



REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.205

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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 (FPPs) that comply with Title 10, ~~“Energy,”~~ Section 50.48(c), of the *Code of Federal Regulations* (10 CFR 50.48(c)) (Ref. 1) 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” (Ref. 2).

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” ~~(Ref. 3).~~ In addition, plants that were licensed to operate before ~~January~~January 1, 1979, must meet the requirements of Appendix R, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979,” to 10 CFR Part 50 ~~(Ref. 4)~~, except to the extent provided for in 10 CFR 50.48(b). ~~Plants~~The NRC requires plants licensed to operate after January 1, 1979, ~~are required~~ to comply with 10 CFR 50.48(a), as well as any plant-specific fire protection license conditions and technical specifications.

The NRC issues regulatory guides to describe and make available to the public methods that the NRC staff considers acceptable for use in implementing specific parts of the agency’s regulations, techniques that the staff uses in evaluating specific problems or postulated accidents, and data that the staff needs in reviewing applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public.

Regulatory guides are issued in 10 broad divisions—: 1, Power Reactors; 2, Research and Test Reactors; 3, Fuels and Materials Facilities; 4, Environmental and Siting; 5, Materials and Plant Protection; 6, Products; 7, Transportation; 8, Occupational Health; 9, Antitrust and Financial Review; and 10, General.

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Paragraph

Paragraph (c) of 10 CFR 50.48, “Fire Protection,” adopted by the NRC in 2004 (69 *Federal Register* (FR) 33536; June 16, 2004) (Ref. 53), incorporates NFPA 805 by reference, with certain exceptions, and allows licensees to adopt and maintain an FPP that meets the requirements of NFPA 805, as an alternative to 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 a license amendment application to the NRC, in accordance with 10 CFR 50.90, “Application for Amendment of License, Construction Permit, or Early Site Permit” (Ref. 6).” ~~Paragraph-Paragraph~~ (c)(3) ~~in-of~~ 10 CFR 50.48 describes the required contents of the application.

The Nuclear Energy Institute (NEI) ~~has~~ developed NEI 04-02, Revision 2, “Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c),” issued ~~April-April~~ 2008 (Ref. 74), to assist licensees in adopting 10 CFR 50.48(c) and making the transition from their current FPP to one based on NFPA 805. This regulatory guide endorses portions of NEI 04-02, Revision 2, where it has been found to provide methods acceptable to the NRC for implementing NFPA 805 and complying with 10 CFR 50.48(c). The regulatory positions in Section C 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 guidance in NEI 04-02.

All references to NEI 04-02 in this regulatory guide refer to Revision 2 of that NEI guidance document. All references to NFPA 805 in this regulatory guide refer to the 2001 ~~Edition~~edition of NFPA 805. Where this regulatory guide refers to an FPP or license of a nuclear power plant as being in compliance with, or meeting, the requirements of NFPA 805, the staff means compliance with 10 CFR 50.48(c) and ~~the~~ applicable portions of NFPA 805.

~~The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency’s regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required.~~

This regulatory guide contains information collection requirements covered by 10 CFR Part 50 that the Office of Management and Budget (OMB) approved under OMB control ~~number~~ number 3150-0011. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

Background

The fire protection requirements of 10 CFR 50.48(b), Appendix R to 10 CFR Part 50, ~~and~~ the associated regulatory guidance, are prescriptive in that they identify specific methods for assuring nuclear safety in the event of a fire. The industry and some members of the public have characterized these requirements as creating an unnecessary regulatory burden to achieve an acceptable level of fire safety

and comply with the general, performance-based requirements of GDC-3. The NRC has issued approximately 900-900 plant-specific exemptions to the requirements of ~~Appendix~~ Appendix R.

~~In~~ On March 26, 1998, the staff sent to the Commission SECY-98-058, “Development of a Risk-Informed, Performance-Based Regulation for Fire Protection at Nuclear Power Plants,” ~~dated March 26, 1998~~ (Ref. 8), ~~the staff~~ 5), in which it proposed to ~~the Commission that the staff~~ work with NFPA and the industry to develop a risk-informed, performance-based consensus standard for nuclear power plant fire protection. This consensus standard could be endorsed in a future rulemaking as an alternative set of fire protection requirements to the existing regulations in 10 CFR 50.48, ~~“Fire Protection.”~~ In SECY-00-0009, “Rulemaking Plan, Reactor Fire Protection Risk-Informed, Performance-Based Rulemaking,” dated January 13, 2000 (Ref. 96), the NRC staff requested and received Commission approval to proceed with a rulemaking to permit reactor licensees to adopt NFPA 805 as an alternative to existing fire protection requirements. On February 9, 2001, the NFPA Standards Council approved the 2001 ~~Edition~~ 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 by reference the 2001 ~~Edition~~ edition of NFPA 805, with certain exceptions, and allows licensees to apply for a license amendment to comply with the 2001 ~~Edition~~ edition of NFPA 805 (69 FR 33536). ~~Subsequent NFPA has issued subsequent editions of NFPA 805 have been issued,~~ but ~~are not endorsed by~~ the regulation ~~does not endorse them~~.

In parallel with the Commission’s efforts to ~~promulgate~~ issue a rule ~~endorsing~~ incorporating the risk-informed, performance-based fire protection provisions of NFPA 805, NEI published implementing guidance for the specific provisions of NFPA 805 and 10 CFR 50.48(c) in NEI 04-02. This regulatory guide provides the NRC staff’s position on NEI 04-02, ~~Revision~~ Revision 2, and offers additional information and guidance to supplement the NEI document and assist licensees in meeting the NRC’s regulations in 10 CFR 50.48(c) related to adopting a risk-informed, performance-based FPP ~~in 10 CFR 50.48(e)~~.

Fire Protection Program Changes

Before the ~~promulgation~~ issuance of 10 CFR 50.48(c), plants typically adopted a standard fire protection license condition. Under this condition, the licensee could make changes to the approved FPP, without prior NRC approval, only if the changes would not adversely affect the plant’s ability to achieve and maintain safe shutdown in the event of a fire. ~~Paragraph~~ Paragraph (c) in 10 CFR 50.48 requires licensees choosing to adopt NFPA 805 to identify license conditions to be revised or superseded. Licensees should request a new fire protection license condition that will define the revised bases for making changes to the approved NFPA 805 FPP without prior NRC approval. Regulatory ~~Position~~ Position 3.1 provides a sample license condition.

Appendices to NFPA 805

As discussed in the Statement of Considerations for the final 10 CFR 50.48(c) rulemaking (Ref. 5), ~~which incorporated by reference NFPA 8053~~, the appendices to NFPA 805 are not considered part of the rule.

Fire Probabilistic Risk Assessment

Although a licensee may ~~make the~~ transition to an ~~NFPA-805-FPP~~ based ~~FPP-on NFPA 805~~ without a fire probabilistic risk assessment (PRA)¹ model, the NRC anticipates that licensees will develop a plant-specific fire PRA ~~in-order~~ to fully realize the safety and cost benefits of ~~transitioning~~~~making the~~ ~~transition~~ to NFPA 805. This is because a fire PRA forms the basis for risk-informed changes to the FPP that can be made without prior NRC review and approval under ~~thea~~ revised plant license condition, as described in Regulatory ~~Position-Position~~ 3.1.

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¹ The NRC considers probabilistic safety analysis (PSA) and ~~probabilistic risk analysis (PRA)~~ to be synonymous. ~~PRA will be used in this~~ This regulatory guide will use PRA. The term "fire PRA," as used in this regulatory guide, encompasses all levels and types of PRAs, including ~~pre-fire PRAs created before the issuance of NUREG/CR-6850-based fire PRAs (Ref. 17),~~ the fire portions of individual plant examinations of external events, and enhanced PRAs for internal events ~~PRAs.~~

C. REGULATORY POSITION

1. Nuclear Energy Institute Guidance Document NEI 04-02

1.1 General

This regulatory guide endorses the guidance in NEI 04-02, Revision 2 (April 2008), which provides methods acceptable to the staff for adopting an FPP consistent with the 2001 ~~Edition~~ ~~edition~~ of NFPA 805 and 10 CFR 50.48(c), subject to the regulatory positions and exceptions described below.

NEI 04-02 provides detailed guidance applicable to many of the regulatory requirements of 10 CFR 50.48(c) and NFPA 805. ~~The guidance in this regulatory~~ This guide sets forth regulatory positions, emphasizes certain issues, clarifies the requirements of 10 CFR 50.48(c) and NFPA 805, clarifies the guidance in NEI 04-02, and modifies the NEI 04-02 guidance where required. Should a conflict occur between NEI 04-02 and this regulatory guide, the ~~Regulatory Positions in this~~ ~~regulatory~~ ~~positions in this~~ guide govern.

