that the process used to demonstrate that the nuclear safety performance criteria are met during NPO modes is consistent with FAQ 07-0040, Revision 4. The licensee’s strategy for control and protection of equipment during NPO modes includes a combination of normal fire protection defense-in-depth actions, additional risk-informed steps based on the availability of systems and equipment needed to support KSFs, and whether or not the plant is in an HRE.

The licensee stated its goal was to ensure that contingency plans are established when the plant is in an HRE, and the possibility of losing a KSF because of a fire exists. The licensee also stated that additional controls and measures are evaluated during an NPO mode where the risk is intrinsically high. LAR Section 4.3.1.4 discusses these additional controls and measures. However, during low risk periods, normal risk management controls, as well as fire prevention and protection processes and procedures will be utilized.

The licensee’s integration of the NFPA 805 fire protection aspects into the existing outage management processes included discussions between the licensee’s PRA staff, fire protection engineers, and outage management staff. Incorporated into this review was outlining the definition of what is considered an HRE. As a result of its review, the licensee determined that the HRE definition should consider the following:

- time to boil
- reactor coolant system and fuel pool inventory
- decay heat removal capability

The licensee stated that activities which may impact KSFs are limited and strictly controlled during HREs or infrequently performed evolutions.

The process used to identify the systems and equipment to be included in the NPO review began with the identification of the plant operational states (POSSs) that need to be considered. The POSSs identified are consistent with those contained in Attachment 2 to Appendix G, “Phase 2 Significance Determination Process Template for PWR During Shutdown,” of NRC Inspection Manual Chapter (IMC) 0609, “Significance Determination Process” (Reference 58). LAR Table 4-1, “PWR POS Disposition For Equipment Selection,” provides the determination of which POSSs required the identification of systems and equipment necessary to support a KSF.

- 78 -

For other non-power conditions (e.g., PWR Mode 3) normal fire protection program controls, processes, and procedures will be used.

After identifying the plant-specific POSs that require additional equipment to be included in the NPO review, the licensee stated that it did the following:

- Determined the KSFs that support the POS of concern.
- Identified the equipment relied upon to provide the KSFs, including support functions, during the POS to be evaluated.
- Compared the equipment credited for achieving these KSFs against the equipment credited for nuclear safety at power (i.e., PWR Mode 1).
- Analyzed the circuits of equipment not already credited (or credited in a different way, such as on versus off, open versus closed, etc.), in accordance with the nuclear safety methodology, and identified additional cables to be included in the NPO review.
- Determined the routing of cables that were not already credited in the nuclear safety capability assessment.

The licensee stated that the HNP outage management procedure defines the KSFs, the success paths to achieve the KSFs, and the components required for the success paths.

Based on its review of the information provided in the LAR, the NRC staff concludes that the licensee used methods consistent with the interim guidance provided in FAQ 07-0040, Revision 4, and RG 1.205, Revision 1 (Reference 12), to identify the equipment required to achieve and maintain the fuel in a safe and stable condition during NPO modes. Furthermore, the licensee has an outage management process in place to ensure that fire protection defense-in-depth measures will be implemented to achieve the KSFs during plant outages.

The licensee identified approximately 16 power-operated components needed to support an NPO KSF that were not included in the post-fire safe shutdown equipment list and required additional circuit analysis. The licensee loaded this information into the Fire Safe Shutdown Program Manager Database (FSSPMD), which allowed sorting of the component and cable information on a fire zone basis. Utilizing the fire zone cable routing and equipment location information from the FSSPMD, the licensee's NPO fire impact calculations focused on analyzing the KSF success paths on a fire zone basis in order to assess the impact of a single fire.

In addition to the above, the licensee has documented its analysis of the impact of a fire in each fire area on the success paths for the KSFs in another site-specific calculation. Consistent with FAQ 07-0040, the recommendations of the site-specific NPO fire impact calculations apply only to those fire areas where fires could cause the complete loss of a KSF (called a pinch point).

In accordance with the method endorsed in NEI 04-02, Revision 2, as further discussed in FAQ 07-0040, Revision 4, the primary mechanism being used to meet the nuclear safety performance criteria during NPO conditions is the use of fire protection defense-in-depth actions (e.g., the use of administrative controls to prevent hot work, making the area a combustible free

zone, performance of additional fire watches, enhanced manual suppression through pre-staging equipment and/or personnel, etc.) to reduce the risk of fire. During HREs, this is achieved by implementing enhanced fire protection defense-in-depth actions that reduce the frequency, severity, or impact of fires such that the key pinch points are protected. During non-HREs, this is achieved by implementing the normal fire protection defense-in-depth actions throughout the plant. This first line of defense regarding the KSFs and associated pinch points ensures that one success path to achieve the nuclear safety performance criteria (i.e., maintaining the fuel in a safe and stable condition) will remain free from fire damage.

With respect to recovery actions, the risk of their use depends heavily on the difference in time between the required time (the time in which the action must be completed before a non-recoverable condition is reached, thereby preventing the achievement of the nuclear safety performance criteria) and the available time (the time in which the action can be reliability completed). The endorsed method for addressing the use of recovery actions during NPO modes utilizes fire protection defense-in-depth actions during HREs to reduce the risk of fire. Because the time necessary to address potential fire damage using recovery actions is usually too short to ensure that the nuclear safety performance criteria are met, implementing enhanced fire protection defense-in-depth actions during HREs reduces the fire risk to an acceptable level.

The licensee has also chosen to take recovery actions in addition to those outlined by the approach contained in the endorsed guidance. In some cases, these recovery actions have been identified as having the ability to mitigate fire damage, should it occur. The licensee indicated that during HREs, compliance will be ensured by preventing or mitigating fire damage through the use of these additional fire protection defense-in-depth actions as a means of reducing fire risk. In cases other than HREs, the time available to take the recovery actions is great enough that the additional risk presented by their use is acceptable.

While performing the review of the licensee's treatment of fire protection during NPO modes, the NRC staff identified several issues that required the licensee to provide additional information in order to adequately demonstrate the ability to achieve and maintain the fuel in a safe and stable condition. By letter dated August 6, 2009 (Reference 37), the staff requested additional information regarding a number of regulatory and technical issues pertaining to the methodology used to perform the assessment of fire protection during NPO modes at HNP (in particular, RAI 3-47, RAI 3-48, and RAI 3-66 of the associated letter address these concerns).

The NRC staff requested that the licensee identify any KSFs achieved solely by crediting recovery actions. In its August 13, 2009 (Reference 5), letter, the licensee indicated that only one KSF is achieved solely by crediting recovery actions, but provided a list of the following five KSFs that could require recovery actions in order to restore the KSF to full operation:

1. RHR Flow Control – Recovery actions are required to regain control of the RHR heat exchanger outlet valve and/or the RHR heat exchanger bypass valve in order to maintain the decay heat removal KSF. Existing abnormal operating procedures provide the necessary guidance to address this potential concern, and supplemental revisions will furnish additional recommended actions. Completion of the procedural revisions to address the RHR flow control issues is an implementation item (SE Section 2.9; Item 2).
2. RHR Loop Temperature – Operators would have to monitor local temperature indicators if the RHR loop temperature indicator in the main control room was lost because of fire.

- 80 -

These actions are currently described in an existing procedure to meet cooldown requirements associated with achieving and maintaining cold shutdown.

3. Volume Control Tank (VCT) Outlet – Fire damage may remove the ability to remotely operate the VCT outlet valves, resulting in the need to locally operate the valves when it is necessary to shift the charging pump suction from the VCT to the refueling water storage tank (RWST). Existing procedures provide the necessary guidance to manually close the VCT outlet valves once the charging pump suction is aligned to the RWST.
4. 120 VAC Uninterruptible Power Supply – Should fire damage cause the loss of any of the existing 120 VAC uninterruptible power supplies, an existing procedure directs the operators to use backup power supplies, alternate components or paths, or local actions, or some combination of all three, to compensate for a loss of component control.
5. Charging Pumps – In the event that fire damage causes the loss of the operating charging pump, the analysis identified the following:
 - a. At least one RHR pump would be available to makeup to the reactor coolant system (RCS) from the RWST.
 - b. Gravity feed to the RCS from the RWST could be used if the RCS is depressurized.
 - c. Sufficient time would be available to set up temporary ventilation if normal heating, ventilation, and air conditioning were lost to the charging pump room.

