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REGULATORY GUIDE

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REGULATORY GUIDE X.XXX

**RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION
FOR EXISTING LIGHT-WATER NUCLEAR POWER PLANTS**

A. INTRODUCTION

This regulatory guide provides guidance for use in complying with the requirements that the U.S. Nuclear Regulatory Commission (NRC) has promulgated for risk-informed, performance-based fire protection programs that meet the requirements of Title 10, Section 50.48(c), of the *Code of Federal Regulations* (10 CFR 50.48(c)) and the referenced 2001 Edition of the National Fire Protection Association (NFPA) standard, NFPA 805, "Performance-Based Standard for Fire Protection for Light-Water Reactor Electric Generating Plants."

In accordance with 10 CFR 50.48(a), each operating nuclear power plant must have a fire protection plan that satisfies General Design Criterion (GDC) 3, "Fire Protection," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." In addition, before the adoption of 10 CFR 50.48(c), plants that were licensed to operate before January 1, 1979, needed to meet the requirements of 10 CFR Part 50 Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," as stated in 10 CFR 50.48(b). Plants licensed to operate after January 1, 1979, were required to comply with 10 CFR 50.48(a), as well as any plant-specific fire protection license condition and technical specifications.

Section 50.48(c) incorporates NFPA 805 by reference, with certain exceptions, and allows licensees to voluntarily adopt and maintain a fire protection program that meets the requirements of

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This guide was issued after consideration of comments received from the public. The NRC staff encourages and welcomes comments and suggestions in connection with improvements to published regulatory guides, as well as items for inclusion in regulatory guides that are currently being developed. The NRC staff will revise existing guides, as appropriate, to accommodate comments and to reflect new information or experience. Written comments may be submitted to the Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

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NFPA 805 as an alternative to meeting the requirements of 10 CFR 50.48(b) or the plant-specific fire protection license conditions. Licensees who choose to comply with 10 CFR 50.48(c) must submit an application for license amendment to the NRC, in accordance with 10 CFR 50.90. Section 50.48(c)(3) describes the required content of the application.

Plants that do not adopt an NFPA 805 performance-based fire protection program, including plants licensed after January 1, 1979, but use a risk calculation approach to evaluate plant changes that affect the fire protection program, must submit a license amendment for those changes in accordance with 10 CFR 50.90. Pending NRC review and approval of the licensee's performance-based methods, the staff cannot accept that these methods will adequately demonstrate that a change "would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire."

The Nuclear Energy Institute (NEI) developed NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," Revision 1, dated September 2005, to assist licensees in adopting 10 CFR 50.48(c) and making the transition from their current fire protection program (FPP) to one based on NFPA 805. This regulatory guide endorses NEI 04-02, Revision 1, because it provides methods acceptable to the NRC for implementing NFPA 805 and complying with 10 CFR 50.48(c), subject to the additional positions contained in Section C of this regulatory guide and the approval authority 10 CFR 50.48(c) grants to the authority having jurisdiction (AHJ). The regulatory positions in Section C, below, include clarification of the guidance provided in NEI 04-02 as well as any NRC exceptions to the guidance. The regulatory positions in Section C take precedence over the NEI 04-02 guidance.

All references to NEI 04-02 in this regulatory guide refer to Revision 1 of the NEI guidance document. All references to NFPA 805 in this regulatory guide refer to the 2001 Edition of NFPA 805. Where "NFPA 805" is used in this regulatory guide to describe the FPP, license, etc., of a nuclear power plant, it means that the FPP, license, etc., are in accordance with 10 CFR 50.48(c). The NRC is the AHJ for nuclear power plant FPPs.

The information collections contained in this regulatory guide are covered by the requirements of 10 CFR Part 50, which were approved by the Office of Management and Budget (OMB) approval number 3150-0011. The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

Background

The *Code of Federal Regulations*, Title 10, Section 50.48(a), requires that all operating nuclear power plants implement an FPP that satisfies GDC 3 of Appendix A to 10 CFR Part 50. In addition to the requirements of 10 CFR 50.48(a), plants licensed to operate before January 1, 1979, must meet the requirements of Appendix R to 10 CFR Part 50, to the extent described in 10 CFR 50.48(b). Nuclear power plants that were licensed to operate after January 1, 1979 (post-79 plants), must comply with 10 CFR 50.48(a), as well as any plant-specific fire protection license conditions and technical specifications. Fire protection license conditions typically reference NRC

safety evaluation reports (SERs), which are the products of the staff's initial licensing reviews against either (1) Appendix A to Branch Technical Position (BTP) Auxiliary Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the criteria of certain sections of Appendix R to 10 CFR Part 50; or (2) Section 9.5.1, "Fire Protection Program," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP). The SRP closely follows the structure and requirements of Appendix R to 10 CFR Part 50.

The fire protection requirements of GDC 3, Appendix R, and the guidance provided in the BTP and the SRP are considered deterministic. The industry and some members of the public have described these requirements as prescriptive and creating unnecessary regulatory burden. The NRC has issued approximately 900 plant-specific exemptions to the requirements of Appendix R, and, where appropriate, has approved numerous deviations from the licensing requirements for post-1979 plants.

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

Effective July 16, 2004, the Commission amended its fire protection requirements in 10 CFR 50.48 to add 10 CFR 50.48(c), which incorporates the 2001 edition of NFPA 805 by reference, with certain exceptions, and allows licensees to apply for a license amendment to comply with NFPA 805. (See Volume 69, page 33536 of the *Federal Register* (69 FR 33536)). The NRC cannot adopt future editions of NFPA 805 without rulemaking. However, licensees may request to use specific risk-informed or performance-based alternatives included in future additions of NFPA 805 by submitting a license amendment, in accordance with 10 CFR 50.48(c)(4).

