

NFPA[®]

806

Performance-Based Standard for
Fire Protection for
Advanced Nuclear Reactor
Electric Generating Plants
Change Process

2020



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NFPA® 806

Performance-Based Standard for

Fire Protection for Advanced Nuclear Reactor Electric Generating Plants Change Process

2020 Edition

This edition of NFPA 806, *Performance-Based Standard for Fire Protection for Advanced Nuclear Reactor Electric Generating Plants Change Process*, was prepared by the Technical Committee on Fire Protection for Nuclear Facilities. It was issued by the Standards Council on November 4, 2019, with an effective date of November 24, 2019, and supersedes all previous editions.

This edition of NFPA 806 was approved as an American National Standard on November 24, 2019.

Origin and Development of NFPA 806

The need for fire protection in nuclear power facilities has been demonstrated in a number of incidents, including the Browns Ferry Fire in 1975 and other more recent incidents in the United States and abroad. Probabilistic risk assessments of existing plants have shown that fire is one of the largest single contributors to the possibility of reactor damage. This document represents a comprehensive consensus of baseline fire protection requirements for all aspects of change process for advanced nuclear reactor electric generating plants, including their construction and all phases of operation, such as shutdown, degraded conditions, and decommissioning.

The first edition of NFPA 806 focused on risk-informed fire protection in advanced nuclear plants where any change process is being performed and was based on current industry best practices and source materials.

The 2015 edition was edited for consistency with NFPA 805, and references to NFPA 251, a withdrawn standard, were removed. Changes were made to include the definitions and requirements from NFPA 101 and NFPA 1144 on combustible, noncombustible, and limited-combustible materials.

The changes made to the 2020 edition are mainly to update extracted material to the current editions of the source documents. Additional language from NFPA 101 has also been incorporated to more clearly identify materials that should be considered limited-combustible.

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Committee Scope: This Committee shall have primary responsibility for documents on the safeguarding of life and property from fires in which radiation or other effects of nuclear energy might be a factor.

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NFPA 806

Performance-Based Standard for

Fire Protection for Advanced Nuclear Reactor
Electric Generating Plants Change Process

2020 Edition

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A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex E.

Chapter 1 Administration

1.1* Scope. This standard provides minimum requirements for a risk-informed, performance-based change process for the fire protection program for advanced nuclear reactor electric generating plants during construction and all phases of plant operation, including shutdown, degraded conditions, and decommissioning. Fundamental fire protection elements for advanced nuclear reactor electric generating plants can be found in NFPA 804.

1.2 Purpose.

1.2.1 This standard covers those requirements essential to ensure that the consequences of fire will have minimal impact on the safety of the public and on-site personnel and on the physical integrity of plant components.

1.2.2 Protecting the safety of the public, the environment, and plant personnel from a plant fire and its potential effect on safe reactor operations is paramount to this standard.

1.3 Application. The requirements in this standard shall apply to all advanced nuclear reactor electric generating plants as deemed applicable by the authority having jurisdiction.

1.4 Units and Formulas. The inch-pound value for a measurement and the SI value given in parentheses shall each be acceptable for use as primary units for satisfying the requirements of this standard.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2018 edition.

NFPA 804, *Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants*, 2020 edition.

2.3 Other Publications.

2.3.1 ANS Publications. American Nuclear Society, 555 North Kensington Avenue, La Grange Park, IL 60526.

ANSI/ANS 58.23, *Fire PRA Methodology*, 2007.

▲ **2.3.2 ASTM Publications.** ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2016.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2016.

ASTM E1355, *Standard Guide for Evaluating the Predictive Capability of Deterministic Fire Models*, 2012.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-Shaped Airflow Stabilizer, at 750°C*, 2016.

ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, 2016.

2.3.3 NEI Publications. Nuclear Energy Institute, 1201 F St., NW, Suite 1100, Washington, DC 20004-1218.

NEI 00-01, *Guidance for Post-Fire Safe Shutdown Analysis*.

▲ **2.3.4 UL Publications.** Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, 2008, revised 2013.