1.2 Exceptions and Clarifications

Specific exceptions and clarifications of the NRC's endorsement of NEI 04-02 are as follows:

- a. 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 in these references has not necessarily been reviewed and approved by the NRC, except where specifically noted in this regulatory guide.
- b. NEI 04-02 includes examples to supplement the guidance. These examples are illustrative only, and each licensee should ensure that an example is applicable to its particular circumstances before implementing ~~theits~~ ~~guidance~~ ~~as described in an example~~.
- c. NEI 04-02 often refers to requirements in NFPA 805 and 10 CFR 50.48(c). In some cases, NEI 04-02 suggests that the requirements are voluntary (e.g., ~~“should”~~, “should” used in place of “shall”). Licensees are required to comply with the applicable regulations, unless an exemption is granted in accordance with 10 CFR 50.12, “Specific Exemptions.” Licensees should follow the words of 10 CFR 50.48(c), which incorporates by reference the text of NFPA 805, 2001 Edition, if there are conflicts with NEI 04-02.
- d. NEI 04-02 states that licensees can use the performance-based methods of NFPA 805 to support changes to their ~~pre-transition~~ fire protection licensing bases. The NRC does not endorse this guidance, as it is not within the scope of this regulatory guide.
- e. NEI 04-02 states, “a substantial part of an existing fire protection program can be transitioned to a new NFPA 805 licensing basis by performing a transition review ~~...”~~...” While this statement may be true for some licensees, it should not be interpreted to mean that the existing FPP, a priori, complies with the requirements of 10 CFR 50.48(c). Licensees should verify that portions of the existing FPP that are to be so “transitioned” ~~do~~, in fact, comply with the requirements of NFPA 805.

- f. NEI 04-02 states that, if operator manual actions that are not allowed under the current regulatory framework or do not have previous NRC approval become recovery actions, they should be evaluated using the change process. ~~While the NRC endorses this guidance, However, NFPA 805 states that~~ the additional risk of recovery actions that ~~necessitate use~~ are relied on to demonstrate the availability of ~~the performance-based approach~~ a success path, as set forth in NFPA 805, Section 4.2.3.1, must be addressed using performance-based methods, as required by NFPA 805, Section 4.2.4 (see Regulatory Position 2.4).
- g. NEI 04-02 states that existing engineering equivalency evaluations (EEEs) are an acceptable alternative to the deterministic requirements in NFPA 805, Section 4.2.3. The NRC endorses this guidance only if the conditions identified in Regulatory Position 2.3.2 are met.
- h. NEI 04-02 lists examples of changes that would not require a license amendment, after a plant has made the transition to NFPA 805, using a plant-specific license condition that permits self-approval of some changes. The NRC does not endorse this list. The plant-specific license condition identifies the types of changes that can be self-approved.
- i. NEI 04-02 provides a sample standard license condition, which the NRC does not endorse. ~~A Regulatory Position 3.1 provides a sample standard license condition is provided in Regulatory Position 3-1.~~
- j. NEI 04-02 identifies FPP changes that require NRC review and approval before implementation. The NRC endorses this guidance with the following exception: combined changes also require prior NRC review and approval if any part of those changes would fail to meet the risk acceptance criteria of the approved license condition (see Regulatory Position 3.2.3).
- k. NEI 04-02, Section 1.5, states that the ~~terms~~ phrases “current licensing basis (CLB)” and “pre-transitional fire protection licensing basis” are used interchangeably in the document. The NRC does not endorse the use of CLB in this context, because ~~CLB is used in~~ 10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants” (Ref. 107), and ~~in~~ 10 CFR 50.54(f) ~~(Ref. 11)~~ use CLB with a different meaning. ~~The NRC has no objection to using “pre-transition fire protection licensing basis.”~~
- l. NEI 04-02, Section 2.2.1, states that licensees can ~~request~~ task the NRC’s Office of the General Counsel for an informal NRC opinion of the acceptability of an interpretation by ~~the~~ NFPA. The NRC Office of the General Counsel does not provide informal advice or informal interpretations to outside entities.
- m. NEI 04-02, Section 2.3.1, includes two bulleted items that set forth strategies a licensee may use to demonstrate prior NRC approval of a particular FPP attribute. The NRC does not endorse the second bullet, which contains a discussion that would imply that there can be tacit acceptance by the NRC of a particular FPP attribute. The NRC’s acceptance should be demonstrated either by an explicit statement of the particular FPP attribute, or by a demonstration that a specific FPP attribute was explicitly made known to the NRC and that the NRC’s acceptance can reasonably be interpreted as including the specific FPP attribute.

- n. Section 4.6.1 of NEI 04-02 provides a list of key items that should be included in a license amendment request. Appendix H to NEI 04-02 provides a license amendment template. The information provided may not be complete; for example, the list in Section 4.6.1 does not include submitting information to support the quality of the PRA models or the use of such models in performing NFPA 805 risk assessments. The licensee should ensure that it submits sufficient information required by applicable regulations and ~~neecessaryneeded~~ for the NRC to make its safety finding on the application.
- o. NEI 04-02, Section 2.3.3, discusses the NRC's interim enforcement discretion policy pertaining to licensees that make the transition to NFPA 805. The NRC does not endorse this section, because it is out of date and does not properly characterize the NRC's policy. Licensees should consult the NRC ~~webWeb~~ site for current information on enforcement discretion ~~at~~ (<http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>).
- p. Appendix D to NEI 04-02 and Appendix C to NFPA 805 contain detailed discussions that may be useful to licensees in determining which fire models to use and in applying those fire models within their limitations. However, the NRC only endorses these appendices to the extent described in Regulatory Position 4.2. Analyses performed by licensees using the information in these appendices should include adequate technical justification for methods and data, as appropriate.

2. License Transition Process

2.1 Transition Schedule

~~Paragraph-Paragraph~~ (c) in 10 CFR 50.48 does not mandate a specific schedule for implementing an FPP that meets the provisions of NFPA 805. However, the statement of considerations for 10 CFR 50.48(c) states that the ~~NFPA-NFPA~~ 805 license amendment will include a license condition imposing the use of NFPA 805, together with an implementation schedule. Licensees should include an implementation schedule with their request to adopt an ~~FPP based on NFPA 805-FPP~~.

2.2 License Amendment Request

2.2.1 *Uncertain Elements of Current Fire Protection Programs*

The NRC may not have specifically approved certain aspects of the plant's current FPP (e.g., through an approved ~~request under 10 CFR 50.12-exemption request~~, "Specific Exemptions"). This has resulted in uncertainty in licensees' fire protection licensing bases. Licensees should submit elements of their plant's FPP, such as the crediting of recovery actions and circuit analysis methods, if they want explicit approval of these elements under 10 CFR 50.48(c). Any submittal addressing these FPP elements should include sufficient detail to allow the NRC to assess whether the licensee's treatment of these elements meets 10 CFR 50.48(c) requirements.

2.2.2 *Performance-Based Methods for Fire Protection Program Elements and Minimum Design Requirements*

In accordance with 10 CFR 50.48(c)(2)(vii), a licensee may request NRC approval (by license amendment) to use NFPA 805 performance-based methods in determining the licensee's compliance with the FPP elements and minimum design requirements in Chapter 3 of NFPA 805. A licensee should provide sufficient information in the license amendment request to allow the NRC staff to determine that the performance-based approach **does 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).

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

Under 10 CFR 50.48(c)(4), a licensee may request NRC approval (by license amendment) of the use of alternative risk-informed or performance-based methods (i.e., methods that differ from those prescribed by NFPA 805) to demonstrate compliance with 10 CFR 50.48(c). A licensee should provide sufficient information in the license amendment request to allow the NRC staff to determine that the proposed alternatives **do the following**:

- a. satisfy the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release;
- b. maintain safety margins; and
- c. maintain fire protection defense in depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe-shutdown capability).

The license amendment request should include complete and concise details of each of the proposed methods **used to demonstrate that an alternative to compliance with NFPA 805 is acceptable**. The license amendment request may reference generic methods (e.g., topical reports) that **have been the NRC has** previously approved **by the NRC** and through which the licensee can demonstrate that the alternative is applicable for its intended use.

Where the ~~alternative risk-informed or performance-based~~ proposed methods have been adequately described in the license amendment request and have been accepted by the NRC, these methods may be applied to the licensee's FPP upon issuance of a license amendment approving the methods. A licensee may apply these approved methods within the limits specifically described in its licensing basis to implement plant changes that affect the FPP.

