

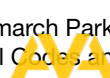
NFPA[®] 801

Standard for Fire Protection for Facilities Handling Radioactive Materials

2025 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02269-9101
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NFPA® 801

Standard for

Fire Protection for Facilities Handling Radioactive Materials

2025 Edition

This edition of NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*, was prepared by the Technical Committee on Fire Protection for Nuclear Facilities. It was issued by the Standards Council on April 22, 2024, with an effective date of May 12, 2024, and supersedes all previous editions.

This edition of NFPA 801 was approved as an American National Standard on May 12, 2024.

Origin and Development of NFPA 801

The Committee on Atomic Energy was organized in 1953 for the purpose of providing the fire protection specialist with certain fundamental information about radioactive materials and their handling and to provide designers and operators of such laboratories with some guidance on practices necessary for fire safety. The first edition of NFPA 801, whose coverage was limited to laboratories handling radioactive materials, was adopted at the 1955 Annual Meeting.

In 1970, the format was revised and the document was updated to reflect current thinking and practices. The document was also expanded to apply to all locations, exclusive of nuclear reactors, where radioactive materials were stored, handled, or used.

The 1975 edition was a reconfirmation of the 1970 edition with editorial changes.

The 1980 edition included a clarified statement regarding the presence and levels of radiation; cautionary statements about the assumption of risks by the fire officer and the importance of training in the handling of radioactive materials by fire department personnel; a clarification concerning the variations of the intensity of a radiation field; and a restyling of the document to conform with the *NFPA Manual of Style*.

The 1985 edition revised and updated previous material for clarification in recognition of technology and terminology changes.

The 1991 edition was a total revision of the document, which included a complete reorganization of the chapters. These revisions provided an update of the latest technology and improved the document's user friendliness.

The 1995 edition included a variety of updates necessary to convert the document from a recommended practice to a standard. One of the more noteworthy changes was a revised scope statement to recognize a threshold value with respect to the amount of radioactive materials that were stored, handled, or used.

The 1998 edition incorporated the recommendations of NFPA 802, *Recommended Practice for Fire Protection for Nuclear Research and Production Reactors*.

The 2003 edition included a new chapter on permanent facility shutdown and decommissioning and was reformatted to conform to the *Manual of Style for NFPA Technical Committee Documents*.

The 2008 edition contained new guidance on interior containment structures and clarified the water supply and drainage requirements as well as the overall language of the document. Definitions were coordinated with the *NFPA Glossary of Terms*.

The 2014 edition contained new guidance for performing fire hazards analyses. In addition, Chapter 7, Facilities, Processes, and Special Hazards, was completely rewritten.

The 2020 edition included a variety of changes to the standard that identified when a fire hazards analysis could justify exceptions to protection elements. This edition also added a description of and

the requirements for a qualified fire protection engineer under whose supervision a fire hazards analysis is prepared.

The 2025 edition expanded the requirements in Chapter 7 to provide clarity to applications for fire hazards and provided new requirements based on combustibility. This edition also added requirements for carbon bed adsorbers and granular activated carbon beds, and included annex material for clarification.

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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 801

Standard for

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

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

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall specify the minimum fire protection requirements for facilities handling radioactive materials during all phases of operation, including design, construction, operation, and decommissioning.

1.1.2* This standard shall not apply to commercial power-generating reactors that are covered by NFPA 804, NFPA 805, and NFPA 806.

1.2 Purpose.

1.2.1 This standard shall apply to facilities handling radioactive materials by outlining the minimum fire protection requirements to reduce personal hazards, minimize the release of radioactive materials to the environment, provide protection from property damage, and minimize process interruption resulting from fire and explosions.