2.3.5 US Government Publications. US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."

2.3.6 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

- NFPA 101®, *Life Safety Code*®, 2018 edition.
- NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*, 2020 edition.
- NFPA 804, *Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants*, 2020 edition.
- NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*, 2020 edition.
- NFPA 1141, *Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas*, 2017 edition.
- NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction. An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be

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3.3 General Definitions.

3.3.1 Action.

3.3.1.1 Compensatory Action. Actions taken if an impairment to a required system, feature, or component prevents that system, feature, or component from performing its intended function. These actions are a temporary alternative means of providing reasonable assurance that the necessary function will be compensated for during the impairment, or an act to mitigate the consequence of a fire. Compensatory measures include but are not limited to actions such as firewatches, administrative controls, temporary systems, and features of components. [805, 2020]

3.3.1.2 Recovery Action. 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. [805, 2020]

3.3.2* Advanced Nuclear Reactor. Reactor plant design incorporating evolutionary improvements in design which have been developed during the lifetime of the currently operating reactor designs, such as improved fuel technology, passive safety systems, and standardized design.

3.3.3 As Low As Reasonably Achievable (ALARA). Making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part [10 CFR 20] as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest. [10 CFR 20]

3.3.4 Availability. The probability that the system, structure, or component of interest is functional at a given point in time. [805, 2020]

3.3.5 Combustible. A combustible material is any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn or will add appreciable heat to an ambient fire. [1144, 2018]

3.3.5.1 In Situ Combustible. Combustible materials that are permanently located in a room or an area (e.g., cable insulation, lubricating oil in pumps). [805, 2020]

3.3.5.2 Limited-Combustible (Material). See Section 4.5.

3.3.6 Containment. Structures, systems, or components provided to prevent or mitigate the release of radioactive materials. [805, 2020]

3.3.7 Core Damage Frequency (CDF). The expected number of core damage events per unit of time.

3.3.8 Damage.

3.3.8.1 Free of Fire Damage. The structure, system, or component under consideration is capable of performing its intended function during and after the postulated fire, as needed. [805, 2020]

3.3.8.2 Fuel Damage. Exceeding the fuel design limits. [805, 2020]

3.3.9* Fire Area. An area that is physically separated from other areas by space, barriers, walls, or other means in order to contain fire within that area. [805, 2020]

3.3.10* Fire Barrier. A continuous membrane or a membrane with discontinuities created by protected openings with a specified fire protection rating, where such membrane is designed and constructed with a specified fire resistance rating to limit the spread of fire. (SAF-FIR) [101, 2018]

3.3.11* Fire Compartment. A subdivision of a building or plant that is a well-defined enclosed room, not necessarily bounded by rated fire barriers. A fire compartment generally falls within a fire area and is bounded by noncombustible barriers where heat and products of combustion from a fire within the enclosure will be substantially confined.

3.3.12 Fire Hazard Analysis (FHA). An analysis to evaluate potential fire hazards and appropriate fire protection systems and features used to mitigate the effects of fire in any plant location. [805, 2020]

3.3.13 Fire Model. Mathematical prediction of fire growth, environmental conditions, and potential effects on structures, systems, or components based on the conservation equations or empirical data. [805, 2020]

3.3.14 Fire Prevention. Measures directed toward avoiding the inception of fire. [801, 2020]

3.3.15 Fire Protection Feature. Administrative controls, fire barriers, means of egress, industrial fire brigade personnel, and other features provided for fire protection purposes. [805, 2020]

3.3.16 Fire Protection Program. The integrated effort involving components, procedures, and personnel utilized in carrying out all activities of fire protection. It includes system and facility design and analyses, fire prevention, fire detection, annunciation, confinement, suppression, administrative controls, fire brigade organization, inspection and maintenance, training, quality assurance, and testing.

3.3.17 Fire Protection System. Any fire alarm device or system or fire-extinguishing device or system, or combination thereof, that is designed and installed for detecting, controlling, or extinguishing a fire or otherwise alerting occupants, or the fire department, or both, that a fire has occurred. [1141, 2017]

3.3.18 Fire Resistance Rating. The time, in minutes or hours, that materials or assemblies have withstood a standard fire exposure as established in accordance with an approved test procedure appropriate for the structure, building material, or component under consideration.

