

NFPA[®]

914

**Code for the
Protection of
Historic Structures**

2019



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NFPA® 914

Code for the

Protection of Historic Structures

2019 Edition

This edition of NFPA 914, *Code for the Protection of Historic Structures*, was prepared by the Technical Committee on Cultural Resources. It was issued by the Standards Council on November 5, 2018, with an effective date of November 25, 2018, and supersedes all previous editions.

This edition of NFPA 914 was approved as an American National Standard on November 25, 2018.

Origin and Development of NFPA 914

The Technical Committee on Cultural Resources was first organized in 1940 as the Committee on Libraries, Museums, and Historic Buildings. The first committee document, published in 1948, was the manual *Protecting Our Heritage: Historic Buildings, Museums, and Libraries*. A second edition of the manual was published in 1970.

The technical committee approved a request in November 1984 to develop a publication similar to NFPA 913, *Recommended Practice for the Protection of Historic Structures and Sites*. NFPA 913 was withdrawn in 1997, but its scope of coverage included protection criteria for historic structures for buildings that were to be rehabilitated for new uses. A recommended practice was prepared in draft form for the 1988 Annual Meeting but was not considered by the technical committee to be ready for publication. The technical committee continued to revise and organize the material, and the document was submitted once again at the 1989 Annual Meeting where the first edition was adopted. The original title was *Recommended Practice for Fire Protection in Rehabilitation and Adaptive Reuse of Historic Structures*.

In 1993, the technical committee moved to consolidate the various requirements for churches, museums, and libraries into a common standard. That consolidation was achieved in 1997 with the issuance of NFPA 909, *Standard for the Protection of Cultural Resources, Including Museums, Libraries, Places of Worship, and Historic Properties*. While this new standard was being developed, a further need to deal with the unique properties of historic structures was identified: in many applications, traditional requirements of codes and standards did not provide practical solutions to correcting fire protection deficiencies in historic properties.

Previous editions of NFPA 914 contained somewhat expanded fire protection guidelines, including the need to develop an overall fire protection plan that emphasized management's responsibility in addressing fire protection and the importance of preserving the historic integrity of these irreplaceable artifacts of history and culture. However, the document still did not contain a roadmap to accomplish these goals. The changes made to the 2001 edition of the document were quite substantial in this regard, including the designation of that edition as a code rather than as a recommended practice. The document gave clear guidance instead of good ideas. Designation as a code also allowed NFPA 914 to be adopted into law by a state or local jurisdiction, since it used mandatory language.

Given the unique nature of this document — an attempt to cover the gamut of existing structures with no occupancy change, structures that had been undergoing an adaptive reuse transformation, or those structures that simply had never been regulated before, given the lack of an authoritative document on this subject — the 2001 edition contained both a prescriptive approach as well as a performance-based approach to finding solutions to the life safety and fire safety problems in historic structures. In both cases, NFPA 914 maintained the importance of preventing or minimizing the intrusion of fire protection systems or solutions so as not to destroy the fabric or significance of the structure.

Also of significance in the 2001 edition was the addition of a process whereby individuals responsible for managing the fire protection plan for a building could be considered part of the

plan. This approach allowed specific direction to be given for a needs assessment, both from the fire protection management standpoint as well as from the historic significance standpoint. This process allowed the responsible parties to develop and implement a plan that encompassed all aspects of the historic structure or site so that it could be preserved for future generations. Guidance for this approach was added to the chapter on management operational systems.

The 2007 edition underwent a major reorganization to comply with the *Manual of Style for NFPA Technical Committee Documents* and to correlate better with the 2005 edition of NFPA 909, *Code for the Protection of Cultural Resource Properties — Museums, Libraries, and Places of Worship*. A new chapter on security and a new annex that illustrated compliance alternatives were added. Technical revisions were made pertaining to life safety performance criteria; temporary enclosures; deficiencies discovered during compliance audits; documentation of modifications to prescriptive requirements; housekeeping practices; hot work; cabling; commercial cooking and food service operations; additions, alterations, and repairs; roofing; plumbing; temporary wiring; fire doors; inspection, testing, and maintenance of fire protection systems; and the use of combustible packing materials. Revisions were also made regarding the type of automatic sprinklers to be used in historic structures properties, and information was added on management operations systems and emergency response plans.

The 2010 edition added criteria and survey forms for conducting vulnerability assessments to mitigate the risk of arson in historic structures; guidance on implementing operational controls; requirement for arc-fault circuit interrupters (AFCIs) to protect electrical circuits; criteria for protection against wildfires; criteria for the determination of contractor qualifications for working in historic structures; inspection, testing, and maintenance requirements for premises security systems; special event security and protection criteria; a new annex on case studies; a new annex on the protection of historic districts; a new annex on example code exceptions for historic buildings; and a new annex on security systems.

For the 2015 edition, the code's scope, goals, and objectives were revised to include security. Consistent with the revised scope, security requirements were revised, consolidated, and relocated to a new chapter on security following the chapter on fire prevention requirements. Plenum storage requirements were extracted from NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and added to the chapter on fire prevention requirements.

For the 2019 edition, the title of NFPA 914 has been revised from *Code for Fire Protection of Historic Structures* to *Code for the Protection of Historic Structures*, and numerous provisions have been revised to reflect its expanded scope and purpose, which includes fire protection, security, and resiliency of historic structures and historic districts. New requirements for fire protection and life safety system commissioning and integrated fire protection and life safety system testing have been added.

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Committee Scope: This Committee shall have primary responsibility for documents on fire safety and security for libraries, museums, places of worship, and historic structures and their contents, but shall not overlap the provisions of NFPA 101, *Life Safety Code*, and NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*.

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2019 Edition

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

Chapter 1 Administration

1.1 Scope.

1.1.1 This code describes principles and practices of protection and recovery for historic structures and districts.

1.1.2* Collections within libraries, museums, and places of worship are not within the scope of this code.

Δ 1.2* Purpose. This code prescribes minimum requirements for the protection and recovery of historic structures from vulnerabilities while preserving the elements, spaces, and features that make these structures historically or architecturally significant.

1.3 Application. This code applies to historic structures.

1.3.1 This code covers ongoing operations, renovation, and restoration and acknowledges the need to preserve historically

significant and character-defining building features and to provide for continuity of operations.

1.3.2 This code addresses those construction, protection, operational, and occupancy features that are necessary to minimize danger to life, structures, and historic fabric from the effects of fire and other vulnerabilities.

1.3.3 This code identifies the minimum fire and security criteria to permit prompt escape of the building occupants to a safe area and to minimize the impact of fire, damage from fire protection equipment, and security vulnerabilities to the structure or historic fabric.

1.3.4 The application of the security requirements of this code is based on the risk considerations determined in Chapter 9.

1.3.5 Libraries, museums, and places of worship housed in historic structures shall also comply with the requirements of NFPA 909.

1.4 Equivalency.

1.4.1 Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, or effectiveness, provided that the following conditions are met:

- (1) Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.
- (2) The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.4.2 Historic structures or portions of such structures that do not strictly comply with this code shall be considered to be in compliance if it can be shown that equivalent protection has been provided or that no specific hazard or security threat will be created or continued through noncompliance.

1.4.3 A designer capable of applying more complete and rigorous analysis to special or unusual problems shall have latitude in the development of the applicable design.

1.4.3.1 In such cases, the designer shall be responsible for demonstrating the validity of the approach.

1.4.3.2 This code shall not do away with the need for competent engineering judgment.

1.4.3.3 This code shall not be intended to be used as a design handbook.

1.5* Enforcement. This code shall be administered and enforced by the AHJ designated by the governing authority.

1.5.1 Organization.

1.5.1.1 The owner or governing body shall designate a fire safety manager who shall administer and enforce the fire safety requirements of this code.

1.5.1.2 The owner or governing body shall designate a security manager who shall administer and enforce the security requirements of this code.

1.5.2 Approvals by Other Authorities Having Jurisdiction. The fire safety manager shall require that the laws, rules, and regulations of all other regulatory agencies having jurisdiction shall be met when not in conflict with this code.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code 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 1, *Fire Code*, 2018 edition.
- NFPA 3, *Standard for Commissioning of Fire Protection and Life Safety Systems*, 2018 edition.
- NFPA 4, *Standard for Integrated Fire Protection and Life Safety System Testing*, 2018 edition.
- NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.
- NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 edition.
- NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2018 edition.
- NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2018 edition.
- NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.
- NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2019 edition.
- NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*, 2019 edition.
- NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2019 edition.
- NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2017 edition.
- NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2015 edition.
- NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition.
- NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2017 edition.
- NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.
- NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.
- NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2016 edition.
- NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 edition.
- NFPA 54, *National Fuel Gas Code*, 2018 edition.
- NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.
- NFPA 70®, *National Electrical Code®*, 2017 edition.
- NFPA 72®, *National Fire Alarm and Signaling Code®*, 2019 edition.
- NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2019 edition.
- NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 edition.
- NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2018 edition.
- NFPA 92, *Standard for Smoke Control Systems*, 2018 edition.
- NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2017 edition.
- NFPA 101®, *Life Safety Code®*, 2018 edition.
- NFPA 110, *Standard for Emergency and Standby Power Systems*, 2019 edition.

- NFPA 204, *Standard for Smoke and Heat Venting*, 2018 edition.
- NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, 2019 edition.
- NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, 2019 edition.
- NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2018 edition.
- NFPA 289, *Standard Method of Fire Test for Individual Fuel Packages*, 2019 edition.
- NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2019 edition.
- NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials*, 2018 edition.
- NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*, 2017 edition.
- NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2019 edition.
- NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2017 edition.
- NFPA 909, *Code for the Protection of Cultural Resource Properties — Museums, Libraries, and Places of Worship*, 2017 edition.
- NFPA 1123, *Code for Fireworks Display*, 2018 edition.
- NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience*, 2016 edition.
- NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*, 2018 edition.
- NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2018 edition.

2.3 Other Publications.

2.3.1 ANSI/UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*, 2014.

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

UL 1975, *Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes*, 2006.

2.3.2 ASCE Publications. American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*, 2010.

2.3.3 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 E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 2016a.

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

ASTM E1591, *Standard Guide for Obtaining Data for Fire Growth Models*, 2013.

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.

2.3.4 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 1, *Fire Code*, 2018 edition.

NFPA 3, *Standard for Commissioning of Fire Protection and Life Safety Systems*, 2018 edition.

NFPA 4, *Standard for Integrated Fire Protection and Life Safety System Testing*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 72®, *National Fire Alarm and Signaling Code®*, 2019 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 edition.

NFPA 101®, *Life Safety Code®*, 2018 edition.

NFPA 557, *Standard for Determination of Fire Loads for Use in Structural Fire Protection Design*, 2016 edition.

NFPA 730, *Guide for Premises Security*, 2018 edition.

NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*, 2017 edition.

NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*, 2015 edition.

NFPA 921, *Guide for Fire and Explosion Investigations*, 2017 edition.

NFPA 1141, *Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas*, 2017 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this code. 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 (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* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 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.

3.2.5* 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.

3.2.6 Shall. Indicates a mandatory requirement.

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

3.2.8 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 phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Access Control. The act of managing ingress or egress through a portal by validating a credential or an individual. [731, 2017]

3.3.2 Adaptive Reuse. The conversion or functional change of a building from the purpose or use for which it was originally constructed or designed.

3.3.3 Addition. An increase in the building area, aggregate floor area, building height, or number of stories of a structure. [5000, 2018]

• **3.3.4 Arc-Fault Circuit Interrupter (AFCI).** A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected. [70:100]

3.3.5 Arson. The crime of maliciously and intentionally, or recklessly, starting a fire or causing an explosion. [921, 2017]

3.3.6* Atrium. A large-volume space created by a floor opening or series of floor openings connecting two or more stories that is covered at the top of the series of openings and is used for purposes other than an enclosed stairway; an elevator hoistway; an escalator opening; or as a utility shaft used for plumbing, electrical, air-conditioning, or communications facilities. [101, 2018]

3.3.7 Barrier.

3.3.7.1* 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. [101, 2018]

3.3.7.2* Smoke Barrier. A continuous membrane, or a membrane with discontinuities created by protected openings, where such membrane is designed and constructed to restrict the movement of smoke. [101, 2018]

3.3.8 Building Manager. The authorized person, formally and officially appointed or designated by the governing body or a responsible party, who is charged with the duties and responsibilities of providing and ensuring the overall management, operation, and maintenance for that facility or institution.

3.3.9* Building Systems. An assembly or set of units made up of components that provide services to spaces in a building.

3.3.10* Buildings. Structures, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy.

3.3.11 Character-Defining Feature. A prominent or distinctive aspect, quality, or characteristic of a cultural resource property that contributes significantly to its physical character.

3.3.12 Collections. Prehistoric and historic objects, works of art, scientific specimens, religious objects, archival documents, archeological artifacts, library media, and cultural materials assembled according to some rational scheme and maintained for the purpose of preservation, research, study, exhibition, publication, or interpretation.

N 3.3.13 Commissioning (Cx). A systematic process that provides documented confirmation that building systems function according to the intended design criteria set forth in the project documents and satisfy the owner's operational needs, including compliance with governing laws, regulations, codes, and standards. [3, 2018]

3.3.14 Compartment. See 3.3.29, Fire Compartment.

3.3.15 Compliance. Adherence or conformance to laws and standards.

3.3.16* Conservation. The professional practice of examination, documentation, treatment, and preventative care devoted to the preservation of cultural property.

3.3.17 Cultural Landscape. A geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values.

3.3.18* Cultural Resource Properties. Buildings, structures, or sites, or portions thereof, that are culturally significant, or that house culturally significant collections for museums, libraries, and places of worship.

3.3.19 Damage Limitation Plan. Written procedures that outline and prioritize the actions to take following a disaster to minimize property damage and loss.

3.3.20* Design Specification. A building characteristic and other conditions that are under the control of the design team. [101, 2018]

3.3.21* Design Team. A group of stakeholders including, but not limited to, representatives of the architect, client, and any pertinent engineers and other designers. [101, 2018]

3.3.22 Early Warning. A signal provided by a system that detects fire in its earliest stages of development to enhance the opportunity of building occupants to escape and to commence manual suppression of the fire prior to arrival of fire service units.

3.3.23 Equivalency. An alternative means of providing an equal or greater degree of safety than that afforded by strict conformance to prescribed codes and standards. [101, 2018]

3.3.24 Exit. That portion of a means of egress that is separated from all other spaces of the building or structure by construction, location, or equipment as required to provide a protected way of travel to the exit discharge. [101, 2018]

3.3.25 Exit Access. That portion of a means of egress that leads to an exit. [101, 2018]

3.3.26 Exit Discharge. That portion of a means of egress between the termination of an exit and a public way. [101, 2018]

3.3.27* Exposure Fire. A fire that starts at a location that is remote from the area being protected and grows to expose that which is being protected. [101, 2018]

3.3.28* Feature (Cultural Landscape). The smallest element(s) of a landscape that contributes to the significance and that can be the subject of a treatment intervention.

3.3.29 Fire Compartment. A space within a building that is enclosed by fire barriers on all sides, including the top and bottom. [5000, 2018]

3.3.30 Fire Hazard. Any situation, process, material, or condition that, on the basis of applicable data, can cause a fire or explosion or that can provide a ready fuel supply to augment the spread or intensity of a fire or explosion, all of which pose a threat to life or property.

3.3.31 Fire Load. The total energy content of combustible materials in a building, space, or area including furnishing and contents and combustible building elements expressed in MJ. [557, 2016]

3.3.32* 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, 2015]

3.3.33 Fire Resistance Rating. The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as established in accordance with the test procedures of ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*.

3.3.34 Fire Resistive. Property or design to resist the effects of any fire to which a material or structure can be expected to be subjected.

3.3.35 Fire Retardant. A liquid, solid, or gas that tends to inhibit combustion when applied on, mixed in, or combined with combustible materials. [1, 2018]

3.3.36* Fire Safety Manager. A person identified by the governing body who is responsible for developing, implement-

ing, exercising, and conducting routine evaluations of fire safety provisions of the code.

▲ 3.3.37 Fire Watch. The assignment of a person or persons to an area for the express purpose of notifying the fire department, the building occupants, or both of an emergency; preventing a fire from occurring; extinguishing small fires; protecting the public from fire and life safety dangers. [1, 2018]

3.3.38 Firestop. A specific system, device, or construction consisting of the materials that fill the openings around penetrating items such as cables, cable trays, conduits, ducts, pipes, and their means of support through the wall or floor openings to prevent the spread of fire. [5000, 2018]

3.3.39 Fuel Load. The total quantity of combustible contents of a building, space, or fire area, including interior finish and trim, expressed in heat units or the equivalent weight in wood. [921, 2017]

3.3.40 Goal. A nonspecific overall outcome to be achieved that is measured on a qualitative basis. [101, 2018]

3.3.41 Governing Body. The board of directors, trustees, owner, or other body charged with governance and fiduciary responsibility of a cultural resource property.

3.3.42* Hazardous Area. An area of a structure or building that poses a degree of hazard greater than that normal to the general occupancy of the building or structure. [5000, 2018]

3.3.43* Historic Building. For the purpose of this code, a building that is designated, or deemed eligible for such designation, by a local, regional, or national jurisdiction as having historical, architectural, or cultural significance.

3.3.44 Historic Character. The sum of all visual aspects, features, materials, and spaces associated with a cultural landscape history (i.e., the original configuration together with losses and later changes). These qualities are often referred to as *character defining*.

3.3.45 Historic District. A geographical area or theme which possesses a significant concentration, linkage or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

3.3.46 Historic Fabric. Original or added building or construction materials, features, and finishes that existed during the period that is deemed to be most architecturally or historically significant, or both.

3.3.47 Historic Integrity. The authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the property's historic or prehistoric period.

3.3.48 Historic Preservation. A generic term that encompasses all aspects of the professional and public concern related to the maintenance of a historic structure, site, or element in its current condition, as originally constructed, or with the additions and alterations determined to have acquired significance over time.

3.3.49 Historic Site. A place, often with associated structures, having historic significance.

3.3.50 Historic Structure. A building, bridge, lighthouse, monument, pier, vessel, or other construction that is designa-

ted or that is deemed eligible for such designation by a local, regional, or national jurisdiction as having historical, architectural, or cultural significance.