Licensee self-approval of FPP changes using approved alternative risk-informed or performance-based methods may be granted in the fire protection license condition when appropriate. Subsequent changes to the approved alternative risk-informed or performance-based method must be submitted for

NRC review and approval (through a license amendment request) before being applied to the licensee's FPP.

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2.2.4 Risk Evaluations

In accordance with 10 CFR 50.48(c), licensees may evaluate fire areas ~~may be evaluated~~ using performance-based approaches. The performance-based approaches may be fire modeling or other engineering analyses (i.e., NFPA 805, Section 4.2.4.1), a fire risk evaluation (i.e., NFPA 805, Section 4.2.4.2), or a risk-informed or performance-based alternative to compliance with NFPA 805 (i.e., 10 CFR 50.48(c)(4)). These ~~methods must be~~ applied to aspects of a fire area that are used as an alternative to the NFPA 805 deterministic criteria,² whether these alternatives ~~involve hardware~~ (equipment and systems) functions or human actions. (Note that EEEEs, as set forth in NFPA 805, ~~Section-Section~~ 2.2.7, can be used to demonstrate compliance with the deterministic criteria; refer to Regulatory ~~Position-Position~~ 2.3.2.)

A license amendment request should clearly demonstrate that the requirements of 10 CFR 50.48(c) and NFPA 805 will be met, including any required risk assessments. The quality of the risk assessments should be consistent with Regulatory Position 4.3.

One type of risk assessment, the plant change evaluation, provides risk information ~~in the Plant Change Evaluation~~, as described in NFPA-NFPA 805, ~~Sections-Sections~~ 2.2.9 and 2.4.4. ~~Plant~~Regulatory Position 3.2 discusses plant change evaluations ~~are applicable~~, which apply to a plant that has made the transition to NFPA 805 ~~and are discussed in Regulatory Position 3.2~~. Another type of risk assessment provides risk information on the performance-based alternatives to the deterministic approach in the ~~Fire Risk Evaluation~~fire risk evaluation, which includes, as necessary, the evaluation of the additional risk of certain recovery actions ~~perin accordance with~~ NFPA 805, ~~Section-Section~~ 4.2.4 (refer to Regulatory ~~Position-Position~~ 2.4). Fire risk evaluations are used ~~for transitioning to~~ make the transition to NFPA 805.

For each fire area where the ~~fire risk evaluation~~licensee has ~~been~~ used a fire risk evaluation to demonstrate compliance with NFPA 805, any increase in risk should be acceptable, as described in Regulatory ~~Position-Position~~ 2.2.4.1. The total increase in risk from these fire areas should also be acceptable, as described in Regulatory ~~Position-Position~~ 2.2.4.2.

2.2.4.1 Fire Risk Evaluations (Including Recovery Actions) by Fire Area

Fire risk evaluations may be performed as a performance-based approach to demonstrate that an alternative to the NFPA 805 deterministic criteria is acceptable. Any increase or decrease in risk (both in

² The “deterministically compliant plant” has been referred to as “an ideal plant” that may not exist or be feasible in practice. Based on experience with the two NFPA 805 pilot plants, the risk of most variances from the deterministic requirements can readily be evaluated by postulating modifications, such as moving or protecting cables, which would meet the deterministic requirements. This provides the base case against which the added risk of the proposed alternative is evaluated. Because of the great similarity between the ~~Deterministic-Criteria~~deterministic criteria of NFPA 805 and the ~~10-CFR-50-Appendix-R~~requirements in Appendix R to 10 CFR Part 50, it should be clear in most cases what the compliant configuration would be. An exception might occur for fire scenarios where evacuation of the main control room is necessary. This has been addressed in the ~~Regulatory-Guide-through~~regulatory guide by defining the term “primary control station,” which is used in the NFPA 805 definition of recovery action; see Regulatory ~~Position-Position~~ 2.4.

terms of core damage frequency (CDF) and large early release frequency (LERF) should be evaluated and provided for each fire area that uses a fire risk evaluation.

In some cases, recovery actions that are proposed in lieu of deterministic requirements have been previously approved by the NRC.³ For these actions, the additional risk should be submitted with the transition license amendment request and can be deemed acceptable⁴ because of the previous approval. These previously- approved alternatives to the deterministic requirements can be “carried over” into the NFPA-NFPA 805 licensing basis. However, the additional risk of previously approved recovery actions is considered during transition when evaluating the acceptability of other risk increases resulting from the use of the fire risk evaluation approach. Regulatory ~~Position-Position~~ 2.2.4.3 provides guidance regarding the post-transition base risk.

~~Figure-Figure~~ 1 provides a convenient framework to focus the discussion of this concept. The flow chart in ~~Figure-Figure~~ 1 starts with a given fire area to which the performance-based (PB) approach of NFPA 805, ~~Section-Section~~ 4.2.4.2, is applied (~~block-block~~ [1]). The additional risk of the previously- approved recovery actions, compared to the NFPA 805 deterministic criteria, must be estimated and submitted in the transition license amendment request. If that additional risk (~~block-block~~ [2]) is greater than the acceptance guidelines in Regulatory ~~Guide-Guide~~ 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” issued November 2004 (~~RG 1.174~~, Ref. 12),8) (i.e., - in “~~Region-Region~~ I of either ~~Figure-Figure~~ 3 or ~~Figure~~ ~~Figure~~ 4 of RG 1.174), then ~~there may be no~~ the NRC staff will not normally approve any net increase in risk in that fire area (~~block-block~~ [3]) from other variances from the deterministic requirements (VFDRs). If there are additional VFDRs associated with that fire area (e.g., - equipment or cables that do not meet the requirements; recovery actions that were not previously approved by the NRC), then those VFDRs would either have to be brought into deterministic compliance, or any additional risk associated with those VFDRs would have to be offset by an equal or greater reduction in risk for that fire area. The NRC staff will not normally approve net risk increases in fire areas where the previously- approved recovery actions represent an additional risk above the ~~RG 1.174~~ acceptance guidelines in Regulatory Guide 1.174 (~~block-block~~ [5]).

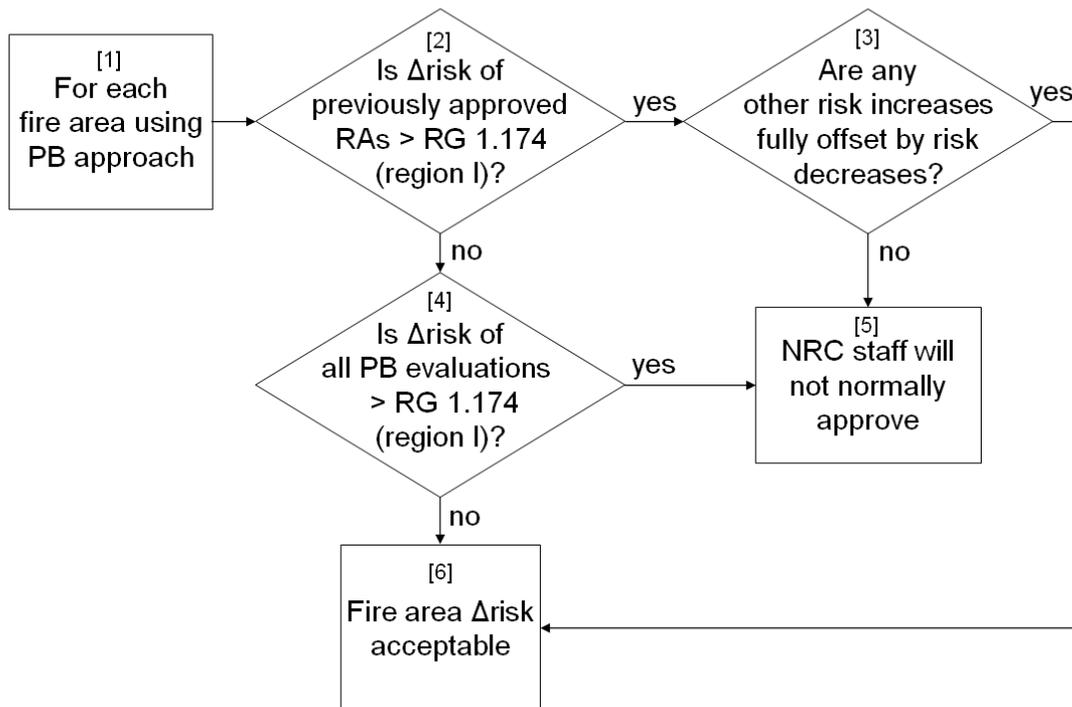
~~Block-Block~~ [4] represents the case in which the additional risk of previously approved recovery actions, compared to the NFPA 805 deterministic criteria, is less than the ~~RG 1.174~~ acceptance guidelines in Regulatory Guide 1.174. In this case, the NRC will normally approve risk increases in that fire area resulting from other, ~~non-previously approved~~ alternatives to deterministic compliance, ~~not previously approved~~, provided that the total risk increase for that fire area (i.e., - from previously approved recovery actions and the other alternatives) meets the ~~RG 1.174~~ acceptance guidelines in Regulatory Guide 1.174. If this total risk increase exceeds the ~~RG 1.174~~ acceptance guidelines in Regulatory Guide 1.174, the NRC staff will not normally approve the proposed alternatives.