Based on the information provided in the LAR as supplemented, as well as the licensee's statements that either existing procedures provide the necessary guidance, additional systems and components provide an alternate means of achieving the KSF, or sufficient time exists to implement temporary actions to address the potential loss of function, the NRC staff concludes that the licensee has adequately assessed the recovery actions necessary to restore a KSF to full operation, pending completion of the associated implementation item.

In its August 13, 2009, letter, the licensee also provided additional information describing how the "approximately 20 generic pinch points" for KSFs would be identified and communicated to the plant for disposition. The licensee stated that a site-specific calculation documents the 20 generic pinch points, the specific KSF paths that may not be available within the fire area of concern, as well as recommendations to mitigate the potential loss of the KSF. In addition, the KSF pinch points are being addressed by one of the following means: (1) implementation of plant modifications, (2) the use of procedures to prevent the pinch point from occurring, or (3) implementation of appropriate recovery actions to restore the KSF should damage occur.

These actions are in addition to the increased fire protection actions also being credited for reducing fire risk during higher risk evolutions. The specific actions to address the pinch points are being addressed in a variety of HNP site and PEC corporate procedures. These procedures will be changed as part of the overall NFPA 805 Transition Engineering Change. Completion of the procedural changes required to address the 20 generic KSF pinch points is an implementation item (SE Section 2.9; Item 3).

In addition, the licensee provided a description of actions being taken to minimize fire-induced spurious actuations of power operated valves (i.e., air operated valves (AOVs) or motor operated valves (MOVs)) during NPO. The licensee stated that the NPO review identified four instances, detailed below, in which pinch points could develop as a result of spurious operation of a plant component and provided a proposed course of action to prevent them from occurring.

1. RHR Pump Suction Valves – The NPO analysis determined that spurious closure of a RHR pump suction valve only occurs for the suction valve that is powered from the opposite electrical train as that of the running RHR pump. To address this potential concern, procedural actions are being taken to remove power from the opposite train RHR pump suction valve when the plant is in Mode 5 or 6 and the RCS is in reduced inventory condition (i.e., less than or equal to 36 inches below the reactor vessel flange).
2. RHR Cross-Connect with the Chemical and Volume Control System (CVCS) – Spurious opening of either Valve 1RH-25 or Valve 1RH-63 when the associated RHR train is operating could result in a diversion of RHR flow and an associated RCS inventory control concern. To address this potential issue, procedures are being changed to instruct the operator to verify that the valves are closed and de-energize them at the MCC when the plant has entered Mode 5 (i.e., reactor temperature is less than 200°F and the steam generators are no longer available to remove decay heat).
3. RCS Hot Leg Valves – Spurious opening of RCS hot leg Valve 1SI-359 during shutdown cooling could result in a short cycling of the RHR flow path, resulting in inadequate cooling of the reactor core. During shutdown cooling, either Valve 1SI-326 or Valve 1SI-327 (associated with the RHR loop being used) is closed, but power is not removed. The NPO analysis identified potential fire scenarios in which spurious actuations could cause two valves (either Valve 1SI-326 or Valve 1SI-327, and Valve 1SI-359) to open, resulting in a thermal short cycling situation for RHR. To address this potential concern, procedures are being revised to remove power from Valve 1SI-359 when the plant has entered Mode 5. For those situations when Valve 1SI-359 needs to be opened in support of operational activities during Mode 5 or 6, the valve will be under administrative control and returned to the closed and depowered condition as soon as the activity requiring it to be open is completed.
4. CVCS Alternate Minimum Flow Valves – Spurious operation of Valve 1CS-746 and Valve 1CS-752 could cause RCS water to be diverted to the RWST. Since these valves only need to be operable when safety injection is required, procedural actions will be taken to remove power to these valves when the plant enters Mode 5.

Based on the information provided in the LAR as supplemented, the licensee is planning to take appropriate actions in order to address potential spurious actuations of power operated valves (both AOVs and MOVs) that could challenge the decay heat removal and inventory control KSFs. Completion of the procedural changes described by the licensee to address spurious valve operations is an implementation item (SE Section 2.9; Item 4).

NFPA 805 requires that the nuclear safety performance criteria be met during any operational mode or condition, including NPO. As described above, the licensee has performed the following engineering analyses to demonstrate that it meets this requirement:

- 82 -

- Identified the KSFs required to support the nuclear safety performance criteria during non-power operations.
- Identified the POSs where further analysis is necessary during non-power operations.
- Identified the SSCs required to meet the KSFs during the POSs analyzed.
- Identified the location of these SSCs and their associated cables.
- Performed analyses on a fire area basis to identify pinch points where one or more KSF could be lost as a direct result of fire-induced damage.
- Planned/implemented modifications to appropriate station procedures in order to employ one or more fire protection strategy for reducing risk at these pinch points during HREs.

In addition, normal fire protection defense-in-depth actions are credited for addressing the risk impact of those fires which potentially affect one or more trains of equipment that provide a KSF required during NPO modes, but would not be expected to cause the total loss of that KSF. Accordingly, based on the information provided in the LAR as supplemented, the NRC staff concludes that the licensee has provided reasonable assurance that the nuclear safety performance criteria are met during NPO modes and HREs at HNP.

3.5.3 Conclusion for Section 3.5

The NRC staff reviewed the licensee's risk-informed, performance-based fire protection program, as described in the LAR and its supplements, to evaluate the nuclear safety capability assessment results. The licensee used a combination of the deterministic approach in accordance with NFPA 805, Section 4.2.3, and the performance-based approach in accordance with NFPA 805, Section 4.2.4, to perform this assessment at HNP.

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

- Deviations from the existing HNP fire protection program were evaluated and found to be valid and acceptable for meeting the deterministic 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 nuclear safety performance criteria for each fire area.
- All defense-in-depth recovery actions were properly documented for each fire area.
- The required automatic fire suppression and automatic fire detection systems were appropriately documented for each fire area.

Accordingly, the staff finds that each fire area utilizing the deterministic approach meets the deterministic requirements of NFPA 805, Section 4.2.3.

For those fire areas that utilized a performance-based approach, the NRC staff verified that:

- 83 -

- Deviations from the existing HNP fire protection program were evaluated and found to be valid and acceptable for meeting the deterministic 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 nuclear safety performance criteria for each fire area.
- All VFDRs were evaluated using the fire risk evaluation performance-based method (in accordance with NFPA 805, Section 4.2.4.2) to address risk impact, defense-in-depth, and safety margins, and found to be acceptable.
- All recovery actions necessary to demonstrate the availability of a success path were evaluated with respect to the additional risk presented by their use and found to be acceptable in accordance with NFPA 805, Section 4.2.4.
- All defense-in-depth recovery actions were properly documented for each fire area.
- The required automatic fire suppression and automatic fire detection systems were appropriately documented for each fire area.

Accordingly, the staff finds that each fire area utilizing the performance-based approach, in accordance with NFPA 805, Section 4.2.4, is able to achieve and maintain the nuclear safety performance criteria. Furthermore, the associated fire risk evaluations meet the requirements for risk, defense-in-depth, and safety margins.

The NRC staff's review of the licensee's analysis for, and outage management process during, NPO modes found that the licensee provided reasonable assurance that the nuclear safety performance criteria will be met during NPO modes and HREs. The staff review also found that the normal fire protection program defense-in-depth actions are credited for addressing the risk impact of those fires which potentially affect one or more trains of equipment that provide a KSF required during NPO modes, but would not be expected to cause the total loss of that KSF. The NRC staff finds this overall approach for fire protection during NPO modes acceptable.

3.6 Radioactive Release Performance Criteria

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

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:

- 84 -

- (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 HNP fire protection program to be implemented under NFPA 805 meets the above requirements, the licensee established an expert panel to review the existing HNP fire pre-plans and fire brigade training materials. Fire pre-plans that address fire areas where there is no possibility of radioactive materials being present were screened from further review. All other fire pre-plans were reviewed to ascertain whether existing engineering controls are adequate to ensure that radioactive materials (contamination) generated as a direct result of fire suppression activities are contained and monitored before release to unrestricted areas, such that the release would meet the NFPA 805 radioactive release performance criteria.

The licensee's review determined that existing engineering controls, such as curbs and forced air ventilation, were adequate to meet the NFPA 805 radioactive release requirements. In addition, 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.

Table 3.6-1, "HNP Fire Areas and Their Compliance with the NFPA 805 Radioactive Release Performance Criteria," in Attachment E to this safety evaluation summarizes, for each fire pre-plan, (1) the fire areas included in the pre-plan, (2) the engineered controls used to minimize radioactive releases generated from the combustion of radioactive materials or from fire suppression activities, and (3) the staff evaluation of the adequacy of these engineered controls.