3.3.19 Fire Scenario. In nuclear facilities, a description of a fire and any factors affecting or affected by it from ignition to extinguishment, including, as appropriate, ignition sources, nature and configuration of the fuel, ventilation characteristics,

locations of occupants, condition of the supporting structure, and conditions and status of operating equipment. [805, 2020]

3.3.19.1 Limiting Fire Scenarios. Fire scenario(s) in which one or more of the inputs to the fire modeling calculation (e.g., heat release rate, initiation location, or ventilation rate) are varied to the point that the performance criterion is not met. The intent of this scenario(s) is to determine that there is a reasonable margin between the expected fire scenario conditions and the point of failure. [805, 2020]

3.3.19.2 Maximum Expected Fire Scenarios. Scenarios that represent the most challenging fire that could be reasonably anticipated for the occupancy type and conditions in the space. These scenarios can be established based on electric power industry experience with consideration for plant-specific conditions and fire experience. [805, 2020]

3.3.20* Fire Zone. A subdivision of a fire area not necessarily bounded by fire-rated assemblies. Fire zone can also refer to the subdivision of a fire detection or suppression system, which provide alarm indications at the central alarm panel.

3.3.21 Flame Spread Index. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame vs. time for a material tested in accordance with ANSI/UL 723 or with ASTM E84. [805, 2020]

3.3.22 Industrial Fire Brigade. An organized group of employees within an industrial occupancy who are knowledgeable, trained, and skilled in at least basic fire-fighting operations, and whose full-time occupation might or might not be the provision of fire suppression and related activities for their employer.

3.3.23 Large Release. A plant radioactive release that (1) has the potential for early health effects or (2) can lead to a statistically significant (measurable) increase in latent health effects. What specifically constitutes a large release is defined by the plant license holder.

3.3.24 Noncombustible (Material). See Section 4.5.

3.3.25 Owner/Operator. The organization(s) with fiscal responsibility for the operation, maintenance, and profitability of the nuclear plant. [805, 2020]

3.3.26 Performance-Based Approach. An approach that relies upon measurable (or calculable) outcomes (i.e., performance results) to be met but provides more flexibility as to the means of meeting those outcomes. A performance-based approach is one that establishes performance and results as the primary basis for decision-making and incorporates the following attributes: (1) Measurable or calculable parameters exist to monitor the system, including facility performance; (2) objective criteria to assess performance are established based on risk insights, deterministic analyses, and/or performance history; (3) plant operators have the flexibility to determine how to meet established performance criteria in ways that will encourage and reward improved outcomes; and (4) a framework exists in which the failure to meet a performance criterion, while undesirable, will not in and of itself constitute or result in an immediate safety concern. [805, 2020]

3.3.27 Performance Criteria. Specific measurable or calculable parameters for systems and features that are quantified and described in engineering terms. [805, 2020]

3.3.28 Plant Change Evaluation. An evaluation performed in the event of a change to a previously approved fire protection program element or other plant changes that could impact the fire protection program.

3.3.29 Prior Distribution. Probability distribution quantifying the analyst's state of knowledge regarding the parameter to be estimated prior to collection of new data. [805, 2020]

3.3.30 Probabilistic Safety Assessment (PSA). A comprehensive evaluation of the risk of a facility or process; also referred to as a probabilistic risk assessment (PRA). [805, 2020]

3.3.31* Reliability. The probability that the system, structure, or component of interest will perform its specified function under given conditions upon demand or for a prescribed time.

3.3.32 Risk. The probability and consequences of an event, as expressed by the "risk triplet" that is the answer to the following three questions: (1) What can go wrong? (2) How likely is it? and (3) What are the consequences if it occurs?

3.3.33 Risk Informed. Consideration of risk insights together with other factors to establish performance requirements that better focus attention on design and operational issues commensurate with their importance to public health and safety.

