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## 5.3 Plant Change Process

### 5.3.1 Overview

#### 5.3.1.1 Regulatory Requirements and Guidance

The plant change evaluation is a required step in the methodology for all changes to previously approved fire protection program elements. NFPA 805 Section 2.2.9 states that:

*In the event of a change to a previously approved fire protection program element, a risk-informed plant change evaluation shall be performed and the results used as described in 2.4.4 to ensure that the public risk associated with fire-induced nuclear fuel damage accidents is low and that adequate defense-in-depth and safety margins are maintained.*

Section 2.4.4 of NFPA 805 provides the criteria against which the change evaluations are evaluated. It states, in part, that:

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

Details regarding the acceptance criteria are provided in Sections 2.4.4.1, 2.4.4.2, and 2.4.4.3 of NFPA 805.

- Section 2.4.4.1 requires the change in public health risk from any plant change be acceptable to the NRC as demonstrated by the change in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF). The NRC already has established acceptable quantitative changes to the CDF and LERF in Regulatory Guide 1.174. The NRC has modified the quantitative acceptance criteria for making changes to the licensee's fire protection program without prior NRC review and approval. These acceptance criteria will be included in or referenced in the licensee's post transition fire protection license condition. Specifically, these criteria should be applied to show that the public health risk associated with fire-induced nuclear fuel damage related to the change is acceptably low.
- Sections 2.4.4.2 and 2.4.4.3 for defense-in-depth and safety margin simply repeat the criterion in Section 2.2.9 requiring the adequate maintenance of these factors. Criteria complying with these requirements also are provided in Regulatory Guide 1.174 and this guidance. Note that sections 2.4.4.2 and 2.4.4.3 also indicate that the deterministic approach for meeting the performance criteria "shall be deemed to satisfy" requirements for defense-in-depth and safety margin.

Under the risk-informed, performance-based regulatory framework, Fire Protection Program changes may be made without prior NRC approval, except where:

- 10 CFR 50.48(c) changes that do not meet the acceptance criteria or other conditions of the approved license condition
- 10 CFR 50.48 (c)(2)(vii). Changes to the program that use NFPA 805 performance-based methods in determining the licensee's compliance with the fire protection program elements and minimum design requirements in Chapter 3 of NFPA 805

- 10 CFR 50.48 (c)(4). Changes to the program that use risk-informed or performance-based alternatives to compliance with NFPA 805 (i.e., methods that differ from those prescribed by NFPA 805)
- Combined changes where any individual change would not meet the risk acceptance criteria of the license condition.

This does not address all possible types of changes to the Fire Protection Program, which are described further in this section and Appendix J.

For those changes that do require NRC approval, the licensee will 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.

#### 5.3.1.2 Definitions

Two terms are used in this section to describe the process and documentation associated with Plant Change Evaluations as defined in NFPA 805 Section 2.2.9 and RG 1.205, Regulatory Position 3.2.

**Fire Protection Change Impact Review** – Process to consider the impact of plant or program changes on a case by case basis as they occur and to perform evaluation of the impact of Fire PRA periodic revisions.

**NFPA 805 Change Evaluation Document** –Engineering Evaluation (e.g., Calculation, Fire Safety Analysis, or Design Basis Document) that contains the changes to the NFPA 805 Fire Protection Program post-transition on a fire area basis. It includes an evaluation of risk, defense in depth and safety margins relative to these changes.

#### 5.3.1.3 Process Overview

The change process (referred to as “Fire Protection Change Impact Review”) under risk-informed, performance-based regulatory framework requires the explicit consideration of risk. The evaluation of risk is limited to the determination of whether an increase has occurred, and if so, whether the increase is within acceptable limits. A structured screening process can meet the requirements of NFPA 805 for this evaluation of risk. This screening process will be used to ‘screen’ minimal increases in risk. Minimal change in fire risk is defined as a change in fire risk that is so small or the uncertainties in determining whether a change in fire risk has occurred are such that it cannot be reasonably concluded that the fire risk has actually changed (i.e., there is no clear trend towards increasing fire risk). For potentially higher risk changes, a more comprehensive treatment would be used. The intent of this approach is to provide analysis flexibility to address a wide range of issues and conditions. In general, the Fire Protection Change Impact Review process focuses on performing those Engineering Analyses needed to establish the acceptability of the change.

Note; Fire modeling is integral to a risk-informed, performance-based fire protection program. During the licensee transition process, some licensees may have elected to use the fire modeling approach of Section 4.2.4.1 of NFPA 805 to establish the compliance basis for certain fire areas in the plant. While this is an acceptable compliance approach, the post-transition change evaluation process must include the consideration of change in risk, defense-in-depth, and safety

margin. While the fire modeling tools may provide the most efficient means to assist in that determination of a change in risk (e.g., no target damage shown through fire modeling can be extrapolated to no/low change in risk), the acceptance criteria of a change evaluation must be in accordance Section 2.4.4 of NFPA 805.

NFPA 805 Section 4.1, states that, “Deterministic requirements shall be “deemed to satisfy” the performance criteria and require no further engineering analysis.” Chapter 4 of NFPA 805 provides the requirements for the baseline evaluation of the fire protection program’s ability to achieve the performance criteria outlined in Section 1.5 of NFPA 805. The ‘deemed to satisfy’ without additional engineering analysis does not imply that a Fire Protection Change Impact Review would not be performed. For example, if a licensee was changing its current licensing basis in a fire area to a ‘deterministic method’, that change would require a ‘Plant Change Evaluation’. Note the Defense in Depth and Safety Margin portion of the “Plant Change Evaluation” would be satisfied by the fact that a ‘deterministic’ option was chosen for compliance (See Sections 2.4.4.2 and 2.4.4.3 of NFPA 805).