In parallel with the Commission's efforts to promulgate a rule endorsing risk-informed, performance-based fire protection provisions of NFPA 805, NEI worked with the industry and the NRC staff to develop implementing guidance for the specific provisions of NFPA 805 and 10 CFR 50.48(c). The NEI published such guidance in NEI 04-02, Revision 1, in September 2005. This NRC regulatory guide provides the staff's position on NEI 04-02 and offers additional information and guidance to supplement the NEI document and assist licensees in meeting the Commission's requirements.

Interim Enforcement Discretion Policy

The Commission approved and published the interim enforcement discretion policy in the *Federal Register* on June 16, 2004 (see 69 FR 33684). In January 2005, the Commission revised this policy to extend the due date for a licensee to submit a letter stating its intent to adopt NFPA 805 until December 31, 2005 (see 70 FR 2662). Additional information on NRC enforcement policies can be found at:

<http://www.nrc.gov/what-we-do/regulatory/enforcement/enforce-pol.html>.

In summary, the enforcement discretion begins upon receipt of the letter of intent from the licensee. The enforcement discretion period is then in effect for up to 2 years. If the licensee submits a license amendment request to transition to NFPA 805, the enforcement discretion would continue until the NRC completes approval of the amendment request, which could potentially extend beyond the 2-year period. In addition, for licensees that submitted a letter of intent (LOI) prior to December 31, 2005, enforcement discretion will be applied for up to 2 years from the date of the LOI to cover corrective action implementation for existing and identified noncompliances, until the licensee completes its transition to 10 CFR 50.48(c). The enforcement policy for discretion for existing noncompliances requires licensees to begin the transition process soon after submittal of the LOI and to submit the transition license amendment request within 2 years of the date of the LOI. In the event that the NRC approves an extension of the 2-year enforcement discretion period, licensees will have the option of following either the original policy or the new policy.

For those plants that submit an LOI, but subsequently decide not to complete the transition to 10 CFR 50.48(c), the enforcement policy requires the licensee to inform the NRC of this decision and withdraw its LOI. Any violations that are identified and corrected before the date of the withdrawal letter would be unaffected by the withdrawal. The staff will consider the continuation of enforcement discretion for violations that are identified before the withdrawal on a case-by-case basis to ensure that timely corrective actions are taken commensurate with the safety significance of the issue. Any violations identified after withdrawal of the LOI would be dispositioned in accordance with normal enforcement practices. Section 3 of NEI 04-02 provides additional details of the application of the enforcement discretion policy.

Fire Protection Program Changes

Prior to the promulgation of 10 CFR 50.48(c), plants typically adopted a standard fire protection license condition. Under this condition, the licensee can only make changes to the approved FPP, without prior Commission approval, if the changes do not adversely affect the plant's ability to achieve and maintain safe shutdown in the event of a fire. A new fire protection license condition will be imposed for licensees choosing to adopt NFPA 805 that will define the bases for making changes to the approved NFPA 805 FPP without prior NRC approval. The NFPA 805 standard contains specific requirements for evaluating changes to the program. See Regulatory Position 3.1 in Section C of this regulatory guide for an acceptable fire protection license condition for plants adopting NFPA 805.

Appendices to NFPA 805

As discussed in the Statements of Consideration for the proposed rulemaking (see 67 FR 66578), and restated in the comment resolution for the final rulemaking that amended 10 CFR 50.48 to incorporate NFPA 805 by reference (see 69 FR 33536), the appendices to NFPA 805 are not considered part of the rule. However, Appendices A, B, C, and D provide useful information for implementing the requirements of NFPA 805. The staff finds the specific guidance contained within these appendices to be acceptable to the extent that this guidance is specifically endorsed within the positions contained in Section C of this regulatory guide.

Fire Probabilistic Safety Assessment

Although a licensee may transition to an NFPA 805-based FPP without a fire probabilistic safety assessment (PSA)¹ model, the NRC anticipates that licensees will develop a plant-specific fire PSA for this purpose. Consequently, much of the guidance provided by this regulatory guide is only applicable to a FPP license that includes a fire PSA. The NRC recommends that licensees adopting an NFPA 805 license develop a plant specific fire PSA as an integral part of their transition process. Without a fire PSA, licensees will not realize the full safety and cost benefits of transitioning to NFPA 805.

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¹ The NRC considers probabilistic safety analysis (PSA) and probabilistic risk analysis (PRA) to be synonymous. PSA will be used in this regulatory guide.

C. REGULATORY POSITIONS

1. NEI 04-02

The regulatory guide endorses the guidance of NEI 04-02, Revision 1, which provides methods acceptable to the staff for adopting an FPP consistent with the 2001 edition of NFPA 805 and 10 CFR 50.48(c), subject to the regulatory positions contained herein. Future revisions to NEI 04-02 may be evaluated by the NRC and acceptable revisions will be endorsed in accordance with the appropriate regulatory process.

NEI 04-02 provides the majority of the guidance applicable to the implementation of the regulatory requirements of 10 CFR 50.48(c) and NFPA 805. The guidance included in this regulatory guide is provided to emphasize certain issues; to clarify the requirements of 10 CFR 50.48(c) and NFPA 805; to clarify the guidance in NEI 04-02; and to modify the NEI 04-02 guidance where required. Should a conflict occur between NEI 04-02 and the regulatory guide, the regulatory guide governs.

Since the purpose of this regulatory guide is to provide guidance for implementation of the requirements of 10 CFR 50.48(c) and NFPA 805, the NRC's endorsement of NEI 04-02 excludes Section 6.0, Implementing Guidance for Use of Tools and Processes Within Existing Licensing Basis, which provides guidance for using the risk-informed methods of NFPA 805 without adopting an NFPA 805 license.

In addition, the NRC's endorsement of NEI 04-02 does not imply the NRC's endorsement of the references cited in NEI 04-02. The guidance provided by these references has not necessarily been reviewed and approved by the NRC, except where specifically noted in this regulatory guide.