The expert panel also reviewed the fire brigade training materials to assess their adequacy in addressing the monitoring and containment of fire suppression agent runoff and combustion products. According to the LAR Section 4.4, "Radioactive Release Performance Criteria," the licensee has developed and implemented new HNP fire brigade and site incident commander lesson plans in order to align with the appropriate requirements. Specifically, attributes are included within the new lesson plans to address the NFPA 805 radioactive release objectives and performance criteria. In addition, lesson plan topics are based on technical skill sets rather than on specific fire areas, and discussion points are included for the topical areas applicable to, or having potential impact on, radioactive releases resulting from firefighting activities.

NFPA 805 requires that the licensee address the nuclear safety and radioactive release goals, objectives, and performance criteria in any operational mode. During NPO modes, the licensee stated in LAR Attachment E, "NEI 04-02 Table G-1 – Radioactive Release Transition," that all containment building openings are internal to the plant with the exception of the containment equipment hatch. Closure of the equipment hatch to establish containment integrity during Modes 5 and 6 is instituted through a containment closure plan with a specific closure time identified. Although an explicit closure time is not specified for the defueled condition, a plant

procedure directs that, when the containment equipment hatch is open, Operations should be requested to maintain ventilation such that the number of containment exhaust fans is equal to or greater than the number of supply fans. This will minimize the potential for positive pressure inside the containment building that could lead to effluent flow from the equipment hatch.

In addition, the licensee's radioactive release analysis concluded that, based on the volume of containment available for collection of smoke, and the location of the equipment hatch in relation to the top of containment (approximately 150 feet below top of dome), the potential for smoke migration to lower elevations is not considered credible prior to containment and monitoring actions being taken. Furthermore, large ignition sources such as the reactor coolant pumps will not be operating during this condition (i.e., defueled with the equipment hatch open).

The licensee will also rely on heightened personnel attendance and monitoring of containment to ensure that the potential for fire hazards large enough to present a radioactive release potential is unlikely. Additionally, the licensee credited administrative controls for hot work and handling of transient combustibles during outages to further enhance the prevention, detection, and response elements of fire protection defense-in-depth for the containment building.

The NRC staff evaluated the licensee's justification provided in the February 4, 2010, letter (Reference 8; see response to RAI 4-1.1) for not having a specific closure time associated with the containment building equipment hatch while the reactor fuel is transferred to the fuel handling building. The staff finds the licensee's justification for omitting a specific closure time for the containment building equipment hatch acceptable because: (1) engineered controls are implemented when the plant is defueled and the equipment hatch is open (i.e., procedural controls to minimize the potential for radioactive release), (2) major ignition sources such as the RCPs are not operating when the plant is in this configuration, and (3) administrative controls are in place to control hot work and handling of transient combustibles during outages.

The licensee's position, as outlined above, is consistent with NFPA 805, Subsection 1.4.2(2), which states that "the source term is capable of being limited." Specifically, when the reactor is defueled, the radioactive source term is significantly reduced, resulting in a much lower potential for radioactive release. Accordingly, the NRC staff finds this approach acceptable. The licensee also stated that (1) the established HNP Configuration Management Program will maintain the results of the radioactive release reviews after completion of the transition to NFPA 805 and (2) the FSA calculations for the applicable fire areas incorporate the results of the radioactive release reviews. (Note: Section 3.8 of this safety evaluation contains the NRC staff's review of the licensee's configuration management processes.)

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, and (4) the development and implementation of newly revised fire brigade training procedures, the NRC staff concludes that the licensee's RI/PB FPP provides reasonable assurance that radiation releases to any unrestricted area resulting from the direct effects of fire suppression activities at HNP 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 RI/PB FPP complies with the requirements specified in NFPA 805, Sections 1.3.2, 1.4.2, and 1.5.2.

3.7 NFPA 805 Monitoring Program

For this section of the safety evaluation, the following requirements from NFPA 805, Section 2.6, are applicable to the NRC staff's review of the licensee's amendment request:

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.

Availability, Reliability, and Performance Levels: Acceptable levels of availability, reliability, and performance shall be established.

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.

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 the monitoring program described in LAR Section 4.6, "Monitoring Program," that the licensee is developing to monitor the availability, reliability, and performance of HNP fire protection program systems and features after the transition to NFPA 805. While the HNP NFPA 805 Monitoring Program was still under development at the time the LAR was submitted for review, the focus of the NRC staff's evaluation involved identifying the critical elements related to the monitoring program, including the selection of fire protection program systems and features to be included in the program, the attributes of those systems and features that will be monitored, and the methods for monitoring those attributes. Implementation of the monitoring program will occur on the same schedule as the NFPA 805 RI/PB FPP implementation, which the NRC staff finds acceptable. Completion of HNP NFPA 805 Monitoring Program is an implementation item (SE Section 2.9; Item 5).

The licensee established an expert panel to identify the HNP fire protection program systems and features, as well as the attributes of those systems and features, which will be monitored.

The scope of licensee's monitoring program includes fire protection program SSCs, fire protection program programmatic elements, as well as key assumptions in the associated engineering analyses. The majority of the systems and equipment necessary to meet the NFPA 805 nuclear safety performance criteria are expected to be already monitored as required by the Maintenance Rule (as promulgated in 10 CFR 50.65). Accordingly, the NRC staff finds that the licensee may use the Maintenance Rule for the components covered by that program as a means to meet the requirements of the NFPA 805 monitoring program. As such, these systems and equipment will not be included in the NFPA 805 monitoring program. However, the expert panel will review those systems and equipment required to meet the nuclear safety performance criteria that are not included in the Maintenance Rule monitoring program for inclusion in the NFPA 805 monitoring program, as appropriate.

In establishing the monitoring program, the licensee defined the term "pseudo-system" as a group of SSCs that functionally relate to a system for performance monitoring purposes. The licensee stated that it is taking a structured approach to identify key pseudo-systems and the performance monitoring groups (PMGs) for those systems, which define the potential areas in which monitoring could be required. Pseudo-systems are functional categories of fire detection and suppression systems and administrative controls, and include (1) passive engineered barriers, (2) manual and automatic suppression systems, (3) automatic, incipient, and prompt detection systems, and (4) transient combustibles. PMGs are the specific HNP fire detection and suppression systems and administrative controls included within each pseudo-system. LAR Figure 4-8, "Performance Monitoring Groups," provides the initial list of HNP PMGs.

The licensee has defined screening thresholds, which are being used to determine the most risk significant fire compartments utilizing the results of the Fire PRA. Those fire compartments (and all fire protection systems and features within the compartments) that are determined to be risk significant will be brought into the scope of the HNP NFPA 805 Monitoring Program. In its August 13, 2009, letter (Reference 5; see response to RAI 6-1), the licensee identified the following screening thresholds being used to determine either the fire compartments or components, or both, to be included in the scope of the HNP NFPA 805 Monitoring Program:

- CDF greater than or equal to $1.0E-07$ per year (on a compartment basis)
- LERF greater than or equal to $1.0E-08$ per year (on a compartment basis)
- risk achievement worth (RAW) greater than or equal to 2 (on a component basis)

The licensee stated that the monitoring program will include all fire protection program SSCs that are in fire compartments which exceed the screening criteria, and that are amenable to risk measurement. The licensee's expert panel may also include in the monitoring program additional fire protection program SSCs from fire compartments that are below the fire compartment screening criteria described above, based on plant-specific considerations.

The screening criteria being implemented at HNP in regard to the NFPA 805 monitoring program are acceptable to the NRC staff based on the following: (1) the CDF and LERF criteria used to screen compartments into the monitoring program are consistent with the self approval limits under the RI/PB FPP license condition (see SE Section 4.0); (2) the NRC staff has previously determined the RAW criteria used for screening individual components into the monitoring program to be acceptable for use in determining risk significant SSCs that must be monitored under the Maintenance Rule, as described in NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" (Reference 59); and (3) the expert panel may screen compartments and SSCs into the monitoring program based on non-risk criteria depending on plant-specific history or operational considerations.

The licensee also stated that it will establish criteria for acceptable levels of availability, reliability, and performance, or appropriate action levels, for each PMG based on Fire PRA insights and accepted industry guidance. As part of its February 4, 2010, letter (Reference 8; see response to RAI 5-36.1), the licensee stated that suppression and detection systems were modeled using the assumptions provided in Appendix P to NUREG/CR-6850 (Reference 44), and that it will continue to use industry guidance such as EPRI Technical Report (TR) 1006756, "Fire Protection Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features" (Reference 28). EPRI TR 1006756 provides guidance for establishing reliability targets, action levels, and monitoring frequency.