3.3.51 Hot Work. Work involving burning, welding, or a similar operation that is capable of initiating fires or explosions. [51B, 2019]

3.3.52 Impairment. A condition where a fire protection system or unit, or portion thereof, is out of order, and the condition can result in the fire protection system or unit not functioning in a fire event. [25, 2017]

3.3.52.1 Emergency Impairment. A condition where a water-based fire protection system or portion thereof is out of order due to an unplanned occurrence, or the impairment is found while performing inspection testing or maintenance activities. [25, 2017]

3.3.52.2 Preplanned Impairment. As used in this code, a condition where a fire protection system or a portion thereof is out of service due to work that has been planned.

3.3.53 Incapacitation. A condition under which humans do not function adequately and become unable to escape untenable conditions. [101, 2018]

3.3.54 Initiating Device. A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch. [72, 2019]

3.3.55 Input Data Specification. Information required by the verification method. [101, 2018]

N 3.3.56 Integrated System. A combination of systems that operate together as a whole to achieve the fire protection and life safety objectives. [3, 2018]

3.3.57 Library. Any building or place in which books and other media are kept for reading, reference, research, or lending.

3.3.58* Limited-Combustible Material. See 4.5.2.

3.3.59 Means of Egress. A continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of three separate and distinct parts: (1) the exit access, (2) the exit, and (3) the exit discharge. [101, 2018]

3.3.60 Means of Escape. A way out of a building or structure that does not conform to the strict definition of means of egress but does provide an alternate way out. [101, 2018]

3.3.61 Museum. An institution that acquires, conserves, researches, communicates, and exhibits material evidence of people and their environment for purposes of study, education, and enjoyment.

3.3.62 Noncombustible. See 4.5.1.

3.3.63 Notification Appliance. A fire alarm system component such as a bell, horn, loudspeaker, visual notification appliance, or text display that provides audible, tactile, or visual outputs, or any combination thereof. [72, 2019]

3.3.64* Objective. A requirement that needs to be met to achieve a goal. [101, 2018]

- 3.3.65 Occupancy.** The purpose for which a building or other structure, or part thereof, is used or intended to be used. [ASCE/SEI 7:1.2.1]
- 3.3.66 Occupant Characteristics.** The abilities or behaviors of people before and during a fire. [101, 2018]
- 3.3.67 Occupant Load.** The total number of persons that might occupy a building or portion thereof at any one time. [101, 2018]
- 3.3.68* Performance-Based Design Approach.** A design process whose fire safety solutions are designed to achieve a specified goal for a specified use or application.
- 3.3.69 Performance Criteria.** Threshold values on measurement scales that are based on quantified performance objectives. [101, 2018]
- 3.3.70 Perimeter Protection.** A scheme of protection that uses devices to detect or deter intrusion into a protected area. [730, 2018]
- 3.3.71 Place of Worship.** Any building that functions primarily as a group meeting place for the practice of religion, which includes, but is not limited to, churches, synagogues, cathedrals, temples, mosques and meeting halls.
- 3.3.72 Plenum.** A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system. [90A, 2018]
- 3.3.73 Preservation.** The act or process of applying measures necessary to sustain the existing form, integrity, and materials of a historic building or structure.
- 3.3.74 Private.** Intended for or limited to the use of some particular person(s) or group.
- 3.3.75 Project Team.** A group of stakeholders including, but not limited to, representatives of architects, clients, engineers and designers, authorities having jurisdiction, and preservation specialists.
- 3.3.76* Proposed Design.** A design developed by a design team and submitted to the authority having jurisdiction for approval. [101, 2018]
- 3.3.77 Protected Premises.** The physical location protected by a fire alarm system, fire suppression system, electronic premises protection system, or other type of protection system.
- 3.3.78* Protection.** Features, systems, and programs implemented to prevent or minimize loss from fire, arson, vandalism, theft, natural disasters, disruptive events, and similar hazards to property collections or operations.
- 3.3.79 Protective Systems.** Automatic sprinklers, standpipes, carbon dioxide systems, clean agent systems, automatic covers, and other devices used for extinguishing fires.
- 3.3.80 Public.** Of, pertaining to, or affecting a population or a community as a whole; open to all persons.
- 3.3.81 Rehabilitation.** For the purpose of this code, the act or process of making possible a compatible use of a property through repair, alteration, and additions, while preserving those portions or features that convey its historic, cultural, or architectural value.
- 3.3.82* Resiliency.** The ability to adapt and recover from adverse or catastrophic events.
- 3.3.83 Restoration.** The act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods of its history, reconstruction of missing features from the restoration period, and repair of damaged or altered features from the restoration period.
- 3.3.84 Safety Factor.** A factor applied to a predicted value to ensure that a sufficient safety margin is maintained. [101, 2018]
- 3.3.85 Safety Margin.** The difference between a predicted value and the actual value where a fault condition is expected. [101, 2018]
- 3.3.86 Scenario.**
- 3.3.86.1 Design Fire Scenario.** A fire scenario selected for evaluation of a proposed design. [101, 2018]
- 3.3.86.2* Fire Scenario.** For the purposes of this code, a set of conditions that defines the development of fire, the spread of combustion products throughout a building or portion of a building, the reactions of people to fire, the impact of a fire on the historic significance in or near a room of particular significance, and the effects of combustion products.
- 3.3.87 Security Vulnerability Assessment (SVA).** A systematic and methodical process for examining ways an adversary might exploit an organization's security vulnerabilities to produce an undesired outcome. [730, 2018]
- 3.3.88 Self-Closing.** Equipped with an approved device that ensures closing after opening. [101, 2018]
- 3.3.89 Sensitivity Analysis.** An analysis performed to determine the degree to which a predicted output will vary given a specified change in an input parameter, usually in relation to models. [101, 2018]
- 3.3.90 Separation.** See 3.3.7.1, Fire Barrier.
- 3.3.91 Smoke Detector.** A device that detects visible or invisible particles of combustion. [72, 2019]
- 3.3.92* Special Event.** Any activity outside of the normal daily operations.
- 3.3.93 Stakeholder.** An individual, or representative of same, having an interest in the successful completion of a project. [101, 2018]
- 3.3.94 System.**
- 3.3.94.1 Fire Alarm System.** A system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals. [72, 2019]
- 3.3.94.2 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]

△ **3.3.94.3* Sprinkler System.** A system, commonly activated by heat from a fire and discharges water over the fire area, that consists of an integrated network of piping designed in accordance with fire protection engineering standards that includes a water supply source, a water control valve, a waterflow alarm, and a drain. The portion of the sprinkler system above ground is a network of specifically sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. [13, 2019]

3.3.95 Uncertainty Analysis. An analysis performed to determine the degree to which a predicted value will vary. [101, 2018]

3.3.96 Verification Method. A procedure or process used to demonstrate or confirm that the proposed design meets the specified criteria. [101, 2018]

3.3.97 Vertical Opening. An opening through a floor or roof. [101, 2018]

3.3.98 Zone. A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent, or an area in which a form of control can be executed. [72, 2019]

Chapter 4 General

4.1 Goals and Objectives. Goals and objectives shall be adopted that reflect the tolerance for risk that is acceptable to those responsible for the historic structure and historic district.

4.2 Goals.

4.2.1 The goals of this code shall be to provide protection against vulnerabilities to hazards for historic structures or historic districts and their occupants while protecting those elements, spaces, and features that make the structures historically or architecturally significant and allow for continuity of operations.

4.2.2 The goals shall be accomplished by operational approaches, system approaches, or the consideration of other factors, and shall include all of the following:

- (1) To provide reasonable safeguards for protection of property and the preservation of historic finishes, spaces, and architectural elements from the damaging effects of fire and security vulnerabilities
- (2) To provide for the protection and life safety of occupants not intimate with the initial fire development and improve the survivability of occupants intimate with the initial fire development
- (3) To provide an environment that is reasonably safe from security threats for the occupants inside or near a building
- (4) To maintain the historic fabric and integrity of the building
- (5) To provide for continuity of operations

4.3* Objectives.

4.3.1 Life Safety.

4.3.1.1 An egress system shall be designed, implemented, and maintained to protect the occupants not intimate with the initial fire development for the time needed to evacuate, relocate, or defend in place.

4.3.1.2 Structural integrity during a fire shall be maintained for the time needed to evacuate, relocate, or defend in place the occupants not intimate with the initial fire development.

4.3.1.3 Building construction and operation necessary to achieve the goals of this code shall be effective, maintained, and operational.

4.3.1.4 Security measures shall be designed, implemented, and maintained to achieve the goals of this code.

4.3.2 Historic Preservation.

4.3.2.1* Fire safety, fire protection features, and security measures shall be designed, approved, implemented, and maintained to preserve the original qualities or character of a building, structure, site, or environment.

4.3.2.2 Removal or alteration of any historic material or distinctive architectural features for the purpose of improving fire protection, security, or life safety shall be minimized.

4.3.2.3 Distinctive stylistic features or examples of skilled craftsmanship that characterize a building, structure, or site shall be treated with sensitivity.

4.3.2.4* A compatible use for a property that requires minimal alteration of the building, structure, or site and its environment shall be encouraged.

4.3.2.5 New additions or alterations shall be designed and constructed in such a manner that, if such additions or alterations were to be removed in the future, the essential form and integrity of the structure would be, to the greatest degree possible, unimpaired.

4.4 Compliance Options.

4.4.1 General. Building design, fire protection and security features, and programs shall meet the life safety and property conservation goals and objectives of Chapter 4, in accordance with one of the following:

- (1) Prescriptive-based provisions of 4.4.2
- (2) Performance-based provisions of 4.4.3
- (3) A combination of prescriptive- and performance-based provisions found acceptable to the authority having jurisdiction

4.4.2 Prescriptive-Based Option. A prescriptive-based design shall be in accordance with Chapters 1 through 8 and Chapters 11 through 16 of this code.

4.4.3 Performance-Based Option. A performance-based design shall be in accordance with Chapters 1 through 7 and Chapters 9, 11, 14, and 15 of this code.

△ **4.4.4 Management Operational Systems.** Management operational systems complying with Chapter 10 of this code shall be permitted as an element of a prescriptive- or performance-based solution.

4.5 Materials.

4.5.1 Noncombustible Material.

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

- (1) The material, 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) The material is reported as passing ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*.
- (3) The material 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*.

[5000:7.1.4.1.1]

4.5.1.2 Where the term *limited-combustible* is used in this code, it shall also include the term *noncombustible*. [5000:7.1.4.1.2]

Δ 4.5.2 Limited-Combustible Material. A material shall be considered a limited-combustible material where all the conditions of 4.5.2(1) and 4.5.2(2), and the conditions of either 4.5.2.1 or 4.5.2.2, are met:

- (1) The material does not comply with the requirements for a noncombustible material in accordance with 4.5.1.
- (2) The material, in the form in which it is used, exhibits a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), when tested in accordance with NFPA 259.

[5000:7.1.4.2]

4.5.2.1 The material shall have the structural base of noncombustible material with a surfacing not exceeding a thickness of $\frac{1}{8}$ 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*. [5000:7.1.4.2.1]

4.5.2.2 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 or ANSI/UL 723 and are 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. [5000:7.1.4.2.2]

N 4.5.2.3 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 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.

[5000:7.1.4.2.3]

4.5.2.4 Where the term *limited-combustible* is used in this code, it shall also include the term *noncombustible*. [5000:7.1.4.2.4]

Chapter 5 Reserved

Chapter 6 Reserved

Chapter 7 Process

7.1* General. The process by which this code shall be applied is shown in Figure 7.1.

7.2* Project Team.

7.2.1 The owner or governing body shall identify a project team to oversee the application of the code to the historic building or historic district.

7.2.2 The team shall include persons with expertise in historic preservation, fire protection, and security.

7.3* Assessment. A detailed assessment or survey of the fire safety features and the historic integrity of the structure, site, or both, shall be completed.

7.3.1* Identification of Historic Elements, Spaces, and Features.

7.3.1.1 Historic Documentation.

7.3.1.1.1 All persons involved with the design of the building shall be aware of the cultural significance of the historic structure or historic district prior to beginning the design.

7.3.1.1.2 All persons involved with the construction process shall be thoroughly briefed on the cultural significance and importance of the structure, spaces, or character-defining features prior to the beginning of the work.

7.3.1.2* Historic Structure: Exterior. The building survey shall identify those character-defining features and finishes that make the exterior of the building significant.

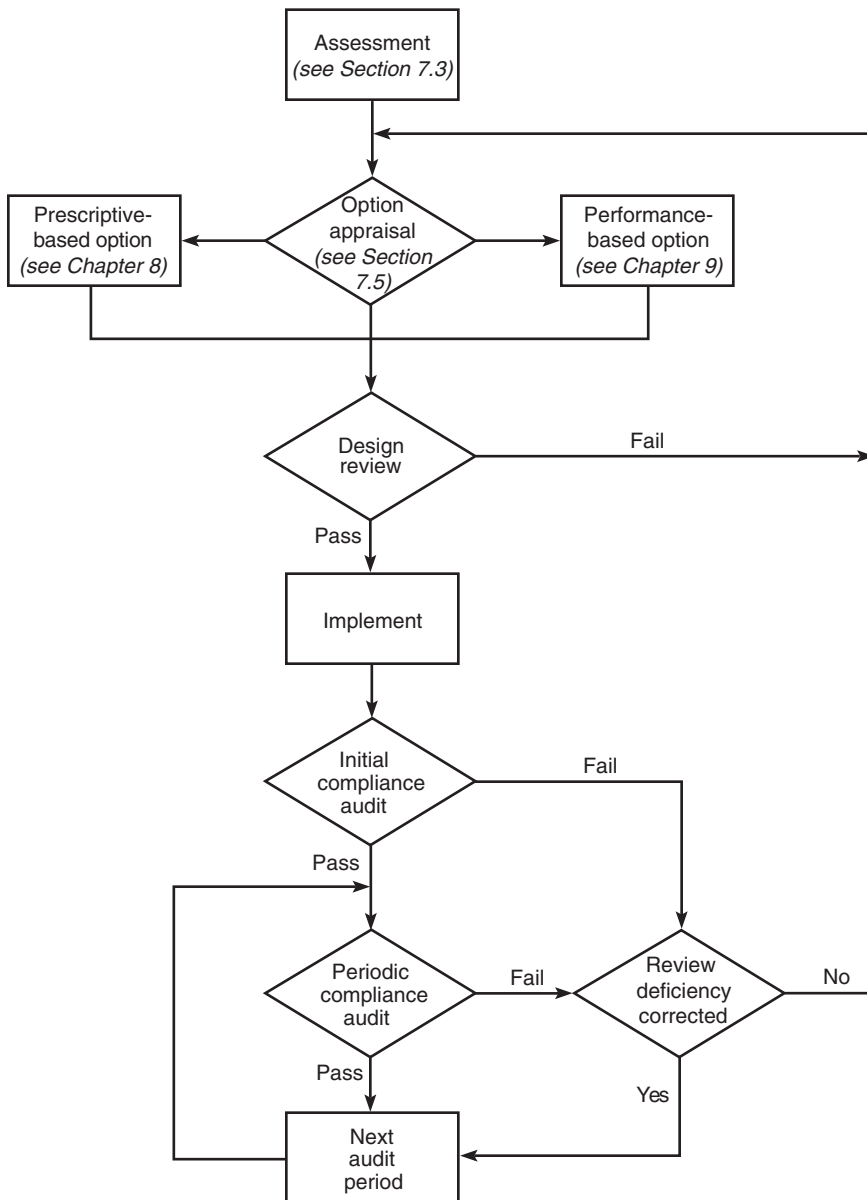
7.3.1.3* Construction. The building survey shall determine primary and secondary significance of all character-defining features and facades.

7.3.1.4 Adjacent and Secondary Structures. The building survey shall include all structures located on or adjacent to the historic property.

7.3.1.5 Site Elements. The building survey shall identify significant character-defining features of the property such as vegetation, landscape features, roads and driveways, walking paths, fencing, and exterior use.

7.3.1.6* Historic Structure: Interior. The building survey shall identify all significant interior spaces, floor plan organization, and character-defining features and finishes in the building, including those original to the building and those changes that have acquired significance in their own right.

7.3.2* Prioritization of Historic Elements, Spaces, and Features. The building survey shall determine relative significance of all historic elements, spaces, and features.



▲ FIGURE 7.1 Process Flow Chart.

7.3.3 Identification of Fire Safety Issues.

7.3.3.1 Code, Standard, and Regulation Compliance.

7.3.3.1.1 The building survey of existing conditions shall include a review of all fire safety-related requirements to determine if and where the historic building or historic district is deficient with respect to applicable codes.

7.3.3.1.2 Alternative methods that offer equivalent or greater protection while preserving the character-defining spaces, features, and finishes of the historic structure shall be permitted.

7.3.3.1.3* Buildings shall be evaluated in accordance with the requirements of the applicable building and fire codes.

7.3.3.2 Fire Hazards and Safety Deficiencies. The building survey shall identify known conditions that contribute to the start or spread of a fire or to the endangerment of people or property by fire.

7.3.3.3 Fire Spread. The building shall be evaluated to determine known potential paths of fire spread, both internal and external, that are inherent to its design.

7.3.3.4* Means of Egress. An evaluation of the means of egress shall be completed that includes, but is not limited to, numbers of means of egress, means of egress capacity, exit enclosure fire resistance, dead-end corridors, travel distances to exits, and unenclosed stairs in accordance with applicable codes.

7.3.4 Prioritization of Fire Safety Issues.

7.3.4.1* The building survey shall determine the relative importance of identified fire safety issues.

7.3.4.2* Where approved by the authority having jurisdiction, historic buildings that are acceptable using a fire risk indexing method shall be considered to be in compliance with applicable fire safety codes.

7.4 Options.

7.4.1 Structures that are found to satisfy both the life safety and historic preservation objectives of this code shall be subject to the periodic compliance audit required by Section 7.9.