1.2.2 Defense-in-Depth.

1.2.2.1 This standard shall be based on the concept of defense-in-depth.

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

- (1) Preventing fires from starting
- (2) Detecting fires rapidly and controlling and extinguishing promptly those fires that do occur, thereby limiting damage and consequences
- (3)* Providing a level of fire protection for structures, systems, and components so that a fire that is not promptly extinguished will not prevent essential facility functions from being performed

1.3* Application. These requirements shall be applicable to all locations where radioactive materials are stored, handled, or used in quantities and conditions requiring regulatory oversight or license to possess or use these materials and to all other locations with equal quantities or conditions.

1.4 Retroactivity.

1.4.1 The provisions of this standard shall be considered necessary to provide a reasonable level of protection from loss of life and property from fire. They reflect situations and the state of the art at the time the standard was issued.

1.4.2 Unless otherwise noted, the provisions of this standard shall not be applied retroactively, except in those cases where it is determined by the authority having jurisdiction (AHJ) that the existing situation involves a distinct hazard to life, property, or the environment.

1.4.3 Any alteration, installation of new equipment, or change in occupancy shall meet the requirements for new construction, except where approved by the AHJ.

1.4.4 Only the altered, renovated, or modernized portion of an existing building, system, or individual component shall be required to meet the provisions of this standard that are applicable to new construction.

1.5 Equivalency.

1.5.1 Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety as alternatives to those prescribed by this standard, provided technical documentation is submitted to the AHJ to demonstrate equivalency, and the system, method, or device is approved for the intended purpose.

1.5.2 The specific requirements of this standard shall be permitted to be modified by the AHJ to allow alternative arrangements that will secure as nearly as practical the level of fire protection intended by this document.

1.5.3 In no case shall a modification afford less fire protection than that which, in the judgment of the AHJ, would be provided by compliance with the corresponding provisions contained in this standard.

1.5.4 Alternative fire protection methods accepted by the AHJ shall be considered as conforming with this standard.

1.6* Responsibilities. This standard shall provide requirements and guidance for personnel responsible for the design, construction, operation, and regulation of facilities that involve

the storage, handling, or use of radioactive materials. The facilities management is responsible for the implementation of the requirements contained within this standard.

1.7* Units and Formulas.

1.7.1 SI Units. Metric units of measurement in this standard shall be in accordance with the modernized metric system known as the International System of Units (SI).

1.7.2* Primary and Equivalent Values. If a value for a measurement as given in this standard is followed by an equivalent value in other units, the first stated value shall be regarded as the requirement.

1.7.3 Conversion Procedure. SI units have been converted by multiplying the quantity by the conversion factor and then rounding the result to the appropriate number of significant digits.

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 2, *Hydrogen Technologies Code*, 2023 edition.
- NFPA 10, *Standard for Portable Fire Extinguishers*, 2022 edition.
- NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2024 edition.
- NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2022 edition.
- NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2022 edition.
- NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2025 edition.
- NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2024 edition.
- NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2022 edition.
- NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2024 edition.
- NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2024 edition.
- NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2025 edition.
- NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2023 edition.
- NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2025 edition.
- NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2023 edition.
- NFPA 30, *Flammable and Combustible Liquids Code*, 2024 edition.
- NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2024 edition.
- NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*, 2024 edition.
- NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2024 edition.
- NFPA 54, *National Fuel Gas Code*, 2024 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2023 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2024 edition.

NFPA 70®, *National Electrical Code®*, 2023 edition.

NFPA 72®, *National Fire Alarm and Signaling Code®*, 2025 edition.

NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, 2024 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2025 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment*, 2024 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code*, 2023 edition.

NFPA 86, *Standard for Ovens and Furnaces*, 2023 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2024 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2024 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids*, 2020 edition.

NFPA 101®, *Life Safety Code®*, 2024 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2025 edition.

NFPA 115, *Standard for Laser Fire Protection*, 2020 edition.

NFPA 204, *Standard for Smoke and Heat Venting*, 2024 edition.

NFPA 220, *Standard on Types of Building Construction*, 2024 edition.

NFPA 232, *Standard for the Protection of Records*, 2022 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, 2022 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 2023 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2023 edition.

NFPA 400, *Hazardous Materials Code*, 2025 edition.

