ATTORNEY GENERAL
DEPARTMENT OF JUSTICE

33 CAPITOL STREET
CONCORD, NEW HAMPSHIRE 03301-6397

JOSEPH A. FOSTER
ATTORNEY GENERAL

ANN M. RICE
DEPUTY ATTORNEY GENERAL

December 19, 2013

Michael J. Iacopino, Esquire
Brennan, Caron, Lenehan & Iacopino, PA
85 Brook Street
Manchester, NH 03104-3605

Re: Groton Wind, LLC

Dear Attorney Iacopino:

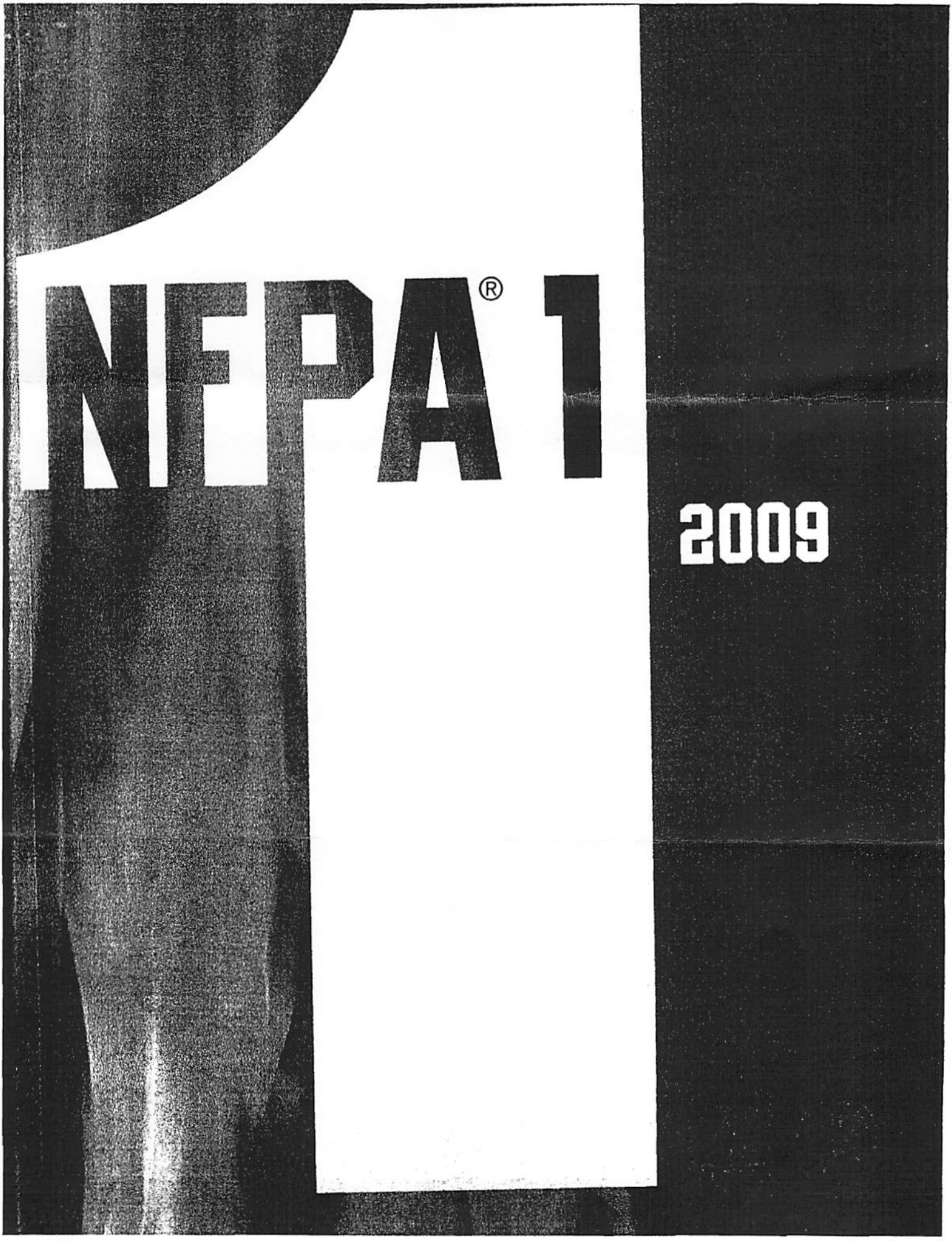
Enclosed please find the NFPA codes you requested. We have not included the International Building Code provisions because those can be accessed online.