7.4.2 Structures that are found to have life safety deficiencies, preservation needs, or both, shall have a plan of correction developed that satisfies one of the following:

- (1) Prescriptive compliance, including equivalency, alternatives, and modifications
- (2) Risk indexing compliance
- (3) Performance-based compliance
- (4) Any combination of items 7.4.2(1) through 7.4.2(3)

7.5 Option Appraisal and Selection.

7.5.1* Selection Criteria.

7.5.1.1 An appraisal of the available options shall be made by the project team and a method of application of the code shall be selected.

7.5.1.2 The method of application shall be the prescriptive-based approach, the performance-based approach, or a combination of both.

Δ 7.5.2 Prescriptive-Based Option. Prescriptive solutions shall meet the requirements of Chapters 1 through 8 and Chapters 11 through 16, including any exceptions contained within the referenced prescriptive codes and standards.

Δ 7.5.3 Performance-Based Option. Performance-based solutions shall be developed in accordance with Chapters 1 through 7 and Chapters 9, 11, 14, and 15 of this code.

7.6 Design Review. The project team shall review and approve the preferred design approach to achieve compliance.

7.7 Initial Compliance Audit. Upon completion of the implementation phase, there shall be an initial compliance audit by the project team to ensure compliance with the selected design approach.

7.8 Approval. The AHJ shall make the final determination as to whether compliance has been achieved.

7.9 Periodic Compliance Audit.

7.9.1 The periodic compliance audit shall be conducted by the AHJ at intervals identified in the approved fire safety management plan, but not less than annually.

7.9.2 Additional compliance audits shall be conducted prior to special events (*see Chapter 16*).

7.9.3 Exit Interview.

7.9.3.1 The AHJ shall conduct an exit interview with the fire safety manager and the owner or governing body of the building upon completion of the periodic compliance audit.

7.9.3.2 The exit interview shall identify all areas of noncompliance with the approved management plan.

7.9.3.3 Following the periodic compliance audit, any deficiencies shall be addressed, with corrective action taken and documented.

Chapter 8 Prescriptive-Based Approach

8.1 General.

8.1.1* Application.

8.1.1.1 Prescriptive requirements of the applicable codes shall be applied with the intent of achieving the goals and objectives of Chapter 4 of this document.

8.1.1.2* Application of prescriptive requirements shall include alternatives, equivalencies, modifications, or any combination thereof.

8.1.2* Alternatives. Prescribed alternative methods of compliance in the applicable codes shall be identified.

8.1.3* Equivalency.

8.1.3.1 The AHJ shall approve other fire safety approaches, systems, methods, or devices that are equivalent or superior to those prescribed by this code, provided that adequate documentation is submitted to demonstrate equivalency.

8.1.3.2* Approaches, systems, methods, or devices approved as equivalent by the AHJ shall be recognized as being in compliance with this document.

8.1.4* Modification of Requirements.

8.1.4.1 The requirements of the applicable codes shall be permitted to be modified if their application clearly would be impractical in the judgment of the AHJ, but only where it is also clearly evident that a reasonable degree of safety is provided.

8.1.4.2 The modifications that are allowed and any additional requirements that are imposed as a result shall be documented.

8.2* Compensatory Features. Where equivalencies or modifications of requirements are proposed, the following fire safety features shall be permitted to be considered as compensatory features:

- (1) Noncombustible or limited-combustible construction materials
- (2) Noncombustible or fire-retardant treatments for new interior finish materials and historic fabrics
- (3) Noncombustible or fire-retardant-treated materials for furnishings and contents
- (4) Walls and doors that will prevent the horizontal spread of fire and smoke, to subdivide building areas or to segregate specific hazards such as boilers, furnaces, or storage areas from the remainder of the building
- (5) Enclosure of stairways, ventilation shafts, and other vertical openings with construction to prevent the vertical spread of fire and smoke
- (6)* Firestops to prevent the spread of fire within walls and between rafters and joists and through horizontal and vertical fire
- (7)* Fire-resistive construction

- (8)* Fire detection and alarm systems that will sound an alarm within the structure and transmit an alarm signal to an alarm monitoring location or local fire department
- (9) Automatic suppression systems, manual suppression systems, or a combination of the two
- (10) Management and operational controls that meet the requirements of Chapter 10
- (11) Installation of arc-fault circuit-interrupters (AFCIs)
- (12) Height of ceilings, with recognition that a large volume of space above head height provides occupants at floor level additional time to safely exit the room or building

Chapter 9 Performance-Based Approach

9.1* General.

9.1.1 Application. The requirements of this chapter shall apply to fire protection systems, management operation systems, and life safety systems designed according to the performance-based option permitted by 7.5.3.

9.1.2 Goals and Objectives. The performance-based design shall meet the goals and objectives of this code in accordance with Sections 4.2 and 4.3.

9.1.3* Approved Qualifications. The performance-based design shall be prepared by a person with qualifications acceptable to the AHJ. (See also 9.8.12.)

9.1.4* Independent Review. The AHJ shall be permitted to require review and evaluation by an approved, independent third party.

9.1.5 Sources of Data.

9.1.5.1 The source for each input data requirement that must be met by using a data source other than a design fire scenario, an assumption, or a building design specification shall be identified and documented.

9.1.5.2 Sources of data shall be characterized as to the degree of conservatism reflected, and a justification for the source shall be provided.

9.1.6 Final Determination. The AHJ shall make the final determination as to whether the performance objectives have been met.

9.1.7* Maintenance of Design Features.

9.1.7.1 The design features and management operational system required for the building or historic district to continue to meet the performance goals and objectives of this code shall be maintained for the life of the building or historic district.

9.1.7.2 This management operational system shall include complying with all documented assumptions and design specifications.

9.1.7.3 Any variations to the management operational system shall require the approval of the AHJ prior to the actual change. (See also 7.9.1.)

9.1.8 Special Definitions. A list of special terms used in this chapter is as follows:

- (1) **Design Fire Scenario.** See 3.3.86.1.
- (2) **Design Specification.** See 3.3.20.
- (3) **Design Team.** See 3.3.21.
- (4) **Exposure Fire.** See 3.3.27.

- (5) **Fire Model.** See 3.3.32.
- (6) **Fire Scenario.** See 3.3.86.2.
- (7) **Fuel Load.** See 3.3.39.
- (8) **Incapacitation.** See 3.3.53.
- (9) **Input Data Specification.** See 3.3.55.
- (10) **Occupant Characteristics.** See 3.3.66.
- (11) **Performance Criteria.** See 3.3.69.
- (12) **Proposed Design.** See 3.3.76.
- (13) **Safety Factor.** See 3.3.84.
- (14) **Safety Margin.** See 3.3.85.
- (15) **Sensitivity Analysis.** See 3.3.89.
- (16) **Stakeholder.** See 3.3.93.
- (17) **Uncertainty Analysis.** See 3.3.95.
- (18) **Verification Method.** See 3.3.96.

9.2 Performance Criteria.

9.2.1 General.

9.2.1.1 An historic structure or district shall meet the performance criteria for life safety and historic preservation.

9.2.1.2 Each design shall meet the objectives specified in Section 4.3, if, for each design fire scenario, assumption, and design specification, the performance criteria in 9.2.2 are met.

9.2.2 Performance Criteria.

9.2.2.1* Life Safety Performance Criteria. Any occupant who is not intimate with ignition shall not be exposed to instantaneous or cumulative untenable conditions.

9.2.2.2* Historic Preservation Performance Criteria. Historically significant rooms, spaces, or contents shall not be exposed to instantaneous or cumulative fire effects that cause irreversible damage.

9.3 Retained Prescriptive Requirements.

9.3.1* Systems and Features. All fire protection systems and features of the building shall comply with applicable NFPA standards for those systems and features.

9.3.2* Means of Egress. Features of the means of egress not specifically addressed in the performance criteria shall comply with NFPA 101.

9.4 Design Specifications and Other Conditions.

9.4.1* Clear Statement. Design specifications and other conditions used in the performance-based design shall be demonstrated to the AHJ to be realistic and sustainable.

9.4.2 Assumptions and Design Specifications Data.

9.4.2.1 Each assumption and design specification used in the design shall be accurately translated into input data specifications as appropriate for the calculation method or model.

9.4.2.2 Any assumptions and design specifications that the design analyses do not explicitly address or incorporate and are, therefore, omitted from input data specifications shall be identified, and a sensitivity analysis of the consequences of that omission shall be performed.

9.4.2.3 Any assumptions and design specifications that are modified in input data specifications because of limitations in test methods or other data generation procedures shall be identified, and a sensitivity analysis of the consequences of the modification shall be performed.

9.4.3* Building Characteristics. Characteristics of the building or its contents, equipment, or operations that are not inherent in the design specifications but affect occupant behavior or the rate of hazard development shall be explicitly identified.

9.4.4* Operational Status and Effectiveness of Building Features and Systems. The performance of fire protection systems and building features shall reflect the documented performance of the components of those systems or features unless design specifications are incorporated to modify the expected performance.

9.4.5 Occupant Characteristics.

9.4.5.1 General.

9.4.5.1.1* The selection of occupant characteristics to be used in the design calculations shall be approved by the AHJ and shall provide an accurate reflection of the expected population of building occupants.

9.4.5.1.2 Occupant characteristics shall not vary across fire scenarios except as authorized by the AHJ.

9.4.5.2* Response Characteristics. Each of the following basic performance response characteristics shall be considered:

- (1) Sensibility
- (2) Reactivity
- (3) Mobility
- (4) Susceptibility

9.4.5.2.1 These estimations shall reflect the expected distribution of characteristics of a population appropriate to the use of the building.

9.4.5.2.2 The source of data for these characteristics shall be documented.

9.4.5.3 Location. The assumption shall be made that in every normally occupied room or area, at least one person shall be located at the most remote point from the exits.

9.4.5.4* Number.

9.4.5.4.1 The design shall be based on the maximum number of people that every occupied room or area is expected to contain.

9.4.5.4.2 Where success or failure of the design is contingent on a maximum number of occupants, operational controls shall be used.

9.4.5.5* Staff Assistance. The ability of trained employees to be included as part of the fire safety system shall be identified, and the necessary training and capabilities shall be documented.

9.4.6 Emergency Response Personnel. Design characteristics or other conditions related to the availability, speed of response, effectiveness, roles, and other characteristics of emergency response personnel shall be specified or characterized sufficiently for evaluation of the design.

9.4.7* Post-Construction Conditions. Design characteristics or other conditions related to activities during the life of the building that affect the ability of the building to meet the stated goals and objectives shall be specified, estimated, or characterized sufficiently to evaluate the design.

9.4.8 Off-Site Conditions. Design characteristics or other conditions related to resources or conditions outside the property being designed that affect the ability of the building to meet the stated goals and objectives shall be specified, estimated, or characterized sufficiently to evaluate the design.

9.4.9* Consistency of Assumptions. The design shall not include mutually inconsistent assumptions, specifications, or statements of conditions.

9.4.10* Special Provisions. Additional provisions not covered by Section 9.4 but that are required for the design to comply with the performance objectives shall be documented.

9.5 Design Fire Scenarios.

9.5.1* General.

9.5.1.1 The AHJ shall approve the parameters involved with design fire scenarios.

9.5.1.2 The proposed design shall meet the goals and objectives if it achieves the performance criteria for each required design fire scenario. (See 9.5.3.)

9.5.2* Evaluation.

9.5.2.1 Design fire scenarios shall be evaluated using a method acceptable to the AHJ and appropriate for the conditions.

9.5.2.2 Each scenario shall be challenging but realistic with respect to at least one of the following scenario specifications:

- (1) Initial fire location
- (2) Early rate of growth in fire severity
- (3) Smoke generation

9.5.2.3 The scenario specifications shall be as challenging as could realistically occur in the building.

9.5.3* Required Design Fire Scenarios.

9.5.3.1 Scenarios selected as design fire scenarios shall include, but not be limited to, those specified in 9.5.3.2 through 9.5.3.9.

9.5.3.1.1 Each scenario shall include a life safety aspect (Part A) and a building protection aspect (Part B), when applicable.

9.5.3.1.2 Design fire scenarios demonstrated by the design team to the satisfaction of the AHJ as inappropriate for the building use and conditions shall not be required.

9.5.3.2* Design Fire Scenario 1. This scenario shall be an occupancy-specific design fire scenario that is representative of a typical fire for the occupancy.

9.5.3.2.1 This scenario shall explicitly account for the following:

- (1) Occupant activities, number, and location
- (2) Room size
- (3) Nature and significance of furnishings and contents
- (4) Fuel properties and ignition sources
- (5) Ventilation conditions

9.5.3.2.2 The first item ignited and its location shall be explicitly defined.

9.5.3.3* Design Fire Scenario 2. This scenario shall be an ultrafast-developing fire in the primary means of egress, with interior doors open at the start of the fire.

9.5.3.3.1 Part A. This design fire scenario shall address reducing the number of available means of egress.

9.5.3.3.2 Part B. This design fire scenario shall address reducing the effects of a rapidly spreading fire on interior finish and structural components.

9.5.3.4* Design Fire Scenario 3. This scenario shall be a fire, starting in a normally unoccupied room, that potentially can endanger a large number of occupants in a large room or other area.

9.5.3.4.1 Part A. This design fire scenario shall address a fire that starts in a normally unoccupied room and migrates into the space that potentially can hold the greatest number of occupants in the building.

9.5.3.4.2 Part B. This design fire scenario shall address a fire that starts in an unoccupied space, that potentially can grow and endanger the area of greatest historical significance.

9.5.3.5* Design Fire Scenario 4. This scenario shall be a fire that originates in a concealed wall or ceiling space that is adjacent to a large number of occupants in a large room.

9.5.3.5.1 Part A. This design fire scenario shall address the concern of a fire that originates in a concealed space that does not have either a detection system or suppression system, and that spreads into the room within the building that potentially can hold the greatest number of occupants.

9.5.3.5.2 Part B. This design fire scenario shall address a fire that originates in a concealed space that does not have either a detection system or a suppression system, that potentially can grow and endanger the area of greatest historical significance.

9.5.3.6* Design Fire Scenario 5. This scenario shall be a slow-developing fire that is shielded from fire protection systems and is in close proximity to a high-occupancy area.

9.5.3.6.1 Part A. This design fire scenario shall address a relatively small ignition source that causes a significant fire.

9.5.3.6.2 Part B. This design fire scenario shall address a relatively small ignition source that causes a significant fire that can potentially endanger the area of greatest historical significance as the result of the delayed suppression of the fire.

9.5.3.7* Design Fire Scenario 6.

9.5.3.7.1 This scenario shall be the most severe fire that results from the largest possible fuel load that is characteristic of the normal operation of the building.

9.5.3.7.2 This scenario shall address the concern of a rapidly developing fire with occupants present.

9.5.3.8* Design Fire Scenario 7.

9.5.3.8.1 This scenario shall be an outside exposure fire.

9.5.3.8.2 This scenario shall address a fire that starts remotely from the area of concern and either spreads into the area, blocks escape from the area, or develops untenable conditions within the area.

9.5.3.9* Design Fire Scenario 8. This scenario shall be a fire that originates in ordinary combustibles in a room or area with

each passive or active fire protection system rendered unavailable one by one.

9.5.3.9.1 This set of design fire scenarios shall address each fire protection system or fire protection feature, considered individually, being unreliable or unavailable.

9.5.3.9.2* Design Fire Scenario 8 shall not be required for fire protection systems where the level of reliability in conjunction with the design performance in the absence of the system is acceptable to the AHJ.

9.5.4 Design Fire Scenario Data.

9.5.4.1 Each design fire scenario used in the performance-based design proposal shall be translated into input data specifications, as appropriate, for the calculation method or model.

9.5.4.2 Any design fire scenario specifications that the design analyses do not explicitly address or incorporate, and are, therefore, omitted from input data specifications, shall be identified, and a sensitivity analysis of the consequences of that omission shall be performed.

9.5.4.3 Any design fire scenario specifications modified in input data specifications because of limitations in test methods or other data generation procedures shall be identified, and a sensitivity analysis of the consequences of the modification shall be performed.

9.6 Evaluation of Proposed Design.

9.6.1* General.

9.6.1.1 A proposed design's performance shall be assessed relative to each performance objective in Section 4.3 and to each applicable scenario in Section 9.5, with the assessment conducted through the use of appropriate calculation methods.

9.6.1.2 The AHJ shall approve the choice of assessment methods.

9.6.2 Use. The design professional shall use the assessment methods to demonstrate that the proposed design will achieve the goals and objectives as measured by the performance criteria, in light of the safety margins and uncertainty analysis, for each scenario, given the assumptions.

9.6.3 Input Data.

9.6.3.1 Data.

9.6.3.1.1 Input data for computer fire models shall be obtained in accordance with ASTM E1591, *Standard Guide for Obtaining Data for Fire Growth Models*.

9.6.3.1.2 Data for use in analytical models that are not computer-based fire models shall be obtained using appropriate measurement, recording, and storage techniques to ensure the applicability of the data to the analytical method being used.

9.6.3.2 Data Requirements. A complete listing of input data requirements for all models, engineering methods, and other calculation or verification methods that are required or proposed as part of the performance-based design shall be provided.

9.6.3.3* Uncertainty and Conservatism in Data. Uncertainty in input data shall be analyzed and, as determined appropriate by the AHJ, addressed through the use of conservative values.

9.6.4* Output Data. The assessment methods used shall accurately and appropriately produce the required output data from input data based on the design specifications, assumptions, and scenarios.

9.6.5 Validity. Evidence shall be provided confirming that the assessment methods are valid and appropriate for the proposed building, use, and conditions.

9.7* Safety Factors. Approved safety factors shall be included in the design methods and calculations to reflect uncertainty in the assumptions, data, and other factors associated with the performance-based design.

9.8 Documentation Requirements.

9.8.1* General.

9.8.1.1 All aspects of the design, including those described in 9.8.2 through 9.8.13, shall be documented.

9.8.1.2 The format and content of the documentation shall be acceptable to the AHJ.

9.8.2* Technical References and Resources.

9.8.2.1 The AHJ shall be provided with sufficient documentation to support the validity, accuracy, relevance, and precision of the proposed assessment methods.

9.8.2.2 The engineering standards, calculation methods, and other forms of scientific information provided shall be appropriate for the particular application and methodologies used.