NFPA 484, *Standard for Combustible Metals*, 2022 edition.

NFPA 600, *Standard on Facility Fire Brigades*, 2020 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2023 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2023 edition.

NFPA 770, *Standard on Hybrid (Water and Inert Gas) Fire-Extinguishing Systems*, 2021 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2023 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 806, *Performance-Based Standard for Fire Protection for Advanced Nuclear Reactor Electric Generating Plants Change Process*, 2020 edition.

NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems*, 2023 edition.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, 2021 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2022 edition.

2.3 Other Publications.

2.3.1 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*, 2022.

ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, 2022.

ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*, 2019a¹.

ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*, 2013a (2017).

ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2018.

ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, 2022a.

ASTM E2690, *Standard Practice for Specimen Preparation and Mounting of Caulks and Sealants to Assess Surface Burning Characteristics*, 2022.

Δ 2.3.2 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 723, *Test for Surface Burning Characteristics of Building Materials*, 2018.

UL 900, *Air Filter Units*, 2015, revised 2022.

UL 1479, *Fire Tests of Through-Penetration Fire Stops*, 2015, revised 2021.

2.3.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2020.

2.4 References for Extracts in Mandatory Sections.

NFPA 122, *Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities*, 2023 edition.

NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*, 2020 edition.

NFPA 850, *Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations*, 2020 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2024 edition.

Chapter 3 Definitions

Δ 3.1 General.

N 3.1.1 The definitions contained in this chapter shall apply to the terms used in this standard.

N 3.1.2 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.

N 3.1.3 *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 (AHJ). 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 considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA manuals of style. When used in a generic sense, such as in the phrases “standards development process” or “standards development activities”, the term “standards” includes all NFPA standards, including codes, standards, recommended practices, and guides.

Δ 3.3 General Definitions.

N 3.3.1 Bituminization. The process of using bitumen to cover or impregnate radioactive waste to be stored until the radioactivity level drops to an acceptable level.

3.3.2 Canyon. An enclosure beside or above a series of hot cells for the purpose of servicing the hot cells.

3.3.3 Cave. See 3.3.24.1.

3.3.4* Compensatory Measure. Measures taken if an impairment to a required system, feature, or component prevents that system, feature, or component from performing its intended function.

3.3.5 Criticality. The state of sustaining a chain reaction, as in a nuclear reactor.

3.3.6 Criticality Incident. An accidental, self-sustained nuclear fission chain reaction.

3.3.7 Decontamination. The removal of unwanted radioactive substances from personnel, rooms, building surfaces, equipment, and so forth, to render the affected area safe.

3.3.8 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.

3.3.9 Fire Barrier. In facilities handling radioactive materials, a continuous vertical or horizontal construction assembly designed and constructed to limit the spread of heat and fire and to restrict the movement of smoke.

3.3.10* Fire Door. The door component of a fire door assembly.

3.3.11* Fire Emergency Organization. Personnel trained to respond to facility fire emergencies, which can include in-plant firefighting operations.

3.3.12 Fire Hazards Analysis. A comprehensive assessment of the potential for a fire at any location to ensure that the possibility of injury to people or damage to buildings, equipment, or the environment is within acceptable limits.

3.3.13 Fire Prevention. Measures directed toward avoiding the inception of fire.

3.3.14 Fire Protection. Methods of providing for fire control or fire extinguishment.

3.3.15* Fire Resistance Rating. The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as established in accordance with an approved test procedure appropriate for the structure, building material, or component under consideration. [805, 2020]

3.3.16 Fire-Resistant Fluid. A listed hydraulic fluid or lubricant that is difficult to ignite due to its high fire point and auto-ignition temperature and that does not sustain combustion due to its low heat of combustion. [850, 2020]

3.3.17* Fissionable Materials. Materials that are capable of being induced to undergo nuclear fission by slow neutrons.