The NRC staff finds that establishing reliability targets, action levels, and monitoring frequency in accordance with EPRI TR 1006756, in conjunction with use of the modeling assumptions for suppression and detection systems taken from NUREG/CR-6850, is an acceptable method for establishing appropriate levels of availability, reliability, and performance because there will be margin between the value assumed in the Fire PRA for a given component or system and the action level used in the NFPA 805 monitoring program to require corrective action.

In addition, the licensee's expert panel will further develop criteria for each PMG that will determine when a system has failed to perform its required function. The expert panel will also establish reliability and availability criteria for each PMG based on the number of SSC functional failures that can occur within a 3-year rolling time period before the action level is triggered. The expert panel will determine the mode of corrective action in the event that an action level is triggered, including whether additional monitoring is required.

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 finds that the licensee's expert panel process provides reasonable assurance that HNP will implement an effective program for monitoring risk significant fire SSCs because the expert panel ensures that the NFPA 805 monitoring program does the following:

- Establishes the appropriate performance monitoring groups to be monitored.
- Utilizes an acceptable screening process for determining the structures, systems, and components to be included in the PMGs.
- Establishes availability, reliability and performance criteria for the SSCs being monitored.
- Requires corrective actions when SSC availability, reliability, and performance criteria targets are exceeded in order bring performance back within the required range.

However, since the final values for availability and reliability, as well as the performance criteria for the SSCs being monitored, have not been established for the monitoring program as of the date of this safety evaluation, completion of the HNP NFPA 806 Monitoring Program is an implementation item, as noted previously. Completion of the monitoring program will occur on the same schedule as the implementation of NFPA 805, which the NRC staff finds acceptable. Accordingly, the NRC staff concludes that, upon successful closure of the implementation item in this area, there is reasonable assurance that the licensee will meet the requirements specified in NFPA 805, Sections 2.6.1, 2.6.2, and 2.6.3 regarding a monitoring program.

3.8 Program Documentation, Configuration Control, and Quality Assurance

For this section of the safety evaluation, the requirements from NFPA 805, Section 2.7, "Program Documentation, Configuration Control, and Quality," are applicable to the NRC staff's review of the licensee's amendment request in regard to the appropriate content, configuration control, and quality of the documentation used to support the transition to NFPA 805 at HNP.

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 appropriateness of the content of the HNP fire protection program design basis document and supporting documentation.

HNP's fire protection program design basis is a compilation of multiple documents (i.e., fire safety analyses, calculations, engineering evaluations, nuclear safety capability assessments, etc.), databases, and drawings, which are identified in LAR Figure 4-9, "NFPA 805 Transition – Planned Post-Transition Documentation Relationships." The licensee stated that the analyses conducted to support the NFPA 805 transition were performed in accordance with a corporate PEC design analysis and calculation procedure, which meets or exceeds the requirements for documentation outlined in NFPA 805, Section 2.7.1.

Specifically, this design analysis and calculation procedure provides 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 HNP's document control system. Being analyses, they are also subject to review and revision consistent with the other plant calculations and analyses, as required by the plant design change process.

In its letter dated August 13, 2009 (Reference 5), the licensee clarified that LAR Figure 4-9 also identifies the following HNP RI/PB FPP licensing basis documents:

- the HNP NFPA 805 Transition Report/LAR
- the NFPA 805 safety evaluation
- the NFPA 805 License Condition
- the revised FSAR, including documents incorporated by reference

As such, LAR Figure 4-9 identifies the engineering analyses, calculations, databases, and other associated documents required to define the fire protection design basis at HNP. In addition, the individual fire safety analysis calculations provide fire hazards identification and a summary of the nuclear safety capability assessment for each fire area. The licensee stated that all supporting analyses and calculations have been referenced as required by these calculations.

The licensee also stated in the LAR that the documentation associated with the HNP RI/PB 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 description provided in the LAR, as supplemented, of the content of the HNP NFPA 805 fire protection program 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 finds that the licensee's approach meets 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 fire protection program design basis documentation.

3.8.2 Configuration Control

The staff reviewed LAR Section 4.7.2, "Compliance with Configuration Control Requirements in Section 2.7.2 of NFPA 805," in order to evaluate the configuration control process at HNP.

To support the many other technical, engineering, and licensing programs at HNP, the licensee has existing configuration control processes and procedures for establishing, revising, or utilizing program documentation. Accordingly, the licensee is integrating the RI/PB 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 HNP licensing programs, including the fire protection program.

In its August 13, 2009, letter (see response to RAI 7-1), the licensee clarified that the configuration control process includes provisions for appropriate design and engineering reviews and approvals, and that approved analyses are considered controlled documents available through the HNP document control system. The licensee further clarified that analyses based on the PSA program, which includes the Fire PRA, are issued as formal analyses subject to these same configuration control processes, and are additionally subjected to the PRA peer review process specified in the ASME/ANS PRA standard (Reference 55).

Configuration control of the fire protection program during the transition period is maintained by the HNP change evaluation process, as defined in project instructions associated with the Fire Protection Initiatives Project and the NFPA 805 Transition Change Evaluations. Once the revised license has been issued, these project instructions will be converted to engineering procedures that will manage the configuration control process following transition to NFPA 805.

In its August 13, 2009, letter (see response to RAI 7-2), the licensee also addressed its plan for revising the HNP Fire Protection Program Manual, a principal document governing the manner in which the fire protection program is implemented at HNP. The licensee described what changes would be made to the HNP Fire Protection Program Manual in order to reflect the requirements of NFPA 805, and the associated training necessary to implement these changes. The HNP Fire Protection Program Manual is a controlled document that will be revised to incorporate the NFPA 805 requirements under the process governed by the existing HNP design change procedure. The licensee stated that this design change process will also lead to identification of the need for changes to the training documents. Completion of the revisions to the HNP Fire Protection Program Manual is an implementation item (SE Section 2.9; Item 6).

Note that the NRC staff reviewed the licensee's process for updating and maintaining the HNP Fire PRA in order to reflect plant changes made after completion of the transition to NFPA 805 in Section 3.4.1 of this safety evaluation, and found it to be acceptable.

Based on the licensee's description of the HNP configuration control process, which indicates that the HNP RI/PB FPP design basis and supporting documentation are controlled documents, and that plant changes are reviewed for potential impact on the fire protection program, the NRC staff finds that the licensee has a configuration control process which meets the requirements of NFPA 805, Sections 2.7.2.1 and 2.7.2.2, for revising fire protection program design basis documents, supporting documents, and applicable fire protection program documentation in order to reflect changes made to the RI/PB FPP after the NFPA 805 fire protection program has been implemented.

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 to NFPA 805 at HNP based on the requirements outlined above.

Review

NFPA 805 requires that each analysis, calculation, or evaluation performed be independently reviewed. The licensee stated that their 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 states that the analyses, calculations, and evaluations performed in support of the transition to NFPA 805 were independently reviewed, and that the analyses, calculations, and evaluations to be performed post-transition will be independently reviewed as required by the existing PEC procedures.

Based on the licensee's description of the HNP process for performing independent reviews of analyses, calculations, and evaluations, the NRC staff finds the licensee's approach for meeting the requirements of NFPA 805, Section 2.7.3.1, acceptable.

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 verification and validation of fire models used to support the development of the HNP Fire PRA, which the NRC staff found acceptable (fire modeling in support of the HNP Fire PRA is addressed in SE Section 3.4.1).

The licensee also 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 fire protection program changes, including those for verification and validation. Revision of the applicable post-transition processes and procedures to include the NFPA 805 requirements for verification and validation is an implementation item (SE Section 2.9; Item 7).

Based on the licensee's description of the HNP process for verification and validation of calculational models and numerical methods, the NRC staff finds the licensee's approach for meeting the requirements of NFPA 805, Section 2.7.3.2, acceptable.

Limitations of Use

NFPA 805 requires that acceptable engineering methods and numerical models only be used for applications to the extent that these methods have been subject to verification and validation; and that they only be applied within the scope, limitations, and assumptions prescribed for that method. The licensee stated that the engineering methods and numerical models used in support of the transition to NFPA 805 were used 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. As an example, in LAR Section 4.5.2, "Fire Modeling," the licensee stated that the fire models developed to support the NFPA 805 transition at HNP fall within their verification and validation limitations.