9.8.3 Building Design Specifications. All details of the proposed building design that affect the ability of the building to meet the stated goals and objectives shall be documented.

9.8.4 Performance Criteria. Performance criteria, with sources, shall be documented.

9.8.5 Occupant Characteristics. Assumptions made about occupant characteristics shall be documented.

9.8.6 Design Fire Scenarios. Descriptions of design fire scenarios shall be documented.

9.8.7 Input Data. Input data to models and assessment methods, including a sensitivity analysis, shall be documented.

9.8.8 Output Data. Output data from models and assessment methods, including a sensitivity analysis, shall be documented.

9.8.9 Safety Factors. Safety factors utilized shall be documented.

9.8.10 Prescriptive Requirements. Retained prescriptive requirements shall be documented.

9.8.11* Modeling Features.

9.8.11.1 Assumptions made by the model user and descriptions of models and methods used, including known limitations, shall be documented.

9.8.11.2 Documentation shall be provided that indicates the validity and appropriateness of the assessment methods used to address the design specifications, assumptions, and scenarios.

9.8.12 Evidence of Modeling Capability. The design team's relevant experience with the models, test methods, databases, and other assessment methods used in the performance-based design proposal shall be documented.

9.8.13 Use of Performance-Based Design Option. Design proposals shall include documentation that provides anyone involved in ownership or management of the building with notification of the following:

- (1) The building was approved as a performance-based design with certain specified design criteria and assumptions.
- (2) Any remodeling, modification, renovation, change in use, or change in the established assumptions shall require a re-evaluation and re-approval.
- (3) All special events shall be reviewed and approved based upon the designs developed under this chapter.

9.9 Records. Records required in this section shall be maintained for the life of the current performance-based design.

9.10* Security Planning. The governing body of a historic structure, or a designated representative, shall be responsible for security planning.

9.10.1* Security planning shall include a security vulnerability assessment (SVA) that evaluates the historic structure's vulnerability to hazards and security risks, as well as the facility's overall preparedness and resiliency.

9.10.2* The SVA shall evaluate all of the following:

- (1)* Threats from vandalism
- (2) Threats from conditions that increase the risk of arson
- (3) Threats from acts of terrorism
- (4) Threats posed by construction, alteration, or renovation projects
- (5) Impact of security countermeasures on the historic character, integrity, and character-defining features of the historic structure and its cultural landscape

9.11 Security Plan.

9.11.1* The security plan shall include countermeasures satisfying the goals and objectives from Chapter 4 for the potential threats identified in the SVA.

9.11.2* Security measures shall not compromise life safety requirements.

9.11.3* Security measures shall be selected and designed to maintain the historic character, integrity, and character-defining features of the historic structure and its cultural landscape.

9.11.4* The governing body of the historic structure shall review and revise the security plan when changes occur that affect the security of the property.

Chapter 10 Management Operational Systems

10.1* General.

10.1.1 Chapter 10 shall apply to historic buildings having on-site trained staff when the building is open to the general public or otherwise occupied.

10.1.2 Chapter 10 shall establish criteria for management operational systems that are acceptable as elements of a

prescriptive solution or a performance-based approach, as provided in 4.4.4.

10.1.3 Other operational control features shall be permitted subject to the approval of the AHJ.

10.2* Responsibility/Authority.

10.2.1* The governing body for the building and site shall designate a fire safety manager in accordance with 1.5.1.

Δ 10.2.2 The fire safety manager shall be responsible for the implementation and maintenance of the management operational system, including, but not limited to, the following:

- (1) Directing the actions of building staff and occupants with regard to fire safety
- (2) Entering into legally binding contractual agreements with the AHJ
- (3) Ordering required fire safety drills and exercises
- (4) Halting contractor and maintenance operations that could threaten the fabric or contents of the building

10.2.3 When a fire is deemed suspicious, the fire safety manager shall take steps to ensure that the fire is reported and the scene is secured pending investigation.

10.3* Management Plan.

10.3.1 The fire safety management plan shall consist of required elements, as set forth in 10.4 through 10.12, and optional elements as agreed to by the property manager and the AHJ.

10.3.2 The fire safety management plan shall be approved by the AHJ.

10.4 Operational Requirements.

Δ 10.4.1* Operational controls or a plan of operations shall be developed and include all special provisions defined by the project team and approved by the AHJ.

10.4.2* Operational controls shall include the special provisions pertaining to the management, operations, and stewardship of the historic property.

10.4.3* Operational controls shall be defined as part of the option appraisal.

10.5 Fire Emergency Response Plan.

10.5.1 The fire safety manager and the owner or governing body shall develop and implement an emergency response plan, subject to the approval of the AHJ.

10.5.2 The plan shall include provisions for notifying the fire department of the type and location of the emergency and directing them to the location when they arrive at the property.

10.5.3 Emergency telephone numbers shall be posted on or adjacent to all telephones.

10.5.4 An emergency evacuation plan shall be prepared in cooperation with the local fire department and other applicable authorities and updated annually.

Δ 10.5.5 The emergency evacuation plan shall include the following:

- (1) Fire safety precautions for special events and celebrations when normal operational conditions that impact life safety are changed

- (2) Necessary adjustments to fire safety precautions for temporary and special exhibits
- (3) Modification of staff training and drills to adjust for circumstances and visitation created by special events and exhibits
- (4) Provisions to notify the local fire department of special events

10.6 Training.

10.6.1 The fire safety manager shall develop an approved training plan.

10.6.2 The fire safety manager, building staff, and volunteers shall receive training in accordance with the approved training plan specified in 10.6.1.

N 10.6.3 Training shall include the fire emergency response plan, use of fire protection equipment, and other elements of the approved management plan.

10.7 Drills.

10.7.1 Drills shall be conducted to reinforce training and evaluate staff and volunteer preparedness, at intervals agreed upon by the fire safety manager and the AHJ, but in no event less than annually.

10.7.2 Where required, the AHJ shall be notified in advance of all scheduled drills.

Δ 10.7.3 Additional training shall be required when any of the following conditions occurs:

- (1) Use, occupancy, structure, or internal layout of the building changes.
- (2)* Drills indicate that staff or volunteers are not sufficiently familiar with the facility's fire safety management plan and fire protection equipment to respond properly under emergency conditions.
- (3) Special events having unusual occupancies or conditions are scheduled.
- (4) Portable fire extinguishers constitute a part of the fire safety management plan.
- (5)* Introduction of new materials, substances, or products into the building.

10.8 Record Keeping.

10.8.1 The fire safety manager shall be responsible for maintaining records for the fire safety management plan and management operational system.

10.8.2 Records shall be made available to the AHJ on request.

10.8.3 Records shall include the following:

- (1) Training of staff and volunteers, including fire evacuation drills and use of portable fire extinguishers
- (2) Inspection, testing, and maintenance reports for all fire safety equipment and systems, including records of actions taken to correct deficiencies
- (3) As-built plans, specifications, wiring and layout diagrams, and acceptance test reports for all fire protection systems including detection, alarm, and suppression systems
- (4) Fire emergency response plan
- (5) Inspection reports by local code enforcement officials, the AHJ, local fire service officials, and insurance loss control representatives, including records of action taken to correct deficiencies identified during each inspection

- (6) Fire protection system(s) activation and alarm reports, complete with the cause of the alarm or activation, the response, and the corrective action(s) taken
- (7) Full reports, including cause, extent of damage, response, and recovery of all fire incidents
- (8) Operational requirements as defined in the approved fire safety management plan
- (9) Additional records as required by the AHJ

10.9 Periodic Compliance Audit.

10.9.1 The periodic compliance audit shall be conducted at intervals identified in the approved fire safety management plan, but not less than annually.

10.9.2 Additional compliance audits shall be conducted prior to special events (*see Chapter 16*).

10.9.3 Closing Conference.

10.9.3.1 The compliance audit shall include a closing conference with the fire safety manager and the governing body of the building upon completion of the periodic compliance audit.

10.9.3.2 The closing conference shall identify all areas of noncompliance with the approved fire safety management plan.

10.9.3.3 Following the periodic compliance audit, any deficiencies shall be addressed, with corrective action taken and documented in the fire safety log or as specified in the historic property's approved fire safety management plan.

10.10* Enforcement. Where a compliance audit reveals noncompliance with the approved fire safety management plan or changes in the use or arrangement of the building, the AHJ shall be notified.

10.11 Modification of Plan. Proposed modification to the fire safety management plan shall be approved by the AHJ.

10.12* Procedures for Opening and Closing. The property management plan shall include checklists identifying specific action required in conjunction with opening and closing the building on a daily basis and for any special events that are held at the property.

Chapter 11 Fire Prevention

11.1 General. This chapter establishes minimum criteria for fire prevention in the operation of historic buildings and districts.

11.2 Decorations.

- ▲ **11.2.1*** Decorative materials shall be noncombustible or be treated with an approved fire-retardant coating.

11.2.2* Clearance between decorations and sources of ignition shall be not less than 36 in. (915 mm).

11.2.3 Draperies, curtains, and other similar loosely hanging furnishings and decorations shall meet the flame propagation performance criteria contained in NFPA 701.

- ▲ **11.2.4*** Fire-retardant treatment of historically significant fabrics shall not be required where such treatment will cause damage to the fabric.

N 11.2.4.1* The provision of 11.2.4 shall apply only on an object-by-object basis.

N 11.2.4.2 Approved alternative protection measures shall be implemented.

11.2.5 The use of combustible vegetation, including natural cut Christmas trees, shall be in accordance with Section 10.14 of NFPA 1.

11.3 Fire Spread Control.

11.3.1 Interior doors shall be kept closed when the building is not occupied except as permitted in 11.3.2.

11.3.2 A risk analysis shall be performed where doors remain open for any of the following reasons:

- (1) To permit interior ventilation
- (2) To permit air movement critical to the conservation of historic building fabric
- (3) Where interior doors are part of the historic fabric

N 11.3.2.1 The risk analysis required by 11.3.2 shall be documented.

N 11.3.2.2 Alternative methods of controlling fire spread shall be implemented.

11.4* Housekeeping.

11.4.1 Means of Egress. Stairs, corridors, doors, and any other portions of the means of egress for a building shall be maintained free of obstructions, combustibles, trash containers, and other materials.

11.4.2 Attics and Crawl Spaces.

▲ **11.4.2.1** Attics and crawl spaces shall be locked or otherwise secured.

▲ **11.4.2.2** Combustible materials shall not be stored in attics or crawl spaces unless such spaces are protected by approved automatic suppression systems.

11.4.3 Utility Rooms and Spaces.

N 11.4.3.1 Electrical rooms, mechanical rooms, and telephone closets shall be kept free of combustible materials.

N 11.4.3.2 Utility rooms and closets shall be locked or otherwise secured.

11.4.4* Air Handling Equipment. Air handling equipment shall be cleaned as frequently as necessary to prevent the buildup of combustible dusts and fibers in accordance with manufacturers' guidelines.

11.4.5 Voids. Void spaces shall be kept clean and free of combustible materials.

11.4.6 Plenums.

11.4.6.1 Plenums shall not be used for occupancy or storage. [90A:4.3.11.1.1]

11.4.6.2 Accessible abandoned material shall be deemed to be in storage and shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved. [90A:4.3.11.1.2]

11.4.6.3 The materials contained within plenums shall comply with NFPA 90A.

11.4.7 Flammable and Combustible Liquids.

N 11.4.7.1 Rags, clothing, and waste material contaminated with oils, such as animal or vegetable oils, paints, thinners, wax, furniture polish, and other liquids or compounds that could cause spontaneous heating shall be kept isolated from other combustibles and shall be stored in metal containers with tight-fitting metal lids.

11.4.7.2 Ventilated metal lockers shall be provided for storage of highly combustible supplies and workers' clothing contaminated with combustible or flammable liquids.

11.4.7.3 Flammable liquids shall be stored in approved safety containers in accordance with NFPA 30.

11.4.8 Combustible Packing Materials.

11.4.8.1* Combustible packing materials shall be stored in approved metal containers with self-closing covers.

Δ 11.4.8.2 Where packing materials cannot be protected using metal containers with self-closing covers, dedicated crating and packing areas shall be enclosed by fire barriers having a 1-hour fire-resistance rating, or they shall be protected by an approved automatic sprinkler system.

11.4.9 Trash and Trash Containers.

11.4.9.1 Trash shall be collected and disposed of at the end of each work day and more often if necessary to prevent the accumulation of waste.

11.4.9.2 Containers used for bulk collection of trash or recyclable paper shall be constructed of metal with metal covers.

11.4.9.3 Dumpsters and other large trash containers inside buildings shall be stored as follows:

- (1) In trash rooms having both approved automatic sprinklers and a 1-hour fire resistance rating
- (2) In loading dock areas, separated from the rest of the building with a 2-hour fire resistance rating or 1-hour fire resistance rating and protected with automatic sprinklers

11.4.9.4 Trash containers, dumpsters, and other central waste-disposal units, located outside, shall be a minimum distance of 15 ft (4.6 m) from all parts of a building exterior, including but not limited to, windows, doors, roof eaves, and utility controls.

11.5 Smoking.

11.5.1 Smoking shall be prohibited except for within designated, exterior smoking areas complying with 11.5.2 through 11.5.5.

11.5.2 Smoking areas shall be clearly and publicly identified.

11.5.3 Smoking areas shall be provided with noncombustible ashtrays or other receptacles for the proper disposal of smoking materials.

N 11.5.4 Smoking areas shall be located not less than 15 ft (4.6 m) from any portion of a historical structure, or as required by local code, whichever is greater.

11.5.5 Smoking areas shall be provided with not less than one portable fire extinguisher, selected and installed in accordance with NFPA 10.

11.6 Open Flame Use.

11.6.1 Approval. Use of open flames and flame-producing devices, including but not limited to candles, oil lamps, fireplaces, forges, kilns, glassblowers, and cook stoves shall be permitted only where approved by the AHJ.

11.6.2 Hot Work. Hot work shall only be permitted when performed in accordance with 14.5.1.

11.6.3 Precautions. The following precautions shall be taken to control open flame and flame-producing devices:

- (1) All employees working around open flame or flame-producing devices shall be trained in the proper use and operation of the device, emergency response procedures, and portable fire extinguisher use.
- (2) Open flames and flame-producing devices shall be monitored constantly by a trained person.
- (3) A fire extinguisher selected in accordance with NFPA 10 shall be located within 30 ft (9.15 m) of the area where open flames or flame-producing devices are in use.
- (4) Candles shall be kept a minimum of 4 ft (1.22 m) from combustible window treatments and wall or ceiling hangings.
- (5) Fireplaces shall be covered with a fire screen when not used for cooking or similar demonstrations.
- (6) Open flames within 100 ft (31 m) of the building shall not be left unattended.
- (7) The use of open flames either inside or outside the building shall be extinguished prior to shutdown of the facility to ensure that the flame is completely extinguished.

11.6.4 Chimneys.

11.6.4.1 Fireplaces or stoves shall be used only where chimneys are in accordance with NFPA 211.

11.6.4.2 Fireplaces or stoves shall be used only where chimneys are lined, provided with a spark arrester, and maintained in good working order.

11.6.4.3 Chimneys serving active fireplaces or stoves shall be inspected and cleaned annually.

11.7 Electrical Systems.

11.7.1 Exposed electrical wiring of any type or extension cords shall not be placed across any means of egress.

11.7.2* All electrical appliances, fixtures, or wiring shall be maintained in accordance with NFPA 70.

Δ 11.7.3 Permanent wiring abandoned in place shall comply with 11.7.3.1 or 11.7.3.2.

N 11.7.3.1 Permanent wiring abandoned in place shall be tagged or otherwise identified at its termination and junction points as "Abandoned in Place."

N 11.7.3.2 Permanent wiring abandoned in place shall be removed from all accessible areas and insulated from contact with other live electrical wiring or devices.

N 11.7.4 Where wiring is removed from accessible areas, penetrations through fire-resistance-rated assemblies shall be protected in accordance with the applicable building code.

11.7.5* Electrical circuits throughout historic structures shall be protected with arc fault circuit interrupters (AFCIs). The

AFCIs shall be installed in the same manner as required in *NFPA 70* or other applicable code.

11.7.6 Portable electrical appliances shall be provided with thermal and electrical limit controls that will cause the appliance to fail in a safe condition.

11.7.7 Decorative lighting and similar accessories used for holiday lighting and similar purposes shall comply with Articles 410 and 590 of *NFPA 70* or other applicable code.

11.8 Cabling.

11.8.1 Communication cabling, such as telecommunication, network, and protective systems cabling, including optical fiber cabling and cable systems, shall comply with the requirements of *NFPA 70* or other applicable code.

11.8.2 Where any such cabling penetrates fire barriers or fire walls, such penetrations shall be protected in accordance with the applicable building code.

11.9 Heating, Ventilating, and Air-Conditioning (HVAC) Systems.

11.9.1 Heating and air-conditioning systems shall be maintained in accordance with the manufacturer's specifications and applicable standards.

11.9.2 Equipment shall be maintained in accordance with the standards identified in 15.6.1.

11.9.3 Heating equipment and ductwork shall be kept free of flammable and combustible deposits.

11.9.4 Portable Heaters.

11.9.4.1 The AHJ shall be permitted to prohibit the use of portable heaters in occupancies or situations where such use or operation would present an undue danger to life or property.

11.9.4.2 Portable heaters shall be located so they cannot be overturned.

11.9.4.3 All portable heaters shall be equipped with an automatic shutoff that activates when the unit is tilted or turned over.

11.9.5 The use of unvented fuel-fired heating equipment shall be prohibited in historic buildings.

11.10 Commercial Cooking and Food Service Operations.

11.10.1 Cooking shall be performed in kitchen facilities.

11.10.2 Kitchens shall be maintained in a clean and orderly manner.

Δ 11.10.2.1 Surfaces and equipment shall be kept free of grease.

N 11.10.2.2 Food wastes shall be disposed of promptly.

11.10.2.3 Means of egress from kitchens shall be maintained free of trash containers and other materials.

11.10.3 Listed residential cooking appliances shall be permitted in kitchens, and shall be installed and maintained in accordance with their listings.