3.3.34 Safe and Stable Conditions. For fuel in the reactor vessel, head on and tensioned, safe and stable conditions are defined as the ability to maintain $K_{eff} < 0.99$, with a reactor coolant temperature at or below the requirements for hot shutdown for a boiling water reactor and hot standby for a pressurized water reactor. For all other configurations, safe and stable conditions are defined as maintaining $K_{eff} < 0.99$ and fuel coolant temperature below boiling. [805, 2020]

3.3.35 Site. The contiguous property that makes up a nuclear power plant facility. This would include areas both inside the protected area and the owner-controlled property. [805, 2020]

3.3.36 Source Term Limitation. Limiting the source of radiation available for release. [805, 2020]

3.3.37* Spurious Operation. An unwanted change in state of equipment due to fire-induced faults (e.g., hot shorts, open circuits, or shorts to ground) on its power or control circuitry. [804, 2020]

3.3.38 Uncertainty.

3.3.38.1 Completeness Uncertainty. Uncertainty in the predictions of a model due to model scope limitations. This uncertainty reflects an unanalyzed contribution or reduction of risk due to limitations of the available analytical methods. [805, 2020]

3.3.38.2 Model Uncertainty. Uncertainty in the predictions of a model related to the equations in the model being correct, whether or not they are appropriate to the problem being solved, and whether or not they are sufficiently complete. [805, 2020]

3.3.38.3 Parameter Uncertainty. Uncertainty in the predictions of a model due to uncertainties in the numerical values of the model parameters. [805, 2020]

3.3.39 Uncertainty Analysis. An analysis intended to (1) identify key sources of uncertainties in the predictions of a model, (2) assess the potential impacts of these uncertainties on the

predictions, and (3) assess the likelihood of these potential impacts. Per this definition, sensitivity analysis performs some but not all of the functions of uncertainty analysis. (See also 3.3.38.1, *Completeness Uncertainty*; 3.3.38.2, *Model Uncertainty*; and 3.3.38.3, *Parameter Uncertainty*.) [805, 2020]

Chapter 4 General Requirements

4.1 Fire Protection Defense-in-Depth.

4.1.1 Protecting the safety of the public, the environment, and plant personnel from a plant fire and its potential effect on safe reactor operations shall be paramount to this standard.

4.1.2 The fire protection standard shall be based on the concept of defense-in-depth.

4.1.3 Defense-in-depth shall be achieved when each of the following elements is provided:

- (1) Preventing fires from starting
- (2) Rapidly detecting, controlling, and extinguishing promptly those fires that do occur, thereby limiting fire damage
- (3) 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 the goals for nuclear safety and radioactive release from being achieved

4.2 Goals.

4.2.1 Nuclear Safety Goal. The nuclear safety goal shall be to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the reactor core in a safe and stable condition.

4.2.2 Radioactive Release Goal. The radioactive release goal shall be to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel, or the environment.

4.3 Performance Objectives.

4.3.1 Nuclear Safety Objectives. In the event of a fire during any operational mode and plant configuration, the plant nuclear safety objectives shall be as follows:

- (1) Reactivity control — capable of achieving and maintaining subcritical conditions
- (2) Fuel cooling — capable of achieving and maintaining decay heat removal
- (3) Fission product boundary — capable of maintaining fundamental fuel geometry
- (4) Heat transfer medium inventory control — capable of maintaining the necessary quantity of heat transfer medium

4.3.2 Radioactive Release Objective. The source term from sources not including fuel in the core shall be capable of being limited.

4.4 Performance Criteria.

4.4.1 Nuclear Safety Performance Criteria.

4.4.1.1 Fire protection features shall be capable of providing reasonable assurance that in the event of a fire the plant is not placed in an unrecoverable condition.

△ 4.4.1.2 To demonstrate that assurance, the following performance criteria shall be met:

- (1) Reactivity control.
 - (a) Reactivity control shall be capable of inserting negative reactivity to achieve and maintain sub-critical conditions.
 - (b) Negative reactivity inserting shall occur rapidly enough such that fuel design limits are not exceeded.
- (2) Fission product boundary. The fundamental geometric relationship between the fuel and the moderator shall be maintained such that reactivity control and decay heat removal can be accomplished.
- (3) Heat transfer medium inventory control. The heat transfer medium utilized by the reactor shall be maintained in sufficient quantity to ensure that decay heat removal can be accomplished.
- (4) Decay heat removal. Decay heat removal shall be capable of removing sufficient heat from the reactor core and spent fuel such that they are maintained in a safe and stable condition.
- (5) Vital auxiliaries. Vital auxiliaries shall be capable of providing the necessary auxiliary support equipment and systems to ensure that the systems required under 4.4.1.2(1) through 4.4.1.2(4) and 4.4.1.2(6) are capable of performing their required nuclear safety function.
- (6)* Process monitoring. Process monitoring shall be capable of providing the necessary indication to ensure that the criteria addressed in 4.4.1.2(1) through 4.4.1.2(5) have been achieved and are being maintained.