2. License Transition Process

2.1 General

The NFPA 805 standard is structured to allow licensees to transition most of their existing FPP from their current licensing basis to an NFPA 805 licensing basis. Licensees need to address the basic elements of NFPA 805 as they transition their FPPs. These elements include (1) the nuclear safety performance criteria for all modes of operation, (2) the radioactive material release performance criteria, (3) compliance with the fundamental FPP and design elements, and (4) the specific documentation, quality, and configuration management provisions of the NFPA standard. In addition, modification must be made to the FPP to address new elements of NFPA 805 that are not addressed by current regulations.

Licensees must submit an application for license amendment to change their fire protection licensing basis to adopt 10 CFR 50.48(c). As stated in 10 CFR 50.48(c)(3)(ii), the licensee must implement the methodology in Chapter 2 of NFPA 805 and modify the FPP required by 10 CFR 50.48(a) to reflect compliance with NFPA 805 before changing its current program or modifying the plant. The modified FPP should not be implemented until the licensee receives the approved SER for the license amendment request.

An NRC-approved exemption or deviation granted prior to adoption of the NFPA 805 license does not need to be evaluated by the NFPA 805 plant change evaluation process, but should be reviewed during the transition to an NFPA 805 license to ensure that the bases for the exemption/deviation requests are still applicable under an NFPA 805 licensing basis.

10 CFR 50.48(c) does not mandate a specific schedule for implementing an FPP which meets the provisions of NFPA 805. However, licensees who wish to take advantage of the Commission's interim enforcement discretion policy for fire protection will need to establish an implementation schedule consistent with the enforcement policy.

2.2 License Amendment Request

Section 4.6.1 of NEI 04-02 provides a list of key items that should be included in the license amendment request. In addition to the items listed in NEI 04-02, the submittal should include a description of all FPP changes, as defined in Regulatory Position 3.2.1, that are to be included in the transition to the NFPA 805 license.

Certain aspects of the plant's FPP may not have been specifically approved by the NRC, e.g., through an SER or approved 10 CFR 50.12 exemption request. This has resulted in uncertainty in licensees' fire protection licensing bases. Licensees may elect to submit elements of the plant FPP which are uncertain, such as the crediting of operator manual actions and circuit analysis methods, in order to obtain explicit approval of these elements under 10 CFR 50.48(c). NEI 04-02 provides guidance on elements of the FPP that licensees may want to address in the license amendment request for this purpose. The submittals addressing these FPP elements should include sufficient detail to allow the NRC to adequately assess whether the licensee's treatment of these elements meets 10 CFR 50.48(c) requirements.

10 CFR 50.48(c)(2)(vii), allows a licensee to request NRC approval by license amendment of the use of NFPA 805 performance-based methods in determining the licensee's compliance with the fire protection program elements and minimum design requirements of Chapter 3 of NFPA 805. 10 CFR 50.48(c)(4), allows a licensee to request NRC approval by license amendment of the use of alternative risk-informed or performance-based methods, i.e., methods that are different from the methods prescribed by NFPA 805, to demonstrate compliance with 10 CFR 50.48(c). Guidance for including such requests in the license amendment request for transitioning to NFPA 805 are provided in Regulatory Position 3.2.3.

The total risk increase associated with all FPP noncompliances (based on current deterministic FPP regulations) that the licensee does not intend to bring into compliance and the total risk change associated with plant changes planned for the transition to NFPA 805 should be estimated and reported in the license amendment request. The baseline FPP risk for the estimate of the net risk change is that for a plant that is fully compliant with the current deterministic regulations for the FPP, including NRC-approved exemptions/deviations. The risk increase may be combined with risk decreases associated with retaining or installing fire protection features not required by NFPA 805 when estimating the total risk change to be reported in the license amendment request. Features not required by NFPA 805 but credited in the risk assessment should become part of the licensing basis. The total change in risk associated with transition to NFPA 805 should be consistent with the acceptance guidelines in RG 1.174.

Upon completing the transition to an NFPA 805 licensing basis, the baseline FPP risk will be the risk of the plant as-designed and operated according to the NRC-approved FPP licensing basis.

2.3 Existing Engineering Equivalency Evaluations

NFPA 805, Section 2.2.7 describes the application of Existing Engineering Equivalency Evaluations (EEEE's) when using a deterministic approach during the transition to an NFPA 805 FPP. One type of EEEE, commonly referred to as a "Generic Letter 86-10 (GL 86-10) evaluation," allows licensees who have adopted the standard fire protection license condition (under their current FPP and in accordance with GL 86-10) to make changes to the approved FPP without prior NRC approval if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. With the exception of evaluations of certain recovery actions and any deviations from NFPA 805 requirements, a GL 86-10 evaluation showing no adverse effect on safe shutdown and permitted under the licensee's current licensing basis is one acceptable means of meeting the NFPA 805 EEEE acceptance criteria of "an equivalent level of fire protection compared to the deterministic requirements." However, EEEE's performed prior to transitioning to a performance-based FPP must be based on deterministic methods. If based on a risk calculation, the EEEE will have to be evaluated using the licensee's approved NFPA 805 change evaluation process.

Recovery actions credited for protection of redundant trains in areas where Appendix R, III.G.2 protection is required, do not meet the deterministic requirements of Chapter 4 of NFPA 805. Consequently these recovery actions, unless specifically approved by the NRC, should be addressed as a plant change in accordance with Section 2.4.4 of NFPA 805 using performance-based methods. The change process must include an evaluation of the risk impact associated with the recovery action, either qualitative or quantitative, as appropriate. Quantitative risk calculations should be in accordance with NFPA 805, Section 4.2.4.2 (a bounding calculation approach is acceptable). Recovery actions that meet the required performance criteria of NFPA 805 and the criteria in this regulatory guide for making changes without prior NRC review and approval do not need to be submitted to the NRC for approval.