11.10.4 Residential cooking appliances in kitchens that are not used for commercial cooking and are ancillary to the operation of the building, and where cooking does not produce

grease-laden vapors, shall be provided with a listed household/consumer hood.

11.10.5 Listed commercial cooking appliances shall be provided with a hood and exhaust system, grease removal devices, auxiliary equipment, and fire-extinguishing equipment in compliance with *NFPA 96*.

11.10.6 Equipment shall be used, inspected, and maintained in compliance with *NFPA 96*.

11.10.7 Only nonflammable cleaners shall be used.

11.10.8 Open-flame food warming devices shall be permitted to be used in constantly attended areas other than kitchens in accordance with 11.6.3 and where approved.

N 11.10.9 Not less than one portable fire extinguisher shall be provided in accordance with 11.10.9.1 and 11.10.9.2.

Δ 11.10.9.1 A portable fire extinguisher as required by *NFPA 10* shall be located within 10 ft (3.1 m) of any cooking, warming, or related operation.

N 11.10.9.2 The location of the portable fire extinguisher required by 11.10.9.1 shall be marked with a sign complying with *NFPA 10*.

11.11 Access.

11.11.1 An approved location at the site shall be designated as a command center and shall contain materials including the following:

- (1) Floor plans
- (2) Utility central plans
- (3) Emergency contact telephone numbers
- (4) Labeled keys
- (5) Appropriate safety data sheets
- (6) Other material as required by the AHJ

11.11.2 Where security is of concern, an approved lockbox or other secure container shall be provided for the information identified in 11.11.1.

11.12 Fire Proofing. The fire safety manager shall inspect accessible structural fire proofing annually to ensure the material is in place and maintained in good condition.

11.13 Lightning Protection. The fire safety manager shall ensure that lightning protection systems, where installed, are inspected and maintained in good working condition by qualified personnel. See *NFPA 780*.

11.14 Protection from Wildland Fires.

Δ 11.14.1 The governing body of a historic structure or district located in a wooded area or surrounded by fire-prone vegetation or heavy brush shall incorporate the requirements of *NFPA 1144* or other applicable code into the fire safety management component of the protection plan.

11.14.2 Reduction of fuel loading in the landscape surrounding and owned by the historic structure shall be implemented in accordance with the requirements of *NFPA 1144* or other applicable code.

11.14.3 Where the landscape is historic and either a contributing element to the property's historic designation, or designated itself, the governing body shall obtain the evaluation and recommendation of a professional historic landscape architect

for reducing fire loading that could threaten either the historic structure or the historic landscape.

11.14.4 The evaluation shall include an analysis with respect to the requirements of NFPA 1144 or other applicable code.

11.14.5 The resulting recommendations of the evaluation shall be included in the fire safety management component of the protection plan.

11.14.6 Access roads shall be maintained and kept fully accessible at all times to accommodate fire service vehicles.

11.15 Water Control. Provisions shall be made for removal of accumulated water from manual and automatic fire fighting operations.

Chapter 12 Security

12.1 Security Systems.

12.1.1* General. Where the security plan requires physical security devices, they shall be installed and maintained in accordance with the manufacturer's specifications.

12.1.2* Electronic Premises Security Systems.

12.1.2.1 Where required by the security plan, an electronic premises security system shall be designed, installed, and maintained by qualified persons in accordance with NFPA 731.

12.1.2.2 Electronic premises security systems shall be installed in compliance with NFPA 731.

12.1.2.3 The following documentation, upon final acceptance of every system, shall be delivered to the party responsible for the protected premises:

- (1) Owner's manual
- (2) User's instructions
- (3) A record of completion by the system installer
- (4) Name and contact telephone number of the organization maintaining the electronic premises security system
- (5) Name and contact telephone number of the organization monitoring the electronic premises security system displayed at the control unit
- (6) Any other documentation required by law or the AHJ

12.1.2.4 Where required by the security plan, emergency communication systems shall comply with NFPA 72.

12.2* Access Control.

12.2.1* Where required by the security plan, electronic access control systems shall be designed, installed, and maintained by qualified persons in accordance with NFPA 731.

12.2.2* Where locking devices are required by the security plan, a key management strategy shall be implemented.

12.3* Video Surveillance Systems. Where required by the security plan, video surveillance systems shall be designed, installed, and maintained by qualified persons in compliance with NFPA 731.

12.4* Exterior Lighting Systems. Where required by the security plan, exterior lighting systems shall be designed, installed, and maintained in accordance with the manufacturer's specifications.

12.5 Construction Areas.

12.5.1 Access to construction areas shall be restricted to personnel authorized by the owner or the contractor.

12.5.2* Where assigned, security officers shall receive daily updates from those responsible for construction on the status of and impairments to the fire protection equipment and security systems and on the status of special hazards, including hot work, modified access routes, and emergency procedures.

12.5.3 Existing electronic premises security systems and physical security systems shall be maintained in proper working order during the project to the extent practicable.

12.5.4 Openings that provide access into protected areas in the historic structure shall be covered or secured to prevent unauthorized access.

12.5.5 Ladders and stairways on scaffolding that provide access to upper levels of the historic property shall be secured to prevent unauthorized persons from using the scaffolding to gain access to the facility.

Chapter 13 Additions, Alterations, and Rehabilitation

13.1 General. Additions, alterations, and rehabilitation shall comply with the applicable building code and this code.

13.2 Construction Oversight.

13.2.1 Contractor Selection. Contractors selected to work on the project shall have a demonstrated knowledge of and experience in working with historic structures.

13.2.2 Initial Meeting/Indoctrination of Contractors.

13.2.2.1 Prior to beginning work on the project, an introductory meeting shall be held with the contractors, subcontractors, and representatives of the historic structure.

13.2.2.2 All persons involved with the construction process shall be thoroughly briefed on the significance and importance of the structure, spaces, and character-defining features, prior to beginning work.

13.2.2.3 The initial meeting shall cover the project fire safety program, as defined in Chapter 14.

13.2.3 Supervision During Construction. The governing body of the historic structure shall designate its own representative who shall have the authority to specify additional protection requirements for the construction project necessary to safeguard the existing facility and fabric.

13.2.3.1 The governing representative shall have the authority to enforce the historic structure's protection requirements and to stop work or other activities when the work or activities jeopardize the safety or security of the facility.

13.2.3.2 This supervision shall include the following:

- (1) Site security and monitoring of contractors and visitors
- (2) Isolation of construction from the existing building
- (3) Location and handling of flammable liquids and gases
- (4) Removal of rubbish and combustibles
- (5) Hot work and other sources of ignition
- (6) Handling of sprinklers and other fire protection system components

- (7) Location and type of portable extinguishers to be used in the proximity of historic fabric

13.2.3.3 Following suspension of work each day, the governing body representative or his or her designee shall conduct a walk-through of the work area and surroundings to ensure that the site is secured and hazards have been eliminated or controlled.

N 13.3* Fire Protection and Life Safety Systems Commissioning.

Where structures undergo additions, alterations, or rehabilitation, the impacted portions of fire and life safety systems shall be commissioned in accordance with NFPA 3.

13.4 Fire Spread Control.

13.4.1 New openings in fire-rated assemblies, such as doorways and duct penetrations, shall have self-closing or automatic fire doors and automatic fire dampers having fire resistance ratings in accordance with the applicable building code.

13.4.2 Penetrations in fire-rated assemblies, such as those around cabling, pipes, and ducts, shall be sealed with approved materials to maintain the integrity of the fire-rated assembly.

13.4.3 New elevator shafts, dumbwaiters, stairways, and other vertical openings through the structure shall be constructed in a manner that prevents the spread of fire, smoke, and heat from one level to another.

13.4.4 New doors in fire-rated assemblies required to remain in the open position for any reason shall be equipped with approved door-holding devices controlled by a listed smoke detector.

13.5 Fire Protection Systems.

13.5.1 Commercial Cooking Equipment. Commercial cooking equipment shall be protected in accordance with NFPA 96.

13.5.2 Fire Alarm Systems. Any fire alarm system shall be installed, tested, and maintained in accordance with the applicable requirements of NFPA 72.

13.5.2.1 Where automatic sprinklers are not installed, smoke detectors shall be installed in every area and space where ambient conditions permit.

13.5.2.2 Where ambient conditions will adversely affect the performance, reliability, and normal operation of smoke detectors, other forms of detection technology, such as heat detection, shall be used.

13.5.2.3 Alarm Monitoring.

13.5.2.3.1 Fire detection and alarm systems and automatic fire suppression systems shall transmit alarm, supervisory, and trouble signals to an approved monitoring facility.

13.5.2.3.2 The monitoring facility and the communications method used for alarm signal transmission shall comply with the requirements of NFPA 72.

13.5.3 Automatic Sprinkler Systems.

- Δ 13.5.3.1** Any automatic sprinkler system shall be in accordance with one of the following standards, in accordance with their scopes:

- (1) NFPA 13
- (2) NFPA 13D
- (3) NFPA 13R

13.5.3.2 Standard response sprinklers shall be permitted for use in light hazard areas.

13.5.4 Other Automatic Extinguishing Systems.

13.5.4.1 In any occupancy where the character of the potential fuel for fire is such that extinguishment or control of fire is effectively accomplished by a type of automatic extinguishing system other than an automatic sprinkler system, or where protection of the building's historic character will be optimized by a type of automatic extinguishing system other than an automatic sprinkler system, such systems shall be installed in accordance with this section.

- Δ 13.5.4.2** Other automatic extinguishing systems shall be installed, tested, and maintained in accordance with the applicable requirements of the standards identified in Table 13.5.4.2.

13.5.5 Portable Fire Extinguishers.

13.5.5.1 Portable fire extinguishers shall be selected, located, mounted, and maintained in accordance with NFPA 10.

13.5.5.2 One approved portable fire extinguisher shall be readily accessible on each floor near each usable stairway.

13.5.6 Standpipe Systems. Any standpipe and hose system shall be provided in accordance with NFPA 14.

13.6 Roof Coverings.

13.6.1 Unlisted combustible roof coverings shall be treated with an approved fire-retardant coating.

13.6.1.1 A fire-retardant coating shall not be required when it would harm historic fabric.

13.6.2 The facility shall maintain a record of this treatment, including certificates of approval of retardant, application method, and re-treatment schedule.

13.6.3 Fire-retardant coated roof coverings shall be re-treated in accordance with the manufacturer's specifications.

13.7 Electrical Systems.

13.7.1 The installation of all new electrical systems, appliances, and equipment shall be in accordance with NFPA 70 or other applicable code.

13.7.2 All existing electrical systems, appliances and equipment to be retained shall be fully evaluated and tested. All deficiencies and unsafe conditions shall be corrected to conform with NFPA 70 or other applicable code.

Δ Table 13.5.4.2 Fire Suppression System Installation Standards

Fire Suppression System	Installation Standard
Low-, medium-, and high-expansion foam	NFPA 11
Carbon dioxide	NFPA 12
Halon 1301	NFPA 12A
Water spray fixed	NFPA 15
Deluge foam–water sprinkler	NFPA 16
Dry chemical	NFPA 17
Wet chemical	NFPA 17A
Water mist	NFPA 750
Clean agent extinguishing	NFPA 2001

13.7.3 Emergency Power.

13.7.3.1 Emergency generators, where required, shall comply with the requirements of NFPA 110.

13.7.3.2 Emergency generators shall have sufficient capacity to support critical fire safety functions and fire suppression systems, where required.

13.7.3.3 Emergency generators that support other functions considered essential shall have sufficient capacity to support all functions with no degradation of fire safety system support.

13.8 Hazardous Areas. Newly constructed hazardous areas shall be separated from other areas by a fire separation with a minimum of 1-hour fire resistance rating.

13.9 Interior Finishes.

13.9.1 Newly installed interior finish materials shall prevent flames from spreading rapidly and generating dangerous amounts of smoke and toxic products of combustion.

13.9.2 Newly installed interior finish materials shall comply with the requirements of the applicable building code.

13.10 Lightning Protection.

13.10.1 A lightning protection system, where required, shall be designed, installed, and maintained in accordance with NFPA 780.

13.10.2 Existing lightning protection systems shall be tested and repaired where necessary as part of the addition, alteration, or renovation work.

13.11 Protection from Wildland Fires.

13.11.1 The governing body or party responsible for cultural resource properties located in areas that are wooded or surrounded by fire-prone vegetation or heavy brush shall incorporate the requirements of NFPA 1144 into the facility's or institution's fire protection program and plan.

13.11.2 Reduction of fuel loading in the landscape surrounding and owned by the cultural resource property shall be implemented in accordance with the requirements of NFPA 1144.

13.11.3 Where the landscape is historic and either a contributing element to the property's historic designation, or is designated itself, the governing body or responsible party shall obtain a professional historic landscape architect evaluation and recommendation for reducing fire loading that could threaten either the cultural resource property or the historic landscape.

13.11.4 The evaluation shall include an analysis with respect to the requirements of NFPA 1144.

13.11.5 The resulting recommendations of the evaluation shall be included in the fire protection program and plan.

13.11.6 Access roads shall be maintained and kept fully accessible at all times to accommodate fire service vehicles.

N 13.12* Integrated Fire Protection and Life Safety Systems.

N 13.12.1 Where integrated fire protection and life safety systems are utilized, they shall be tested in accordance with NFPA 4.

N 13.12.2 An integrated systems test plan shall not be required for buildings with limited integrated systems. [4:4.5.3]

N 13.12.3 If an integrated system test plan is not required, integrated system testing is still required. [4:4.5.3.1]

13.13 Water Control. Provisions shall be made for removal of accumulated water from manual and automatic fire-fighting operations.

Chapter 14 Fire Precautions During Construction, Repair, and Alterations

14.1 General.

14.1.1* All persons involved with the design of the building, exhibits, and other aspects of the project shall have a demonstrated knowledge of the historic significance of the structure.

14.1.2* All persons involved with the construction process shall be thoroughly briefed on the significance and importance of the structure, spaces, and character-defining features, prior to the beginning of the work.

14.1.3* Contractor Selection. Contractors selected to work on the project shall have a demonstrated knowledge and experience in working with historic structures.

14.1.4* Contracts. All construction, alteration, or renovation contracts shall specify methods and responsibility for controlling fire hazards.

14.1.5* Initial Meeting/Indoctrination of Contractors. Prior to beginning work on projects, an introductory meeting shall be held with the contractors, subcontractors, and representatives of the historic structure in accordance with 13.2.2.

14.2 Fire Protection Systems.

14.2.1 Alterations or renovations of fire protection systems shall comply with the provisions of Section 13.5 and the applicable building code.

14.2.1.1 Temporary protection strategies using performance-based designs that incorporate nontraditional use of fire protection systems shall be permitted where such designs comply with the requirements of Chapter 9 of this code.

14.2.2 Alterations or renovations of fire protection systems shall be approved by the AHJ.

14.2.3 Impairments. The provisions of Section 15.4 shall apply when fire protection systems or equipment are taken out of service.

14.3 Precautions.

14.3.1 Contracts. All construction, alteration, or renovation contracts shall specify methods and responsibilities for controlling fire hazards.

14.3.2 Construction, alterations, and renovations shall comply with requirements for safeguarding construction activities in accordance with NFPA 241 and other applicable codes or standards.

14.3.3 Supervision.

14.3.3.1 Responsibility for enforcement of the terms of the contract relating to fire hazards shall be assigned, and authority shall be given to stop work pending correction of hazards.

14.3.3.2 The AHJ shall be consulted.

14.3.4 Temporary Enclosures.

14.3.4.1 Only noncombustible panels, flame-resistant tarpaulins, or approved materials of equivalent fire-retardant characteristics shall be used.

14.3.4.2 Any other fabrics or plastic films used shall be certified as conforming to the requirements of Test Method 2 contained in NFPA 701.

14.3.4.3 Where used to enclose structures, forming equipment, and similar items, the enclosing material shall be fastened securely or guarded by construction so it cannot be blown by the wind against heaters or other sources of ignition.

▲ 14.3.4.4 Fire extinguishers shall be accessible and protected from accidental damage in accordance with NFPA 10.

14.3.5 Smoking.

14.3.5.1 Smoking shall be prohibited inside any building, building space, or area under construction, renovation, or repair.

14.3.5.2 Where contractors and workers are permitted to smoke, the fire safety manager or the responsible party for the institution or property shall designate a smoking area outside of the work area at a distance approved by the AHJ.

14.3.5.3 The designated smoking area shall be clearly and publicly identified and shall be located a sufficient distance away from all combustible and flammable materials or liquids to prevent a fire from starting.

14.3.5.4 Receptacles for spent smoking materials shall be provided in the designated smoking area.

14.3.5.5 A portable fire extinguisher, in compliance with the provisions of NFPA 10, shall be located at each designated smoking area.

14.3.6 Ignition Sources.

14.3.6.1 Hot work operations shall comply with 14.5.1.

14.3.6.2 Portable heating appliances shall comply with 14.5.2.

14.3.6.3 On-site recharging of gas cylinders shall be prohibited.

14.3.6.4 Temporary lighting and wiring shall comply with the requirements of NFPA 70.

14.3.6.5 Gasoline-powered engines, such as those used in compressors and hoists, shall not be permitted inside the building.

14.3.7 Housekeeping.

14.3.7.1 The accumulation of debris or rubbish shall not be permitted inside construction areas or close to a source of ignition.

14.3.7.2 Debris and rubbish shall be removed daily from the site and shall not be burned in the vicinity.

14.3.7.3 Contractors shall provide metal receptacles with metal lids for rubbish, papers, and other debris.

14.3.7.4 Where construction debris is removed from the upper floors of a building, it shall be conveyed to containers by means of a chute erected on the outside of the building.

14.3.7.5 Where exterior chutes are used, the lower section of the chute shall be disconnected or removed to a point not less than 10 ft (3.1 m) above the dumpster at the close of each work day.

14.3.7.6 Burning waste materials on the premises shall not be permitted.

14.3.8 Flammable and Combustible Liquids. No more than a one-day supply of paint thinners, solvents, and other flammable and combustible liquids used in the project shall be kept in the building.

14.3.8.1 Flammable liquids shall be stored in approved safety cabinets and containers.

14.3.8.2 The provisions of NFPA 30 on limits of storage of flammable and combustible liquids inside buildings shall apply.