If you need any other sections, please let us know.

Sincerely,

Mary C. Evans
Legal Assistant
Transportation and Construction Bureau
(603) 271-3675
Fax: (603) 223-6208

mce
Enclosures
983210


NFPA® 1
2009

4.1.3.2 Safety During Building Use.

4.1.3.2.1* Safety-During-Building-Use Goal. The safety-during-building-use goal of this *Code* shall be to provide an environment for the occupants of the building that is reasonably safe during the normal use of the building.

4.1.3.2.2 Safety-During-Building-Use Objectives.

4.1.3.2.2.1 Buildings shall be designed and constructed to reduce the probability of death or injury of persons from falling during normal use of the building.

4.1.3.2.2.2 Buildings shall be designed and constructed to provide for reasonably safe crowd movement during emergency and nonemergency conditions.

4.1.3.2.2.3 Buildings shall be designed and constructed to provide reasonable life safety for occupants and workers during construction and demolition.

4.1.3.2.2.4 Buildings shall be designed and constructed to provide reasonable notification to occupants of fire and other emergency situations.

4.1.3.2.2.5 Buildings shall be designed and constructed to provide reasonable signage and lighting to identify hazards, exits, means of egress, and other building safety features.

4.1.3.3 Safety from Hazardous Materials.

4.1.3.3.1 Safety-from-Hazardous-Materials Goal. The safety-from-hazardous-materials goal of this *Code* shall be to provide an environment for the occupants in a building or facility and to those adjacent to a building or facility that is reasonably safe from exposures to adverse affects from hazardous materials present therein.

4.1.3.3.2 Safety-from-Hazardous-Materials Objectives.

4.1.3.3.2.1 The storage, use, or handling of hazardous materials in a building or facility shall be accomplished in a manner that provides a reasonable level of safety for occupants and for those adjacent to a building or facility from health hazards, illness, injury, or death during normal storage, use, or handling operations and conditions.

4.1.3.3.2.2* The storage, use, or handling of hazardous materials in a building or facility shall be accomplished in a manner that provides a reasonable level of safety for occupants and for those adjacent to a building or facility from illness, injury, or death due to the following conditions:

(1) An unplanned release of the hazardous material
(2) A fire impinging upon the hazardous material or the involvement of the material in a fire
(3) The application of an external force on the hazardous material that is likely to result in an unsafe condition

4.1.4 Property Protection.

4.1.4.1 Property Protection Goal. The property protection goal of this *Code* shall be to limit damage created by a fire, explosion, or event associated with hazardous materials to a reasonable level to the building or facility and adjacent property.

4.1.4.2 Property Protection Objectives.

4.1.4.2.1* Prevention of Ignition. The facility shall be designed, constructed, and maintained, and operations associated with the facility shall be conducted, to prevent unintentional explosions and fires that result in failure of or damage to adjacent compartments, emergency life safety systems, adjacent properties, adjacent outside storage, and the facility's structural elements.

4.1.4.2.2* Fire Spread and Explosions. In the event that a fire or explosion occurs, the building or facility shall be sited, designed, constructed, or maintained, and operations associated with the facility shall be conducted and protected, to reasonably reduce the impact of unwanted fires and explosions on the adjacent compartments, emergency life safety systems, adjacent properties, adjacent outside storage, and the facility's structural elements.

4.1.4.2.3 Structural Integrity. The facility shall be designed, constructed, protected, and maintained, and operations associated with the facility shall be conducted, to provide a reasonable level of protection for the facility, its contents, and adjacent properties from building collapse due to a loss of structural integrity resulting from a fire.

4.1.4.2.4 Hazardous Materials. The facility shall be designed, constructed, and maintained, and operations associated with the facility shall be conducted, to provide reasonable property protection from damage resulting from fires, explosions, and other unsafe conditions associated with the storage, use, and handling of hazardous materials therein.

4.1.5 Public Welfare.

4.1.5.1* Public Welfare Goal. The public welfare goal of this *Code* shall be to maintain a high probability that buildings and facilities that provide a public welfare role for a community continue to perform the function for their intended purpose following a fire, explosion, or hazardous materials event.

4.1.5.2* Public Welfare Objective. Buildings and facilities that provide a public welfare role for a community shall be designed, constructed, maintained, and operated to provide reasonable assurance of continued function following a fire, explosion, or hazardous materials event.