NEI 04-02, Section 4.1.1, Transition Process Overview, notes that the licensee will review EEEE's during the transition process to ensure the quality level and the basis for acceptability are still valid. Except as noted above, satisfactory results from this review will provide adequate basis to transition EEEE's as meeting the deterministic requirements of Chapter 4 of NFPA 805. Guidance for acceptable EEEE's is provided in NUREG-0800, Section 9.5.1, Fire Protection, and in Regulatory Guide 1.189, "Fire Protection for Operating Nuclear Power Plants."

EEEE's which support deviations from the requirements and methods of NFPA 805 must be submitted for NRC approval in accordance with 10 CFR 50.48(c) and NFPA 805. Specific guidance for submittal requirements are also provided in Regulatory Position 3.2.4. Of the EEEE's that must be approved by the NRC, those that are pre-existing and those performed during the transition to an NFPA 805 licensing basis should be submitted with the fire protection license amendment request.

2.4 Documentation of Prior NRC Approval

Chapter 3 of NFPA 805 notes that previously approved alternatives from the fundamental FPP attributes of Chapter 3 by the NRC take precedence over the requirements contained in Chapter 3. The documentation which demonstrates prior NRC approval of an alternative to Chapter 3 requirements, as well as approval of noncompliances with existing license regulatory requirements, includes SERs and NRC approvals of exemption or deviation requests. Inspection reports, meeting minutes and letters from licensees without a corresponding NRC approval response in writing are examples of documents that do not represent NRC approval for this purpose. Documents listed in Section 2.3.1 of NEI 04-02 which are not addressed in this regulatory position do not necessarily represent NRC approval and must be evaluated by the NRC on a case-by-case basis. Changes to the approved FPP that have not been specifically reviewed and approved by the NRC are subject to review through the Reactor Oversight Process.

3.0 NFPA 805 Fire Protection Program

3.1 Standard License Condition

As specified in 10 CFR 50.48(c)(3)(i), the license amendment request must identify any license conditions to be revised or superseded. 10 CFR 50.48(c) and NFPA 805 identify aspects of a performance-based FPP that must be specifically approved by the NRC (referred to as the AHJ in NFPA 805) via a license amendment. It is the intent of 10 CFR 50.48(c) that certain changes may be made to the FPP without prior review and approval of the NRC. This intent is reflected in the regulatory analysis for 10 CFR 50.48(c) that states "Licensees choosing to use the flexibilities provided by the rulemaking could use risk-informed and performance-based approaches and methods in NFPA 805 rather than submitting an exemption or deviation request each time they wish to depart from current requirements."

The NRC intends to provide this flexibility to make changes without prior NRC review and approval for licensees that transition to 10 CFR 50.48(c) by their adoption of the following fire protection license condition which includes acceptance criteria for making changes to the licensee's fire protection program without prior review and approval by the NRC. The application of these risk acceptance criteria requires that the plant have an acceptable fire PSA that is in accordance with the guidance in Regulatory Position 4.3 and has been subjected to a peer review process assessed against a standard or set of acceptance criteria that is endorsed by the NRC.

(Name of Licensee) shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c) as specified in the licensee amendment request dated _____ and as approved in the safety evaluation report dated _____ (and supplements dated _____). Except where NRC (AHJ) approval for changes or deviations is required by 10 CFR 50.48(c) and NFPA 805, 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), 10 CFR 50.48(c), and the following:

- (a) Prior NRC review and approval is not required for a change that results in a net decrease in risk for both CDF and 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 change evaluation.

- (b) Prior NRC review and approval is not required if the change results in a net calculated risk increase less than $1\text{E-}7/\text{yr}$ for CDF and less than $1\text{E-}8/\text{yr}$ 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 change evaluation. Change reports need not be submitted to the NRC for these changes.
- (c) Where the calculated plant change risk increase is $<1\text{E-}6/\text{yr}$, but $\leq 1\text{E-}7/\text{yr}$ for CDF or $<1\text{E-}7/\text{yr}$, but $\leq 1\text{E-}8/\text{yr}$ for LERF, the licensee must submit a summary description of the change to the NRC following completion of the change evaluation. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. If the NRC does not object to the change within 90 days, the licensee may proceed with implementation of the proposed change.

3.2 NFPA 805 Fire Protection Program Change Evaluation Process

3.2.1 Definition of a Change

NFPA 805 includes provisions for licensees to make changes to their approved FPP (once the transition to an NFPA 805 license is complete). In the context of an NFPA 805 FPP that complies with 10 CFR 50.48(c), a change may be any of the following:

- (a) A physical plant modification that affects the FPP
- (b) A programmatic change (e.g., change to a procedure, assumption or analysis) that affects the FPP
- (c) An in-situ condition (physical or programmatic) that is a FPP regulatory requirement noncompliance or a fire protection licensing basis noncompliance and that the licensee does not intend to correct via a plant or programmatic modification

Noncompliances are based on the applicable regulations, as well as staff positions (e.g., generic letters, regulatory issue summaries) developed in support of fire protection regulatory requirements, that were applicable to the licensee prior to the transition to a 10 CFR 50.48(c) FPP. The requirements of 10 CFR 50.48(c) and the guidance provided by this regulatory guide for evaluating changes are applicable regardless of when the noncompliance is identified (during or after the transition to an NFPA 805 license).

For “changes” that involve acceptance of an existing unapproved condition (i.e., a noncompliance), appropriate compensatory measures should be established and should remain in place until the condition is accepted via the plant change evaluation process or until the licensee receives notification that the NRC does not object to the change (or the NRC does not notify the licensee within 90-days), as applicable.

3.2.2 Fire Protection Program Change Evaluations

The licensee should perform an engineering evaluation to demonstrate the acceptability of the change in terms of the plant change evaluation criteria and compliance with the fire protection requirements of 10 CFR 50.48(a) and NFPA 805 as endorsed in 10 CFR 50.48(c). The plant change evaluation process includes an integrated assessment of the acceptability of risk, defense-in-depth (DID), and safety margins, regardless of the methods or approaches used to evaluate the change.