14.3.8.3 Quantities of flammable and combustible liquids in excess of those necessary to complete a day's work shall be stored at least 50 ft (15.2 m) away from the main construction project.

14.3.8.4 Gasoline-powered engines, such as those used in compressors and hoists, shall not be permitted inside the building.

14.3.9 Fire Protection Systems.

14.3.9.1 Fire Detection Systems.

14.3.9.1.1 Existing fire detection and alarm systems shall be maintained in working order during the project to the extent consistent with the nature of the construction.

14.3.9.1.2 Smoke detectors within the construction area shall be removed or shall be protected from dust, dirt, and extreme temperatures during construction.

14.3.9.1.3 Smoke detectors inside the construction area that are covered to keep out dust and dirt while work is in progress shall be uncovered at the end of each work day.

14.3.9.1.4 After final construction cleanup by all trades, all smoke detectors shall be cleaned or replaced in accordance with NFPA 72.

14.3.9.1.5 Reacceptance testing in accordance with NFPA 72 shall be performed after any adjustment, modification, or repair to any fire detection system wiring or component.

14.3.9.2 Fire Suppression Systems.

14.3.9.2.1 Automatic fire suppression systems shall be kept in working order during the project to the extent consistent with the nature of the construction.

14.3.9.2.2 Disconnected or shutoff standpipes or fire suppression systems shall be restored to service as soon as it is practical.

14.3.9.2.3 Inspections of standpipe and sprinkler valves shall be conducted and recorded in accordance with the provisions of NFPA 25.

14.3.9.2.4 Fire hydrants, sprinklers, standpipe and sprinkler fire department connections, and hose outlet valves shall not be obstructed and shall be maintained in accordance with NFPA 25.

14.4 Temporary Construction and Equipment.

14.4.1 Construction Offices and Sheds.

14.4.1.1 Temporary offices, trailers, sheds, and other temporary facilities of combustible construction shall comply with Chapter 4 of NFPA 241.

14.4.1.2 Heating devices used in construction offices and sheds shall be listed.

14.4.1.3 A minimum clearance of 36 in. (915 mm) shall be maintained around stoves and heaters, and a minimum clearance of 6 in. (152 mm) shall be maintained around all chimney and vent connectors, to prevent ignition of adjacent combustible materials.

14.4.1.4 Structures, equipment, and materials shall not impede egress of occupants or workers from the building or hinder access by fire apparatus to the building and hydrants.

14.4.1.5 The areas beneath all temporary offices and other facilities shall not be used for the storage of construction materials, equipment, or supplies, and measures shall be put in place to ensure that no combustible waste matter is allowed to accumulate in these areas.

14.4.2 Construction Equipment and Materials.

14.4.2.1 Equipment.

14.4.2.1.1 Internal combustion engine-powered air equipment, such as compressors, hoists, derricks, and pumps, shall be placed so the exhaust discharges away from combustible materials and air intakes for the building heating, ventilation, and air-conditioning (HVAC) system.

14.4.2.1.2 A minimum clearance of 6 in. (152 mm) shall be maintained between equipment exhaust piping and combustible materials.

14.4.2.1.3 Service areas and fuel for construction equipment shall not be located inside the building.

14.4.2.2 Materials.

14.4.2.2.1* Storage of flammable and combustible liquids shall comply with 14.3.8.

14.4.2.2.2 Combustible construction components stored inside the building shall be limited to the minimum required to complete a day's project.

14.4.2.2.3 Where steel construction is present, combustible storage shall not be placed in areas where specified fire-resistive coatings have not been applied to structural members.

14.4.2.2.4 Storage of highly combustible materials such as foam, plastic, and rubber products, shall not be permitted inside the building.

14.4.2.2.5 Storage of construction materials shall not impede egress from buildings or access of fire apparatus to hydrants or to the building.

14.4.2.2.6 Tarpaulins or plastic sheeting, where used, shall meet the flame propagation requirements contained in NFPA 701.

14.5 Construction Processes and Hazards.

14.5.1 Cutting, Welding, and Other Hot Work Operations. Cutting, welding, and other hot work operations shall comply with the requirements of NFPA 51B.

14.5.1.1 The person designated to be in charge of fire protection shall issue a hot work permit each day that cutting and welding and other hot work operations are being conducted, as required by Section 11.6.

14.5.1.2 At the close of the work day the person responsible for fire protection on the site shall inspect areas where welding and cutting or other hot work operations have been conducted, for hot metal or smoldering combustible materials.

14.5.1.3 Flammable gas cylinders used in the welding or cutting process shall be protected from vehicle damage and high temperatures.

14.5.2 Temporary Heating Equipment.

14.5.2.1 Temporary heating equipment shall be listed for the purpose and used and installed in accordance with the listing.

14.5.2.2 Temporary heating equipment shall comply with NFPA 31, NFPA 54, and NFPA 58.

14.5.2.3 Temporary heating equipment shall be used only on a stable surface in a protected location where they will not be overturned.

14.5.2.4 Portable equipment using oil or liquefied petroleum gas as fuel shall be removed to a well-ventilated area away from combustible materials and allowed to cool prior to refueling.

14.5.2.5 A portable fire extinguisher selected in accordance with NFPA 10 shall be located within 30 ft (9.1 m) of all portable heating devices.

14.5.2.6 Chimney or vent connectors from direct-fired heaters, where required, shall be maintained at least 18 in. (457 mm) from combustible materials.

14.5.2.7 Temporary heating equipment shall be attended and maintained by trained personnel.

14.5.3 Roofing.

14.5.3.1 General.

14.5.3.1.1 The provisions of this section shall apply to any type of equipment including, but not limited to, chassis-mounted equipment used for preheating or heating tar, asphalt, rubberized asphalt, pitch, or similar substances for roofs, floors, pipes, or similar objects. [1:16.7.1.1]

14.5.3.1.2 Operating kettles shall not be located inside of or on the roof of any building. [1:16.7.2.1]

14.5.3.2 Tar Kettle Location. The kettle shall be operated in a controlled area. The area shall be identified by the use of traffic cones, barriers, and other suitable means as approved by the AHJ. [1:16.7.2.2]

14.5.3.3 Kettle Supervision.

14.5.3.3.1 An operating kettle shall be attended by a minimum of one employee who is knowledgeable of the operations and hazards. [1:16.7.2.3.1]

14.5.3.3.2 The employee shall be within 25 ft (7.6 m) of the kettle and shall have the kettle within sight. [1:16.7.2.3.2]

14.5.3.4 Fire Extinguishers for Tar Kettles.

14.5.3.4.1 Two approved 4-A:40-B:C fire extinguishers shall be provided and maintained within 25 ft (7.6 m) of the operating kettle. [1:16.7.2.4.1]

14.5.3.4.2 A minimum of one approved 4-A:40-B:C fire extinguisher shall be provided and maintained on the roof in close proximity to the roofing operations while the roofing material is being applied. [1:16.7.2.4.2]

14.5.3.5 Exits.

14.5.3.5.1 Roofing kettles shall not block exits, means of egress, gates, roadways, or entrances. [1:16.7.2.5.1]

14.5.3.5.2 Kettles shall not be closer than 10 ft (3 m) from exits or means of egress. [1:16.7.2.5.2]

14.5.3.6 Liquefied Petroleum Gas (LP-Gas).

14.5.3.6.1 Cylinders or containers used for fueling tar kettles shall be protected against tampering and vandalism.

14.5.3.6.2 Containers shall be kept a minimum distance of 20 ft (6 m) from combustible materials or spare containers.

14.5.3.6.3 When possible, cylinders and containers shall be placed in a secured area for protection against tampering.

14.5.3.6.4 Cylinders or containers that cannot be secured in a protected area shall have the dome covers locked and secured, or the valve handle shall be removed or secured in the "off" position.

14.5.3.6.5 Storage of LP-Gas cylinders on rooftops shall not be permitted.

14.5.4 Plumbing.

14.5.4.1 Plumbing work involving open flames shall be conducted only under the supervision of the person in charge of fire protection and shall require a hot work permit reissued each day.

14.5.4.2 The provisions of 14.5.1 shall apply to cutting and welding operations.

14.5.5 Demolition Work.

14.5.5.1 Gas supplies shall be shut off at a point outside the affected area and shall be capped.

14.5.5.2 Electrical service shall be reduced or eliminated in the affected area.

14.5.5.3 Hot work shall not be permitted in combustible buildings except as outlined in Section 11.6.

14.5.5.4 Fire walls, fire barrier walls, fire doors, and other fire separation assemblies shall have their integrity or operation maintained.

14.5.6 Other Hazardous Operations. The owner or governing body shall conduct a hazard assessment of operations that introduce fire hazards to determine if the risk is consistent with the facility's fire safety objectives.

14.5.6.1 Paint stripping operations involving heat-producing devices shall not be permitted.

14.5.6.2 Floor sander dust accumulation bags shall be emptied into closed metal containers outside of the building before the close of the day.

14.5.7 Electrical.

14.5.7.1 Prior to construction, the electrical equipment and circuits that might be impacted by or used during the alteration, addition, or renovation work shall be identified, relocated as needed, and made safe by approved personnel.

14.5.7.2 Electrical wiring and equipment shall comply with the requirements of *NFPA 70*.

14.5.7.3* Temporary lighting, bulbs, and fixtures shall be installed so they do not come in contact with combustible materials.

14.5.7.4 Circuit breakers for circuits that are not in use shall be shut off and tagged.

14.5.7.5 Temporary wiring shall be removed immediately upon elimination of the need for which the wiring was installed.

14.5.8 Environmental Conditions. Openings in structures susceptible to damage from high winds that could cause skewing and misalignment of the structure, disruption of water supplies, or delivery systems for fire protection shall have secure coverings.

14.6 Fire Resistive Construction.

14.6.1 The construction, repair, or modification of walls, horizontal assemblies, and similar construction, and the installation of opening protectives required to comply with provisions of the applicable building code shall be completed as soon as practical.

14.6.2 Fire doors with approved closing devices and hardware shall be installed as soon as practical and before combustible materials are introduced.

14.6.3 Fire doors shall be operable and unobstructed.

14.7 Fire Suppression.

14.7.1 Fire Incident Response.

14.7.1.1* An approved location at the site shall be provided with floor plans, utility control plans, emergency contact telephone numbers, labeled keys, and material safety data sheets.

14.7.1.2 Where security is of concern, the location specified by 14.7.1.1 shall be locked.

14.7.2 Access for heavy fire-fighting equipment to the immediate job site shall be provided at the start of construction and maintained until all construction is completed.

14.7.3 Free access from the street to fire hydrants and to outside connections for standpipes, sprinklers, or other fire-extinguishing equipment, whether permanent or temporary, shall be provided and maintained at all times.

14.7.4 Protective pedestrian walkways shall be constructed so as not to impede access to hydrants, fire department connections, or fire-extinguishing equipment.

14.7.5 During construction operations, free access to permanent, temporary, or portable fire-extinguishing equipment and systems shall be maintained.

14.7.6 At least one stairway shall be provided in usable condition at all times in multistory buildings.

14.8 Water Supply. Water for fire suppression shall be available throughout all phases of construction.

14.9 Standpipe Systems.

14.9.1 New standpipes that are required or existing standpipes in buildings being altered shall be maintained in accordance with the progress of building activity, such that the standpipes are always ready for fire department use.

14.9.2 Class I manual dry standpipes shall be permitted where approved by the AHJ.

14.9.3 Where fire suppression systems existed prior to the rehabilitation project, the system shall be kept in service as long as possible during the rehabilitation work.

14.10 Automatic Fire Suppression Systems.

14.10.1 Where required by the responding fire department, hoses and nozzles shall be provided and made ready for use, as either the temporary or permanent water supply becomes available.

14.10.2 Where automatic fire suppression systems are provided, the installation shall be placed in service and monitored as soon as it is practical.

14.10.3 Where fire suppression systems must be taken out of service for modification, the local fire department shall be notified and the system shall be returned to service as soon as possible.

14.11 Portable Fire Extinguishers.

14.11.1 Portable fire extinguishers shall be protected from accidental damage in accordance with NFPA 10.

Δ 14.11.2 At least one portable fire extinguisher selected and installed in accordance with NFPA 10 shall be accessible on each floor near each usable stairway.

14.12 Emergency Communication.

14.12.1 Prior to beginning any renovations or alterations, workers shall be instructed on emergency communications procedures.

14.12.2 A fixed telephone or equivalent method of summoning the fire service shall be provided and available.

14.12.3 The telephone number of the fire service shall be prominently posted on or immediately adjacent to each telephone.

14.12.4 Written instructions that include the following information shall be posted:

- (1) Building or site address
- (2) Procedures for notification of the local fire service in the event of a fire
- (3) Actions for security officers or other staff after notifying the fire service

14.12.5 Upon activation of a fire alarm or other notification device, or identification of an actual fire, personnel shall evacuate the building.

Chapter 15 Inspection, Testing, and Maintenance

15.1* General.

15.1.1 This chapter shall establish the requirements for critical and regular inspection, testing, and maintenance of protection features, systems, and devices in historic structures and districts.

15.1.2 Records of inspection, testing, and maintenance activities shall be retained until the occurrence of the next activity and for 1 year thereafter.

15.2 Responsibility.

15.2.1 The responsibility for maintenance of protection features, systems, and devices shall be that of the owner or governing body or responsible party of the historic structure or district.

15.2.2 Inspection, testing, and maintenance shall be implemented in accordance with procedures meeting or exceeding those established in the standard for that type of protection feature, system, or device, and shall be in accordance with the manufacturer's instructions.

15.2.3 Personnel who have developed competence through training and experience shall perform inspection, testing, and maintenance of protection features, systems, and devices.

15.3 Fire Protection Systems.

Δ 15.3.1 Requirements. All fire protection systems shall be inspected, tested, and maintained in full compliance with the manufacturer's recommendations and with the standards identified in Table 15.3.1, as applicable.

15.3.2 Inspection. Inspection activities, frequencies, responsibilities, routines, and reporting procedures shall comply with the standards identified in Table 15.3.1 or other approved standards as applicable.

15.3.3 Testing.

15.3.3.1 Testing activities, frequencies, responsibilities, routines, and reporting procedures shall comply with the standards identified in Table 15.3.1, or other approved standards as applicable.

15.3.3.2 All fire protection systems shall be tested to verify that they function as intended.

Δ Table 15.3.1 Inspection, Testing, and Maintenance Codes and Standards — Fire Protection Systems

Type of System	NFPA Standard
Integrated systems	NFPA 4
Carbon dioxide	NFPA 12
Halon 1301	NFPA 12A
Dry chemical	NFPA 17
Wet chemical	NFPA 17A
Water-based	NFPA 25
Alarm and detection	NFPA 72
Smoke control	NFPA 92
Cooking equipment	NFPA 96
Smoke and heat venting	NFPA 204
Water mist	NFPA 750
Clean agent	NFPA 2001

15.3.3.3 Test results shall be compared with those of the original acceptance test (if available) and with the most recent test results.

N 15.3.3.4* Integrated fire protection systems shall be tested in accordance with NFPA 4.

15.3.4 Maintenance.

15.3.4.1 Maintenance activities, frequencies, responsibilities, routines, and reporting procedures shall comply with the standards identified in Table 15.3.1 or other approved standards as applicable.

15.3.4.2 Maintenance shall be performed to keep all fire protection systems operable. Necessary repairs shall be made.

15.3.4.3 As-built system installation drawings, original acceptance test records, and device or equipment manufacturer's maintenance bulletins shall be retained by the fire safety manager to assist in developing and maintaining the inspection, testing, and maintenance standards for all fire protection equipment and systems and components.

15.4 Impairments to Fire Protection Systems.

15.4.1 General. When an emergency or a preplanned impairment takes any fire protection system out of operational service, adequate measures shall be taken during the impairment to ensure that increased risks are minimized and the duration of the impairment is limited.

15.4.1.1 When any fire protection system is out of service for 4 hours or more, the owner or governing body shall notify the fire department and post a fire watch.

15.4.1.2 The fire watch shall be provided with an approved means of notification of the fire department.

15.4.2 Preplanned Impairments.

15.4.2.1 All preplanned impairments shall be authorized in advance of work by the fire safety manager.

15.4.2.2 The fire safety manager shall be responsible for verifying that written procedures for impairments are followed before authorizing a system impairment. (See 15.4.3.)

15.4.3 Procedure.

15.4.3.1 A written procedure shall be established and implemented by the owner or governing body to control any emergency or preplanned impairment.

15.4.3.2 The written procedure shall include, as a minimum, the following:

- (1) Identification and tagging of all impaired equipment and systems
- (2) Inspection/risk evaluation
- (3) Identification of extent or expected duration of impairment
- (4) Notification of the fire department
- (5) Notification of other personnel or organizations as appropriate
- (6) Statement of additional measures deemed necessary for the duration of the system impairment
- (7) Actions to be taken and notifications to be made when all impaired equipment and systems are restored to operational service

(8) Prior to a preplanned impairment, assembly of all necessary parts, tools, materials, and labor at the impairment site before removing the system or equipment from service

(9) Expedition of all repair work

15.4.4 Restoring Systems to Service. When all impaired systems are restored to operational service, the impairment coordinator shall verify that the following procedures have been completed:

- (1) Any necessary inspections and tests required in accordance with 15.3.1 for the fire protection system or equipment involved have been conducted to verify that affected systems and equipment are operational.
- (2) Those individuals listed in 15.4.3.2(5) have been advised that protection has been restored.
- (3) Impairment tags shall have been removed.

15.5 Electronic Premises Security Systems.

15.5.1 All electronic premises security systems shall be inspected, tested, and maintained in full compliance with the manufacturer's recommendations.

15.5.2 Inspection, testing, and maintenance of electronic premises security systems shall be performed by personnel who have developed competence through training and experience.

15.5.3 Inspection and testing frequencies and test routines shall comply with manufacturers' recommendations.

15.5.4 Testing.

15.5.4.1 All electronic premises security systems shall be tested to verify that they function as intended.

15.5.4.2 Test results shall be compared with those of the original specifications for the system, the results of the original acceptance test (if available), and the results of the most recent test. Any variances in the performance of the system shall be documented and corrections made to bring the system performance to an acceptable level.