Figure 5-1 depicts the Fire Protection Change Impact Review Process. The Fire Protection Change Impact Review can be divided into the following subtasks:

- Defining the Change (See Section 5.3.2)
- Performing the Preliminary Risk Screening (See Section 5.3.3)
- Performing the Risk Evaluation (See Section 5.3.4)
- Reviewing the Acceptance Criteria (See Section 5.3.5)

This process is intended to be guidance for review of individual plant changes, where the changes are assessed against the acceptance criteria. Another process for addressing Fire PRA updates and cumulative risk is provided in Appendix J. The process for addressing Fire PRA updates and cumulative risk is intended to be performed periodically as Fire PRA updates are made, but are not intended to replace the review of individual changes. In other words, for an individual change that warrants quantitative treatment, a change evaluation would be performed and documented. The cumulative risk treatment would be considered a “safety net” that would evaluate potential risk increases that could occur since the last PRA update, and would include potential risk increases that may have been evaluated on an individual basis, as well as changes due to other reasons.

Appendix J contains additional information regarding the Fire Protection Change Impact Review. The following subsections provide guidelines for performing the reviews.

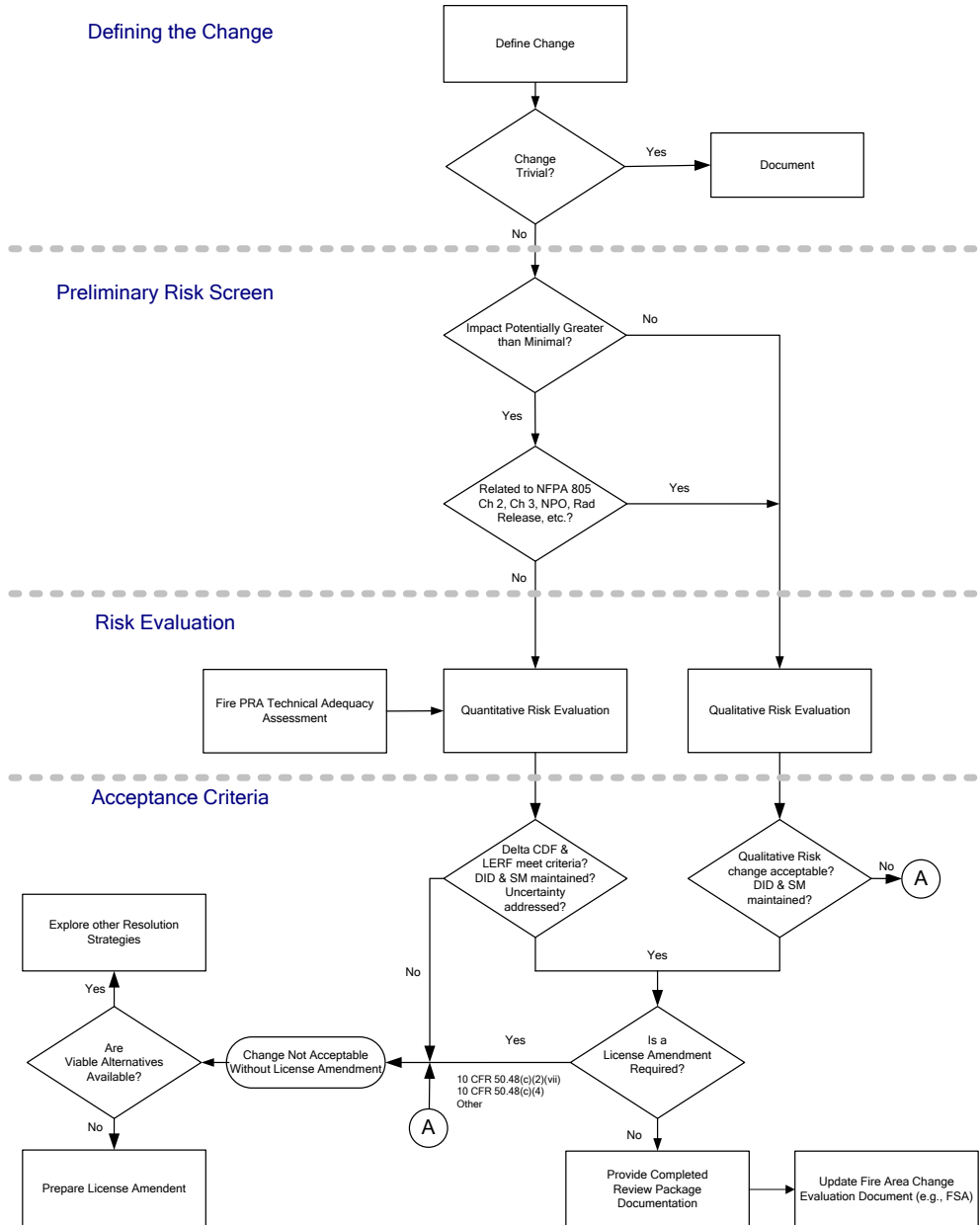


Figure 5-1 – Fire Protection Change Impact Review Process

### 5.3.2 Defining the Change

#### 5.3.2.1 General Guidance

Changes can involve either physical components of the plant or specific details of the fire protection program. The need to perform a review can arise through a number of events or conditions.

- A physical plant modification that affects the fire protection program
- A programmatic change (e.g., change to a procedure, assumption, or analysis) that affects the fire protection program
- An in-situ condition (physical or programmatic) that is not in compliance with the plant's fire protection program. Note, appropriate compensatory measures, in accordance with the licensee's program, should be established and remain in place until the condition is accepted via applicable plant change processes

The Fire Protection Change Impact Review process begins by defining the change or altered condition to be examined and the compliant configuration as defined by the NFPA 805 Licensing Basis:

- The changed or altered condition or configuration that is not consistent with the current plant NFPA 805 Licensing Basis is defined as the proposed alternative. The proposed alternative may be another fully acceptable option under NFPA 805, but not currently used for the given situation.
- The compliant condition is defined as that plant condition or configuration that is consistent with the NFPA 805 Licensing Basis.