³ “Previously approved” means “submitted to the NRC Office of Nuclear Reactor Regulation and approved by the NRC; (e.g., - in a safety evaluation report or in an exemption-2).”

⁴ ~~Unless~~It could be deemed acceptable unless circumstances indicate that a backfit under ~~10 CFR~~ 10 CFR 50.109, “Backfitting,” is warranted on an adequate protection or cost-beneficial safety improvement basis. Any actions to impose a backfit would ~~take place~~ be independent of the licensing action under consideration, ~~per~~ in accordance with 10 CFR 50.109(d), which states: “No licensing action will be withheld during the pendency of backfit analyses required by the Commission’s rules.”

If there is no net risk increase in a fire area (~~block-block~~ [3]) or the total additional risk from ~~both previously approved and non-previously approved~~ alternatives to deterministic criteria, ~~both previously approved and not previously approved~~, is within the ~~RG-1.174~~ acceptance guidelines in ~~Regulatory Guide 1.174~~ (~~block-block~~ [4]), then the NRC staff will normally find that the additional risk associated with that fire area is acceptable for ~~transitioning~~making the transition to NFPA 805 (~~block-block~~ [6]).

Figure 1- Framework for Fire Risk Evaluations During Transition When Crediting Previously Approved Recovery Actions ▲



2.2.4.2 Total Plant Delta Risk of Implementing NFPA 805

The total increase or decrease in risk associated with the implementation of NFPA 805 for the overall plant should be calculated by summing the risk increases and decreases for each fire area (including any risk increases resulting from previously- approved recovery actions). ~~Any~~The total risk increase should be consistent with the acceptance guidelines in ~~RG-Regulatory Guide~~ ~~Regulatory Guide~~ 1.174. If the additional risk associated with previously- approved recovery actions is greater than the acceptance guidelines ~~of RG in Regulatory Guide~~ 1.174, then the net change in total plant risk ~~due to incurred by~~ any proposed alternatives to the ~~NFPA-805, Chapter 4,~~ deterministic criteria in NFPA 805, Chapter 4 (other than the previously- approved recovery actions), should be risk-neutral or ~~represent~~ a risk decrease.

2.2.4.3 Baseline Risk for Plant Change Evaluations

Upon completing the transition to an NFPA 805 licensing basis, the post-transition baseline risk for use in evaluating the effect on cumulative risk will be the risk of the plant at the point of full implementation of NFPA 805; (i.e., after completing all plant modifications and changes that the licensee has committed to make during the transition).

2.2.5 *Non-power Operational Modes*

The scope of NFPA 805 requires licensees to address the impacts of fires during all phases of plant operation, including shutdown, degraded conditions, and decommissioning. Section 4.3.3 and Appendix F to NEI 04-02 provide detailed guidance on one acceptable approach to addressing fires during non-power operational modes.

2.2.6 *Radioactive Release Transition*

A licensee's FPP must comply with the radioactive release performance criteria in NFPA 805, Section 1.5.2. The license amendment request should clearly demonstrate that this requirement will be met once the transition is complete. The licensee should address methods for achieving the performance criteria for both smoke and fire suppression agents, on a fire-area-by-fire-area basis, during all modes of operation, and address the potential for cross-contamination (water run-off and smoke from a contaminated area being directed through an uncontaminated area), and include the following:

- a. the method used to identify which systems, components, and flow paths are used to meet the release criteria;
- b. the identification of FPP elements, including measures, systems, procedural control actions, and flow paths, credited to meet the criteria;
- c. a description of plant programs, such as fire brigade training and equipment maintenance, that are relied upon to sustain equipment reliability and fire brigade performance; and
- d. a bounding analysis, qualitative risk analysis, or quantitative risk analysis that demonstrates that the release criteria have been met.

NEI 04-02 Section 4.3.4 and Appendix G of NEI 04-02 provide additional guidance related to this topic.

2.3 Carryover of Current Fire Protection Programs into NFPA 805

In certain cases, the NRC may have granted exemptions or deviations that are reflected in the licensee's current FPP that would be acceptable alternatives to the NFPA 805 requirements. Where prior NRC approval of such alternatives exists, licensees should reference documentation of that approval. Elements of a licensee's pre-transition fire protection licensing bases that can be shown to meet NFPA 805 requirements, including approved exemptions, deviations, and safety evaluation reports, are not "changes to a previously approved FPP" and would not be included in the NFPA 805, Section 2.4.4, plant change evaluation. However, certain recovery actions, whether or not part of the pre-

transition fire protection licensing basis, require the use of performance-based methods, as discussed in Regulatory Position 2.4.

2.3.1 *Previously NRC-Approved Alternatives to NFPA 805, Chapter 3, Fundamental Fire Protection Program and Design Elements*

NFPA 805 states that previously approved alternatives to the fundamental FPP attributes identified in Chapter 3 take precedence over the requirements in NFPA 805, ~~Chapter~~ Chapter 3.

The provisions of ~~Appendix~~ Appendix R to ~~10 CFR Part~~ 10 CFR Part 50 do not apply to nuclear power plants licensed to operate before ~~January~~ January 1~~7~~, 1979, to the extent that the NRC staff accepted fire protection features ~~were accepted by the NRC staff~~ in comprehensive fire protection safety evaluation reports issued before ~~Appendix~~ August 1976, when Appendix A to Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1 was published ~~in August~~ 1976, or they were accepted by the NRC staff as satisfying the provisions of ~~Appendix~~ Appendix A to BTP ~~APCSB~~ APCSB 9.5-1 reflected in ~~NRC~~ the NRC's fire protection safety evaluation reports issued before the effective date of ~~February~~ February 19~~7~~, 1981. The fire protection license condition for these facilities references these safety evaluation reports for the regulatory basis for a major portion of their ~~fire protection program~~ FPPs.

The documentation ~~which that~~ demonstrates prior NRC approval of an alternative to ~~Chapter~~ Chapter 3 requirements, as well as approval of noncompliances with existing license regulatory requirements, includes NRC approvals of exemption or deviation requests and fire protection safety evaluation reports ~~related to plant-specific licensing actions~~. Inspection reports, meeting minutes, and letters from licensees without a corresponding written NRC approval are examples of documents that do not represent NRC approval for this purpose.

Existing exemptions or deviations ~~to from~~ these Chapter 3 attributes are previously approved alternatives ~~from to~~ the fundamental FPP attributes and, therefore, take precedence over the requirements in NFPA 805, Chapter 3, provided the NRC staff determines that the licensee has acceptably addressed the continued validity of any exemption or deviation in effect at the time of application. The term "valid," used in this context, means that the technical basis for approval of the original exemption or deviation still applies (e.g., plant modifications or other changes have not invalidated the assumptions or analysis that formed the basis for the exemption or deviation; new information has not surfaced that would invalidate the original finding).

In the case of exemptions, the NRC will rescind, if appropriate, the original exemption in the NFPA 805 license amendment, since, ~~in many cases~~, the NRC's approval to use 10 CFR 50.48(c) and NFPA 805 ~~in many cases~~ will negate the licensee's need for the exemption.

2.3.2 *Previously NRC-Approved Alternatives to NFPA 805, Section 4.2.3, Deterministic Requirements*

NFPA 805, Section 2.2.7, defines EEEEs and states that, when applying a deterministic approach, ~~licensees may use~~ EEEEs ~~may be used~~ to demonstrate compliance with the specific deterministic fire protection design requirements in Chapter 4 for existing plant configurations. These EEEEs ~~are required~~

~~to~~must clearly demonstrate an equivalent level of fire protection compared to the deterministic requirements.