15.5.5 Maintenance.

15.5.5.1 Maintenance shall be performed to keep all electronic premises security systems operable. Necessary repairs shall be made.

15.5.5.2 As-built system installation drawings, original acceptance test records, and device or equipment manufacturer's maintenance bulletins shall be retained by the governing body to assist in developing and maintaining the inspection, testing, and maintenance standards for all electronic premises security systems, equipment, and components.

15.6 Heating, Air-Conditioning, and Cooking Equipment.

15.6.1 Heating and air-conditioning systems and cooking appliances shall be maintained in accordance with the manufacturer's specifications and shall comply with NFPA 90A, NFPA 90B, and NFPA 96.

15.6.2 Heaters and ductwork, including hoods and ducts for cooking appliances, shall be kept free of flammable and combustible deposits.

15.7 Chimneys. Chimneys for active stoves or fireplaces shall be inspected and cleaned annually in accordance with NFPA 211.

15.8 Electrical Systems. Electrical systems shall be maintained in compliance with *NFPA 70* or other applicable codes, and the manufacturer's instructions.

15.9 Fire Walls and Fire Barrier Walls. The integrity of fire walls and fire barrier walls shall comply with the applicable building code. Openings in such walls shall be protected and maintained in accordance with *NFPA 80*.

15.10 Fire-Retardant-Treated Materials. Applied coatings and treatments shall be maintained in accordance with *NFPA 703*.

15.11 Fire Extinguishers. Portable fire extinguishers shall be maintained in accordance with *NFPA 10*.

Chapter 16 Special Events

16.1* General.

16.1.1 Plans for special events shall be reviewed and approved by the governing body and, where required, by the authority having jurisdiction.

16.1.2 Where required by the AHJ, a fire emergency response plan shall be prepared in accordance with Section 10.5.

16.2 Occupant Loading.

16.2.1 The event coordinator shall ensure that the number of occupants admitted to the building is monitored and controlled so that the occupant load does not exceed the capacity of the means of egress, for the number of exits required by the applicable code.

16.2.2 Orderly circulation of guests shall be maintained when special events are planned for large groups.

16.3 Means of Egress.

16.3.1 Exits, access to exits, and all other evacuation capabilities shall be maintained.

16.3.2 Tables, plants, stages, or other temporary fixtures shall not visually or physically obstruct an exit, exit sign, or exit access, or reduce the width of an exit passage.

16.3.3 Prior to a performance or event, staff (especially temporary or part-time staff), contractor personnel, attendees, and participants shall be notified of the following:

- (1) How fire alarms are annunciated (i.e., audibly, visually, by voice communication, or a combination of these methods)
- (2) Locations of exit routes, exits, and assembly points
- (3) How to safely evacuate the area

16.3.4 Key staff, including event coordinators, volunteers, and security, shall be familiar with exit routes and shall ensure that exits are obvious, operable, and not blocked or restricted in any way.

16.3.5 Upon activation of the fire alarm, occupants shall be evacuated from the building according to the egress plan.

16.4 Commercial Cooking and Food Service Operations. Cooking and food warming shall be in accordance with Section 11.10.

16.5 Smoking. Smoking shall be prohibited except as provided in Section 11.5.

16.6 Fireworks.

16.6.1 Demonstrations of fireworks shall be held outside the building or structure and shall conform to *NFPA 1123*.

16.6.2 Demonstrations of fireworks or other pyrotechnics before a proximate audience shall conform to *NFPA 1126*.

16.7 Combustibles.

16.7.1 Tents and canopies shall comply with the applicable building code and fire code and shall be noncombustible or certified as having been treated with an approved fire-retardant coating.

16.7.2 Temporary draperies, bunting, textiles, wood, and miscellaneous support and decorative materials used inside the building shall comply with 16.7.2.1 through 16.7.2.6, except as provided in Section 11.2.

16.7.2.1 Furnishings or decorations of an explosive or highly flammable character shall not be used. [101:10.3.4]

16.7.2.2 Fire-retardant coatings shall be maintained to retain the effectiveness of the treatment under service conditions encountered in actual use. [101:10.3.5]

16.7.2.3 The authority having jurisdiction shall impose controls on the quantity and arrangement of combustible contents in assembly occupancies to provide an adequate level of safety to life from fire. [101:12.7.4.2; 101:13.7.4.2]

16.7.2.4 Exposed foamed plastic materials and unprotected materials containing foamed plastic used for decorative purposes or stage scenery shall have a heat release rate not exceeding 100 kW where tested in accordance with one of the following:

- (1) ANSI/UL 1975, *Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes*
- (2) *NFPA 289* using the 20 kW ignition source [101:12.7.4.3; 101:13.7.4.3]

16.7.2.5 The requirement of 16.7.2.4 shall not apply to individual foamed plastic items and items containing foamed plastic where the foamed plastic does not exceed 1 lb (0.45 kg) in weight. [101:12.7.4.4; 101:13.7.4.4]

16.7.2.6 Wood shall be fire-retardant treated and meet the requirements of *NFPA 703*.

16.8 Electrical Equipment.

16.8.1 Electrical appliances and equipment, including temporary installations, shall be listed, and wiring shall comply with *NFPA 70*.

16.8.2 Exposed electrical wiring and extension cords shall not be placed across travel or exit routes.

16.8.3* A licensed or registered electrician shall verify that electrical circuits do not exceed their rated capacity.

16.9 Use of Historic Structures by Others.

16.9.1 The governing body or a designated representative shall enforce the historic structure's fire prevention and security plans. They shall have the authority to stop work or other activities when the work or activities jeopardize the safety or security of the historic structure.

16.9.2 The fire prevention and security plans described in 16.9.1 shall include, but shall not be limited to, all of the following:

- (1) Fire spread control systems
- (2) Fire protection systems
- (3) Electrical systems
- (4) Security systems
- (5) Housekeeping
- (6) Storage of flammable liquids and gases
- (7) Hot work and other sources of ignition

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.2 Collections within libraries, museums and places of worship should be evaluated and protected in accordance with NFPA 909.

A.1.2 As an example, this code is intended to provide a level of protection that will assist in the following **four** main categories:

- (1) Protect the occupants, a group that is intended to include the staff and the visitors, as well as any outside contract agents who **might** work in the facility
- (2) Protect the contents of the structure
- (3) Protect the physical structure itself from the effects of an unwanted fire
- (4) Plan for resiliency

In all cases, the protection scheme derived is intended to minimize the intrusion on the historic fabric of the facility.

The U.S. Department of the Interior establishes a list of guidelines and criteria that are typically used by various entities to establish overall objectives for maintaining the fabric of an historic site or structure. (See Annex N for additional information.)

A.1.5 A sample ordinance is provided in Annex M.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection depart-

ment, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 Code. The decision to designate a standard as a “code” is based on such factors as the size and scope of the document, its intended use and form of adoption, and whether it contains substantial enforcement and administrative provisions.

A.3.2.5 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.6 Atrium. As defined in NFPA 92, a large-volume space is an uncomparted space, generally two or more stories in height, within which smoke from a fire either in the space or in a communicating space can move and accumulate without restriction. Atria and malls are examples of large-volume spaces.

A.3.3.7.1 Fire Barrier. A fire barrier, such as a wall or floor assembly, might be aligned vertically or horizontally.

A.3.3.7.2 Smoke Barrier. A smoke barrier, such as a wall, floor, or ceiling assembly, might be aligned vertically or horizontally. A smoke barrier might or might not have a fire resistance rating.

A.3.3.9 Building Systems. Building systems include all electrical power services; communication and security services; electrical control systems; HVAC systems; water, steam, wastewater, and drainpipes and services; fire suppression systems including water-based and non-water-based systems; oil and piped hydraulic and pneumatic systems.

A.3.3.10 Buildings. The term *building* is to be construed as if followed by the words “or portions thereof.” Each portion of a building that is separated from other portions by a noncombustible fire wall with a minimum 2-hour fire resistance rating can be considered to be a separate building.

A.3.3.16 Conservation. The four explicit functions of conservation are examination, documentation, preservation, and restoration. Examination is a procedure used to determine the nature, method of manufacture, or properties of materials and the causes of their deterioration. Documentation procedures record the condition of an object before, during, and after treatment and outline, in detail, treatment methods and materials used. Preservation is action taken to prevent, stop, or retard deterioration. The process includes both the stabilization of the condition of a work of art by conservation and the stabilization of the environment surrounding a work of art by preventative conservation methods to minimize the effects of agents of deterioration. Restoration is the reconstruction of missing parts in an effort to recreate the original appearance of a damaged work of art.

A.3.3.18 Cultural Resource Properties. Such properties include, but are not limited to, museums, libraries, historic structures, and places of worship.

A.3.3.20 Design Specifications. Design specifications include both hardware and human factors, such as the conditions produced by maintenance and training. For purposes of performance-based design, the design specifications of interest are those that affect the ability of the building to meet the stated goals and objectives. Additionally, these specifications should also include any special techniques or procedures that might be necessary to minimize intrusion into the historically significant portions of the building.

A.3.3.21 Design Team. The individuals responsible for the governance of the property are essential to this team. Establishing boundaries for the limits of the work or guiding discussions on prioritizing the areas or spaces to be preserved should be based on the significance of the property and needs of the governing body.

A.3.3.27 Exposure Fire. An exposure fire usually refers to a fire that starts outside a building, such as a wildlands fire or vehicle fire, and that, consequently, exposes the building to a fire. [101, 2018]

A.3.3.28 Feature (Cultural Landscape). Examples include a woodlot, hedge, lawn, specimen plant, allée, house, meadow or open field, fence, wall, earthwork, pond or pool, bollard, orchard, or agricultural terrace.

A.3.3.32 Fire Model. Due to the complex nature of the principles involved, models are often packaged as computer software. Attached to the fire models will be any relevant input data, assumptions, and limitations needed to properly implement the model.

A.3.3.36 Fire Safety Manager. In smaller organizations, this role is permitted to be combined with that of another position or appointment. In larger institutions, the person's responsibilities are permitted to include supervision of other fire protection staff. The authorized person is permitted to be an employee of the institution who has experience with generally accepted fire protection practices. Alternatively, cultural resource facilities or institutions are permitted to designate appropriate outside persons such as consulting fire protection engineers, fire service personnel, insurance company loss control representatives, local code officials, or other individuals with similar fire protection credentials.

A.3.3.42 Hazardous Area. Hazardous areas include those areas used for the storage or use of combustibles or flammables; toxic, noxious, or corrosive materials; or heat-producing appliances. [5000, 2018]

A.3.3.43 Historic Building. Designation could be in an official existing or future national, regional, or local historic register, listing, or inventory. Properties that meet the criteria for eligibility should be treated as eligible. Properties meeting the criteria for eligibility include buildings in a historic district that are not architecturally distinguished, but whose scale, proportions, materials, and details are consistent with the character of the district. This can also include iconic structures.

Iconic Structure—Edifice or object of such global cultural significance that its preservation is of utmost importance to maintain the identity and economy of the area where it is located.

Many historical structures and sites have a global, national, or local significance that goes beyond traditional preservation. For example, UNESCO World Heritage Sites need a higher

level of protection than most historic buildings addressed by this code.

Such iconic sites should have a fire protection program with appropriate emphasis on the following:

- (1) Increased administrative oversight of fire risk assessment, fire hazard abatement, and fire emergency pre-planning
- (2) Enhanced fire prevention limitation of combustibles and ignition sources
- (3) Optimal built-in fire containment and control including structural fire barriers, fire detection and alarm, automatic fire suppression systems, and smoke management
- (4) Greater emergency response in the event of a fire, including suppression, damage-limitation, and salvage

Each facility will need to identify the potential of a fire loss and the relationship to other threats.

A.3.3.58 Limited-Combustible Material. Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric conditions are considered combustible.

A.3.3.64 Objective. Objectives define a series of actions necessary to make the achievement of a goal much more likely. Objectives are stated in more specific terms than goals and are measured on a more quantitative, rather than qualitative, basis.

A.3.3.68 Performance-Based Design Approach. This process allows performance-based documents to be implemented and ensures that their goals are met.

A.3.3.76 Proposed Design. The design team might develop a number of trial designs that are evaluated to determine if they meet the specified performance criteria. One or more of the trial designs will be selected from those that meet the performance criteria, for submission to the AHJ as the proposed design.

The proposed design is not necessarily limited to fire protection systems and building features; it also includes any component of the proposed design that is installed, established, or maintained for the purpose of life safety, without which the proposed design could fail to achieve specified performance criteria. In addition, the impact of the proposed design on the historic fabric and character of the building needs to be evaluated. As such, the proposed design often includes emergency procedures, management operational systems, and organizational structures that are necessary to meet the performance criteria specified for the proposed design.

A.3.3.78 Protection. In its broadest sense, protection also includes long-term efforts to deter or prevent vandalism, theft, arson, and other criminal acts against historic resources.

A.3.3.82 Resiliency. Resiliency can also be considered the adaptive capacity of an organization in a complex and changing environment, or the ability of an organization to manage disruptive related risk. Further, it might be an organization's ability to prevent or resist being affected by an event, the ability to return to an acceptable level of performance in an acceptable period of time after being affected by an event, or the capability of a system to maintain its functions and structure in the face of internal and external change.

A.3.3.86.2 Fire Scenario. A fire scenario defines the conditions under which a proposed design is expected to meet the fire safety goals. Factors typically include fuel characteristics,

ignition sources, ventilation, building characteristics, and occupant locations and characteristics. *Fire scenario* includes more than the characteristics of the fire itself, but it excludes design specifications and any characteristics that do not vary from one fire to another; the latter are called *assumptions*. The term *fire scenario* is used here to mean only those specifications required to calculate the fire's development and effects, but in other contexts, the term can be used to mean both the initial specifications and the subsequent development and effects (i.e., a complete description of fire from conditions prior to ignition to conditions following extinguishment).

A.3.3.92 Special Event. Special events are intended to include events that introduce unusual hazards to the facility. Special events include, but are not limited to, receptions, dinners, private viewings, pyrotechnic displays, exhibits, or fairs.

A.3.3.94.3 Sprinkler System. As applied to the definition of a sprinkler system, each system riser serving a portion of a single floor of a facility or where individual floor control valves are used in a multistory building should be considered a separate sprinkler system. Multiple sprinkler systems can be supplied by a common supply main. [13, 2019]

A.4.3 The primary difference between goals and objectives is that objectives are more specific to the problem being solved or the document being developed. The same goals can be applied to most NFPA documents, while objectives are intended to reflect the nature and intent of a particular document in question.

A.4.3.2.1 Substantial renovation or modification to an existing historic building will often be a difficult challenge. Additional means to minimize alteration of the historic structure should be considered. Such means would include the following:

- (1) Presence of a limited amount of combustible material
- (2) Installation of active fire protection systems
- (3) Reliance on staff members
- (4) Any combination thereof

A.4.3.2.4 Where adaptive reuse of a building is being undertaken, there may be fewer changes required in the egress system, fire protection equipment, and other features, for certain new occupancies than for others. Depending upon the significance of various elements to the historic character of the building, life safety and historic preservation goals may be more easily achieved with some new uses than with others.

A.7.1 This code gives both prescriptive-based and performance-based approaches to achieving its fundamental objectives. Equivalency is also included as an integral concept to achieve compliance. The code, therefore, provides a specific process chapter to guide the user in the code's application and to reduce possible confusion in the reading and implementation of the code.

A.7.2 A project team should be interdisciplinary in nature, representing both safety and preservation concerns. Early consultation and coordination at each step of the process is highly desirable and strongly recommended. While every effort should be made to create an interdisciplinary team of players, the code recognizes that there will be times when such a diversity of members is not possible. The code, therefore, urges but does not require any particular membership of the team. Participants on the team can include the following:

- (1) Design professionals
- (2) Fire protection consultant

- (3) AHJs, including, but not limited to:
 - (a) Preservation officer or review agency
 - (b) Fire code official
 - (c) Building code official or permitting authority
 - (d) Insurance company representative/broker
- (4) Representative contractor
- (5) Building manager
- (6) Fire safety manager
- (7) Building occupants
- (8) Building owner

A.7.3 The assessment is intended to evaluate the relevant historic elements, spaces, and features and the relevant fire safety issues in the building or structure. The extent and depth of the assessment might vary, depending upon the historic significance of the building and its component elements, the size and complexity of the building, changes of occupancy classification, and other factors as appropriate.

A.7.3.1 Fire risk indexing is an accepted approach that identifies the relative importance of fire safety features. The process consists of a multi-attribute decision analysis for quantitatively balancing variables of risk, hazard, and safety to achieve an acceptable level of fire safety. Fire risk indexing is a systemic approach to equivalency that considers the building in its entirety and produces a calculated value to identify the degree of compliance with the intent of a prescriptive code. It highlights and measures relative weakness of areas of deficiency and identifies areas of strength that can be used to offset deficiencies. As such, it is an efficient approach to evaluation of code compliance and can be used to identify the need for adaptation of prescriptive requirements or implementation of a performance-based option.

A.7.3.1.2 Required exterior modifications or additions should be located on the less visible and least significant elevations in order to keep the impact on the historic character to a minimum. Character-defining features include, but are not limited to, sheathing or facade materials, roofing materials, chimneys, skylights, cornices, windows and doors, and porches and railings.

A.7.3.1.3 The building survey should establish important characteristics of the building organization, building type, style, period of construction, or historic function. The building survey should review significant spaces to establish rooms or other interior locations that are typical of the building type or style or are associated with specific persons or events.

A.7.3.1.6 Character-defining features and finishes include, but are not limited to, distinctive architectural details, wainscoting, parquet flooring, picture molding, mantels, ceiling medallions, built-in bookshelves and cabinets, crown molding, and arches, as well as simpler, more utilitarian features, such as plain windows and doors and associated trim.

A.7.3.2 Examples of methods used to determine historical significance can include the General Services Administration Guidelines for Zoning for Historic Properties and the Secretary of the Interior Standards.

Modifications or additions should be located at less visible, secondary areas in a manner that minimizes visual impact and damage to historic materials. Modifications and additions should be permitted at primary areas when it is not practicable to utilize secondary areas.