3.3.18* Fixed Fire-Suppression System. An engineered or pre-engineered total flooding or local application system consisting of a fixed supply of extinguishing agent permanently connected for fixed agent distribution to fixed nozzles that are arranged to discharge an extinguishing agent into an enclosure (total flooding), directly onto a hazard (local application), or a combination of both; or an automatic sprinkler system. [122, 2023]

3.3.19* Fixed Inerting System. A system that produces and maintains continuous atmospheric concentrations below levels that will support combustion or reactions of the materials at risk.

▲ 3.3.20 Flame Spread Index. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*. [5000, 2024]

3.3.21* Gamma Rays. High-energy short-wavelength electromagnetic radiation.

3.3.22* Glovebox. A sealed enclosure in which items inside the box are handled exclusively using long gloves sealed to ports in the walls of the enclosure.

3.3.23* Hood. An enclosure, with or without gloveports or doors, characterized by the flow of air from the room to the enclosure.

3.3.24 Hot Cell. A heavily shielded enclosure in which radioactive material can be handled safely by persons working from outside the shield using remote tools and manipulators while viewing the work through special leaded-glass or liquid-filled windows or through optical devices.

3.3.24.1 Cave. A small hot cell intended for a specific purpose and limited equipment.

3.3.25 Isotope. Any of two or more forms of an element having the same atomic number and similar chemical properties but differing in mass number and radioactive behavior.

N 3.3.26 Limited-Combustible Material. See 7.1.2. [5000, 2024]

3.3.27 Liquid.

3.3.27.1* Combustible Liquid. Any liquid that has a closed-cup flash point at or above 37.8°C (100°F).

3.3.27.2 Flammable Liquid. A liquid that has a closed-cup flash point that is below 37.8°C (100°F) and a maximum vapor pressure of 2068 mm Hg (40 psia) at 37.8°C (100°F).

3.3.28* Noncombustible Material. See 7.1.1. [5000, 2024]

3.3.29 Occupancy. The purpose for which a building or other structure, or part thereof, is used or intended to be used. [5000, 2024]

3.3.30 Particle.

3.3.30.1* Alpha Particle. A positively charged particle emitted by certain radioactive materials, identical to the nucleus of a helium atom.

3.3.30.2* Beta Particle. An elementary particle, emitted from a nucleus during radioactive decay, with a single electrical charge and a mass equal to $\frac{1}{1837}$ that of a proton.

3.3.31 Qualified Fire Protection Engineer. An individual specializing in fire protection with a combination of minimum education, experience, or professional registration(s)/license(s). (See Section 4.3.)

3.3.32* Radiation. The emission and propagation of energy through matter or space by means of electromagnetic disturbances that display both wave-like and particle-like behavior.

3.3.32.1 Nuclear Radiation. The emission from atomic nuclei in various nuclear reactions including alpha, beta, and gamma radiation and neutrons.

3.3.33 Radiation Area. An area, accessible to personnel, in which radiation exists, originating in whole or in part within radioactive material, at such levels that a major portion of the body could receive a dose in excess of 5 millirems (5×10^{-5} sievert) during any single hour or a dose in excess of 100 millirems (100×10^{-5} sievert) during any five consecutive days.

3.3.34 Radioactivity. The spontaneous decay or disintegration of an unstable atomic nucleus accompanied by the emission of radiation.

Chapter 4 Fire Protection Program

4.1* Management Policy and Direction. Management shall establish policies and institute a program to promote life safety, the conservation of property and essential equipment, the protection of the environment, and the continuity of operations through provisions of fire prevention and fire protection measures at each facility.

4.1.1* A policy document shall be prepared that defines management authority and responsibilities and establishes the general policy for the site fire protection program.

4.1.2* The policy document shall designate the senior management position with immediate authority and responsibility for the fire protection program.

4.1.3 Administrative controls for changes in processes, equipment, or facilities shall be developed to include fire protection concerns.

4.1.4 For the life of the facility, the administrative controls for facilities shall be reviewed and maintained to reflect current conditions and be updated periodically.