The licensee also 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 fire protection program changes, including those for limitations of use. Revision of the applicable post-transition processes and procedures to include the NFPA 805 requirements for limitations of use is an implementation item (SE Section 2.9; Item 8).

Based on the licensee's statements that the fire models used to support development of the Fire PRA were used within their limitations, and the description of the HNP process for placing limitations on the use of engineering methods and numerical models, the NRC staff finds the licensee's approach for meeting the requirements of NFPA 805, Section 2.7.3.3, acceptable.

Qualification of Users

NFPA 805 requires that personnel performing engineering analyses and applying numerical methods (e.g., fire modeling) 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. 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 HNP. The licensee has developed training guides (i.e., qualification cards) for engineers performing PRA analyses (one for general PRA and one for Fire PRA), fire protection analyses, and safe shutdown analyses.

On February 4, 2010 (Reference 8; see response to RAI 5-4.1), the licensee provided supplemental information regarding the qualifications required for continued use of the fire modeling performed in support of the HNP Fire PRA. This information demonstrated that a qualification and training program will ensure that personnel performing fire modeling in the future will meet the requirements of NFPA 805, Section 2.7.3.4.

The licensee stated that it will implement a specific fire modeling qualification guide to ensure that individuals performing fire modeling at HNP will continue to meet the qualification requirements of NFPA 805, Section 2.7.3.4. The qualification program and associated training will be developed in accordance with the licensee's internal training development program, and will be completed prior to implementation of the RI/PB FPP. Establishing the NFPA 805 qualification program and associated training is an implementation item (SE Section 2.9; Item 9). Appropriate project management processes are also in place to assure that these competence and experience requirements are applicable for contractor staff.

The licensee stated that the personnel who performed engineering analyses in support of the transition to NFPA 805 were competent and experienced, and that personnel who will perform engineering analyses and apply numerical methods post-transition will also be competent and experienced, as required by PEC procedures.

The NRC staff concludes that appropriately competent and experienced personnel developed the HNP Fire PRA, including both the supporting fire modeling calculations and the additional documentation for models and empirical correlations not identified in previous NRC approved verification and validation documents. In addition, based on the licensee's description of the HNP procedures for ensuring that the personnel who use and apply engineering analyses and numerical methods are competent and experienced, the NRC staff finds the licensee's approach for meeting the requirements of NFPA 805, Section 2.7.3.4, acceptable.

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.

The industry consensus standard for PRA development (i.e., the ASME/ANS PRA standard) includes requirements to address uncertainty. Accordingly, the licensee addressed uncertainty as a part of the development of the HNP Fire PRA. Table Y-7, "Sources of Uncertainty," in LAR Attachment Y, "Fire PRA Insights," provides a detailed listing of the sources of uncertainty in the Fire PRA and the licensee's evaluation of each. The NRC staff's evaluation of the licensee's treatment of these uncertainties is discussed in SE Section 3.4.7.

The licensee also 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 fire protection program changes, including those regarding uncertainty analysis. Revision of the applicable post-transition processes and procedures to include the NFPA 805 requirements regarding uncertainty analysis is an implementation item (SE Section 2.9; Item 10).

Based on the licensee's description of the HNP process for performing an uncertainty analysis, the NRC staff finds the licensee's approach for meeting the requirements of NFPA 805, Section 2.7.3.5, acceptable.

Based on the above discussions, the NRC staff finds that the HNP RI/PB FPP quality assurance process adequately addresses each of the requirements of NFPA 805, Section 2.7.3, which include conducting independent reviews, performing verification and validation, 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. The individual sections of this safety evaluation provide the NRC staff's evaluation of the application of the NFPA 805 quality requirements to the licensee's FPP, as appropriate.

3.8.4 Fire Protection Quality Assurance Program

GDC 1 of Appendix A to 10 CFR Part 50 requires that:

Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

- 94 -

The licensee established its Fire Protection Quality Assurance Program in accordance with the guidelines of NUREG-0800, Section 9.5-1, BTP CMEB C.4, "Quality Assurance Program" (Reference 10). In addition, the guidance in Appendix C to NEI 04-02 (Reference 19) suggests that the LAR include a description of how the existing fire protection quality assurance (QA) program will be transitioned to the new NFPA 805 RI/PB FPP, as discussed below.

Because the original LAR did not address the licensee's plans for developing and implementing a QA program for the RI/PB FPP, the licensee provided additional information regarding this issue in its letter dated August 13, 2009 (see response to RAI 7-3). Specifically, the licensee stated that it would continue to use its current fire protection QA program, and described the changes it would make to the existing program to reflect the requirements of NFPA 805.

The licensee stated that it will make editorial and administrative changes to reference the appropriate NFPA 805 requirements. In addition, the scope of the QA program will be expanded to include systems in the power block that were not previously included in the QA program, but which are required by Chapter 4 of NFPA 805. In particular, the licensee will expand its fire protection QA program to encompass certain fire protection and safe shutdown systems in the waste processing building, the fuel handling building, and the turbine building that are required by NFPA 805 Chapter 4. Completion of the expansion of the fire protection QA program to encompass NFPA 805 is an implementation item (SE Section 2.9; Item 11).

The NRC staff finds that, upon completion of the implementation item, the licensee's changes to the fire protection QA program are acceptable because they include expansion of the program to include those fire protection systems not previously included within the scope of the fire protection QA program that are required by NFPA 805 Chapter 4.

3.8.5 Conclusion for Section 3.8

The NRC staff reviewed the licensee's RI/PB FPP, as described in the LAR and its supplements, to evaluate the NFPA 805 program documentation content, the associated configuration control process, and the appropriate quality assurance requirements. The NRC staff concludes that, upon completion of the implementation items related to these requirements, the licensee's approach meets the requirements specified in NFPA 805, Section 2.7, regarding program documentation, configuration control, and quality.

4.0 FIRE PROTECTION LICENSE CONDITION

The licensee proposed a fire protection program license condition regarding transition to a 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 Regulatory Guide 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," 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 HNP, and is therefore acceptable.

The following license condition is included in the revised license for the Shearon Harris Nuclear Power Plant, Unit 1, and will replace Renewed Operating License No. NPF-63 Condition 2.F:

Fire Protection Program

Carolina Power & Light Company 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 revised license amendment request dated October 9, 2009, supplemented by letters dated February 4, 2010, and April 5, 2010, and approved in the associated safety evaluation dated June 28, 2010. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c) and NFPA 805, 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.

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

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the proposed change may include methods that have been used in 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.

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

Other Criteria for Changes that May Be Made to the NFPA 805 Fire Protection Program Without Prior NRC Approval

- (1) Changes to NFPA 805 Chapter 3, Fundamental Fire Protection Program Elements and Design Requirements

Prior NRC review and approval is 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 is not required for changes to the licensee’s fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process, as approved in the NRC safety evaluation dated June 28, 2010, to determine that certain fire protection program changes meet the minimal risk criterion. The licensee shall in all cases ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

- 97 -

- (3) Unless License Condition (2) is met, risk-informed changes to the licensee's fire protection program which involve fire areas that credit incipient detection may not be made without prior NRC review and approval until the Harris Fire PRA model has been modified to incorporate an NRC-accepted method for modeling incipient detection.

Transition License Conditions

- (1) Before achieving full compliance with 10 CFR 50.48(c), as specified by Transition License Condition (2), 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 License Condition (2) above.
- (2) The licensee shall implement the following modifications to its facility in order to complete the transition to full compliance with 10 CFR 50.48(c) by December 31, 2010 (note that each modification is listed by Engineering Change (EC) Number, as described in Attachment S of the Shearon Harris NFP 805 License Amendment Request Transition Report, and outlined in Table 2.8.1-2 of the associated NRC safety evaluation):

• EC 62343	• EC 69501
• EC 62820	• EC 69764
• EC 68645	• EC 69765
• EC 68646	• EC 70027
• EC 68648	• EC 70350
• EC 68658	• EC 70895
• EC 68769	• EC 71147
- (3) The licensee shall maintain appropriate compensatory measures in place until completion of the modifications delineated above.

5.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION

The Commission's regulations in 10 CFR 50.92(c) state that the Commission may make a final determination that a proposed license amendment involves no significant hazards consideration if operation of the facility in accordance with the amendment would not:

- (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or
- (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or
- (3) Involve a significant reduction in a margin of safety.