In the past, licensees have requested and received exemptions or deviations ~~to~~from the specific requirements in pre-transition fire protection regulations (i.e., Appendix R). ~~Existing licensees may use existing~~ exemptions or deviations ~~may be used~~ to demonstrate compliance with the specific deterministic fire protection design requirements in Chapter 4 of NFPA 805, provided the NRC staff determines that the licensee has acceptably addressed the continued validity of any exemption or deviation in effect at the time of the NFPA 805 license amendment application and that the exemption or deviation does not involve a recovery action, as defined in NFPA 805, Section 1.6.52, that is used to demonstrate the availability of a success path for the nuclear safety performance criteria (see also Regulatory Position 2.4). The term “valid,” used in this context, means that the technical basis for approval of the original exemption or deviation still applies (e.g., plant modifications or other changes have not invalidated the assumptions or analysis that formed the basis for the exemption or deviation; new information has not surfaced that would invalidate the original finding).

The NRC’s approval of the licensee’s request to implement an FPP based on NFPA 805 should reference the valid exemption or deviation as the basis for demonstrating an equivalent level of fire protection as permitted under Section 2.2.7 of NFPA 805. The NRC will rescind, as appropriate, the original exemption in the license amendment, since, **in many cases**, the NRC’s approval to use 10 CFR 50.48(c) and NFPA 805 ~~in many cases~~ will negate the licensee’s need for the exemption.

A licensee may use EEEEs as described in Section 2.2.7 of NFPA 805 to demonstrate equivalency to the deterministic requirements, in cases where an exemption or deviation was not granted, provided the following are true:

- a. The EEEE clearly demonstrates an equivalent level of fire protection compared to the deterministic requirements in NFPA 805, Chapter 4.
- b. The EEEE is not based on a risk calculation.
- c. The EEEE does not include any recovery actions, as defined in NFPA 805, Section 1.6.52, to demonstrate **the** availability of a success path for the nuclear safety performance criteria.

One type of EEEE, commonly referred to as a “Generic ~~Letter~~ **Letter (GL) 86-10** (~~GL 86-10~~ “Implementation of Fire Protection Requirements,” dated April 24, 1986) evaluation” (Ref. ~~139~~), permits licensees that have adopted the GL 86-10 standard fire protection license condition to make changes to their approved ~~FPPFPPs~~ 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. ~~These changes~~ **The NRC** may not have ~~been~~ reviewed and approved ~~by the NRC~~ **these changes**, and **they** may not necessarily demonstrate an equivalent level of fire protection compared to the deterministic requirements required by Section 2.2.7 of NFPA 805. The licensee should verify that any EEEEs relied upon to meet the deterministic requirements of NFPA 805, Section 4.2.3, including ~~GL-GL 86--10~~ evaluations, meet the three conditions above.

NEI 04-02, Section 4.1.1, notes that the licensee should review EEEEs during the NFPA 805 transition process to ensure that the quality level and basis for acceptability are still valid. **Detailed**

~~guidance on review of EEEEs is provided in NEI 04-02, Appendix B-3.~~ Appendix B-3 to NEI 04-02 provides detailed guidance on the review of EEEEs. Except as noted above, satisfactory results from this review should provide an adequate basis to show that the EEEEs meet the deterministic requirements of Chapter 4 of NFPA 805. Guidance for acceptable EEEEs appears in Regulatory Guide 1.189, "Fire Protection for Nuclear Power Plants," issued March 2007 (Ref. 410).

~~NEI 04-02, Section B.3.2, states that those licensees should summarize EEEEs that demonstrate that a fire protection system or feature is "adequate for the hazard" should be summarized in their documentation for their license amendment request.~~ documentation. If a licensee is not requesting specific approval for an "adequate for the hazard" EEEE, then the license amendment request should state that ~~an EEEE the licensee has been used an EEEE~~ to demonstrate compliance and should provide a brief description of the evaluated condition. Licensees requesting specific NRC approval for "adequate for the hazard" EEEEs, as discussed in Regulatory ~~Position~~ 2.2.1, should state that ~~they have used the EEEE has been used~~ to demonstrate compliance and submit a detailed summary, including sufficient detail to allow ~~for the~~ NRC staff ~~evaluation of to evaluate~~ the EEEE. At a minimum, the level of detail is expected to include: ~~a) (1) a summary of the each condition; b) (2) a summary of the evaluation of each condition; and c) (3) a summary of the resolution of each condition.~~

In all cases, licensees that rely on EEEEs to demonstrate compliance with NFPA 805 requirements should document this usage in their license amendment request.

2.4 Recovery Actions

Use of recovery actions, as defined in NFPA 805, Section 1.6.52, to demonstrate the availability of a success path for the nuclear safety performance criteria, does not meet the deterministic requirements in Section 4.2.3 of NFPA 805. Consequently, the licensee must address recovery actions, whether or not previously approved by the NRC, using the performance-based methods in Section 4.2.4, as required by NFPA 805, Section 4.2.3.1, and must evaluate the additional risk of their use according to NFPA 805, Section 4.2.4. Regulatory ~~Position~~ 2.2.4 provides guidance on calculating this additional risk of recovery actions.

~~Recovery~~ NFPA 805, Section 4.2.3.1, identifies recovery actions for which the additional risk must be evaluated, as required by NFPA 805, Section 4.2.4, ~~are identified in NFPA 805, Section 4.2.3.1.~~ These "success path" recovery actions are operator actions that, if not successful, would lead to the fire-induced failure of the ~~"one success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria."~~ Other operator actions that may be credited in plant procedures or the fire PRA to overcome a combination of fire-induced and random failures may also be recovery actions, but ~~licensees do not need to evaluate the additional risk of their use does not need to be evaluated. Likewise, actions taken in the process of abandoning a control room and transferring to a primary control station may meet the definition of a recovery action but the additional risk of their use does not need to be evaluated to demonstrate compliance with NFPA 805.~~

NFPA 805, Section 1.6.52, defines a recovery action as "activities to achieve the nuclear safety performance criteria that take place outside ~~of~~ the main control room or outside ~~of~~ the primary control station(s) for the equipment being operated, including the replacement or modification of components."

The staff has identified two cases where operator actions taken outside the main control room may be considered as taking place at a *primary control station*. ~~These two cases involve dedicated shutdown or alternative shutdown controls, which have been reviewed and approved by the NRC. In either case, the location or locations become primary when command and control is shifted from the main control room to these other locations.~~⁵ For these two cases, the operator actions are not considered recovery actions, even if they are necessary to achieve the nuclear safety performance criteria. Activities to achieve the nuclear safety performance criteria that take place outside ~~of~~ the main control room and are not covered by one of these two cases should be considered recovery actions as defined in NFPA 805.

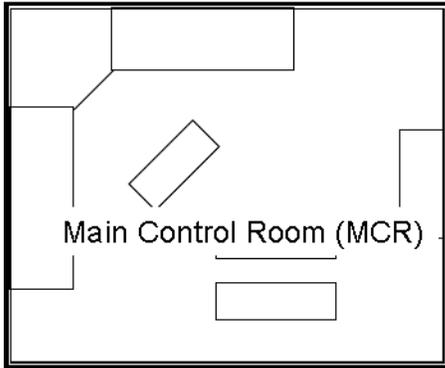
- a. The first case involves the controls for a system or component specifically installed to meet the “dedicated shutdown” option ~~of Appendix R, in~~ Section III.G.3 ~~of Appendix R~~. The NRC staff considers ~~the~~ operation of this equipment as taking place at a primary control station. A system or component that has been specifically installed under the dedicated shutdown concept is a system or component that is operated from a location outside the control room and is fully separated from the fire area where its use is credited. These systems or components ~~cannot~~ be operated from the control room. Operation of dedicated shutdown equipment ~~would not be considered a recovery action, since this would be the primary control station.~~
- b. The second case involves controls for systems and components that have been modified to meet the “alternative shutdown” option in ~~Appendix R, Section III.G.3, to 10 CFR Part 50, of~~ ~~Appendix R~~, to provide independence and electrical separation from the control room to address a fire-induced control room evacuation. These alternative shutdown controls may be considered the primary control station, provided that ~~(1)~~, once enabled, the systems and equipment controlled from the panel are independent and electrically separated from the fire area, and ~~(2)~~ the additional criteria below are ~~also~~ met.
 - (1) The location should be considered the primary command and control center when the main control room can no longer be used. The control room team will evacuate to this location and use its alternative shutdown controls to safely shut down the plant.
 - (2) The location should have the requisite system and component controls, plant parameter indications, and communications so that the operator can adequately and safely monitor and control the plant using the alternative shutdown equipment.
 - ~~There should be more(3)~~ More than one component ~~being should be~~ controlled from this location (a local control station provided to allow an individual component to be locally controlled, as in the local handwheel on a motor~~--~~operated valve, does not meet this definition).