#### 5.3.2.2 Specific Changes of Interest

It may not be appropriate to address certain types of changes to the fire protection program by quantitative risk-informed, performance-based treatment. These types of changes include:

- NFPA 805 Chapter 2 – Methodology/Process Changes
- NFPA 805 Chapter 3 – Fundamental Fire Protection Program and Design Elements
- Non-Power Operational (NPO) Modes
- Radioactive Release Performance Criteria

This discussion is not intended to prohibit the use of risk-informed, performance-based treatment. Certain aspects of these sections of NFPA 805 may **not** warrant or be conducive to a risk-informed, performance-based treatment (e.g., NFPA 805 Chapter 3 fire protection systems or features whose risk contribution can be quantitatively estimated using the Fire PRA). Other topics in these sections of NFPA 805 however, are programmatic in nature or clearly not amenable to risk-informed, performance-based treatment (e.g., Design Basis Document requirements in Section 2.7.2.1 of NFPA 805). The discussion below addresses ways to address these types of changes to the Fire Protection Program.

**Comment [S1]:** Not sure the "not" is right.

#### NFPA 805 Chapter 2 – Methodology/Process Changes

NFPA 805 Chapter 2 provides a general approach for establishing the fire protection requirements for the plant. NFPA 805 Chapter 2 provides a combination of:

- General methodology, and

- Requirements, which should be reviewed for impact, when changes are proposed to the fire protection program.

Plant-specific implementation of the methodology and requirements of NFPA 805 Chapter 2 are addressed in the NFPA 805 Safety Evaluation for the plant. Therefore, changes to the methodology for implementing NFPA 805 should be reviewed as part of the plant change process. Changes related to NFPA 805 Chapter 2 may not be the types of changes that can be measured in terms of change in risk or maintaining defense-in-depth and safety margins. Changes to methodologies, however, should be reviewed to determine acceptability and need to obtain approval from the NRC.

Methodology changes may be made to the plant fire protection program within the bounds of the license condition. Changes to the fire protection program related to NFPA 805 Chapter 2 can be made under the following circumstances:

- The change meets the literal requirements of NFPA 805 Chapter 2.
- The change is considered to be editorial or trivial in nature and clearly has no adverse impact on the fire protection program.
- The change is consistent with the plant specific licensing basis as defined in the NFPA 805 Safety Evaluation or accepted by the NRC in a formal process such as the NFPA 805 FAQ process and the results meet the appropriate acceptance guidelines.

Additional guidance on Fire PRA methods and determination of Fire PRA Technical Adequacy are provided in Appendix J.

### **NFPA 805 Chapter 3 – Fundamental Fire Protection Program and Design Elements**

#### General Guidance

Guidance on the NFPA 805 Chapter 3, Fundamental Fire Protection Program and Design Elements, is provided in RG 1.205 Rev. 1, Regulatory Position 3.1. Comparison of the NFPA 805 Chapter 3 requirements for a licensee is addressed in the NFPA 805 Safety Evaluation. Therefore, changes to the plant's compliance with NFPA 805 Chapter 3, as approved in the Safety Evaluation and subsequent updates performed in accordance with the license condition, should be reviewed as part of the plant change process. Types of changes related to NFPA 805 Chapter 3 are not likely to be the types of changes that can be measured in terms of a quantitative change in risk.

Changes, however, should be reviewed to determine acceptability and need to obtain approval from the NRC. The changes should be reviewed against the approved configuration in the Safety Evaluation, as supplemented by subsequent Change Evaluations that have been performed since the approval of the Safety Evaluation in accordance with the license condition. The individual Fire Protection Change Impact Review should consider changes against the last approved fire protection program document (e.g., Fire Safety Analysis, Design Basis Document, etc.).

Certain aspects of Chapter 3 may warrant or be conducive to a risk-informed, performance-based treatment. For example, NFPA 805 Chapter 3 fire protection systems or features whose risk contribution can be quantitatively estimated using the Fire PRA. The change in risk associated with these types of changes should be measured quantitatively, as appropriate, and subject to the risk acceptance criteria of the license condition. Outstanding changes to the approved fire

protection program are addressed on a cumulative basis as discussed in Attachment J, Section J.6.2.

10 CFR 50.48(c)(2)(vii)

As discussed in Section 2.2 and 5.3.1.1, 10 CFR 50.48(c)(2)(vii) provides additional requirements related to NFPA 805 Chapter 3. 10 CFR 50.48(c)(2)(vii) states, in part:

*(vii) Performance-based methods. Notwithstanding the prohibition in Section 3.1 against the use of performance-based methods, the fire protection program elements and minimum design requirements of Chapter 3 may be subject to the performance-based methods permitted elsewhere in the standard. Licensees who wish to use performance-based methods for these fire protection program elements and minimum design requirements shall submit a request in the form of an application for license amendment under § 50.90....”*

The review of the change should ensure that the compliance with NFPA 805, Chapter 3, does not utilize performance-based methods, other than those approved as part of the transition process or allowed per the license condition (e.g., “functionally equivalent” or “adequate for the hazard” evaluations).

Special Considerations for Certain NFPA 805 Chapter 3 Sections

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 should perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

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

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

Licensees 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 elements in NFPA 805, Chapter 3. Upon NRC approval of the bounding method, the licensee may make subsequent minor changes to Chapter 3 elements by performing an engineering analysis to



demonstrate that the proposed change is within the scope of the approved method and complies with the bounding conditions. The licensee's fire protection license condition will reference the approval to make these changes.

See Attachment J for guidance on the treatment of changes related to NFPA 805 Chapter 3, Fundamental Fire Protection Program and Design Elements.

### **Non-Power Operational (NPO) Modes**

Changes may be made to the plant response to fires originating in non-power operational modes using the same basic process as fires originating in at-power operational modes in the NSCA. However, due to the current state of knowledge/practice in the industry, the change in risk associated with fire protection changes may be performed qualitatively, rather than quantitatively. Plant-specific approval of the process for addressing fires originating in non-power operational modes is contained in the NFPA 805 Safety Evaluation for the plant.