Section 5.3 of NEI 04-02 addresses the evaluation of changes to a licensee's FPP. In addition to addressing change process considerations, Section 5.3 of NEI 04-02 describes methods and tools for evaluating changes to the FPP. Regulatory Position 4 describes the NRC staff positions regarding these methods and tools. The following regulatory positions are also applicable to the process of evaluating changes, submitting changes for NRC review and/or approval, and implementing changes following completion of the transition to a 10 CFR 50.48(c) FPP.

The risk evaluation performed as part of the engineering evaluation should use the methods and tools described in Regulatory Position 4.3, as appropriate. NEI 04-02 contains a detailed discussion useful in evaluating changes in risk when using quantitative risk assessment methods and tools. When comparing the risk impact of a change to the risk thresholds provided in Regulatory Position 3.1, use the combined change in risk for all FPP changes related to the same FPP issue or for all FPP changes that affect the same fire area of the plant, as appropriate.

NEI 04-02 also provides useful information regarding the assessment of DID and identifies acceptable industry guidelines that are consistent with the approach to assessing DID as described in Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis".

As applicable to the FPP change being evaluated, the evaluation should address the following items:

- (a) For changes that affect the protection of plant structures, systems, and components necessary to meet performance criteria in the event of a fire, the evaluation should demonstrate that nuclear safety and radiological release performance criteria will continue to be met considering all relevant plant modes and configurations using, as appropriate for the change being evaluated, the methodologies provided in NFPA 805 or in the NRC-approved plant FPP.

The licensee shall demonstrate reasonable assurance that at least one success path necessary to achieve and maintain nuclear safety performance criteria remains free from fire damage, as defined in NFPA 805, Section 1.6.29, considering the effects of the fire and fire suppression activities.

When using fire modeling (see NFPA 805, Section 4.2.4.1) to demonstrate that at least one success path remains free from fire damage, the evaluation shall demonstrate that the margin between the maximum expected fire scenario and the limiting fire scenario is sufficiently large to bound any uncertainties in the fire model engineering analysis.

Section 2.4.7 of Appendix D to NEI 04-02 contains a detailed discussion that is useful in evaluating the margin between the maximum expected fire scenario and the limiting fire scenario.

- (b) For changes to the FPP that involve fundamental program and design elements, the evaluation should address how the change affects compliance with the requirements of NFPA 805, Chapter 3 and the plant specific fire protection license condition.

The performance objectives of NFPA 805 must be met in the event of a fire during any operational mode and plant configuration. Consequently, the plant change evaluation should include an assessment of the affect the change has on the ability to meet the performance objectives when the plant is at low power operation and shut down. See NEI 04-02, Section 4.3.3 and Appendix F, for additional guidance with respect to non-power plant modes.

3.2.3 *Deviations From NFPA 805 Chapter 3 Requirements and Alternative Change Evaluation Methodologies*

10 CFR 50.48(c)(2)(vii), allows a licensee to request NRC approval by license amendment of the use of NFPA 805 performance-based methods in determining the licensee's compliance with the fire protection program elements and minimum design requirements of Chapter 3 of NFPA 805. 10 CFR 50.48(c)(4), allows a licensee to request NRC approval by license amendment of the use of alternative risk-informed or performance-based methods, i.e., methods that are different from the methods prescribed by NFPA 805, to demonstrate compliance with 10 CFR 50.48(c). Since the appendices of NFPA 805 are not endorsed by 10 CFR 50.48(c), a risk-informed or performance based method described in the appendices but not in the main body of NFPA 805 is considered an alternative method and must be reviewed and approved by the NRC via a license amendment request.

Performance-based methods, including proposed alternative methods, applied to the licensee's FPP, including evaluation of changes to the program, must ensure the following:

- (a) The required NFPA 805 performance goals, performance objectives and performance criteria are satisfied
- (b) Safety margins are maintained
- (c) Fire protection defense-in-depth is maintained

Alternative risk-informed, performance-based methods should be described in a license amendment request and must be approved by the NRC prior to incorporation in the licensee's FPP. The description should include, as a minimum, the following:

- (a) Detailed description of the alternative risk-informed, performance-based method
- (b) Description of how the method will be applied, which aspects of the FPP it will applied to, and under what circumstances it will be applied

- (c) Acceptance criteria, including risk increase acceptance criteria, that the licensee will apply when determining whether the results of an evaluation that uses this methodology meet the required NFPA 805 performance goals, performance objectives and performance criteria
- (d) For PSA-based methodologies, an explanation of how the PSA is of sufficient technical adequacy for evaluation of the changes to which it will be applied
- (e) For PSA-based methodologies, a description of the peer review and how the review findings have been addressed

The licensing amendment request should include complete and concise details of the proposed methodology to minimize the potential for misinterpretations. Where the methods have been adequately described in the license amendment request and have been accepted by the NRC in an SER, these alternative methods may be applied to the licensee's FPP. A licensee may apply these approved methods within the limits specifically described in the licensing basis to implement plant changes that affect the FPP without prior NRC review and approval.

The types of plant changes that may be approved without prior review and approval will be limited to those for which the risk assessment methods are adequate to demonstrate that any increase in risk will be below the appropriate thresholds. In additions, subsequent changes to the approved alternative methodology must be submitted for NRC review and approval via a license amendment request prior to their application to the licensee's FPP.

3.2.4 NRC Approval of Fire Protection Program Changes

The following FPP changes must be submitted for NRC review and approval via a license amendment request prior to implementation, except where permitted otherwise by the approved fire protection licensing basis:

- (d) Changes that are alternatives from the fundamental FPP attributes required by NFPA 805, Chapter 3, and that have not been previously approved by the NRC.
- (e) Changes that do not meet the acceptance criteria of the approved license condition.
- (f) Changes that have been evaluated using performance-based methods other than those described in Regulatory Position 4, included in NFPA 805, or described in the NRC-approved plant FPP.
- (g) Changes that involve, or require conforming changes to, a license condition or the plant's technical specifications.