4.2 Assumptions.

4.2.1* Single Fire Source.

4.2.1.1 The fire protection methods of this *Code* shall assume that multiple simultaneous fire incidents will not occur.

4.2.1.2 The single fire source assumption shall not preclude the evaluation of multiple design fire scenarios as required by Section 5.4.

4.2.2* Single Hazardous Material Release.

4.2.2.1 The protection methods of this *Code* shall assume that multiple simultaneous unauthorized releases of hazardous materials from different locations will not occur.

4.2.2.2 The single hazardous material release assumption shall not preclude the evaluation of multiple design scenarios as required by Section 5.4.

4.2.3* Incidents Impinging on Hazardous Materials. The protection methods of this *Code* shall assume that a fire, explosion, hazardous materials release, or external force that creates a dangerous condition has the potential to impinge on hazardous materials being stored, handled, or used in the building or facility under normal conditions. *(See Section 5.4 for performance-based design scenarios.)*

4.3 Compliance Options. Compliance with the goals and objectives of Section 4.1 shall be provided in accordance with either of the following:

(1) The prescriptive-based provisions per 4.3.1
(2) The performance-based provisions per 4.3.2

4.3.1 Prescriptive-Based Option.

4.3.1.1 A prescriptive-based option shall be in accordance with Chapter 1 through Chapter 4 and Chapter 10 through Chapter 73 of this *Code*.

4.3.1.2 Where specific requirements contained in Chapter 20 for occupancies differ from general requirements contained in Chapter 1 through Chapter 4 and Chapter 10 through Chapter 73, the requirements of Chapter 20 shall govern.

4.3.2 Performance-Based Option.

4.3.2.1 A performance-based option shall be in accordance with Chapter 1 through Chapter 5 of this *Code*.

4.3.2.2 Prescriptive requirements shall be permitted to be used as part of the performance approach, if they, in conjunction with the performance features, meet the overall goals and objectives of this *Code*.

4.4 Fundamental Requirements.

4.4.1 Multiple Safeguards.

4.4.1.1 The design of every building or structure intended for human occupancy shall be such that reliance for property protection and safety to life does not depend solely on any single safeguard.

4.4.1.2 Additional safeguard(s) shall be provided for property protection and life safety in the event that any single safeguard is ineffective due to inappropriate human actions, building failure, or system failure.

4.4.2 Appropriateness of Safeguards. Every building or structure shall be provided with means of egress and other safeguards of the kinds, numbers, locations, and capacities appropriate to the individual building or structure, with due regard to the following:

(1) Characteristics of the occupancy
(2) Capabilities of the occupants
(3) Number of persons exposed
(4) Fire protection available
(5) Capabilities of response personnel
(6) Height and type of construction of the building or structure
(7) Other factors necessary to provide occupants with a reasonable degree of safety
(8) Other factors necessary to protect the building and contents from damage

4.4.3 Means of Egress.

4.4.3.1 Unobstructed Egress.

4.4.3.1.1 In every occupied building or structure, means of egress from all parts of the building shall be maintained free and unobstructed.

4.4.3.1.2 No lock or fastening shall be permitted that prevents free escape from the inside of any building other than in health care occupancies and detention and correctional occupancies where staff are continually on duty and effective provisions are made to remove occupants in case of fire or other emergency.

4.4.3.1.3 Means of egress shall be accessible to the extent necessary to ensure reasonable safety for occupants having impaired mobility.

4.4.3.2 Awareness of Egress System.

4.4.3.2.1 Every exit shall be clearly visible, or the route to reach every exit shall be conspicuously indicated.

4.4.3.2.2 Each means of egress, in its entirety, shall be arranged or marked so that the way to a place of safety is indicated in a clear manner.

4.4.3.2.3 Lighting. Illumination of means of egress shall be provided. [*See 5.3.4(10).*]

4.4.4* Occupant Notification. In every building or structure of such size, arrangement, or occupancy that a fire itself could not provide adequate occupant warning, fire alarm systems shall be provided where necessary to warn occupants of the existence of fire.

4.4.5 Vertical Openings. Every vertical opening between the floors of a building shall be suitably enclosed or protected, as necessary, to provide the following:

(1) Reasonable safety to occupants while using the means of egress by preventing spread of fire, smoke, or fumes through vertical openings from floor to floor to allow occupants to complete their use of the means of egress
(2) Limitation of damage to the buildings and its contents

4.4.6 System Design/Installation. Any fire protection system, building service equipment, feature of protection, or safeguard provided to achieve the goals of this *Code* shall be designed, installed, and approved in accordance with applicable codes and standards referenced in Chapter 2.