~~Figure~~ Figure 2 provides a summary illustration of a primary control station as described above.

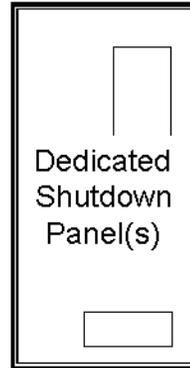
⁵ For example, use of a dedicated shutdown control would not be considered a recovery action following abandonment of the main control room because that location may be considered a primary control station. Conversely, operation of dedicated or alternative shutdown controls while the main control room remains the command and control location would normally be considered recovery actions because for such scenarios the dedicated or alternative controls are not considered primary.

Figure 2. Illustration of Primary Control Station for Defining Recovery Actions

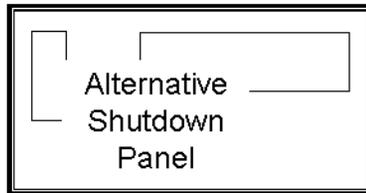




Control Room actions are not recovery actions



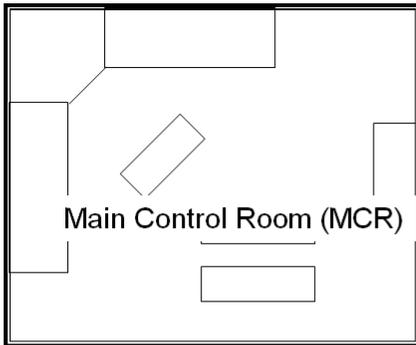
Dedicated Shutdown Panel actions are not recovery actions*



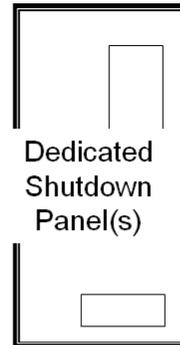
Alternative Shutdown actions are not recovery actions* provided:

- Primary command & control
- Requisite controls, indications, & communications
- Multiple components controlled from location

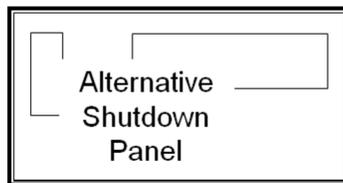
* When command and control is shifted from the MCR



Control Room actions are not recovery actions



Dedicated Shutdown Panel actions are not recovery actions



Alternative Shutdown actions are not recovery actions provided:

- Primary command & control
- Requisite controls, indications, & communications
- Multiple components controlled from location

3. NFPA 805 Fire Protection Program

NFPA 805 refers to “the authority having jurisdiction ~~(AHJ).~~” The NRC is the ~~AHJ~~ authority having jurisdiction for 10 CFR 50.48(c).

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. ~~Paragraph~~ Paragraph (c) in 10 CFR 50.48 and NFPA 805 identify aspects of a performance-based FPP that ~~the NRC must be specifically approved by the NRC approve~~ through a license amendment. It is the intent of 10 CFR 50.48(c) to allow certain changes to be made to the FPP without prior NRC review and approval, once the NRC approves the transition to a performance-based FPP. This intent is reflected in the regulatory analysis for 10 CFR 50.48(c), which 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 certain changes without prior NRC review and approval in a license condition for licensees that make the transition to 10 CFR 50.48(c). A sample license condition, which includes acceptance criteria for making changes to the licensee’s FPP without prior NRC review and approval, is shown below. The application of these risk acceptance criteria requires that the plant have an acceptable fire PRA that is in accordance with the guidance in Regulatory Position 4.3; refer also to Regulatory ~~Position~~ Position 3.2.4.

(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 supplements dated _____) and as approved in the safety evaluation report dated _____ (and supplements dated _____). Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied.

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

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

demonstrated to bound the ~~method may be applied without a plant specific license amendment being granted~~ risk impact.

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

Other Changes that May Be Made Without Prior NRC Approval

~~{Include a plant specific list of any non risk informed changes to the FPP.}~~

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

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

- 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).

(2) Fire Protection Program Changes that have No More Than Minimal Risk Impact

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

shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

Transition License Conditions

- (1) Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change clearly does not increase risk.
- (2) The licensee shall implement the following modifications to its facility to complete transition to full compliance with 10 CFR 50.48(c) by {date}.

{Include a plant-specific list of any modifications identified by the licensee as necessary to complete transition to its new fire protection license basis.}
- (3) The licensee shall maintain appropriate compensatory measures in place until completion of the modifications delineated above.

3.2 NFPA 805 Plant Change Evaluation Process

3.2.1 Definition of a Change

NFPA 805 includes provisions for licensees to make changes to their approved FPPs, once the transition to a 10 CFR 50.48(c) license is complete. Sections 2.2.9 and 2.4.4 of NFPA 805 require a "plant change evaluation" for any change to a previously approved FPP element. 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; or
- c. an in-situ condition (physical or programmatic) that is not in compliance with the plant's FPP.

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 either the plant is modified to achieve compliance or the condition is found acceptable. Acceptance of the as-found condition may be the result of either the NRC's review and approval or the self-approval process ~~per~~, according to the licensee's fire protection license condition.

3.2.2 *Plant Change Evaluations*

The licensee should perform an engineering evaluation to demonstrate 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). The plant change evaluation process includes an integrated assessment of the acceptability of the change in risk, defense in depth, and safety margins, regardless of the methods or approaches used to evaluate the change. Regulatory ~~Guide-Guide~~ 1.174 (Ref. ~~42~~, 8) provides acceptance guidance applicable to NFPA 805 plant change evaluations.

NFPA 805, Section 2.4.4.2, “Defense-in-Depth,” states that the ~~concept of~~ defense-in-depth ~~concept~~ should be maintained, ~~relative as it relates~~ to fire protection and nuclear safety. Under NFPA 805, Section 1.2, fire protection defense in depth is achieved when an adequate balance of each of the following elements is provided:

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

The philosophy of nuclear safety defense in depth is maintained when a reasonable balance is preserved among prevention of core damage, prevention of containment failure, and mitigation of consequences. Regulatory ~~Guide-Guide~~ 1.174 provides guidance on maintaining the philosophy of nuclear safety defense in depth that is acceptable for NFPA 805 plant change evaluations.

3.2.3 *NRC Approval of Fire Protection Program Changes*

The following ~~FPP changes~~ are examples of FPP changes that licensees must ~~be submitted~~ submit for NRC review and approval through a license amendment request before implementation:

- a. changes that do not meet the acceptance criteria of the approved license condition;
- b. changes to the fundamental FPP elements and design requirements of Chapter 3 of NFPA 805, which use performance-based methods ~~that have not previously been approved by, unless specified in the NRC, as permitted under 10 CFR 50.48(e)(2)(vii)~~ fire protection license condition for the plant;
- c. 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); and

- d. combined changes where any individual change would not meet the risk acceptance criteria of the approved license condition.

Licenseses may request, in accordance with 10 CFR 50.48(c)(2)(vii), NRC approval of a method, using a bounding analysis approach, to use when evaluating minor changes to ~~NFPA 805 Chapter 3~~ elements in NFPA 805, Chapter 3. Upon NRC approval of the bounding method, the licensee may make subsequent minor changes to ~~Chapter~~ Chapter 3 elements by performing an engineering analysis to demonstrate that the proposed change is within the scope of the approved method and is compliant ~~to~~with the bounding conditions. ~~Approval to make these changes will be referenced in the~~The licensee's fire protection license condition ~~will reference the approval to make these changes.~~

3.2.4 *Plant Changes Without Prior NRC Approval*

The sample standard license condition in Regulatory Position 3.1 sets forth criteria for making changes to the approved NFPA 805 FPP without prior NRC approval. The risk acceptance criteria for plant changes provided in this sample standard license condition are acceptable to the NRC.

Where permitted by the approved fire protection license condition, licensees of plants that have a fire PRA that is in accordance with Regulatory Position 4.3 may make risk-informed changes without prior NRC review and approval. The types of plant changes that may be implemented without prior NRC review and approval will be limited to those for which the risk assessment methods are adequate to demonstrate that any increase in risk will continue to meet the risk acceptance criteria.

~~The licensee may self approve changes based on approaches for modeling the cause and effect relationship that employ methods that:~~

- ~~• have been used in the peer-reviewed baseline PRA; or,~~
- ~~• have been endorsed by NRC through a license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments; or,~~
- ~~• have been demonstrated to bound the risk impact.~~

~~–Licensees must also maintain appropriate levels of defense in depth and adequate safety margins.~~

The licensee should document each plant change evaluation consistent with ~~Section 4 of~~ Regulatory ~~Guide-Guide~~ 1.200, “An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,” issued March 2009 (Ref. ~~15~~), ~~Section 4,~~ “~~Documentation to Support a Regulatory Submittal,~~”¹¹), and retain the documentation in accordance with the requirements of NFPA 805, ~~Section-Section~~ 2.7.