Following completion of the licensee's change evaluation, the licensee shall submit the request for approval of the change(s) to the NRC pursuant to 10 CFR 50.48(c) and 10 CFR 50.90. For "changes" that involve acceptance of an existing condition (i.e., a noncompliance), appropriate compensatory measures should be established and should remain in place until the license amendment is approved by the NRC.

3.2.5 Plant Changes Without Prior NRC Approval

This regulatory guide provides one acceptable approach for licensees to make FPP changes without prior NRC review and approval. NFPA 805 Section 2.4.4.1, Risk Acceptance Criteria, notes that the change in public health risk from any plant change shall be acceptable to the AHJ. The risk acceptance criteria for plant changes as provided in the standard license condition in Regulatory Position 3.1 are acceptable to the NRC.

Where permitted by the approved fire protection license condition, plants that have an acceptable fire probabilistic safety assessment (PSA) that is in accordance with the guidance in Regulatory Position 4.3 and has been subjected to a peer review process assessed against a standard or set of acceptance criteria that is endorsed by the NRC, may make changes without prior NRC review and approval based on the criteria in Regulatory Position 3.1.

When comparing the risk impact of a change to the risk thresholds provided in Regulatory Position 3.1, use the combined change in risk for all FPP changes related to the same FPP issue or for all FPP changes that affect the same fire area of the plant, as appropriate. The guidance for combining changes provided in Section 2.1.2 of RG 1.174 is applicable. For changes with a calculated plant change risk increase of $<1\text{E-}6/\text{yr}$, but $\$1\text{E-}7/\text{yr}$ for CDF or $<1\text{E-}7/\text{yr}$, but $\$1\text{E-}8/\text{yr}$ for LERF, the licensee must submit a summary description of the change to the NRC following completion of the change evaluation. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The summary description required for reporting changes should include the following information:

- Summary of the change evaluation
- Assumptions
- Description of programmatic control elements (e.g., hot work permitting/fire watches and combustibles control) in place that support the analysis
- Change in CDF/LERF, including the change in individual parameters used to calculate the $\Delta\text{CDF}/\Delta\text{LERF}$
- Affect of the change on safety margin
- Affect of the change on defense-in-depth

The change description should be submitted in accordance with 10 CFR 50.4(a) and (b)(1). The submittal should be signed by the responsible officer for the licensee's FPP. Within 90 calendar days of receipt of the change description, the NRC will notify the licensee if the change is accepted and may be implemented or that additional information is required to assess the acceptability of the change evaluation. In the event that the NRC does not respond within 90 days, the licensee may proceed with implementation of the proposed change, as provided for in the standard fire protection license condition.

3.2.6 Cumulative Risk of Changes

Section 2.4.4.1 of NFPA 805 requires that licensees evaluate the cumulative effect of plant changes on overall risk and states that if more than one plant change is combined into a group for the purposes of evaluating acceptable risk, the evaluation of each individual change shall be performed along with the evaluation of combined changes. Evaluation of the cumulative risks shall be performed in accordance with Section 3.3.2 of RG 1.174.

Following the transition to the NFPA 805 license, the total risk associated with multiple changes should be combined in accordance with Regulatory Guide 1.174 Sections 2.1.1 and 2.1.2 when evaluating the combined change against the risk thresholds provided in this regulatory guide or in the plant fire protection license condition. For plants using PSA methods, approved changes should be incorporated in the periodic updates of the PSA model. Cumulative risk increase associated with all changes made after the transition is complete does not need to be calculated. Acceptability of total plant risk will be judged according to RG 1.174. Post-transition risk reductions for plant changes that are not related to the FPP may be used to offset risk increases due to FPP-related changes in accordance with Section 2.1.2 of RG 1.174, but must be pre-approved by the NRC as required by the standard fire protection license condition. Risk reductions for changes related to the FPP may be used as offsets without pre-approval by the NRC.

3.2.7 Monitoring Fire Protection Program Changes

Section 2.6 of NFPA 805 sets forth provisions for monitoring the FPP and Section 5.2 of NEI 04-02 provides guidance with respect to monitoring. The licensee's monitoring program should include evaluation of FPP changes with respect to their affect on the monitoring program. This evaluation should address any changes to the monitoring program that are necessary to ensure that the assumptions made in the engineering evaluations for FPP changes are maintained and remain valid.

3.2.8 Documentation of Changes

The licensee should document descriptions of changes made to the FPP, reasons for the changes, and engineering evaluations related to the changes and retain them until termination of the license. The licensee should organize its change documentation so that changes can be readily identified and the associated documentation retrieved for inspection by the NRC.

Documentation should: (1) clearly describe the assumptions, identify the methods, and present the results of the evaluation in a manner that is easily understood and in sufficient detail to allow future review of the entire analyses, and (2) conform to the quality requirements of NFPA 805, Section 2.7.3. Additional guidance for documentation of plant change evaluations is provided in Section 3 of Regulatory Guide 1.174 and Section 4 and Appendix C of NEI 04-02.

3.3 Circuit Analysis

Industry guidance document NEI 00-01, Revision 1, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," used in conjunction with NFPA 805 and this regulatory guide, provides one acceptable approach to circuit analysis for a plant that has transitioned to a 10 CFR

50.48(c) licensing basis. Where the deterministic requirements of NFPA 805 Chapter 4 for the protection of required circuits cannot be met, circuit analysis assumptions regarding the number of spurious actuations, the manner in which they occur (e.g., sequentially or simultaneously) and the time between spurious actuations should be supported by engineering analysis and/or test results that are accepted by industry and the NRC. Aspects of circuit protection that do not conform to the deterministic requirements of NFPA 805 Chapter 4 and were not previously approved by the NRC in accordance with Regulatory Position 2.4 may be evaluated using the NFPA 805 plant change process. Those evaluations of nonconformances that adequately demonstrate that the required performance criteria of NFPA 805 are met in accordance with this regulatory guide, do not need to be submitted to the NRC for approval.