4.2 Qualified Fire Protection Engineer.

4.2.1 A qualified fire protection engineer shall have 3 years of responsible charge experience in the field of fire protection specific to the types of facilities within the scope of this standard.

4.2.2 A qualified fire protection engineer shall meet one or more of the following criteria:

- (1) Be a graduate of an approved fire protection engineering curriculum
- (2) Be a registered or licensed fire protection engineer by a state or local authority
- (3) Demonstrate fire protection engineering knowledge and experience and provide evidence of qualifications acceptable to the AHJ

4.3* Fire Hazards Analysis.

4.3.1 A documented fire hazards analysis shall be performed at the beginning of the design process or when configuration and other facility changes are made to ascertain whether the fire prevention and fire protection requirements of this standard have been achieved.

4.3.1.1 The fire hazards analysis shall address the following goals and objectives:

- (1) Nuclear safety goal
- (2) Radioactive and hazardous material release goal
- (3) Life safety goal
- (4) Nuclear safety objectives
- (5) Radioactive and hazardous material release objective
- (6) Life safety objectives

4.3.1.2 The fire hazards analysis shall be updated as necessary to reflect facility modifications, changes in fire hazards, and operating experience.

4.3.1.3 The completed fire hazards analysis shall be reviewed at least every 3 years and modified, when necessary, in order to ensure the analysis remains current.

4.3.1.4* The fire hazards analysis shall assess the hazards from fire in relationship to existing or proposed fire safety features to ensure that the facility can be safely controlled and stabilized during and after a fire.

4.3.2 Fire Hazards Analysis Content.

4.3.2.1* The fire hazards analysis shall be provided in order to incorporate adequate fire protection into the facility design using a graded approach.

4.3.2.2 The following topics shall be addressed as part of the fire hazards analysis:

- (1) Description of facility construction
- (2) Description of process systems and equipment, including a description of the special hazards and associated safety features
- (3) Description of fire hazards
- (4) Description of facility operations, including the construction and decommissioning phases of a facility's life cycle, when applicable
- (5) Description of the fire protection program, including but not limited to roles and responsibilities, transient combustible control program, hot work controls, control of ignition sources, and housekeeping standards
- (6) Natural hazards, including but not limited to earthquake, flood, wind, lightning, and wildland fire impact on fire safety
- (7) Fire damage and recovery potential
- (8) Fire protection features, including but not limited to fire water supply systems, fire detection and alarm systems, fire suppression systems, passive fire protection features, and smoke control and HVAC
- (9) Protection of essential safety systems
- (10) Life safety considerations
- (11) Emergency planning
- (12) Fire department/fire brigade response
- (13) Safeguards and security considerations related to fire protection
- (14) Exposure fire potential and the potential for fire spread between two fire areas
- (15) Effect of significant fire safety deficiencies on fire risk
- (16) Potential for a toxic, biological, and/or radiological incident due to a fire
- (17) Environmental impacts from a fire including suppression system run-off considerations
- (18) A conclusion that meets the following:
 - (a) Demonstrates compliance with this standard
 - (b) Identifies and technically resolves where the current fire protection requirement(s) and/or objectives do not conform to the requirement(s) and/or objectives of this standard

4.3.3 The fire hazards analysis shall be prepared by or under the supervision of a qualified fire protection engineer.

4.4* Fire Protection Program. A written fire protection program shall be established and implemented for all facility conditions and shall include the following:

- (1) Management and policy direction as indicated in Section 4.1

- (2) Standards, procedures, processes and supporting documentation for fire protection design and operation of the facility
- (3) Preparation and maintenance of a fire hazards analysis as indicated in Section 4.3
- (4) Management of changes to the facility that affect fire protection
- (5) Fire safety information for all employees and contractors, including familiarization with procedures for fire prevention, emergency alarm response, and reporting of fires
- (6)* Documented facility inspections conducted at least monthly, including provisions for remedial action to correct conditions that increase fire hazards
- (7)* A description of the general housekeeping practices and the control of transient combustibles
- (8)* Fire prevention surveillance
- (9) Control of flammable and combustible liquids and gases and oxidizers in accordance with the applicable documents referenced in Section 7.1
- (10)* Control of ignition sources including, but not limited to, grinding, welding, and cutting in accordance with NFPA 51B
- (11) Restriction of smoking to designated and supervised areas of the facility
- (12) Inspection, testing and maintenance of fire protection design features and equipment as indicated in Section 4.5
- (13) Procedures for planned and unplanned impairments to fire protection design features and equipment as indicated in Section 4.6
- (14)* Fire reports, including an investigation and a statement on the corrective action to be taken
- (15)* Construction, demolition, and renovating activities that conform to the requirements of NFPA 241
- (16) Emergency response requirements as indicated in Section 4.7
- (17) Provision of the facility fire emergency organization as indicated in Section 4.8
- (18) Preparation of pre-incident fire plans as indicated in Section 4.9
- (19) Quality assurance and self-auditing of the above activities
- (20) Provision for staff and training to carry out the above activities

4.5 Testing, Inspection, and Maintenance.

4.5.1* Upon installation, fire protection systems and features shall be inspected and tested in accordance with the applicable standards or guidelines that are acceptable to the AHJ.

4.5.2 Testing, inspection, and maintenance shall be documented by means of written procedures, with the results and follow-up actions recorded, and specific acceptance criteria shall be provided for each test.

4.6 Impairments.

4.6.1 A written procedure shall be established to address impairments to fire protection systems and shall include the following:

- (1) Identification, tagging, and tracking of impaired equipment
- (2) Identification of personnel to be notified
- (3)* Determination of needed compensatory measures

4.6.2 Impairments to fire protection systems shall be managed to minimize the duration of the equipment outage.

4.6.2.1 If the impairment is planned, all necessary parts and personnel shall be assembled prior to removal of the protection system(s) from service.

4.6.2.2 When an unplanned impairment occurs, or when a system has discharged, the repair work or fire protection system restoration shall be expedited.

4.6.3 Once repairs are completed, tests shall be conducted to ensure that full fire protection equipment capabilities are restored and operational.

4.6.4 Following restoration to service, those parties previously notified of the impairment shall be advised.

4.7* Emergency Response. A written emergency response plan shall be developed and shall include the following:

- (1) Response to fire alarms and fire systems supervisory signals
- (2) Notification of personnel identified in the plan
- (3) Evacuation from the fire area of personnel not directly involved in firefighting activities
- (4)* Coordination with security forces, radiation protection personnel, and other designated personnel for the admission of public fire department and other emergency response agencies
- (5)* Fire extinguishment activities, particularly those that are unique to the facility handling radioactive materials
- (6)* The effects of firefighting water on such areas, assuming disruption of the contents by accident or by fire hoses
- (7) Requirements for training, drills, and exercises to verify the adequacy of the emergency response plan, including practice sessions coordinated around previously developed valid emergency scenarios particular to the facility

4.8 Facility Fire Emergency Organization.

4.8.1* A facility fire emergency organization in accordance with the requirements of NFPA 600 or NFPA 1500 shall be provided.

4.8.2 The size of the facility and its staff, the complexity of firefighting problems, and the availability and response time of an off-site fire department shall determine the composition of the facility fire emergency organization.

4.8.3 Facility fire emergency organization training requirements and drill frequencies necessary to demonstrate proficiency shall be implemented in accordance with the emergency response plan in Section 4.7.

4.8.4 Drills shall be critiqued and documented.

4.8.5 A means of communicating between emergency organization responders shall be provided.

4.9 Pre-Incident Fire Plans.

4.9.1* Detailed pre-incident fire plans for all site fire areas shall be developed for assisting the facility fire emergency organization.

4.9.2 Pre-incident fire plans shall be reviewed and updated to reflect the current facility conditions.

4.9.3* Pre-incident fire plans shall be made available to the facility fire emergency organization.