~~There are two categories of changes to the NFPA 805 Chapter 3 fundamental FPP elements and design requirements that a licensee may make without prior NRC review and approval under NFPA 805. These are changes for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is:~~

- ~~• functionally equivalent; or,~~
- ~~• adequate for the hazard.~~

~~A licensee may use an engineering evaluation to demonstrate that a given minor change to an NFPA 805, Chapter 3, element is functionally equivalent to the corresponding technical requirement. To the extent that a qualified fire protection engineer has concluded a minor change has not affected the component, system, procedure or physical arrangement functionality using a relevant technical requirement or standard, the licensee continues to meet NFPA 805 and therefore does not require prior NRC approval.~~

~~A licensee may also 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.” Four specific sections in NFPA 805, Chapter 3, include requirements that are based on the results of the analyses performed under NFPA 805 Chapter 4. Prior NRC approval would not be required for changes related to these four specific sections if the licensee could demonstrate that the alternative is “adequate for the hazard.” The four specific sections of NFPA 805, Chapter 3, are:~~

- ~~• 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).~~

~~NFPA 805 Section 2.4, “Engineering Analyses,” allows use of qualitative or quantitative methods to evaluate the effectiveness of fire protection features in relation to their ability to detect, control, suppress, and extinguish a fire and provide passive protection to achieve the performance criteria. To the extent a qualified fire protection engineer has concluded that a minor change to one of the four NFPA 805, Chapter 3, sections listed above is “adequate for the hazard” using a relevant technical requirement, the licensee continues to meet NFPA 805 and prior NRC approval of the change is not required.~~

3.2.5 Combined Changes and Cumulative Risk of Changes

Section 2.4.4.1 of NFPA 805 requires licensees to evaluate the cumulative effect of plant changes (including all previous changes that have increased risk) on overall risk. Licensees should evaluate the cumulative risk in accordance with Section 3.3.2 of Regulatory Guide 1.174 (Ref. 128).

After the transition to NFPA 805, the cumulative risk of subsequent FPP changes is the change in risk compared to the post-transition baseline risk (see Regulatory Position 2.2.4). Also, after the transition to NFPA 805, licensees should only include changes associated with the FPP in cumulative risk evaluations. In the sample license condition in Regulatory Position 3.1, the NRC chose risk acceptance criteria low enough to provide reasonable assurance that the effect of self-approved changes on cumulative risk would be acceptable. However, when licensees request FPP changes that they may not self-approve after the transition to NFPA 805, their license amendment requests should address the cumulative impact of all previous FPP changes since adopting NFPA 805.

Section 2.4.4.1 of NFPA 805 further states that, if more than one plant change is combined into a group for the purposes of evaluating acceptable risk, each individual change shall be evaluated, along with the evaluation of the combined change. Any risk increases may be combined with risk decreases

when estimating the total risk change. Licensees should address combined changes in accordance with the guidance in Regulatory Positions 2.1.1 and 2.1.2 of Regulatory Guide 1.174.

DRAFT

3.3 Circuit Analysis

~~Identifying and Evaluating Risk-Significant Circuits~~

The industry guidance document NEI 00-01, ~~Revision 1~~, “Guidance for Post-Fire Safe Shutdown Circuit Analysis²²,” ~~Revision 1, issued January 2005~~ (Ref. ~~4612~~), when used in conjunction with NFPA 805 and this regulatory guide, provides one acceptable approach to circuit analysis for a plant implementing an FPP under 10 CFR 50.48(c). Where the deterministic requirements in Chapter 4 of NFPA 805 are not met for the protection of required circuits, 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, test results, or both, that are accepted by the NRC. Aspects of circuit protection that do not conform to the deterministic requirements in Chapter 4 of NFPA 805 and were not previously approved by the NRC in accordance with Regulatory Position 2.3.2 may be evaluated using the ~~fire risk evaluation (transition) or the plant change process evaluation (posttransition)~~ in NFPA 805.

NEI 04-02, Section B.2.1, provides one acceptable approach for identifying and screening multiple spurious actuations when analyzing the post-fire safe-shutdown circuits. Licensees should use the ~~fire risk evaluation or plant change evaluation (as applicable)~~ described in Regulatory ~~Position~~ Positions 2.2.4 and 3.2.2 for unscreened spurious actuations.

The nuclear safety capability circuit analysis should address both the possible equipment damage caused by spurious actuation and the inability to restore equipment operability, including the types of failures described in the NRC’s Information Notice (IN) 92-18, “Potential for Loss of Remote Shutdown Capability During a Control Room Fire,” issued February 1992 (Ref. ~~1713~~). In addressing the failures described in ~~IN 92-18~~, some licensees have credited ~~the~~ thermal overload protection (~~TOL~~) installed in the electrical circuits for the associated motor-operated valves (~~MOVs~~). Licensees that ~~utilize TOL~~ use thermal overload protection to prevent ~~MOV~~ damage to motor-operated valves should ~~utilize~~ use the guidance provided in Regulatory ~~Guide~~ Guide 1.106, ~~Revision~~ Revision 1, “Thermal Overload Protection for Electric Motors on Motor-Operated Valves,” issued ~~March~~ March 1977 (Ref. ~~48~~), 14). 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.

4. NFPA 805 Analytical Methods and Tools

4.1 General

NFPA 805, Section 2.7.3, has requirements for the quality of engineering analyses and associated methods that the licensee applies to demonstrate compliance with the ~~performance criteria for~~ nuclear safety and radioactive release ~~performance criteria~~.

4.2 Fire Models

~~NEI~~NEI 04-02, ~~Section~~ Section 5.1.2, provides guidance on ~~what the~~ fire models ~~have been found acceptable for that~~ licensees may use in ~~NFPA-an~~ NFPA 805 transition, ~~how~~ compliance with the ~~NFPA-NFPA~~ NFPA 805 fire modeling requirements ~~can be achieved~~, and ~~about~~ fire model verification and

validation (V&V). ~~Use~~The NRC accepts the use of these models to perform the performance-based evaluations in NFPA 805, Section 4.2.4, ~~is acceptable to the NRC~~ if each model ~~used~~ is shown to have been appropriately applied within the range of its applicability and V&V.

Licenses may also propose the use of other fire models; however, licenses are responsible for providing evidence of ~~the~~ acceptable V&V of these fire models. ~~The Licenses should submit the~~ V&V documents for licensee-proposed fire models ~~should be submitted with the~~ their license amendment ~~request~~requests for NRC review. A license amendment request may use other fire models, documented in generic reports (e.g.,- topical reports), which the NRC has previously reviewed and found acceptable, if the licensee can demonstrate that the model has been used within the range of its applicability and V&V.

Appendix C to NFPA 805 and Appendix D to NEI 04-02 contain discussions that may be useful to licenses in determining which fire models to use and applying those fire models within their limitations; however, the NRC only endorses the fire models, methods, data, and examples in those appendices to the extent that they have been (or can be) adequately verified and validated or to the extent that they are demonstrated appropriate for the specific application.

4.3 Fire Probabilistic Risk Assessment

The fire PRA used to perform the risk assessments ~~of in~~ NFPA 805, Section 2.4.4 (plant change evaluation), and Section 4.2.4.2 (fire risk evaluation), must be of sufficient technical adequacy to support the application. In accordance with ~~Section~~Section 2.4.3.3 of ~~NFPA~~NFPA 805, the PRA approach, methods, and data must be acceptable to the NRC. There are two aspects to assessing the technical adequacy of the PRA results. First, the underlying PRA (i.e.,- the baseline model) should be technically adequate. Second, the analyses, assumptions, and approximations to map the cause-effect relationship associated with the application must be technically adequate.

The licensee may address the first aspect for risk-informed applications by conforming ~~with~~to the peer review and self-assessment processes in Regulatory Guide 1.200, ~~“An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities,” issued March 2009 (Ref. 15).~~“An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities,” issued March 2009 (Ref. 15). Regulatory Guide 1.200(1). This regulatory guide provides one approach acceptable to the NRC for determining the technical adequacy of the baseline PRA model. Regulatory Guide 1.200 endorses, with certain clarifications and qualifications, Addendum A to the American Society of Mechanical Engineers/American Nuclear Society, “Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications” (ASME/ANS RA-~~Sa~~Sa 2009) (“PRA Standard”) (Ref. 4915).