Changes, however, should be reviewed to determine acceptability and need to obtain approval from the NRC. The changes should be reviewed against the approved configuration in the Safety Evaluation, as supplemented by subsequent Change Evaluations that have been performed since the approval of the Safety Evaluation. The individual Fire Protection Change Impact Review should consider changes against the last approved fire protection program document (e.g., FSA, DBD, etc.).

Changes may be made to the plant fire protection program within the bounds of the license condition. Changes to the fire protection program related to NFPA 805 Chapter 4 for fires originating in non-power operational modes can be made under the following circumstances:

- The change meets the literal requirements of NFPA 805 Chapter 4, Section 4.2 for fires originating in non-power operational modes.
- The change is considered to be editorial or trivial in nature and clearly has no adverse impact on the fire protection program.
- The change is not editorial or trivial, but a qualitative evaluation of change in risk using an engineering evaluation shows the change is acceptable, including maintenance of defense-in-depth and safety margins.
- The change is evaluated using the process used in the transition or accepted by the NRC in a formal process such as the NFPA 805 FAQ process and the results meet the appropriate acceptance guidelines.

### **Radioactive Release Performance Criteria**

Changes may be made to the plant fire protection program as it relates to meeting the radioactive release performance criteria. The change in risk associated with radioactive release changes is performed qualitatively. Plant-specific approval of the process for addressing the impact of fire on radioactive release is contained in the NFPA 805 Safety Evaluation for the plant.

Changes, however, should be reviewed to determine acceptability and need to obtain approval from the NRC. The changes should be reviewed against the approved configuration in the Safety Evaluation, as supplemented by subsequent Change Evaluations that have been performed since the approval of the Safety Evaluation. The individual Fire Protection Change Impact Review should consider changes against the last approved fire protection program document (e.g., FSA, DBD, etc.).

Changes may be made to the plant fire protection program within the bounds of the license condition. Changes to the fire protection program related to NFPA 805 Chapter 4, Section 4.3 can be made under the following circumstances:

- The change meets the literal requirements of NFPA 805 Chapter 4, Section 4.3.
- The change is considered to be editorial or trivial in nature and clearly has no adverse impact on the fire protection program.
- The change is evaluated using the process used in the transition or accepted by the NRC in a formal process such as the NFPA 805 FAQ process and the results meet the appropriate acceptance guidelines.

#### **5.3.2.3 Trivial Changes**

Trivial Changes - Changes such as editorial changes to procedures are not required to be processed through the Fire Protection Change Impact Review Process.

#### **5.3.3 Preliminary Risk Screening**

Once the definition of the change is established, a screening is performed. This screening is consistent with fire protection regulatory review processes in place at nuclear plants under traditional licensing bases. This process will address most administrative changes (e.g., organizational changes, plant administrative procedure changes, etc.).

The characteristics of an acceptable screening process that meets the “assessment of the acceptability of risk” requirement of Section 2.4.4 of NFPA 805 are:

- The quality of the screen is sufficient to ensure that potentially greater than minimal risk increases receive detailed risk assessments appropriate to the level of risk.
- The screening process must be documented and be available for inspection by the NRC.
- The screening process does not pose undue evaluation or maintenance burden. If any of the above is not met, proceed to Section 5.3.4 Risk Evaluation.

The impact of the plant change on each of these factors can be evaluated (either qualitatively or quantitatively) and categorized as: “no” impact, “minimal” impact or “potentially greater than minimal” impact. The nature of the change would enable a licensee to choose among the three categories. The licensee should document the basis for the conclusion. The acceptance criteria also include consideration of defense-in-depth and safety margin, which would typically be qualitative in nature. The level of review for defense-in-depth and safety margin should be commensurate with the nature and complexity of the change. For those changes that do not meet the screening criteria, a more detailed Risk Evaluation is required.

The preliminary risk screening and risk evaluations should also identify decreases in risk that are associated with the change. Depending upon the nature and magnitude of the decrease, consideration should be given to updating the risk model to account for the decrease.

#### **5.3.4 Risk Evaluation**

The screening is followed by engineering evaluations that may include risk assessment techniques. The results of these evaluations are then compared to the acceptance criteria. Changes that satisfy the acceptance criteria of NFPA 805 Section 2.4.4 can be implemented within the framework provided by NFPA 805. Changes that do not satisfy the acceptance criteria cannot be implemented within this framework. The acceptance criteria also include

consideration of defense-in-depth and safety margin, which would typically be qualitative in nature.

The change should be evaluated to determine the need for and nature of engineering analysis that may be necessary to support the change.

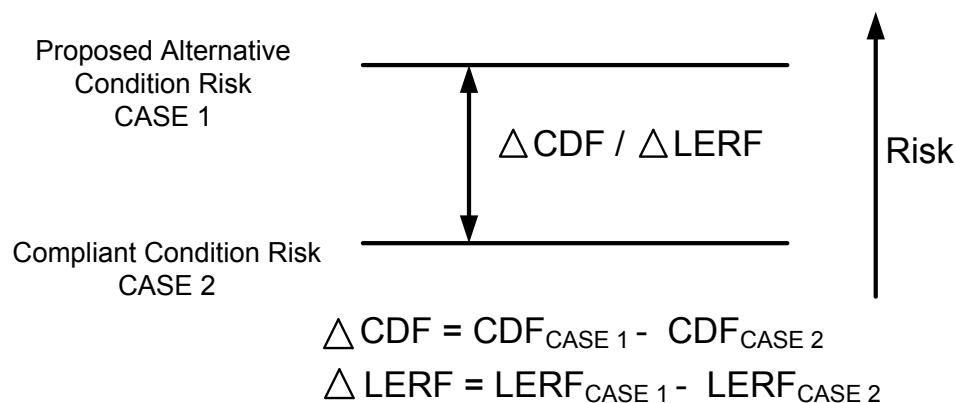
#### 5.3.4.1 Quantitative Risk Evaluations

##### Overview

The quantitative risk evaluation involves the application of risk assessment techniques to obtain a measure of the changes in risk associated with the proposed change. In certain circumstances, an initial evaluation in the development of the risk assessment could be a simplified analysis using bounding assumptions provided the use of such assumptions does not unnecessarily challenge the acceptance criteria discussed in Section 5.3.5.