NEI 04-02, Section B.2.1 describes three thresholds applicable to the change in risk associated with multiple spurious actuations when performing the post-fire safe-shutdown circuit analysis, including change evaluations. The staff accepts the NEI thresholds for screening ($<1\text{E}-8/\text{yr}$ for ΔCDF and $<1\text{E}-9/\text{yr}$ for ΔLERF) and for circuit protection ($<1\text{E}-6/\text{yr}$ for ΔCDF and $<1\text{E}-7/\text{yr}$ for ΔLERF). However, for a risk increase $1\text{E}-7/\text{yr}$ but $<1\text{E}-6/\text{yr}$ for CDF or $1\text{E}-8/\text{yr}$ but $<1\text{E}-7/\text{yr}$ for LERF, the actions required should be in accordance with the standard license condition in Regulatory Position 3.1. Although the NEI 04-02 thresholds assume no credit for recovery actions, the thresholds in the standard license condition may be applied after appropriate credit is given to feasible and reliable recovery actions.

Quantitative risk calculations must use the approach described in NFPA 805, Section 4.2.4.2 (compare the noncompliance risk to the compliance risk based on the deterministic approach of Section 4.2.3 of NFPA 805). A bounding calculation approach is acceptable. New scenarios resulting from multiple spurious actuations that are identified should not be screened out of the deterministic evaluation prior to the determination of whether they are risk significant or not.

The nuclear safety circuit analysis should address possible equipment damage and the inability to restore equipment operability caused by spurious actuation, including the types of failures described in NRC Information Notice (IN) 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire," dated February 1992 and Regulatory Guide 1.106, "Thermal Overload Protection for Electric Motors on Motor-Operated Valves," dated November 1975. The type of failure described in IN 92-18 is an example of a failure mechanism that may not have been considered during the post-fire safe-shutdown analysis. Protecting against this one type of failure does not preclude the requirement to address other possible fire-induced failure mechanisms.

3.4 Physical Protection and Security Orders

NRC requirements for the physical protection of nuclear power plants are set forth in 10 CFR Part 73 "Physical Protection of Plant and Materials." The physical protection requirements are further supplemented by various security Orders (e.g., EA-02-026, February 25, 2002, "Interim Safeguards and Security Compensatory Measures", EA-03-086, April 29, 2003, "Revised Design Basis Threat for Operating Power Reactors", and other security related orders for operating reactors as applicable), Advisories, other generic communications, and plant specific security commitments. Licensees who implement changes to their plant shall ensure

that compliance with the physical protection requirements, security orders and subsequent rulemaking, and adherence to their commitments applicable to their plant are maintained.

4. NFPA 805 Analytical Methods and Tools

4.1 General

Engineering analyses and associated methods that the licensee applies to demonstrate compliance with the nuclear safety and radioactive release performance criteria should have the requisite degree of technical and defensible justification, as dictated by the scope and complexity of the specific application. Persons qualified in the specific analytical methods should perform these analyses, which should include any necessary verification and validation (V&V) of methods used in the specific applications.

4.2 Fire Models

Section 1.6.18 of NFPA 805 defines a fire model as the “mathematical prediction of fire growth, environmental conditions, and potential effects on structures, systems, or components based on the conservation equations or empirical data.” Section 2.4.1.2 of NFPA 805 requires that only fire models acceptable to the AHJ (NRC) be used in fire modeling calculations. Further, NFPA 805, Sections 2.4.1.2.2 and 2.4.1.2.3, state that the fire models be applied within their limitations, and be V&V'd.

Licensees should justify that the fire models and methods that have been determined to be acceptable by the NRC for use in performance-based analysis are used within their limitations and with the rigor required by the nature and scope of the analysis. These analyses may use simple hand calculations or more complex computer models, depending on the specific conditions of the scenario being evaluated. Appendix C to NFPA 805 and Appendix D to NEI 04-02 contain detailed discussions that are useful in determining what fire models to use and applying those fire models within their limitations.

The NRC's Office of Nuclear Regulatory Research (RES) and the Electric Power Research Institute (EPRI) have documented the V&V for 5 fire models in draft NUREG-1824 and EPRI 1011999, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications." The specific fire models documented are (1) NUREG-1805, "Fire Dynamics Tools (FDTs)," (2) Fire-Induced Vulnerability Evaluation (FIVE), Revision 1, (3) the National Institute of Standards and Technology (NIST) Consolidated Model of Fire Growth and Smoke Transport (CFAST), (4) the Electricité de France (EdF) MAGIC code, and (5) the NIST Fire Dynamics Simulator (FDS).

Licensees may propose the use of fire models that have not been specifically V&V'd by the NRC; however, licensees are responsible for providing V&V of these fire models. The V&V documents for licensee proposed fire models are subject to NRC review and approval under the provisions of 10 CFR 50.48(c)(4).

4.3 Fire Probabilistic Safety Assessment/Risk Analysis

Section 2.4.3.3 of NFPA 805 requires that the PSA approach, methods, and data be acceptable to the AHJ. This section of the regulatory guide provides guidance with respect to the acceptability of the approaches, methods and data used for the PSA approach. Additional guidance for the PSA approach is provided by NEI 04-02, including Sections 5.1.3, 5.3.4, J.4 and J.5.