4.5 General Requirements.

4.5.1 Authority Having Jurisdiction (AHJ).

4.5.1.1 The AHJ shall determine whether the provisions of this *Code* are met.

4.5.1.2 Where it is evident that a reasonable degree of safety is provided, any requirement shall be permitted to be modified if its application would be hazardous under normal occupancy conditions in the judgment of the AHJ.

4.5.2 Historic Structures and Cultural Resource Buildings. The provisions of this *Code* shall be permitted to be modified by the AHJ for buildings or structures identified and classified as historic structures in accordance with Section 20.17.

4.5.3 Provisions in Excess of *Code* Requirements. Nothing in this *Code* shall be construed to prohibit a better type of building construction, an additional means of egress, or an otherwise safer condition than that specified by the minimum requirements of this *Code*.

4.5.4 Conditions for Occupancy. No new construction or existing building shall be occupied in whole or in part in violation of the provisions of this *Code* unless the following conditions exist:

(1) A plan of correction has been approved.
(2) The occupancy classification remains the same.
(3) No serious life safety hazard exists as judged by the AHJ.

4.5.5 Warrant of Fitness.

4.5.5.1 Where compliance with this *Code* is effected by means of a performance-based design, the owner shall annually certify compliance with the conditions and limitations of the design by submitting a warrant of fitness acceptable to the AHJ.

and recorded. Changes from acceptance test shall be investigated. [72: Table 10.4.2.2, 14(d)2]

13.7.4.5.3 Nonrestorable (General). Heat tests shall not be performed. Functionality shall be tested mechanically and electrically. [72: Table 10.4.2.2, 14(d)4]

13.7.4.5.4 Restorable Line Type, Pneumatic Tube Only. Heat tests shall be performed (where test chambers are in circuit), or a test with pressure pump shall be conducted. [72: Table 10.4.2.2, 14(d)5]

13.7.4.6 Smoke Detectors.

13.7.4.6.1 In Other than One- and Two-Family Dwellings, System Detectors and Single-Station Smoke Alarms. The detectors shall be tested in place to ensure smoke entry into the sensing chamber and an alarm response. Testing with smoke or listed aerosol approved by the manufacturer shall be permitted as acceptable test methods. Other methods listed in the manufacturer's published instructions that ensure smoke entry into the sensing chamber shall be permitted. Any of the following tests shall be performed to ensure that each smoke detector is within its listed and marked sensitivity range:

(1) Calibrated test method
(2) Manufacturer's calibrated sensitivity test instrument
(3) Listed control equipment arranged for the purpose
(4) Smoke detector/control unit arrangement whereby the detector causes a signal at the control unit when its sensitivity is outside its listed sensitivity range
(5) Other calibrated sensitivity test method approved by the AHJ [72: Table 10.4.2.2, 14(g)1]

13.7.4.6.2 Projected Beam Type. The detector shall be tested by introducing smoke, other aerosol, or an optical filter into the beam path. [72: Table 10.4.2.2, 14(g)5]

13.7.4.6.3 A functional test shall be performed on all smoke detectors upon initial installation and at least annually as required by Table 13.7.3.2.4. [72: Table 10.4.4, 15(h)]

13.7.4.7* In other than one- and two-family dwellings, sensitivity of smoke detectors and single- and multiple-station smoke alarms shall be tested in accordance with 13.7.4.7.1 through 13.7.4.7.6. [72:10.4.4.2]

13.7.4.7.1 Sensitivity shall be checked within 1 year after installation. [72:10.4.4.2.1]

13.7.4.7.2 Sensitivity shall be checked every alternate year thereafter unless otherwise permitted by compliance with 13.7.4.7.3. [72:10.4.4.2.2]

13.7.4.7.3 After the second required calibration test, if sensitivity tests indicate that the device has remained within its listed and marked sensitivity range (or 4 percent obscuration light gray smoke, if not marked), the length of time between calibration tests shall be permitted to be extended to a maximum of 5 years. [72:10.4.4.2.3]

13.7.4.7.3.1 If the frequency is extended, records of nuisance alarms and subsequent trends of these alarms shall be maintained. [72:10.4.4.2.3.1]