4.4.2 Radioactive Release Performance Criteria. Radiation release to any unrestricted area (but not involving fuel damage to fuel in the core during operation) shall be as low as reasonably achievable and shall not exceed applicable regulatory limits.

4.5 Materials.

4.5.1* Noncombustible Material. [101:4.6.13]

△ 4.5.1.1 A material that complies with any of the following shall be considered a noncombustible material:

- (1)* A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat
- (2) A material that is reported as passing ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*
- (3) A material that is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*

[101:4.6.13.1]

4.5.1.2 Where the term *limited-combustible* is used in this document, it shall also include the term *noncombustible*. [101:4.6.13.2]

△ 4.5.2* **Limited-Combustible Material.** A material shall be considered a limited-combustible material where one of the following is met:

- (1) The conditions of 4.5.2.1 and 4.5.2.2, and the conditions of either 4.5.2.3 or 4.5.2.4, shall be met.
- (2) The conditions of 4.5.2.5 shall be met. [101:4.6.14]

4.5.2.1 The material shall not comply with the requirements for noncombustible material in accordance with 4.5.1. [101:4.6.14.1]

4.5.2.2 The material, in the form in which it is used, shall exhibit a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) where tested in accordance with NFPA 259. [101:4.6.14.2]

4.5.2.3 The material shall have the structural base of a noncombustible material with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*. [101:4.6.14.3]

4.5.2.4 The material shall be composed of materials that, in the form and thickness used, neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, and shall be of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723. [101:4.6.14.4]

△ 4.5.2.5 Materials shall be considered limited-combustible materials where tested in accordance with ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, at an incident heat flux of 75 kW/m² for a 20-minute exposure and both of the following conditions are met:

- (1) The peak heat release rate shall not exceed 150 kW/m² for longer than 10 seconds.
- (2) The total heat released shall not exceed 8 MJ/m². [101:4.6.14.5]

4.5.2.6 Where the term *limited-combustible* is used in this document, it shall also include the term *noncombustible*. [101:4.6.14.6]

Chapter 5 Methodology

5.1 Intent.

5.1.1 This chapter shall describe the general approach for self-approval of plant changes, including programmatic changes, that potentially impact the approved or accepted plant fire protection program for advanced reactor designs.

5.1.2 The chapter shall provide the requirements for the engineering analyses used to evaluate the potential impact of plant changes, in particular the analyses used for a risk-informed, performance-based approach to ensuring that the fire protection program will continue to fulfill the goals, objectives, and criteria provided in Chapter 4.

5.2* General Approach. The general approach of this standard shall involve the following steps (see Figure 5.2):

- (1) Identify and fully describe the proposed plant change.
- (2) Identify the plant features and the approved fire protection program features that will potentially be impacted by the proposed change.
- (3) Identify the performance criteria that apply to each of the plant features and fire protection program features potentially impacted by the change as specified in Chapter 4.
- (4) Determine whether the existing approved program will be met or modified or a risk-informed performance-based (RI/PB) change evaluation process will be applied to evaluate the change.