The quantitative Change Evaluation process begins by defining the change or altered condition to be examined and the compliant configuration as defined by the NFPA 805 Licensing Basis:

- The changed or altered condition or configuration that is not consistent with the NFPA 805 Licensing Basis, but is the anticipated final configuration, is defined as the proposed alternative (Case 1)
- The compliant condition is defined as that plant condition or configuration that is consistent with the NFPA 805 Licensing Basis (Case 2).



**Figure 5-2 – Compliant versus Changed/Altered Conditions (for an example risk increase)**

Note that the compliant condition (Case 2) is the risk associated with the NFPA 805 licensing basis, but not necessarily deterministic compliance with Section 4.2.3 of NFPA 805. It is also relative to the latest revision of the plant Fire PRA that has been evaluated per the process in Appendix J, Section J.6.2, Treatment of Cumulative Program Changes.

## Technical Adequacy

Section 2.4.3.3 of NFPA 805, which applies to the Fire PRA used during NFPA 805 transition in performing fire risk evaluations and post-transition in performing Change Evaluations, includes, in part, the following:

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

In order to perform a quantitative change evaluation using the Fire PRA, the technical adequacy of the Fire PRA must be ensured to support the specific change evaluation. The accuracy of the technical content of the Fire PRA must be sufficient to justify the specific results and insights that are used to support the change evaluation process.

Refer to Appendix J for additional detail on Fire PRA technical adequacy and treatment of changes to the Fire PRA.

### 5.3.4.2 Qualitative Risk Evaluations

Qualitative risk evaluations can be performed where quantitative treatment is not warranted. Qualitative risk evaluations can also be performed where engineering judgment and analysis provides a more appropriate assessment of risk than numerical treatment.

Qualitative risk evaluations are performed for topics such as:

- NFPA 805 Chapter 2 – Methodology/Process Changes
- NFPA 805 Chapter 3 – Fundamental Fire Protection Program and Design Elements
- Non-Power Operational (NPO) Modes
- Radioactive Release Performance Criteria

Qualitative risk evaluations may also be used to address changes to the “at power” Nuclear Safety Capability Assessment, in cases where the qualitative treatment provides an appropriate assessment of risk.

The risk evaluations should use engineering analysis to assess the impact of the proposed change. The complexity of the evaluation should be commensurate with the significance of the change. For example, the complexity and level of analysis to support a change identified as “not potentially greater than minimal” would likely not be extensive, while a substantial change to the NPO analysis may involve a more detailed review and assessment.

### 5.3.5 Review of Acceptance Criteria

#### 5.3.5.1 Quantitative Risk Evaluations

##### Quantitative Risk Acceptance Criteria

Regulatory Guide 1.205 includes risk acceptance guidance acceptable to the AHJ. The fire protection license condition either specifies or references the following quantitative risk acceptance criteria for self-approval of changes:

- Individual changes that result in a risk increase less than  $1 \times 10^{-7}$ /year (yr) for CDF, and
- Individual changes that result in a risk increase less than  $1 \times 10^{-8}$ /year (yr) for LERF.

Prior NRC approval is also not required for changes that clearly result in a decrease in risk.

If the self-approval guidelines are not met, an LAR must be submitted to the NRC for review and approval. The NRC will use the guideline values in RG 1.174 which are applicable to the

cumulative change in risk of all changes in the Fire Protection Program, or credited for the Fire Protection Program, after transition to NFPA 805.

### **Defense-in-Depth**

The result of the proposed change must also satisfy defense-in-depth and safety margin considerations. In general, the defense-in-depth requirement is satisfied if the proposed change does not result in a substantial imbalance in:

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

A process to evaluate the defense-in-depth implications of changes to the Fire Protection Program was developed and applied during the transition to NFPA 805. This process should be applied to changes to the Fire Protection Program following transition.

### **Safety Margins**

The licensee is expected to choose the method of engineering analysis appropriate for evaluating whether sufficient safety margins would be maintained. An acceptable set of guidelines for making that assessment is summarized below. Other equivalent acceptance guidelines may also be used.

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

A process to evaluate whether sufficient safety margins are maintained following changes to the Fire Protection Program was developed and applied during the transition to NFPA-805. This process should be applied to changes to the Fire Protection Program following transition.

The requirements related to safety margins for the change analysis is described for each of the specific analysis types used in support of the fire risk assessment. These analyses can be grouped into three example categories. These categories are:

1. Fire Modeling
2. Plant System Performance
3. Fire PRA Logic Model

#### Fire Modeling

Fire modeling used in support of the NFPA 805 Change Evaluations (i.e., as part of the Fire PRA) should use evaluation tools that have been subjected to appropriate Verification and Validation testing. The use of the fire modeling tools shall be within its limitations for use. Users should be qualified to use the models.

#### Plant System Performance

The development of the fire risk assessment may involve the re-examination of plant system performance given the specific demands associated with the postulated fire event. The methods,

input parameters, and acceptance criteria used in these analyses need to be reviewed against that used for the plant design basis events. This review would serve to establish that the Safety Margin inherent in the analyses for the plant design basis events have been preserved in the analysis for the fire event and therefore satisfy the requirements of this section.

#### Fire PRA Logic Model

The quantification for fire related CDF/LERF relies upon the Fire PRA model. It is recognized that use of a Fire PRA often requires model modifications to be performed to the internal events PRA. These modifications may include altering basic event failure probabilities, adding basic events, and logic structure changes. These changes should be evaluated against the methods and criteria for the overall Fire PRA model development for consistency, or confirmation of bounding treatment, to confirm that the Safety Margin inherent in the Fire PRA model is preserved.

#### **Uncertainty Considerations**

NFPA 805 Section 2.7.3.5 requires uncertainty analysis to provide reasonable assurance that the performance criteria have been met. This is accomplished by the analysis of uncertainties in the Fire PRA that support the change evaluation. As part of the review of the Fire PRA to support a NFPA 805 Change Evaluation, consideration should be given to sources of uncertainty that could affect the results.