13.7.4.7.3.2 In zones or in areas where nuisance alarms show any increase over the previous year, calibration tests shall be performed. [72:10.4.4.2.3.2]

13.7.4.7.4 To ensure that each smoke detector or smoke alarm is within its listed and marked sensitivity range, it shall be tested using any of the following methods:

(1) Calibrated test method
(2) Manufacturer's calibrated sensitivity test instrument
(3) Listed control equipment arranged for the purpose
(4) Smoke detector/fire alarm control unit arrangement whereby the detector causes a signal at the fire alarm control unit where its sensitivity is outside its listed sensitivity range
(5) Other calibrated sensitivity test methods approved by the AHJ [72:10.4.4.2.4]

13.7.4.7.5 Detectors or smoke alarms found to have a sensitivity outside the listed and marked sensitivity range shall be cleaned and recalibrated or be replaced.

Exception: Devices listed as field adjustable shall be permitted to be either adjusted within the listed and marked sensitivity range and cleaned and recalibrated, or they shall be replaced. [72:10.4.4.2.5]

13.7.4.7.6 The detector or smoke alarm sensitivity shall not be tested or measured using any device that administers an unmeasured concentration of smoke or other aerosol into the detector or smoke alarm. [72:10.4.4.2.6]

13.8 Other Fire Protection Systems. Where other fire protection systems are required to be installed by the provisions of this *Code*, or are installed with the approval of the AHJ as an alternative or equivalency, the design and installation of the system shall comply with the appropriate standards listed in Table 13.8. The system shall be tested and maintained in accordance with Section 10.4.

Chapter 14 Means of Egress

14.1 Application. Means of egress in new and existing buildings shall comply with this *Code* and NFPA *101, Life Safety Code*.

14.2 Exit Access Corridors. Corridors used as exit access and serving an area having an occupant load exceeding 30 shall be separated from other parts of the building by walls having not less than a 1-hour fire resistance rating in accordance with Section 12.7, unless otherwise permitted by the following:

(1) This requirement shall not apply to existing buildings, provided that the occupancy classification does not change.
(2) This requirement shall not apply where otherwise provided in Chapters 11 through 43 of NFPA *101*. [*101*:7.1.3.1]

14.3 Exits.

14.3.1 Where this *Code* requires an exit to be separated from other parts of the building, the separating construction shall meet the requirements of Section 8.2 of NFPA *101* and the following:

(1)* The separation shall have a minimum 1-hour fire resistance rating where the exit connects three or fewer stories.
(2)* The separation shall have a minimum 2-hour fire resistance rating where the exit connects four or more stories, unless one of the following conditions exists:
  (a) In existing non-high-rise buildings, existing exit stair enclosures shall have a minimum 1-hour fire resistance rating.
  (b) In existing buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3, existing exit stair enclosures shall have a minimum 1-hour fire resistance rating.
  (c) The minimum 1-hour enclosures in accordance with 28.2.2.1.2, 29.2.2.1.2, 30.2.2.1.2, and 31.2.2.1.2 of NFPA *101* shall be permitted as an alternative to the requirement of 14.3.1(2).

and adjacent to such buildings or structures, shall maintain an effective defensible space in accordance with NFPA 1144.

17.3.5.2.2 Where required by the AHJ because of extra hazardous conditions, additional areas shall be maintained to include additional defensible space from buildings or structures. trees adjacent to or overhanging a building shall be maintained free of deadwood, and the roof of a structure shall be free of leaves, needles, or other dead vegetative growth.

17.3.5.3 **Roadways.** Areas within 10 ft (3 m) on each side of portions of highways and private streets shall be cleared of combustible vegetation and other combustible growth. Single specimens of trees, shrubbery, or cultivated ground cover such as green grass, ivy, succulents, or similar plants used as ground covers shall be permitted to be exempt provided that they do not form a means of readily transmitting fire.

17.3.6 **Unusual Circumstances.** The AHJ shall determine that difficult terrain, danger of erosion, or other unusual circumstances could require additional safeguards.

17.3.7 **Fire Roads, Firebreaks, and Emergency Access.**

17.3.7.1 The provisions of 17.3.7 and NFPA 1141, *Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas*, shall be used to determine the design, clearances, and provisions for emergency access (ingress and egress).

17.3.7.2 Unauthorized vehicles shall not be driven upon fire roads or firebreaks. Vehicles shall not be parked in a manner that obstructs the entrance to a fire road or firebreak.