The licensee should address the second aspect by describing the specific modeling of each cause- ~~and~~ effect relationship associated with the application. ~~As outlined in SRP Section 19.1, the~~The NRC staff will review the engineering analyses, assumptions, and approximations made in developing and using the PRA model to determine whether they are appropriate, focusing on the key assumptions (i.e.,- those that are significant to the application), ~~as outlined in Section 19.1 of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” issued March 2007 (Ref. 16).~~as outlined in Section 19.1 of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” issued March 2007 (Ref. 16).

The licensee should submit the documentation described in ~~Section~~Section 4.2 of Regulatory ~~Guide~~Guide 1.200 to address the baseline PRA and application-specific analyses. For PRA Standard

“supporting requirements” important to the NFPA 805 risk assessments, the NRC position is that Capability Category II is generally acceptable. Licensees should justify use of Capability Category I for specific supporting requirements in their NFPA 805 risk assessments, if they contend that it is adequate for the application. Licensees should also evaluate whether portions of the PRA need to meet Capability Category III, as described in the PRA standard.

The staff will ~~continue to rely on this process to rely on the guidance in Regulatory Guide 1.200~~ to review all facility changes associated with implementing ~~NFPA-NFPA~~ 805 that are submitted for prior staff review and approval. The staff will ~~also continue to rely on this process guidance~~ to provide confidence that self-approved changes meet the acceptance guidelines. The licensee’s self-approval process should include an evaluation of all unresolved peer review issues to assess the potential impact of the unresolved issue on the application-specific evaluation. Any unresolved issue that could have a substantive impact on the results must be resolved. The licensee’s self-approval process should also include the methods for modeling the cause and effect relationship ~~as~~ described in Regulatory ~~Position~~ **Position** 3.2.4.

The NRC and ~~the Electric Power Research Institute (EPRI)~~ have documented a methodology for conducting a fire PRA in NUREG/CR-6850/EPRI 1011989, “EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities²²,” ~~issued September 2005~~ (Ref. ~~2017~~). However, recognizing that merely using the methods explicitly documented in NUREG/CR-~~6850/EPRI-EPRI~~ 1011989 may result in a conservative assessment of fire risk, licensees may choose to perform more detailed plant-specific analyses to provide greater realism in the fire PRA model.

Although a licensee may ~~make the~~ transition to an ~~NFPA 805-FPP~~ based ~~FPP-on NFPA 805~~ without a fire PRA model that encompasses all the areas in its facility, licensees must develop a plant-specific fire PRA of sufficient scope and technical adequacy ~~in order~~ to demonstrate that the risk-informed requirements in the rule are met for all areas where the risk-informed approach described in ~~NFPA-NFPA~~ 805, ~~Sections-Sections~~ 2.4.3 ~~and~~ and 4.2.4.2 is used. If a licensee develops a fire PRA ~~is~~ only ~~performed~~ for areas where the risk-informed approach is used, ~~the licensee should develop, review, and maintain this limited-scope PRA should be developed, reviewed, and maintained~~ in accordance with all applicable guidelines. The acceptance guidelines of Regulatory ~~Guide-Guide~~ 1.174 may require the total CDF ~~and/or, LERF for evaluation of, or both, to evaluate~~ changes ~~whosewhere the~~ risk impact exceeds specific guidelines. If there are no areas that rely on the risk-informed approach, licensees may propose an alternative approach for ~~transitioningmaking the transition to, and making changes to, their~~ ~~10 CFR-an FPP based on 10 CFR 50.48(c)-based fire protection program.~~

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC’s plans for using this regulatory guide. The NRC does not intend or approve any imposition or backfit in connection with its issuance.

In some cases, applicants or licensees may propose an alternative or use a previously established acceptable alternative method for complying with specified portions of the NRC’s regulations. Otherwise, the methods described in this guide will be used in evaluating compliance with the applicable regulations for license applications, license amendment applications, and amendment requests.

GLOSSARY

NFPA 805, Section 1.6, contains definitions applicable to the 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, licensees should use the NFPA 805 definitions ~~should be used~~.

DRAFT

REFERENCES⁶

1. ~~10 CFR 50.48, “Fire Protection~~ 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” U.S. Nuclear Regulatory Commission, Washington, DC.
2. NFPA 805, “Performance-Based Standard for Fire Protection for Light-Water Reactor Electric Generating Plants,” 2001 Edition, National Fire Protection Association, Quincy, MA.⁷
3. ~~10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, Washington, DC.~~
4. ~~10 CFR Part 50, Appendix R, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979,” U.S. Nuclear Regulatory Commission, Washington, DC.~~
5. 69 FR 33536, “Voluntary Fire Protection Requirements for Light Water Reactors; Adoption of NFPA 805 as a Risk-Informed, Performance-Based Alternative,” *Federal Register*, Volume 69, Number 115, pp. 33536–33550, Washington, DC, June 16, 2004.
6. ~~10 CFR 50.90, “Application for Amendment of License, Construction Permit, or Early Site Permit,” U.S. Nuclear Regulatory Commission, Washington, DC.~~
74. 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. (NRC’s Agencywide Documents Access and Management System (ADAMS) Accession No. ML081130188)
85. SECY--98--058, “Development of a Risk-Informed, Performance-Based Regulation for Fire Protection at Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, Washington, DC, March 26, 1998. (ADAMS Accession No. ML992910106)
96. SECY--00--0009, “Rulemaking Plan, Reactor Fire Protection Risk-Informed, Performance-Based Rulemaking,” U.S. Nuclear Regulatory Commission, Washington, DC, January 13, 2000. (ADAMS Accession No. ML003671923)
- 10.7. 10 CFR, Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, Washington, DC.
11. ~~10 CFR 50.54, “Conditions of Licenses,” U.S. Nuclear Regulatory Commission, Washington, DC.~~

⁶ Publicly available NRC published documents such as Regulations, Regulatory Guides, NUREGs, and Generic Letters listed herein are available electronically through the Electronic Reading Room on the NRC’s public Web site at: <http://www.nrc.gov/reading-rm/doc-collections/>. Copies are also available for inspection or copying for a fee from the NRC’s Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail PDR.Resource@nrc.gov.

⁷ Copies of the non-NRC documents included in these references may be obtained directly from the publishing organization.

- ~~128.~~ Regulatory ~~Guide~~~~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)
- ~~139.~~ Generic ~~Letter~~~~Letter~~ 86-10, “Implementation of Fire Protection Requirements,” U.S. Nuclear Regulatory Commission, Washington, DC, April 24, 1986. (ADAMS Accession No. ML031150322)
- ~~1410.~~ Regulatory ~~Guide~~~~Guide~~ 1.189, “Fire Protection for Nuclear Power Plants,” Revision 1, U.S. Nuclear Regulatory Commission, Washington, DC, March 2007. (ADAMS Accession No. ML070370183)
- ~~15~~
11. Regulatory ~~Guide~~~~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)
- ~~1612.~~ NEI 00-01, “Guidance for Post-Fire Safe-Shutdown Circuit Analysis,” Revision 1, Nuclear Energy Institute, Washington, DC, January 2005. (ADAMS Accession No. ML050310295)
- ~~17~~—13. Information Notice ~~IN~~~~IN~~ 92-18, “Potential for Loss of Remote Shutdown Capability During a Control Room Fire,” U.S. Nuclear Regulatory Commission, Washington, DC, February 1992. (ADAMS Accession No. ML031200481)
- ~~18.~~—14. Regulatory ~~Guide~~~~Guide~~ 1.106, “Thermal Overload Protection for Electric Motors on Motor-Operated Valves,” Revision 1, U.S. Nuclear Regulatory Commission, Washington, DC, March 1977. (ADAMS Accession No. ML003740323)
- ~~1915.~~ ASME/~~ANS~~~~ANS~~ RA-Sa-Sa 2009, “Standard for ~~Level~~~~Level~~ 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications,” American Society of Mechanical Engineers, New York, NY, and American Nuclear Society, La Grange Park, IL, 2009.
- ~~2016.~~ NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, Washington, DC, March 2007.
17. NUREG/CR-6850/EPRI 1011989, “EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities,” ~~Volume 1~~~~Volume 1~~: “Summary and Overview,” ~~Volume~~~~Volume~~ 2: “Detailed Methodology,” ~~Office of Nuclear Regulatory Research~~, U.S. Nuclear Regulatory Commission, Washington, DC, September 2005. (ADAMS Accession Nos. ML052580075 and ML052580118)