Uncertainty can be addressed by identifying key assumptions and determining whether a reasonable alternative to those assumptions would substantively change the decision whether the proposed change is acceptable. There will be an uncertainty and sensitivity study that was used to support the initial transition that reflects the method used by the licensee and the particular configuration of the plant.

#### **5.3.5.2 Qualitative Risk Evaluations**

Qualitative risk evaluations are performed for topics such as:

- NFPA 805 Chapter 2 – Methodology/Process Changes
- NFPA 805 Chapter 3 – Fundamental Fire Protection Program and Design Elements
- Non-Power Operational (NPO) Modes
- Radioactive Release Performance Criteria

Qualitative risk evaluations may also be used to address changes to the “at power” Nuclear Safety Capability Assessment, in cases where the assessment bounds numerical treatment or if the qualitative treatment provides a more appropriate assessment of risk than numerical treatment. The risk evaluations should use engineering analysis to assess the impact of the proposed change. The evaluation should also consider the impact of the change on defense-in-depth and safety margins, using the same process and criteria described in Section 5.3.5.1 for quantitative risk evaluations.

#### **5.3.5.3 License Amendment Determination**

Based upon the nature of the change and the results of the review, a decision is made as to whether prior NRC review and approval is needed. A number of steps in the review could identify the need for a license amendment, such as:

- Change in CDF or LERF associated with the change exceeds the criteria in the plant specific license condition and approval is desired.
- Defense-in-depth or Safety Margin are not maintained and approval of the configuration is desired.
- Fire PRA Technical Adequacy cannot be demonstrated and the Fire PRA methods, data or assumptions cannot be concluded to be “acceptable to the AHJ” and approval is desired.
- 10 CFR 50.48 (c)(2)(vii). Changes to the program to use NFPA 805 performance-based methods that were not previously approved by the NRC in determining the licensee’s compliance with the fire protection program elements and minimum design requirements in Chapter 3 of NFPA 805
- 10 CFR 50.48 (c)(4). Changes to the program to use risk-informed or performance-based alternatives to compliance with NFPA 805 that were not previously approved by the NRC (i.e., methods that differ from those prescribed by NFPA 805)
- Combined changes where any individual change would not meet the risk acceptance criteria of the license condition.
- Processes and methods described in the NFPA 805 LAR and approved in the NFPA 805 Safety Evaluation have changed to the extent that NRC approval is desired.
- Other regulations, technical specifications, license condition, or requirements requires NRC approval.

If the reviews determine that a License Amendment is necessary, the licensee should submit the request using licensee-specific processes for submittal under 10 CFR 50.90.

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**I. PLANT CHANGE EVALUATION FORM**

This attachment no longer used.

## **J. PLANT CHANGE PROCESS**

This Appendix supplements information contained in Sections 4.4 and 5.3. Refer to Figure 5-1.

This Appendix provides:

- Supplemental information on the overall Fire Protection Change Impact Review process (Section J.1)
- Additional guidance on selected NFPA 805 topics (Sections J.2 through J.6)
  - NFPA 805 Chapter 2 Methodology Changes (J.2)
  - NFPA 805 Chapter 3 Changes (J.3)
  - NPO Changes (J.4)
  - Radioactive Release Changes (J.5)
  - Fire PRA Related Changes (J.6)

### **J.1. Plant Change Process and Regulatory Guidance**

Placeholder for additional guidance.

### **J.2. NFPA 805 Chapter 2 – Methodology/Process Changes**

Placeholder for additional guidance.

### **J.3. NFPA 805 Chapter 3 – Fundamental Fire Protection Program and Design Elements**

Placeholder for additional guidance.

### **J.4. Non-Power Operational (NPO) Modes**

Placeholder for additional guidance.

### **J.5. Radioactive Release Performance Criteria**

Placeholder for additional guidance.

### **J.6. Fire PRA Related Changes**

Additional clarification is provided on the following topics related to Fire PRA and the change evaluation process:

1. Fire PRA updates (J.6.1)
2. Cumulative Risk (J.6.2)
3. Technical Adequacy (J.6.3)
4. Fire PRA Methods (J.6.4)

#### **J.6.1 Fire PRA Updates Guidance**

RG 1.205, Revision 1, Regulatory Position 2.2.4.3, provides the following on baseline risk for plant change evaluations:

*2.2.4.3 Baseline Risk for Plant Change Evaluations*

*Upon completing the transition to an NFPA 805 licensing basis, the posttransition baseline risk for use in evaluating the effect of subsequent plant changes 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).*

NFPA 805 is a risk-informed performance-based standard for implementing fire protection at nuclear power plants. As such, the Fire PRA is an integral tool. Because the Fire PRA is expected to reflect the as-built, as-operated plant, it will need to be updated periodically, consistent with the plant. These Fire PRA updates should not pose any unique challenges to the fire protection program, since the plant changes themselves must be evaluated for their impact on fire risk. However, Fire PRAs can also be updated due to new or improved data, and other modeling refinements. Requirements and guidance for PRA Maintenance, Upgrades, and Updates are included in the PRA Standard and Regulatory Guide 1.200.

Fire PRA methods used in modeling refinements should be reviewed for Technical Adequacy per the guidance in Section J.6.23.

**Comment [S2]:** Perhaps should be 3

Most PRAs go through a periodic update cycle. Typically every one or two refueling cycles, the appropriate elements of the PRA are revised and the models are re-quantified to produce a new CDF and other results. Based on these results, the various risk-informed applications are evaluated as needed to reflect the updated PRA. The specific needs will vary by application. Some examples:

- Maintenance Rule : Update performance criteria if the system's safety significance changes
- AOV/MOV: Add or remove valves from program based on risk importances
- MSPI: Re-evaluate system status and performance thresholds

Some risk-informed applications do not require any specific evaluations due to periodic PRA updates. These might include one time, or even permanent AOT changes.