17.3.7.3 Radio and television aerials, guy wires, and other obstructions shall not be installed or maintained on fire roads or firebreaks unless the vertical clearance is sufficient to allow the movement of fire and emergency apparatus.

17.3.7.4 Motorcycles, motor scooters, and motor vehicles shall not be operated within hazardous fire areas, except upon clearly established public or private roads.

17.3.8 **Tampering with Fire Safety Equipment.** See Section 10.8 for requirements on tampering with fire safety equipment.

17.3.9 **Maintenance.** See Section 10.4 for requirements on maintenance.

Chapter 18 Fire Department Access and Water Supply

18.1 **General.** Fire department access and water supplies shall comply with this chapter.

18.1.1 **Plans.**

18.1.1.1 **Fire Apparatus Access.** Plans for fire apparatus access roads shall be submitted to the fire department for review and approval prior to construction.

18.1.1.2 **Fire Hydrant Systems.** Plans and specifications for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

18.2 **Fire Department Access.**

18.2.1 Fire department access and fire department access roads shall be provided and maintained in accordance with Section 18.2.

18.2.2* **Access to Structures or Areas.**

18.2.2.1 **Access Box(es).** The AHJ shall have the authority to require an access box(es) to be installed in an accessible location where access to or within a structure or area is difficult because of security.

18.2.2.2 **Access to Gated Subdivisions or Developments.** The AHJ shall have the authority to require fire department access be provided to gated subdivisions or developments through the use of an approved device or system.

18.2.2.3 **Access Maintenance.** The owner or occupant of a structure or area, with required fire department access as specified in 18.2.2.1 or 18.2.2.2, shall notify the AHJ when the access is modified in a manner that could prevent fire department access.

18.2.3 **Fire Department Access Roads.**

18.2.3.1 **Required Access.**

18.2.3.1.1 Approved fire department access roads shall be provided for every facility, building, or portion of a building hereafter constructed or relocated.

18.2.3.1.2 Fire department access roads shall consist of roadways, fire lanes, parking lot lanes, or a combination thereof.

18.2.3.1.3* When not more than two one- and two-family dwellings or private garages, carports, sheds, agricultural buildings, and detached buildings or structures 400 ft^2 (37 m^2) or less are present, the requirements of 18.2.3.1 through 18.2.3.2.1 shall be permitted to be modified by the AHJ.

18.2.3.1.4 When fire department access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the AHJ shall be authorized to require additional fire protection features.

18.2.3.2 **Access to Building.**

18.2.3.2.1 A fire department access road shall extend to within 50 ft (15 m) of at least one exterior door that can be opened from the outside and that provides access to the interior of the building.

18.2.3.2.1.1 Where a one- or two-family dwelling is protected with an approved automatic sprinkler system that is installed in accordance with NFPA 13D, the distance in 18.2.3.2.1 shall be permitted to be increased to 150 ft (46 m).

18.2.3.2.2 Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 ft (46 m) from fire department access roads as measured by an approved route around the exterior of the building or facility.

18.2.3.2.2.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.2 shall be permitted to be increased to 450 ft (137 m).

18.2.3.3 **Multiple Access Roads.** More than one fire department access road shall be provided when it is determined by the AHJ that access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions, or other factors that could limit access.

accessory gearboxes or actuators mounted directly in the nacelle. Properly designed metallic hose is an alternative for hydraulic and lube oil lines in high vibration areas to allow relative motion between rigid pipe supply lines and manifolds, and at the points of entry at the gearbox and generator interfaces.

(2) Rigid piping connected directly to the gearbox should be supported such that failures will not occur due to the natural frequency of the piping coinciding with the rotational speed of the gearbox, drive shaft and hub, and generator. Care should be taken in the design of pipe supports to avoid vibrations induced by other equipment that can excite its natural frequency.

(3) Welded pipe joints are preferred. Threaded couplings and flange bolts in oil piping should be assembled using a torque wrench and torqued to the manufacturer's requirements. Threaded fittings should have a positive locking device to prevent unscrewing.

(4) Instrumentation tubing, piping, and gauges should be protected from accidental mechanical damage. Sight glasses should be listed.

(5) Lubricating oil lines should use "guarded" pipe construction with the pressure feed line located inside the return line. Where guarded pipe construction is not used, piping sleeves should be used to reduce the possibility of oil atomization. All mechanical connections should be guarded.

(6) Containment and drainage should be provided so as to minimize the spread of oil within the nacelle or externally, which poses a risk to equipment or personnel below.