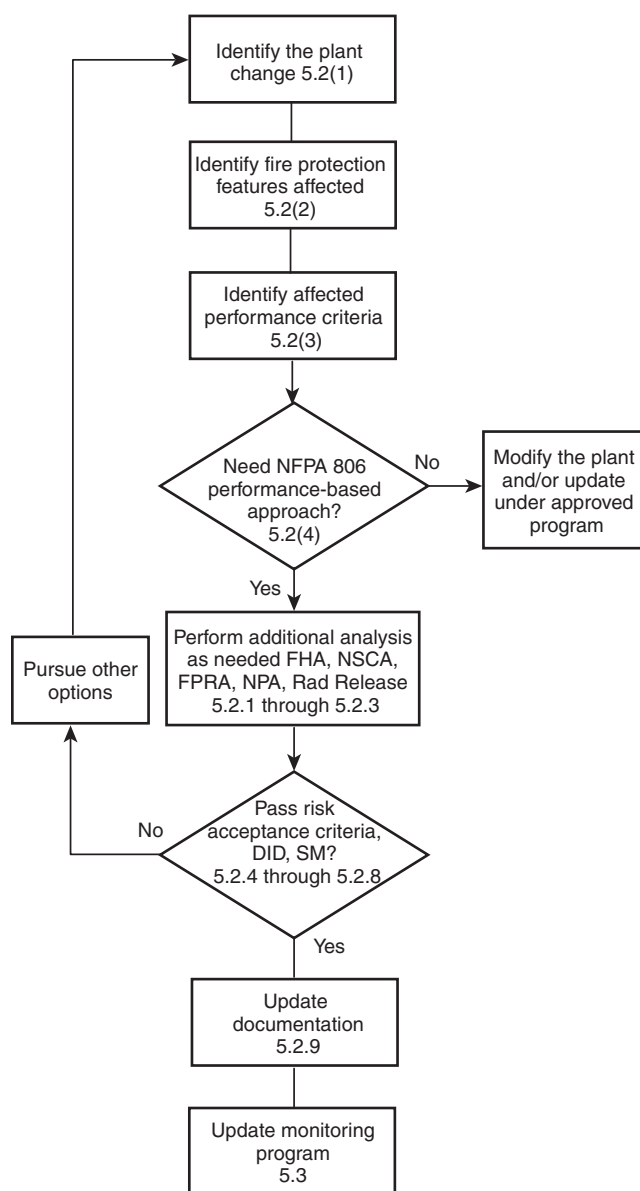


FIGURE 5.2 Methodology.

5.2.1* When a risk-informed, performance-based approach is being applied, engineering analyses, including the change evaluation, shall be performed to demonstrate that performance-based requirements would be satisfied during and after the proposed change is implemented.

5.2.1.1 Evaluating Performance Criteria. To determine whether the proposed plant change will impact the ability to satisfy the performance criteria, an analysis shall be performed on a fire area basis, considering the potential fire exposures and damage thresholds.

5.2.1.2 Nuclear Safety Capability Assessment.

5.2.1.2.1 A nuclear safety capability assessment shall be performed to confirm that the proposed plant change will not have an unacceptable impact on the capability of the plant to meet the nuclear safety performance criteria.

5.2.1.2.2 A nuclear safety capability assessment shall be performed in accordance with NEI 00-01, *Guidance for Post-Fire Safe Shutdown Analysis*.

5.2.1.3* Fire Hazard Analysis. A fire hazard analysis shall be performed to assess the impact on all the affected fire protection features.

5.2.2 Radiation Release.

5.2.2.1 To fulfill the criteria for radiation release described in Chapter 4, the source of radiation shall be limited, or the ability to contain any release shall be established so that the consequences of any release of radioactivity are acceptable.

5.2.2.2 Designs that balance source term limitation and containment shall also be acceptable.

5.2.3* Fire Modeling.

5.2.3.1 Fire modeling calculations shall be a required component of a risk-informed, performance-based analysis, because they provide important input to the analysis, including support for the risk assessment.

5.2.3.2 Fire modeling shall be used to examine the potential fire risk associated with a proposed plant changes.

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

5.2.3.4 Limitations of Use. A fire model shall be applied only within the limitations of that fire model.

5.2.3.5 Validation of Models. The fire models shall be verified and validated according to ASTM E1355, *Standard Guide for Evaluating the Predictive Capability of Deterministic Fire Models*.

5.2.3.6 Fire Modeling Calculations. Fire modeling used to support the plant change evaluation for the fire protection program shall be in accordance with 5.2.3.6.1 through 5.2.3.6.2.

5.2.3.6.1 Identify Targets. The equipment and required circuits within the physical confines of the fire area or compartment under consideration needed to achieve the nuclear safety performance criteria shall be determined and the physical plant locations identified in accordance with the provisions of this chapter.