The Fire PRA has two primary functions under NFPA 805. First, during transition of the plant to NFPA 805, the Fire PRA is used to assess the risk significance of the variance from the deterministic requirements (VFDRs) to determine if the risks are acceptable to allow transition. After transition, the Fire PRA is used as needed to assess the risk of changes to the fire protection program. Changes in risk above a defined threshold will require regulatory approval to implement. The Fire Protection Change Impact Review process is used to identify if self-approval is allowed under NFPA 805. Most of these reviews are qualitative. The most current Fire PRA should be used as the baseline to measure the risk impact of the changes (see Section 5.3.4.1).

### Example Reviews after Fire PRA Maintenance and/or Upgrade

The following are example reviews that may occur following Fire PRA Maintenance and/or Upgrade. This is an example of how risk insights can be used to improve the fire protection program. It is not expected that previously accepted changes are re-evaluated every time the Fire PRA is updated, however, because the Fire PRA is an integral part of the fire protection program, certain attributes should be evaluated for general risk insights. Examples of these attributes include:

- Ignition source Rankings
- Physical Analysis Unit (PAU)/NFPA 805 Fire Area Rankings
- Importance rankings of fire protection features
- Importance rankings of recovery actions

Changes in these rankings may indicate the need to make changes to the fire protection program based on indirect impacts caused by equipment reliability or procedures, or environmental impacts. Addressing these insights should help ensure the overall health of the fire protection program, without the need to re-assess all previous plant or programmatic changes since transition to NFPA 805.

### J.6.2 Fire PRA – Treatment of Cumulative Fire Protection Program Changes

The purpose of this section is to define a method in which cumulative risk can be addressed with respect to the post-transition fire protection program. It uses the change in risk estimates developed for each individual fire protection program modification supported by the periodic Fire PRA model update (i.e., Fire PRA Maintenance and/or Upgrade) process as an opportunity to assess cumulative risk on a fire area/compartments basis. The process is using the most current model to evaluate cumulative risk. The process uses the criteria in or referenced in the license condition as guidance for review.

**Comment [S3]:** “Modification” instead of “change” is proposed otherwise the word “change” appears too often.

**Comment [S4]:** Unclear what the value added is.

For individual modification changes that warrant quantitative treatment, a change evaluation would be performed and documented. Tracking and summing the cumulative impact of individual modifications is consistent with the requirement in NFPA-805 Section 2.4.4.1 that the cumulative effect of previous modifications are evaluated. While modifications to the facility unrelated to the fire protection program and changes to the PRA models may change the risk impact of past modifications, summing the estimated impact is an evaluation technique that does measure cumulative changes in risk.

All modifications to the facility and changes to the PRA models can also be evaluated by tracking changes in the fire risk from one PRA update to the next. This ~~The~~ cumulative risk treatment would be considered a “safety net” that would evaluate potential risk increases that could occur since the last PRA update, and would include potential risk increases that may have been evaluated on an individual basis, as well as changes due to other reasons.

Guidance on combined changes and cumulative risk of changes is provided in RG 1.205, Rev. 1, Regulatory Position 3.2.5:

*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. 8).*

*After the transition to NFPA 805, the cumulative risk of subsequent FPP changes is the change in risk compared to the posttransition 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 purpose 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.*

As discussed in RG 1.205, the evaluation of cumulative risk is required when licensees request fire protection program changes that they may not self-approve after the transition to NFPA 805. When a license amendment is needed post-transition, the license amendment requests should address the cumulative impact of previous fire protection program changes. The process discussed below is a means of evaluating cumulative risk in the event of license amendment request.

Figure J-1 depicts the process to evaluate cumulative impact of changes to the Fire Protection Program to support, as necessary, the submittal of a post-transition license amendment request.

- Follow the established Fire Protection Change Impact Review process for individual changes using the Fire PRA of record. Maintain and upgrade the Fire PRA following the normal Fire PRA process. Track the cumulative impact of individual changes undertaken between each Fire PRA Maintenance and/or Upgrade.
- When a new Fire PRA is issued (which includes the cumulative impact of changes since last Fire PRA Maintenance and/or Upgrade )
  - Provide updated metrics for fire protection (CDF/LERF by area).
  - Determine if the fire area risk increases by less than 1E-07 CDF/yr and 1E-08 LERF/yr. If risk is lower than the threshold, cumulative risk change is satisfactory without the need for additional review. These are conservative change in risk threshold values consistent with the license condition values from Regulatory Guide 1.205, Revision 1.

When fire area risk exceeds the threshold from above, determine the fire protection changes made that impact the fire risk in that NFPA 805 Fire Area since the last NRC approved submittal (e.g., NFPA 805 transition Safety Evaluation or subsequent approval document). Modifications to the facility fire protection program changes that affect ignition frequencies, fire growth and propagation, suppression, etc., would be considered fire protection program changes.

Other modifications items such as internal events model changes, component failure rates, human error probability (HEP) values, etc., are not considered fire protection program changes although their change in value could affect calculated risk numbers.

Alternatively, fire protection program changes that affect ignition frequencies, fire growth and propagation, suppression, etc., would be considered fire protection program changes.

- When needed to support a license amendment request, determine the cumulative<sup>11</sup> delta risk due to those fire protection changes using the cumulative impact of previous individual changes being documented and tracked as described above. This cumulative estimate may be modified and augmented as appropriate by changes to the risk profile caused by the PRA maintenance and update process. Fire PRA model from the previous step above. Use of the current Fire PRA model ensures the most accurate and appropriate measure of risk and change in risk.
  - If cumulative impact plus the change being requested is less than the established threshold (RG 1.174), no further action is required.
    - If cumulative impact plus the additional risk of the change being requested exceeds the threshold (RG 1.174), determine viable options for reducing the risk to within acceptable levels prior to submittal.
- Note: This condition should be documented in the plant corrective action program and appropriate compensatory measures implemented.

<sup>11</sup> RG 1.205 clarifies that an acceptable measure of the cumulative risk of post-transition changes is the change in risk compared to the post-transition baseline risk.