(7) Fluid piping should be routed below all electrical equipment to preclude leaked fluid dripping on the equipment.

10.5.2.2 For wind turbine generators, the following monitors and or trip functions should be provided to safely monitor the operation of wind turbine generators and initiate a safe shutdown of abnormal operating conditions or parameters:

(1) Grid disturbance
(2) Yaw errors or limits
(3) Braking issues
(4) Abnormal vibration
(5) Overspeed (including wind conditions)
(6) Temperature faults
(7) Oil condition (gearbox/lubrication and hydraulic)
(8) Motor protection
(9) Loss of communication between modules or with control center
(10) Blade angles and battery status

10.5.2.3 For gearbox lubrication, a listed fire-resistant fluid should be considered. System designs should reflect a design objective to minimize the amount of oil needed and the amount of piping and associated components outside of the gearbox.

10.5.2.4 Hydraulic control systems should use a listed fire-resistive hydraulic fluid. System designs should reflect a design objective to minimize the amount of hydraulic fluid needed and the amount of piping and associated components required.

10.5.2.5 Electrical power delivery and control systems as well as communications systems, including cabling, wiring, insulation, fans/motors, and cabinetry, should meet the applicable industry design standards for the use intended and duty cycle specified. Such standards should be applied to systems within the nacelle and tower as well as those associated with moving power from the wind turbine units to the grid. As such, this includes power cables and lines, transformers, and power conditioning systems and/or components. Electrical equipment faults are the most likely source of ignition for combustible materials. Electrical equipment should consist of listed arc resistant switchgear.

10.5.2.6 Transformers are used to step-up the electrical power generated by the generator in the nacelle. These transformers can be located in the nacelle, in the tower, or on pads near the base of the tower. The plant design should include features that address the exposures posed by such transformers and, if the transformers are not dry type or filled with a listed less-flammable fluid insulating oil, should take into account transformer location, containment of oil, spacing from other objects, including the tower, and the use of barriers and fixed protection. The same principles should be applied to the step-up transformers used to connect a wind farm to the grid. The step-up transformer installations should reflect a proper evaluation of the exposure created with respect to other transformers as well as wind farm support structures. Appropriate physical separation should be observed, or barrier walls should be erected, where necessary to control such exposures.

10.5.2.7 Batteries are frequently employed to provide back-up power in the nacelle and hub of a wind turbine proper, and other support structures (e.g., control rooms). Batteries should be provided adequate ventilation and should be kept clean.

10.5.2.8 Special-purpose electrical heaters can be used in wind turbine nacelles to provide for oil sump and space heating. These heaters should be listed for the type of use in which they are employed.

10.5.2.9 Lightning protection for blades, nacelles, towers, power lines, transformers, and support structures should be provided in accordance with International Electrotechnical Commission (IEC) TR 61400-24, *Wind Turbine Generator Systems*—Part 24, Lightning Protection.

10.5.2.10 Materials of construction should be noncombustible or less-flammable materials whenever possible. Such principles should be applied to nacelles, towers, O&M/control buildings, and other support structures such as relay houses, switchyard control buildings, and power conditioning buildings.

10.5.2.11 High speed brakes (if used) can create a large quantity of sparks. The use of shield(s) should be considered to isolate these sparks from combustible equipment components and locations where leaked combustible fluids can accumulate.

10.5.3 Fire Protection for Wind Generating Facilities.

10.5.3.1 General.

10.5.3.1.1 Determination of the need for fire detection/suppression and associated wind turbine safe shutdown sequence for wind generating facilities should be based on the facility design and layout, including specific equipment and components used in producing power within the facility. This should be addressed in the Fire Protection Design Basis with regard to the wind turbine and tower as well as power delivery and control circuits. In addition, consideration should be given to the consequences of loss of a wind turbine unit or

multiple units as well as the vulnerability of adjacent structures and equipment to damage.

10.5.3.1.2 Should the fire protection design basis indicated in 10.5.3.1.1 determine a need for fire detection system(s), the system(s) should be arranged to activate alarms at a constantly attended location or via the provision of remote operator circuits. This applies to nacelles, towers, electrical equipment enclosures, and buildings.

10.5.3.1.3 Due to the remote location of the majority of onshore wind generating facilities and the lack of abundant water supplies, the use of water-based fire protection systems is unlikely. For off-shore facilities, the same is true because the construction of pumping and fire water distribution systems would be cost prohibitive. If the design of a particular facility does, however, permit the use of water suppression systems, these systems should follow the general recommendations in Chapter 7.