As required by 10 CFR 50.91(a), in its May 29, 2008 application, as revised on October 9, 2009, to transition the fire protection program at the Shearon Harris Nuclear Power Plant, Unit 1, to

one based on NFPA 805, in accordance with 10 CFR 50.48(c), the licensee provided its analysis of the issue of no significant hazards consideration. In its October 9, 2009, submittal, the licensee stated that "to the extent that these conclusions apply to compliance with the requirements in NFPA 805, they are based on statements in the Statements of Consideration accompanying the adoption of alternative fire protection requirements based on NFPA 805."

The following evaluation in relation to the standards of 10 CFR 50.92(c) explains the NRC staff's final no significant hazards consideration determination.

Criterion 1: The Proposed Change Does Not Involve a Significant Increase in the Probability or Consequences of an Accident Previously Evaluated

Operation of HNP in accordance with the proposed amendment does not increase the probability or consequences of accidents previously evaluated. The proposed amendment does not adversely affect accident initiators or precursors, nor does it alter design assumptions, conditions, or configurations of the facility, and it does not adversely impact the ability of structures, systems, or components (SSCs) to perform their intended function to mitigate the consequences of an initiating event within the assumed acceptance limits. The proposed changes do not physically alter safety-related systems nor affect the way in which safety-related systems perform their functions. The SSCs required to safely shut down the reactor and to maintain it in a safe shutdown condition will remain capable of performing their design functions.

The purpose of this amendment is to permit HNP to adopt a new risk-informed, performance-based fire protection licensing basis that complies with the requirements in 10 CFR 50.48(a) and 10 CFR 50.48(c), as well as the guidance contained in Regulatory Guide 1.205. The NRC considers that NFPA 805 provides an acceptable methodology and performance criteria for licensees to identify fire protection requirements that are an acceptable alternative to the 10 CFR Part 50, Appendix R, fire protection features (69 FR 33536; June 16, 2004).

The purpose of the fire protection program is to provide assurance, through defense-in-depth, that the NRC's fire protection objectives are satisfied. These objectives are: (1) preventing fires from starting; (2) rapidly detecting and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage; (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; and (4) ensuring that fires will not significantly increase the risk of radioactive releases to the environment. In addition, fire protection systems must be designed such that their failure or inadvertent operation does not adversely impact the ability of the SSCs important to safety to perform their safety-related functions.

NFPA 805, taken as a whole, provides an acceptable alternative for satisfying General Design Criterion 3 (GDC 3) of Appendix A to 10 CFR Part 50, meets the underlying intent of the NRC's existing fire protection regulations and guidance, and achieves defense-in-depth along with the goals, performance objectives, and performance criteria specified in NFPA 805 Chapter 1. In addition, if there are any increases in core damage frequency (CDF) or risk as a result of the transition to NFPA 805, the increase will be small, governed by the delta risk requirements of NFPA 805, and consistent with the intent of the Commission's Safety Goal Policy.

Engineering analyses, which may include engineering evaluations, probabilistic safety assessments, and fire modeling calculations, have been performed to demonstrate that the

performance-based requirements of NFPA 805 have been met. The Final Safety Analysis Report (FSAR) documents the analyses of design basis accidents (DBAs) at HNP. All accident analysis acceptance criteria will continue to be met with the proposed amendment. The proposed changes will not affect the source term, containment isolation, or radiological release assumptions used in evaluating the radiological consequences of any accident previously evaluated. The proposed changes will not alter any assumptions or change any mitigation actions for the radiological consequence evaluations in the FSAR. In addition, the applicable radiological dose acceptance criteria will continue to be met.

Based on the above, the implementation of this amendment to transition the FPP at HNP to one based on NFPA 805, in accordance with 10 CFR 50.48(c), does not increase the probability of any accident previously evaluated. In addition, all equipment required to mitigate an accident remains capable of performing the assumed function. Therefore, the consequences of any accident previously evaluated are not increased with the implementation of this amendment.

Criterion 2: The Proposed Change Does Not Create the Possibility of a New or Different Kind of Accident from Any Accident Previously Evaluated

Operation of HNP in accordance with the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated. Any scenario or previously analyzed accident with offsite dose consequences was included in the licensee's evaluation of DBAs documented in the FSAR as a part of the transition to NFPA 805. The proposed amendment does not impact these accident analyses. The proposed change does not alter the requirements or functions for systems required during accident conditions, nor does it alter the required mitigation capability of the fire protection program, or its functioning during accident conditions as assumed in the licensing basis analyses and/or DBA radiological consequences evaluations.

Implementation of the new risk-informed, performance-based fire protection licensing basis, which complies with the requirements in 10 CFR 50.48(a) and 10 CFR 50.48(c), as well as the guidance contained in Regulatory Guide 1.205, will not result in new or different kinds of accidents. The proposed amendment does not involve a significant change in the methods governing normal plant operation. The proposed change does not alter any safety analysis assumptions and is consistent with current plant operating practice regarding fire protection. No new accident scenarios, transient precursors, failure mechanisms, or limiting single failures will be introduced as a result of this amendment. There will be no adverse impact or additional challenges imposed on any safety-related system as a result of the proposed change. No new modes of operation are introduced by the proposed amendment, nor will it create any failure mode not bounded by previously evaluated accidents. Further, the impacts of the proposed change are not directly assumed in any safety analysis to initiate an accident sequence.

The requirements in NFPA 805 address only fire protection, and the impacts of fire on the plant have been evaluated. The proposed fire protection program changes do not involve new failure mechanisms or malfunctions that could initiate a new or different kind of accident beyond those already analyzed in the FSAR. Based on this, as well as the discussion above, the implementation of this amendment to transition the FPP at HNP to one based on NFPA 805, in accordance with 10 CFR 50.48(c), does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Criterion 3: The Proposed Change Does Not Involve a Significant Reduction in a Margin of Safety

Operation of HNP in accordance with the proposed amendment does not involve a significant reduction in a margin of safety. The transition to a new risk-informed, performance-based fire protection licensing basis that complies with the requirements in 10 CFR 50.48(a) and 10 CFR 50.48(c) does not alter the manner in which safety limits, limiting safety system settings, or limiting conditions for operation are determined. The safety analysis acceptance criteria are not affected by this change. The proposed amendment does not adversely affect existing plant safety margins or the reliability of equipment assumed in the FSAR to mitigate accidents. The proposed change does not adversely impact systems that respond to safely shut down the plant and maintain the plant in a safe shutdown condition. In addition, the proposed amendment will not result in plant operation in a configuration outside the design basis for an unacceptable period of time without implementation of appropriate compensatory measures.

The risk evaluations for plant changes, in part as they relate to the potential for reducing a safety margin, were measured quantitatively for acceptability using the delta risk (i.e., ΔCDF and $\Delta LERF$) criteria from Section 5.3.5, "Acceptance Criteria," of NEI 04-02, as well as the guidance contained in Regulatory Guide 1.205. Engineering analyses, which may include engineering evaluations, probabilistic safety assessments, and fire modeling calculations, have been performed to demonstrate that the performance-based methods of NFPA 805 do not result in a significant reduction in the margin of safety. As such, the proposed changes are evaluated to ensure that risk and safety margins are kept within acceptable limits. Based on the above, the implementation of this amendment to transition the FPP at HNP to one based on NFPA 805, in accordance with 10 CFR 50.48(c), will not significantly reduce a margin of safety.

NFPA 805 continues to protect public health and safety and the common defense and security because the overall approach of NFPA 805 is consistent with the key principles for evaluating risk-informed licensing basis changes, as described in Regulatory Guide 1.174, is consistent with the defense-in-depth philosophy, and maintains sufficient safety margins. Based on the above discussion, it appears that the three standards of 10 CFR 50.92(c) are satisfied. Therefore, the NRC staff has made a final determination that the amendment request to transition the FPP at the Shearon Harris Nuclear Power Plant, Unit 1, to one based on NFPA 805, in accordance with 10 CFR 50.48(c), involves no significant hazards consideration.

6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the State of North Carolina official was notified on June 21, 2010, of the proposed issuance of the amendment. The North Carolina State official had no comments.

7.0 ENVIRONMENTAL CONSIDERATION

The proposed amendment transitions the fire protection program at the Shearon Harris Nuclear Power Plant, Unit 1, to one based on NFPA 805, in accordance with 10 CFR 50.48(c), which subsequently impacts a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20, as well as changing certain inspection and surveillance requirements.

Accordingly, the NRC staff evaluated the proposed change against the categorical exclusion requirements of 10 CFR 51.22(c)(9), which state that in order for a license amendment to be excluded from the need for an environmental review, it must meet the following criteria:

- (i) The amendment involves no significant hazards consideration;
- (ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and
- (iii) There is no significant increase in individual or cumulative occupational radiation exposure.