Licensees should justify that the methods that the NRC finds acceptable for use in meeting NFPA 805 requirements are appropriate for each specific application. These analyses may use screening methods or more complex quantitative PSA methods, depending on the specific conditions of the scenario being evaluated. Appendix D to NFPA 805 provides useful information for implementing the requirements of NFPA 805; specific guidance contained within this appendix is acceptable to the staff for the use and application of PSA when applied in accordance with the positions presented in Section C of this regulatory guide.

When licensees choose to rely on information in an internal events-based PSA model to quantify risk associated with fires, they should review the analysis to ensure that the model addresses applicable NFPA 805 requirements, including the engineering analysis requirements of NFPA 805, Section 2.4.2. Section D.3.4 of Appendix D to NFPA 805 provides useful guidance regarding fire-specific issues that should be addressed when applying internal events-based analyses to the assessment of risk from fires. Based on the review, the licensee should modify its internal events-based PSA model, as necessary, to meet applicable NFPA 805 requirements.

Where licensees choose to rely on past fire protection PSAs (e.g., IPEEE for fires), the licensees should review these past analyses to determine their continued applicability and adequacy (e.g., inputs, assumptions, data) in meeting the NFPA 805 requirements. Licensees should reconsider scenarios previously screened from analysis, if changes associated with NFPA 805 implementation or compliance alter the scope of the original analysis or the screening conclusions. Some detailed fire PSAs implicitly model failure of fire detectors and manual/automatic suppression per fire area and scenario when assigning the fire initiation frequency to that particular scenario. If so, any "modification factor," typically called a "severity factor" and employed to compensate for the fire initiation frequency not implicitly accounting for detection or suppression, should not include considerations of detection or suppression in order to avoid any non-conservative double-counting.

The NRC Office of Research (RES) and the EPRI have documented fire PSA methods, tools, and data to support risk assessments in NUREG/CR-6850 and EPRI 1011989, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities." This document discusses methods to perform fire risk analyses. Additional guidance on PSA quality is provided in Regulatory Guide 1.174 and Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (February 2004 – for trial use). The American Nuclear Society (ANS) plans to issue a standard for evaluating the technical adequacy of each plant's fire risk assessment for regulatory applications. The ANS standard is intended to provide the necessary information for determining the technical adequacy of the licensees' fire risk analyses for regulatory applications.

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. Plants that do not participate in the Pilot Program should subject their fire PSA to a peer review to the extent that adequate industry guidance is available in a timely manner to support the transition process (in the event that adequate industry guidance is not available for conducting a fire PSA peer review, the NRC will review the fire PSA for acceptability). The licensee should submit the documented findings from the fire PSA peer review with the 10 CFR 50.48(c) license amendment request, including the resolution (or proposed resolution) of potentially risk-significant findings. Actions required as a result of the review may be completed later, but a schedule for completion should be provided prior to license amendment request approval. Incomplete actions that could have a nonconservative affect on the outcome of a plant change evaluation, should be completed before the licensee's fire PSA is applied to the evaluation of the plant change.

The licensee is required to maintain the quality of the fire PSA in accordance with the resolution commitments in the approved license amendment request, ensuring that updates to this fire PSA (e.g., updates to incorporate post-transition plant changes) conform to the quality of the approved fire PSA. One acceptable means to maintain fire PSA quality is by periodically (e.g., at each licensee triennial) performing a reduced-scope peer review, analogous to what was performed for the license amendment request. The results of these periodic licensee peer reviews should be made available to NRC inspectors for their review.

The NRC plans to revise this regulatory guide in the future to endorse, to the extent practical, specific risk assessment methods for use in implementing NFPA 805 and to provide additional guidance on PSA quality. That guidance will be based on updates to Regulatory Guide 1.200, the final ANS Fire PRA Standard, and the knowledge gained during the pilot programs planned for the first two plants that adopt a performance-based fire protection program in accordance with 10 CFR 50.48(c).

5. Quality Assurance

The quality assurance (QA) program for a performance-based FPP in accordance with 10 CFR 50.48(c) should be part of the overall plant QA program. For fire protection systems, the licensee must have and maintain a QA program that provides assurance that the fire protection systems are designed, fabricated, erected, tested, maintained, and operated so that they will function as intended. As applicable, additional guidance for the fire protection QA program is provided in Regulatory Guide 1.189, Section 1.7.

D. IMPLEMENTATION

The purpose of this section is to provide information to licensees regarding the NRC's plans for using this regulatory guide.

Except in those cases in which a licensee proposes or has previously established an acceptable alternative method for complying with specified portions of the NRC's regulations, the NRC staff will use the methods described in this guide to evaluate licensee compliance with the requirements of 10 CFR 50.48(c).

Regulatory Analysis

The NRC staff did not prepare a separate regulatory analysis for this regulatory guide. The regulatory basis for this guide is the regulatory analysis prepared for the amendments to 10 CFR Part 50, "Voluntary Fire Protection Requirements for Light-Water Reactors; Adoption of NFPA 805 as a Risk-Informed, Performance-Based Alternative," issued on June 16, 2004 (see 69 FR 33536), which examines the costs and benefits of the rule as implemented by this guide. A copy of this regulatory analysis is available for inspection and may be copied for a fee at the NRC's Public Document Room located at One White Flint North, 11555 Rockville Pike, Room O1-F15, Rockville, Maryland.

Backfit Analysis

As stated in the backfit analysis for the rulemaking (see 69 FR 33536), the rulemaking does not involve a backfit because it does not impose new regulatory requirements. Further, adoption of NFPA 805 by a licensee is voluntary. Similar to the rule, this regulatory guide does not involve a backfit because it does not impose requirements on the licensees.

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GLOSSARY

NFPA 805, Section 1.6, contains definitions applicable to terminology used in the standard. Regulatory Guide 1.189 also contains a substantial list of definitions of fire protection terminology applicable to nuclear power generating stations. Where potential differences or conflicts exist between definitions in NFPA 805 and other fire protection regulatory documents, and where these definitions are important to the licensing basis, the licensee’s documentation should clearly identify the definition that is being applied.