10.5.3.2 Total Flooding Gaseous Systems.

10.5.3.2.1 Where total flooding gaseous systems are used, electrical enclosures, cabinets, or buildings should be arranged for minimum leakage by automatic closing of ventilation dampers and doors, as applicable, and automatic shutdown of fans.

10.5.3.2.2* Maintenance and inspection of total flooding gaseous agent systems and interlocked equipment are critical.

10.5.3.2.3 For electrical enclosures or cabinetry located in buildings or other such structures, provisions should be addressed for safely removing the gas and potential toxic combustion by-products from these structures following system actuation.

10.5.3.3 Total Flooding Water Mist Systems.

10.5.3.3.1 Where total flooding water mist systems are used, the system should be installed in accordance with NFPA 750, *Standard on Water Mist Fire Protection Systems*, and should be listed for the application. The system should be installed in accordance with the manufacturer's installation procedures.

10.5.3.3.2 Electrical enclosures, cabinets, and buildings should be arranged for reduced leakage by automatic closing of doors, ventilation dampers, and automatic shutdown of fans.

10.5.3.3.3 The water (and agent) supply should be sized to be capable of providing protection for as long as the hazards above the autoignition temperature exist. The system should be listed and sized for the application.

10.5.3.4 Compressed Air Foam Systems.

10.5.3.4.1 Where compressed air foam systems are used, the system should be installed in accordance with NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, and should be listed for the application. The system should be installed in accordance with the manufacturer's installation procedures.

10.5.3.4.2 The water (and agent) supply should be sized to be capable of providing protection for as long as the hazards above the autoignition temperature exist. The system should be listed and sized for the application.

10.5.3.5 Nacelle Fire Protection.

10.5.3.5.1 The need for automatic fixed fire protection within the nacelle of a wind turbine generator should be based on the Fire Protection Design Basis and associated Fire Risk Evaluation. Fire suppression within sealed electrical enclosures and cabinets is discussed in 10.5.3.2 and 10.5.3.3. A local application system is more appropriate for unsealed electrical enclosures and cabinets within the nacelle and tower. Likewise, a local application extinguishing system might be appropriate for the gearbox lubrication system or hydraulic control system. If used, fire suppression capability should be provided for oil piping or any area where oil can flow, accumulate, or spray. Fire extinguishing systems, where provided for hydraulic control equipment, should include protection of reservoirs, pumps, accumulators, piping, and actuating systems. Listed systems should be used.

10.5.3.5.2* Discharge rates and duration should be such that cooling and shutdown occur to prevent re-ignition of the fire. System operation should be arranged to coincide with automatic shutdown of the wind turbine.

10.5.3.5.3 The positioning of local application nozzles should be such that maintenance access to the wind turbine components within the nacelle is maintained.

10.6 Electrical Equipment Enclosures and Buildings.

10.6.1 The size and complexity of the wind generating facility site will determine what, if any, control enclosures are provided. Control enclosures are typically used for power conditioning and grid stability equipment and are designed to be unattended. This type of enclosure contains control panels, switchgear, batteries, relays, rectifiers, and electronic switching circuits.

10.6.2* Auxiliary electrical equipment enclosures, where provided, might contain excitation equipment, switchgear, current transformers, potential transformers, grounding transformers, and other electrical equipment.

10.6.3 A smoke detection system should be installed to provide early warning and alarm functions in the event of an electrical fire within the enclosure.

10.6.4 An automatic suppression system should be considered for the enclosures.

Chapter 11 Solar Thermal Power Generation

11.1* General. Chapter 11 covers fire hazards associated with solar thermal generating stations. The process used in current commercial applications typically involves heating heat transfer fluid (HTF) in solar fields and using this fluid to generate steam to drive a steam turbine generator.

11.2 Application of Chapters 4 through 7, 15, and 16.

11.2.1 The recommendations contained in Chapters 4 through 7, 15, and 16 apply. The Fire Protection Design Basis should determine which recommendations apply to any specific facility. This determination is done by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. The remaining paragraphs in this chapter provide recommendations that are beyond the scope of other chapters in this recommended practice.

11.3* Risk Considerations.

11.3.1 The major hazards associated with solar generating plants are as follows:

(1) Release of large quantities of combustible HTF
(2) Shielded fires involving large quantities of HTF in the heater