Compliance with NFPA 805 explicitly requires the attainment of performance criteria, objectives, and goals for radioactive releases to the environment. The radioactive release goals provide reasonable assurance that a fire will not result in a radiological release that affects the public, plant personnel, or the environment. The NFPA 805 transition has been evaluated based on fire suppression activities, but not involving fuel damage, and does not create any new source terms. Therefore, the proposed amendment will not change the types or amounts of any effluents that may be released offsite.

Furthermore, the proposed change will not significantly alter the types or increase the amount of individual or cumulative occupational radiation exposures based on the results of the evaluation performed regarding fire fighting activities. In addition, the modifications being implemented as a part of the transition to NFPA 805 at HNP will reduce the need for recovery actions within the plant, which may function to lower overall operator occupational exposures in many scenarios.

Therefore, 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 made a final finding that the amendment involves no significant hazards consideration in Section 5.0, "Final No Significant Hazards Consideration," of this safety evaluation. Accordingly, this 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 NRC staff reviewed the licensee's application, as supplemented by various letters, to transition to a risk-informed, performance-based fire protection program in accordance with the requirements established by NFPA 805. The staff concludes that the licensee's approach, methods, and data are acceptable to establish, implement, and maintain a risk-informed, performance-based fire protection program 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 modifications that must be completed in order to support the conclusions made in this safety evaluation, as well as an established date by which full compliance with 10 CFR 50.48(c) will be achieved. In addition, before the licensee is able to fully implement the transition to a fire

protection program based on NFPA 805 and use the new fire protection license condition to its full extent, a number of implementation items must be completed within the timeframe specified.

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) 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.

9.0 REFERENCES

1. National Fire Protection Association (NFPA) Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, National Fire Protection Association, Quincy, MA
2. Letter from Robert J. Duncan, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-08-061), dated May 29, 2008, "Request For License Amendment To Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants (2001 Edition)" [Agencywide Document Access and Management System (ADAMS) Accession Nos. ML081560641 (letter), ML081840706 (public transition report), ML090500552 & ML091480650 (public attachments), and ML081560644 (non-public transition report and attachments)]
3. Letter from Christopher L. Burton, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-08-113), dated November 14, 2008, "Supplement to Request for License Amendment to Adopt NFPA 805 Performance-Based Standards for Fire Protection for Light Water Reactor Generating Plants (2001 Edition)" [ADAMS Accession Nos. ML083240593 (letter) and ML083240594 (non-public enclosures)]
4. Letter from Christopher L. Burton, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-08-121), dated December 11, 2008, "Supplement 2 to Request for License Amendment to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants (2001 Edition)" [ADAMS Accession Nos. ML083510191 (letter) and ML083510192 (non-public enclosures)]
5. Letter from Christopher L. Burton, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-09-084), dated August 13, 2009, "Response to Request for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC NO. MD8807)" [ADAMS Accession No. ML092320120]
6. Letter from Christopher L. Burton, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-09-086), dated August 28, 2009, "Second Response to Request for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC NO. MD8807)" [ADAMS Accession No. ML092580661]

- 103 -

7. Letter from Christopher L. Burton, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-09-094), dated October 9, 2009, "Third Response to Request for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC NO. MD8807)" [ADAMS Accession Nos. ML092940499 (letter), ML092940500 (non-public transition report, part 1), and ML092940501 (non-public transition report, part 2)]
8. Letter from Christopher L. Burton, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-10-008), dated February 4, 2010, "Response to Second Request for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC NO. MD8807)" [ADAMS Accession Nos. ML100500540 (letter) and ML100500541 (non-public enclosure)]
9. Letter from John C. Warner, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-10-040), dated April 5, 2010, "Response to Third Round of Requests for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC NO. MD8807)" [ADAMS Accession Nos. ML100990363 (letter) and ML100990364 (non-public enclosure)]
10. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light Water Reactor Edition," Section 9.5.1, "Fire Protection Program," Branch Technical Position (BTP) CMEB [Chemical Engineering Branch] 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," Revision 3, U. S. Nuclear Regulatory Commission, Washington, DC, July 1981
11. Letter from Cornelius J. Gannon, Progress Energy, to the U.S. Nuclear Regulatory Commission (Serial HNP-06-082), dated June 9, 2006, "60-Day Response to NRC Generic Letter 2006-03, 'Potentially Nonconforming HEMYC™ and MT™ Fire Barrier Configurations'" [ADAMS Accession No. ML061710062]
12. Regulatory Guide 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1, U. S. Nuclear Regulatory Commission, Washington, DC, December 2009 [ADAMS Accession No. ML092730314]
13. Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 1, U. S. Nuclear Regulatory Commission, Washington, DC, November 2002 [ADAMS Accession No. ML023240437]
14. Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, U.S. Nuclear Regulatory Commission, Washington, DC, March 2009 [ADAMS Accession No. ML090410014] [[RG 1.200, Revision 1, January 2007 – ADAMS Accession No. ML070240001; Clarification to RG 1.200, Revision 1, July 2007 – ADAMS Accession No. ML071940235; Draft RG 1.200, Revision 1, was issued as DG-1161, September 2006 – ADAMS Accession No. ML062480134; RG 1.200, Revision 0,

- February 2004 – ADAMS Accession No. ML040630078; RG 1.200, Revision 0, was issued for trial use with SRP Chapter 19.1 – ADAMS Accession No. ML040630300; Draft RG 1.200, Revision 0, was issued as DG-1122, November 2002 – ADAMS Accession No. ML023360076]]
15. Regulatory Guide 1.189, “Fire Protection for Operating Nuclear Power Plants,” Revision 2, U. S. Nuclear Regulatory Commission, Washington, DC, October 2009 [ADAMS Accession No. ML092580550]
 16. NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light Water Reactor Edition,” Section 9.5.1.2, “Risk-Informed, Performance-Based Fire Protection,” Revision 0, U. S. Nuclear Regulatory Commission, Washington, DC, October 2009 [ADAMS Accession No. ML092590527]
 17. NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light Water Reactor Edition,” Section 19.1, “Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,” Revision 2, U. S. Nuclear Regulatory Commission, Washington, DC, June 2007 [ADAMS Accession No. ML071700657]
 18. NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light Water Reactor Edition,” Section 19.2, “Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance,” Revision 0, U. S. Nuclear Regulatory Commission, Washington, DC, June 2007 [ADAMS Accession No. ML071700658]
 19. NEI 04-02, “Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c),” Revision 2, Nuclear Energy Institute, Washington, DC, April 2008 [ADAMS Accession No. ML081130188]
 20. Regulatory Issue Summary 2007-19, “Process for Communicating Clarifications of Staff Positions Provided in Regulatory Guide 1.205 Concerning Issues Identified During the Pilot Application of National Fire Protection Association Standard 805,” Revision 0, U. S. Nuclear Regulatory Commission, Washington, DC, dated August 20, 2007 [ADAMS Accession No. ML071590227]
 21. Letter from Samuel J. Collins, U.S. Nuclear Regulatory Commission, to C. S. Hinnant, Progress Energy, dated February 25, 2002, “Issuance of Order for Interim Safeguards and Security Compensatory Measures for Shearon Harris Nuclear Power Plant, Unit 1” [ADAMS Accession Nos. ML020510187 (letter) and ML020510635 (Order EA-02-026)]
 22. NEI 98-03, “Guidelines for Updating Final Safety Analysis Reports,” Revision 1, Nuclear Energy Institute, Washington, DC, June 1999 [ADAMS Accession No. ML003779028]
 23. Regulatory Guide 1.181, “Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71(e),” Revision 0, U. S. Nuclear Regulatory Commission, Washington, DC, September 1999 [ADAMS Accession No. ML003740112]

24. NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," Revision 1, Nuclear Energy Institute, Washington, DC, September 2005 [ADAMS Accession No. ML052590476]
25. Regulatory Guide 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 0, U. S. Nuclear Regulatory Commission, Washington, DC, March 2006 [ADAMS Accession No. ML060600183]
26. Information Notice 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire," U. S. Nuclear Regulatory Commission, Washington, DC, dated February 28, 1992 [ADAMS Legacy Library Accession No. 9202240025]
27. Letter from Christopher L. Burton, Progress Energy, to the U. S. Nuclear Regulatory Commission (Serial HNP-10-064), dated June 9, 2010, "Additional Items Related to License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC NO. MD8807)" [ADAMS Accession No. ML101670181]
28. EPRI Technical Report 1006756, "Fire Protection Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features," Electric Power Research Institute, Charlotte, NC, July 2003
29. NUREG-1038, "Safety Evaluation Report related to the Operation of Shearon Harris Nuclear Power Plant, Units 1 and 2," U.S. Nuclear Regulatory Commission, Washington, DC, November 1983 [ADAMS Legacy Library Accession No. 8312230068]
30. NUREG-1038, "Safety Evaluation Report related to the Operation of Shearon Harris Nuclear Power Plant, Unit No. 1," Supplement No. 2, U.S. Nuclear Regulatory Commission, Washington, DC, June 1985 [ADAMS Legacy Library Accession No. 8506270137]
31. NUREG-1038, "Safety Evaluation Report related to the Operation of Shearon Harris Nuclear Power Plant, Unit No. 1," Supplement No. 3, U.S. Nuclear Regulatory Commission, Washington, DC, May 1986 [ADAMS Legacy Library Accession No. 8605210455]
32. NUREG-1038, "Safety Evaluation Report related to the Operation of Shearon Harris Nuclear Power Plant, Unit No. 1," Supplement No. 4, U.S. Nuclear Regulatory Commission, Washington, DC, October 1986 [ADAMS Legacy Library Accession No. 8611050030]
33. Letter from Chandu P. Patel, U.S. Nuclear Regulatory Commission, to Cornelius J. Gannon, Carolina Power & Light Company, dated May 1, 2006, "Shearon Harris Nuclear Power Plant, Unit 1 - Issuance of Amendment on Use of Fire Resistive Cable (TAC NO. MC8134)" [ADAMS Accession No. ML061140227]

34. Generic Letter 1986-10, "Implementation of Fire Protection Requirements," dated April 24, 1986, Supplement 1, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Trains Within the Same Fire Area," dated March 25, 1994, U.S. Nuclear Regulatory Commission, Washington, DC
35. NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revision 2, Nuclear Energy Institute, Washington, DC, December 2007 [ADAMS Accession No. ML091770265]
36. NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revision 1, Nuclear Energy Institute, Washington, DC, January 2005 [ADAMS Accession No. ML050310295]
37. Letter from Marlayna Vaaler, U.S. Nuclear Regulatory Commission, to Christopher L. Burton, Progress Energy, dated August 6, 2009, "Shearon Harris Nuclear Power Plant, Unit 1 - Request for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC No. MD8807)" [ADAMS Accession No. ML092170715]
38. Letter from Marlayna Vaaler, U.S. Nuclear Regulatory Commission, to Christopher L. Burton, Progress Energy, dated January 14, 2010, "Shearon Harris Nuclear Power Plant, Unit 1 - Second Request for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC No. MD8807)" [ADAMS Accession No. ML100130254]
39. Draft NEI 04-06, "Guidance for Self-Assessment of Circuit Failure Issues," Revision L, Nuclear Energy Institute, Washington, DC, March 2005 [ADAMS Accession No. ML050760219]
40. Regulatory Issue Summary 2004-03, "Risk-Informed Approach for Post-Fire Safe-Shutdown Circuit Inspections," Revision 1, U. S. Nuclear Regulatory Commission, Washington, DC, dated December 29, 2004 [ADAMS Accession No. ML042440791]
41. NUREG-1852, "Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire," U. S. Nuclear Regulatory Commission, Washington, DC, October 2007 [ADAMS Accession No. ML073020676]
42. NFPA 72, "National Fire Alarm and Signaling Code," 2010 Edition, National Fire Protection Association, Quincy, MA
43. NFPA 76, "Standard for the Fire Protection of Telecommunications Facilities," 2009 Edition, National Fire Protection Association, Quincy, MA
44. NUREG/CR-6850, "EPRI/NRC-RES, Fire PRA Methodology for Nuclear Power Facilities," Volumes 1 and 2, U. S. Nuclear Regulatory Commission, Washington, DC, September 2005 [ADAMS Accession Nos. ML052580075 (volume 1) and ML052580118 (volume 2)]

45. HNP Fire PRA Pre-Submittal Audit, "Harris Nuclear Plant Fire Probabilistic Risk Assessment Pre-Submittal Audit to ASME Standard for Level 1 / Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," U.S. Nuclear Regulatory Commission, Washington, DC, May 2008 [ADAMS Accession No. ML080650420]
46. Draft ASME/ANS RA-S-2007, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," American Society of Mechanical Engineers and the American Nuclear Society, La Grange Park, IL, September 2007
47. NEI 07-12, "Fire Probabilistic Risk Assessment Peer Review Process Guidance," Revision 0, Nuclear Energy Institute, Washington, DC, November 2008 [ADAMS Accession No. ML083430464]
48. NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volumes 1-7, U.S. Nuclear Regulatory Commission, Washington, DC, May 2007 [ADAMS Accession Nos. ML071650546 (volume 1), ML071730305 (volume 2), ML071730493 (volume 3), ML071730499 (volume 4), ML071730504 (volume 5), ML071730527 (volume 6), and ML071730543 (volume 7)]
49. Yokoi, S., Report Number 24 - "Study on the Prevention of Fire Spread Caused by Hot Upward Current," Building Research Institute, Tokyo, Japan, 1960
50. ASTM E 1355-05a, "Standard Guide for Evaluating Predictive Capability of Deterministic Fire Models," American Society for Testing and Materials, West Conshohocken, PA
51. EPRI Technical Report 1016735, "Fire PRA Methods Enhancements: Additions, Clarifications, and Refinements to EPRI 1011989 (NUREG/CR-6850)," Electric Power Research Institute, Palo Alto, CA, December 2008 [ADAMS Accession No. ML090290195]
52. Memorandum to file from Alexander R. Klein, U.S. Nuclear Regulatory Commission, dated November 23, 2009, "Closure of National Fire Protection Association 805 Frequently Asked Question 08-0046 - Incipient Fire Detection Systems" [ADAMS Accession No. ML093220426]
53. Memorandum from Steven Laur to Alexander R. Klein and Donald G. Harrison, dated April 29, 2009, "Summary of Site Audit to Support the Review of a License Amendment Request for Shearon Harris Nuclear Power Plant to Transition to the National Fire Protection Association Standard 805 Fire Protection Licensing Basis (TAC No. MD0390)," [ADAMS Accession No. ML090990504]
54. BSR/ANS-58.23, "Fire Probabilistic Risk Assessment Methodology Standard," American Nuclear Society, La Grange Park, IL, 2007
55. ASME/ANS RA-Sa-2009, "Standard for Level 1 / Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," American Society of Mechanical Engineers and the American Nuclear Society, La Grange Park, IL, 2009

- 108 -

56. EPRI Technical Report 1003111, "Fire Event Database and Generic Ignition Frequency Model for U.S. Nuclear Power Plants," Electric Power Research Institute, Charlotte, NC, November 2001
57. Letter from S. R. Zimmerman, Carolina Power & Light Company, to Harold R. Denton, U.S. Nuclear Regulatory Commission (Serial NLS 86-315), dated August 25, 1986, "Fire Protection - Additional Information" [ADAMS Legacy Library Accession No. 8608280015]
58. Inspection Manual Chapter 0609, "Significance Determination Process," Appendix G, "Shutdown Operations Significance Determination Process," Attachment 2, "Phase 2 Significance Determination Process Template for PWR During Shutdown," U. S. Nuclear Regulatory Commission, Washington, DC, February 2005 [ADAMS Accession No. ML051400248]
59. NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, Nuclear Energy Institute, Washington, DC, April 1996 [ADAMS Accession No. ML101020415]
60. Letter from Marlayna Vaaler, U.S. Nuclear Regulatory Commission, to Christopher L. Burton, Progress Energy, dated March 9, 2010, "Shearon Harris Nuclear Power Plant, Unit 1 – Discussion of Clarification Questions Related to the License Amendment Request to Adopt National Fire Protection Association Standard 805, 'Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants' (TAC No. MD8807)" [ADAMS Accession No. ML100600987]

Principal Contributors: Harold Barrett, NRR
 Ray Gallucci, NRR
 Andrew Howe, NRR
 Naeem Iqbal, NRR
 Steven Laur, NRR
 Robert Layton, PNNL
 Charles Moulton, NRR
 Steven Short, PNNL

Date: June 28, 2010

A publicly accessible version of the
HNP NFPA 805 Safety Evaluation
attachments will be available on or
before July 23, 2010, at
ADAMS Accession No. ML101750604.