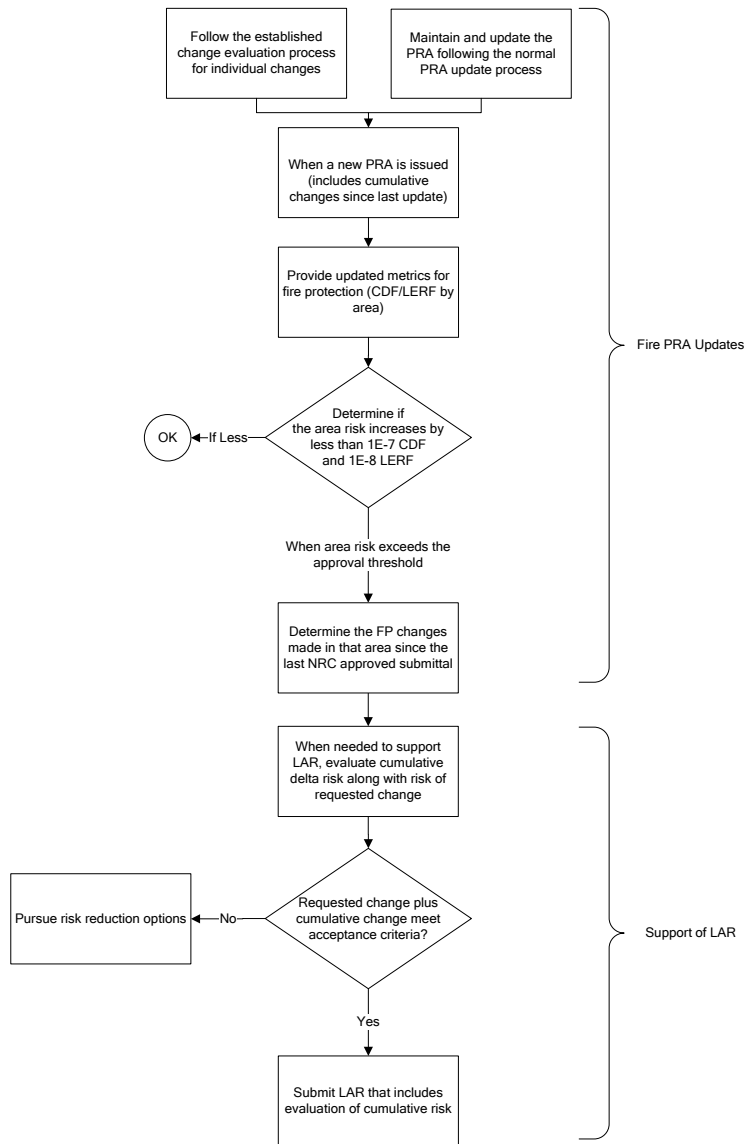


Figure J-1 – Fire PRA Treatment of Cumulative Risk

### J.6.3 Technical Adequacy

Section 2.4.3.3 of NFPA 805, which applies to the Fire PRA used during NFPA 805 transition in performing fire risk evaluations and post-transition in performing Change Evaluations, includes, in part, the following:

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

Guidance is provided below on technical adequacy of the base Fire PRA model and what constitutes “acceptable to the AHJ”.

#### Base Fire PRA Model

Additionally, the first aspect, technical adequacy of the base Fire PRA model, implies that (1) the Fire PRA model, or those parts of the model required to support the application, represent the as-built and as-operated plant, which, in turn, implies that the Fire PRA is up to date and reflects the current design and operating practices, (2) the Fire PRA logic model has been developed in a manner consistent with industry good practice and that it correctly reflects the dependencies of systems and components on one another and on operator actions, and (3) the probabilities and frequencies used are estimated consistently with the definitions of the corresponding events of the logic model.

An acceptable approach that can be used to ensure technical adequacy is to perform a peer review of the PRA in accordance with RG 1.200. [The peer review should identify any deviations from methods acceptable to the AHJ and, if identified, these methods should be submitted to the NRC for review. A peer review process can be used to identify the strengths and weaknesses in the Fire PRA and their importance to the confidence in the Fire PRA results.](#)

Administrative controls and processes should be used to maintain the Fire PRA model current with plant changes and to evaluate any outstanding changes not yet incorporated into the Fire PRA model for potential risk impact as a part of the routine change evaluation process. Further, the licensee should have a program for ensuring that developers and users of fire models are appropriately trained and qualified. This ensures that the Fire PRA is adequate to support risk-informed decision making with respect to the plant change evaluation process.

The types of questions that should be confirmed when using the Fire PRA to support a change evaluation include:

- Is the Fire PRA current and does it reflect the as-built, as operated plant?
- If there are outstanding changes to the Fire PRA, has the impact of the outstanding changes been considered?
- Are the peer reviews on the Fire PRA for sections that could impact the NFPA 805 Change Evaluation Document or the Fire Protection Change Impact Review up to date, with findings satisfactorily resolved to support the change evaluation? Are Fire PRA supporting requirements related to the NFPA 805 Change Evaluation Document Capability Category II or greater, or justified as adequate to support the change evaluation?
- Does the peer-reviewed model support the quantification of change for the change under review?
- Have the sources of uncertainty that could affect the results of the change evaluation been adequately considered?



**Guidance on “Acceptable to the AHJ”**

The following list provides examples of Fire PRA methods, which, if followed appropriately, should constitute methods “acceptable to the AHJ” and satisfy that particular requirement of Section 2.4.4.3 of NFPA 805:

- Fire PRA methods using the guidance in NUREG/CR-6850
- Fire PRA methods using the guidance in NUREG/CR-6850 Supplement 1
- Fire PRA Methods approved by EPRI Fire PRA Review Panel (old process), as accepted by the NRC in writing
- Other methods accepted by the NRC (NUREGs/Regulatory Guides, plant-specific Safety Evaluations, etc.)
- Fire PRA methods using the guidance in approved NFPA 805 FAQs
- Fire PRA methods approved using the guidance in approved Fire PRA FAQs
- Fire PRA methods approved by the Fire PRA Methods Development Panel), as accepted by the NRC in writing.