▲ **A.7.3.3.1.3** Both NFPA 101 and NFPA 914 recognize that fully complying with the requirements of any code or standard might not be practicable in a historic building or structure. NFPA 914 is predicated upon this approach. In addition, NFPA 101 also recognizes this potential problem.

The following text is from the 2018 edition of NFPA 101:

The provisions of this *Code* shall be permitted to be modified by the authority having jurisdiction for buildings or structures identified and classified as historic buildings or structures where it is evident that a reasonable degree of safety is provided. [101:4.6.4.2]

In existing buildings, it is not always practical to strictly apply the provisions of this *Code*. Physical limitations can cause the need for disproportionate effort or expense with little increase in life safety. In such cases, the authority having jurisdiction needs to be satisfied that reasonable life safety is ensured. [101:A.4.6.5]

In existing buildings, it is intended that any condition that represents a serious threat to life be mitigated by the application of appropriate safeguards. It is not intended to require modifications for conditions that do not represent a significant threat to life, even though such conditions are not literally in compliance with the *Code*. [101:A.4.6.5]

An example of what is intended by 4.6.5 [of NFPA 101] would be a historic ornamental guardrail baluster with spacing that does not comply with the 4 in. (100 mm) requirement. Because reducing the spacing would have minimal impact on life safety but could damage the historic character of the guardrail, the existing spacing might be approved by the authority having jurisdiction. [101:A.4.6.5]

A.7.3.3.4 The building survey should be evaluated in accordance with the means of egress requirements of NFPA 101 or other applicable codes.

A.7.3.4.1 See A.7.3.1.

A.7.3.4.2 The following documents have an established record of meeting code objectives through a fire risk indexing approach:

- (1) Chapters 4 through 9 of the 2019 edition of NFPA 101A
- (2) *Wisconsin Administrative Code*, Subchapter IV, Building Evaluation Method, Chapter Comm. 70–Historic Buildings, 2005
- (3) Chapter 12, “Compliance Alternatives,” International Existing Building Code, 2003 edition

A.7.5.1 The selection of the method of application of the code could result from a consideration of the following:

- (1) Extent of deviation of the building from the prescriptive code
- (2) Difficulty in providing remedies to the prescriptive code
- (3) Historic significance of features that would be compromised by meeting the prescriptive code

The relative cost of the performance-based and prescriptive-based approaches could also require consideration, as this information might affect the financial means of the building owner to provide code compliance in the building.

The option appraisal and selection portion of the code can function as a tool to assist in selection of a prescriptive-based

and performance-based application. A building need not meet both sets of requirements.

A.8.1.1 The three approaches to compliance with prescriptive requirements, alternatives, equivalencies, and modifications are in order of their legal certitude. Therefore, they should be considered in this order to minimize the need for lengthy negotiations or variance hearings. However, early conversations among interested parties can establish an acceptable level of compliance for a particular case.

A.8.1.1.2 Compliance with prescriptive requirements of applicable codes does not always require the construction or installation of intrusive elements or features that might negatively impact the historic fabric of the subject building.

A.8.1.2 Alternatives refer to options that are explicitly stated in the requirements of the prevailing code. These alternatives are often incorporated into exceptions to specific provisions. A careful reading of the prevailing code could reveal more acceptable options to the standard compliance requirements. Particular attention to alternatives should be given where jurisdictions have adopted model codes but have made exceptions for existing or historic buildings. See Annex F for examples of compliance alternatives.

A.8.1.3 Equivalency refers to alternative fire safety measures that can be established to provide a level of safety that is equivalent to the prevailing code; for example, installing fire detection and suppression that is not legally required in place of structurally altering the interior of a building. A less common alternative is the compensation for a code deficiency by operational features; for example, compensating for a dead-end corridor with occupant training.

Equivalency is a common code clause that allows other means of compliance if those means can be demonstrated and documented. There are many ways to address the issue of documenting equivalency, such as precedents, ad hoc equivalency, fire risk indexing, and component performance evaluation. These ways are explained in order of complexity.

Precedents are continually established in the regulation of fire safety for historic buildings. They represent acceptable alternatives that have not been formally incorporated into a regulatory document. The annexes of this document are a unique source of identifying many of these precedents. Other precedents might be available locally.

Ad hoc equivalency can be established by employing subjective logic. One qualitative approach used to evaluate alternative arrangements for equivalent safety from fire is NFPA 550. The tree is a logic diagram that represents all possible means of meeting fire safety objectives. By increasing fire safety measures on one branch of the tree, one can offset a lack of required measures on another branch, thus establishing an arrangement of equivalent fire protection.

Performance-based fire safety can also be approached on a component basis rather than on a systemic basis. Some fire safety components already have a form of performance criteria, such as fire resistance. Component performance can also be evaluated on a more ad hoc basis through the use of equivalency clauses in building codes. Codifying more component performance criteria can provide solutions for many problems; for example, establishing measurable fire safety objectives for doors, stairs, fire escapes, dead ends, exit signs, and so forth, would help when dealing with these issues in historic buildings.

A.8.1.3.2 Any departure from the prescriptive code should be shown through adequate documentation to provide an equivalent level of protection. The extent of documentation/analysis required to demonstrate equivalency shall be commensurate with the complexity of the issue.

Equivalent solutions rely on the prescriptive code or standard as a departure point from strict compliance. Identification is made of the areas where the building deviates from the prescriptive requirement, and an equivalent solution is considered for any nonconforming issue. Equivalent solutions continue to work within the framework of the prescriptive code and justify departures from the prescriptive requirements, either individually or collectively, with an alternative acceptable to the AHJs. The code provides extensive annex material in an effort to provide a stronger framework of information to AHJs as they form decisions on proposed equivalent alternatives. The annex material also encourages the identification of still more resources to continue to support AHJs in their role of judging proposed alternatives. Maximum flexibility within the confines of equivalent safety is encouraged at all times.

It is the intent of this code that liberal use be made of the annex material and references in the code as a basis for establishing equivalency. These and other materials, which are commonly consulted to provide documentation for performance-based design approaches, also provide strong guidance and support for equivalency solutions. Other materials and information to be considered can include the identification of precedents and research findings.

The annex material, as well as the referenced documents cited throughout this code can be used as sources of information to evaluate design alternatives. The application of specific information from these or other sources must be demonstrated as sound through the performance-based approach requirements described in Chapter 9 of this code. The annexes and referenced documents are not intended to be exclusive sources of information. Any source of information that can be demonstrated to be credible and valuable to the evaluation of the proposed design can be used in conjunction with this code.

A.8.1.4 In historic buildings, it is not always practical to strictly apply the provisions of the prevailing code. Physical limitations can require disproportionate effort or expense with little increase in life safety. In such cases, the AHJ should be satisfied that reasonable life safety is ensured.

In historic buildings it is intended that any condition that represents a serious threat to life be mitigated by application of appropriate safeguards. It is not intended to require modifications for conditions that do not represent a significant threat to life, even though such conditions are not literally in compliance with the prevailing code. Among the means of reasonably modifying prescriptive requirements are tolerances and waivers.

Tolerances allow for flexibility by relaxing the many “magic numbers” in code requirements; for example, 50 people, 32 in. wide, 1-hour fire resistance, and so forth. Reasonable dimensional tolerances should be permitted in applying prescriptive requirements to historic buildings. A 10 percent to 20 percent tolerance in prescriptive criteria may be reasonable if it allows historic preservation objectives to be achieved. In legal jargon, such tolerances are referred to as *de minimis*; that is, they are considered insignificant with respect to the overall safety of the building. Tolerance in strict application of installation stand-

ards can also be appropriate; for example, allowing a particularly sensitive room to remain unprotected in an otherwise fully sprinklered building.

Waivers can be another form of *de minimis* code application. Waivers can be appropriate where applying a code requirement in a historic building is not reasonable; for example, a requirement that all exit doors in historic buildings need to swing outward could be unreasonable for some situations.

A.8.2 The subjects discussed in Section 8.2 are intended to be a partial listing of safety features or beneficial attributes of a historic structure that could help compensate or offset one or more prescriptive code deficiencies. These provisions are not mandatory but should be identified when making an argument for alternative approaches, equivalencies, or modifications to the prescriptive code requirement.

A.8.2(6) Filling concealed spaces with inert materials, such as mineral wool insulation or similar fire-resistive materials, can further retard the spread of fire. Care should be taken to ensure that the introduction of fire barriers or fire stopping does not inadvertently result in a disturbance of the building's microclimate by impeding air flow, which might result in the growth of mold or fungus.

A.8.2(7) The U.S. Department of Housing and Urban Development has developed the *Guideline on Fire Ratings of Archaic Materials and Assemblies* to identify approximate fire resistance qualities of older construction methods.

A.8.2(8) Fire detection systems that can discriminate or identify any number of characteristics of fire (e.g., presence of smoke, critical temperature rise, or infrared/ultraviolet radiation) are also considered to be a compensatory feature. The detection device that offers the fastest response with respect to the type of occupancy should be a primary consideration.

A.9.1 Chapter 9 of this code provides requirements for the evaluation of a performance-based life safety and fire protection design. The evaluation process is summarized in Annex L.

A.9.1.3 Qualifications should include experience, education, and credentials that demonstrate knowledgeable and responsible use of applicable models and methods.

A.9.1.4 A third-party reviewer is a person or group of persons chosen by the AHJ to review proposed performance-based designs. For more information on peer review of fire protection designs, see the *SFPE Guidelines for Peer Review in the Fire Protection Design Process*.

A.9.1.7 Continued compliance with the goals and objectives of the code involves many things. The building construction — including openings, interior finish, and fire- and smoke-resistive construction — and the building and fire protection systems should retain at least the same level of performance as provided for the original design parameters. Performance designs that include such features related to management operational systems should include specific instructions related to features. The use and occupancy should not change to the degree that assumptions made about the occupant characteristics, combustibility of furnishings, and existence of trained personnel are no longer valid. In addition, actions provided by other personnel, such as event staff or emergency responders, should not be diminished below the documented assumed levels. Also, actions needed to maintain reliability of systems at the anticipated level should meet the initial design criteria.

A.9.2.2.1 Annex H identifies methods that can be used to develop means by which occupants' exposure to untenable conditions can be addressed.

▲ A.9.2.2.2 This evaluation should consider the use of multiple or redundant systems, features, and techniques. Objects or building features, if any, that are deemed acceptable to lose to a fire should be evaluated and determined. The following could be potential areas of evaluation for the design team:

- (1) Set detailed performance criteria that would ensure that selected rooms or spaces are protected from flame, heat, or smoke. The *SFPE Engineering Guide to Performance-Based Fire Protection* describes a process of establishing damage limits. The *SFPE Handbook of Fire Protection Engineering* also contains relevant information on thermal damage to various building materials and information on corrosivity of smoke.
- (2) Demonstrate for each design fire scenario and the design specifications, conditions, and assumptions, that each room or area will be fully isolated from the fire before the smoke and thermal layer in the room descend to a level where irreversible damage can occur.
- (3) Demonstrate for each design fire scenario and the design specifications and assumptions, that the smoke and thermal layer will not descend to a level where irreversible damage can occur in any room. The advantage of this procedure is that it conservatively requires that no historically significant item need be exposed to fire effects for the demonstration, regardless of where that room or space is located.
- (4) Demonstrate for each design fire scenario and the design specifications and assumptions, that no fire effects will reach any room or space beyond the room of origin. An advantage of this procedure is that it also removes the need for some of the modeling of fire effects, because it is not necessary to model the filling of rooms, only the spread of fire effects to those rooms. This is even more conservative and simpler than the procedures in A.9.2.2.2(2) and A.9.2.2.2(3), because it does not allow any fire effects into any rooms with historically significant features.

A.9.3.1 This requirement applies both to systems and features, including management operational systems required by the code, that reference applicable standards, and to additional systems or features included in the design at the discretion of the design team. The referenced standards are hereby expected to state maintenance, testing, and other requirements needed to provide positive assurance of an acceptable level of reliability. The referenced standards themselves can be prescriptive- or performance-based.

A.9.3.2 The design should comply with the following requirements for select components in the means of egress. The following components are taken from NFPA 101:

- (1) Changes in level in means of egress
- (2) Guards
- (3) Doors
- (4) Stairs
- (5) Ramps
- (6) Fire escape ladders
- (7) Alternating tread devices
- (8) Capacity of means of egress
- (9) Impediments to egress
- (10) Illumination of means of egress

- (11) Emergency lighting
- (12) Marking of means of egress

A.9.4.1 The design specifications and other conditions form the input to evaluation of proposed designs (see Section 9.6). Where a specification or condition is not known, a reasonable estimation can be made. However, the design team should take steps to ensure that the estimation is valid during the life of the building. Any estimations need to be documented. (See Section 9.8.)

A.9.4.3 These characteristics should extend beyond the normal analysis of building construction features. Elements such as the type of construction, construction technique, use of special materials, as well as any unusual design features in the building, should also be explicitly identified.

A.9.4.4 Systems addressed by this requirement include automatic fire suppression systems and fire alarm systems. Performance issues that need to be documented might include response time indexes, discharge densities, and distribution patterns. Calculations should not include an unlimited supply of extinguishing agent if only a limited supply is provided in the actual structure or building.

A.9.4.5.1.1 Examples of design features that might be incorporated to modify expected occupant characteristics include training, use of staff to assist with notification and movement, or type of notification appliance used. For more information on occupant characteristics, see the *SFPE Engineering Guide to Human Behavior in Fire*.

A.9.4.5.2 The four basic characteristics — sensibility, reactivity, mobility, and susceptibility — comprise a minimal, exhaustive set of mutually exclusive, performance characteristics of people in buildings that can affect a fire safety system's ability to meet life safety objectives. The characteristics are briefly described as follows:

- (1) *Sensibility* (to physical cues) is the ability to sense the sounding of an alarm. It can also include discernment and discrimination of visual and olfactory cues in addition to auditory emanations from the fire itself.
- (2) *Reactivity* is the ability to interpret cues correctly and to take appropriate action. Reactivity can be a function of cognitive capacity, speed of instinctive reaction, or group dynamics. Occupants might need to understand how relying on familiarity with the premises could influence wayfinding and increased likelihood of a wrong decision.
- (3) *Mobility* (speed of movement) is determined by individual capabilities as well as by crowding phenomena such as arching at doorways.
- (4) *Susceptibility* (to products of combustion). Metabolism, lung capacity, pulmonary disease, allergies, or other physical limitations can affect survivability in a fire environment.

In application, as with the use of computer evacuation models, assumptions can address a larger number of factors that are components of the basic performance characteristics described in Table A.9.4.5.2.

A.9.4.5.4 The number of people expected to be contained in a room or area should be based on the occupant load factor specified in NFPA 101 or other approved sources.

Table A.9.4.5.2 Performance Characteristics

Characteristics	Description
Alertness	Awake/asleep, can depend on time of day
Responsiveness	Ability to sense cues and react
Commitment	Degree to which occupant is committed to an activity underway before the alarm
Focal point	Point to which an occupant's attention is focused (e.g., to front of classroom, stage, or server in business environment)
Physical and mental capabilities	Can affect ability to sense, respond, and react to cues; can be related to age or disability
Role	Can determine whether occupant will lead or follow others
Familiarity	Can depend on time spent in building or participation in emergency training
Social affiliation	Extent to which an occupant acts/reacts as an individual or as a member of a group
Condition	Over the course of the fire, the effects — both physiological and psychological — of the fire and its combustion products on each occupant

A.9.4.5.5 For example, in museums, staff characteristics such as number, location, quality, and frequency of training should be considered.

A.9.4.7 Design proposals need to state explicitly any design specifications or estimations regarding building fire safety plans, inspection programs, or other ongoing programs, whose performance is necessary for the building when occupied and operational or when closed after hours, to meet the stated goals and objectives.

Programs of interest include any maintenance, training, labeling, or certification programs required to assure operational status or reliability in building systems or features.

A.9.4.9 This requirement includes assumptions about the interrelations between the performance of building elements and systems, occupant behavior, or emergency response actions that conflict with each other. For each fire scenario, care needs to be taken to assure that conflicts in actions do not occur. Typical conflicts could include the following and similar assumptions:

- (1) A fire door will remain closed during the fire event to contain smoke, while this same door is used by occupants during egress from the area.
- (2) A room door to a historically significant space is closed at all times, yet the door is normally open for public viewing.
- (3) Fire apparatus will arrive immediately from a distant location to charge fire department connections to provide water.

For example, an assumption that compartmentation blocking the passage of fire and smoke will be maintained at the door from a historically significant space or to a stairwell cannot be paired with an assumption that evacuation through that door will extend over many minutes.

A.9.4.10 This requirement includes provisions that are in excess of basic requirements covered by referenced codes and

standards, typical design requirements, and operating procedures. It includes provisions such as more frequent periodic testing and maintenance to increase the reliability of fire protection systems, redundant systems to increase reliability, on-site staff assistance to enhance detection of fires and aid in fire response procedures, staff training, availability and performance of emergency response personnel, and other factors.

A.9.5.1 Design fire scenarios define the challenge a building is expected to withstand. They also need to define the threat to the historically significant features or attributes of the building. Design fire scenarios capture and limit value judgments on the type and severity of the fire challenge to which a proposed fire safety system needs to respond. The fire safety system includes any or all of the following aspects of the proposed design that are intended to mitigate the effects of a fire:

- (1) Egress system
- (2) Automatic detection and suppression
- (3) Barriers
- (4) Staff training
- (5) Placement of manual extinguishers

Design fire scenarios come from two sources — those that are specified in paragraphs 9.5.3.2 through 9.5.3.9, and those that are developed by the design team based on the unique characteristics of the building as required by 9.5.2. In most, if not all cases, more than one design fire scenario should be developed to meet the requirements of 9.5.2.

Once the set of design fire scenarios is established — both those specified by 9.5.3.2 through 9.5.3.9 and those that are developed as required by 9.5.2 — they must be quantified into a format that can be used for the evaluation of proposed designs. The *SFPE Engineering Guide to Performance-Based Fire Protection* outlines a process and identifies tools and references that can be used at each step of this process.

A.9.5.2 The protection systems and features used to meet the challenge of the design fire scenario should be typical of, and