

<p><b><u>Chapter 3 Fundamental Fire Protection Program and Design Elements</u></b></p>	<p><b><u>Mapped to 10CFR50, Appendix R 9/1/1982</u></b></p>
<p><b>3.1* General.</b>                      This chapter contains the fundamental elements of the fire protection program and specifies the minimum design requirements for fire protection systems and features. These fire protection program elements and minimum design requirements shall not be subject to the performance-based methods permitted elsewhere in this standard. Previously approved alternatives from the fundamental protection program attributes of this chapter by the AHJ take precedence over the requirements contained herein.</p>	
<p><b>3.2 Fire Protection Plan.</b>  <b>3.2.1 Intent.</b>                      A site-wide fire protection plan shall be established. This plan shall document management policy and program direction and shall define the responsibilities of those individuals responsible for the plan’s implementation. This section establishes the criteria for an integrated combination of components, procedures, and personnel to implement all fire protection program activities.</p>	<p><b><u>II.A Fire protection program</u></b>                      A fire protection program shall be established at each nuclear power plant. The program shall establish the fire protection policy for the protection of structures, systems, and components important to safety at each plant and the procedures, equipment, and personnel required to implement the program at the plant site.</p>
<p><b>3.2.2* Management Policy Direction and Responsibility.</b>                      A policy document shall be prepared that defines management authority and responsibilities and establishes the general policy for the site fire protection program.</p>	<p><b><u>II.A Fire protection program</u></b>                      A fire protection program shall be established at each nuclear power plant. The program shall establish the fire protection policy for the protection of structures, systems, and components important to safety at each plant and the procedures, equipment, and personnel required to implement the program at the plant site.</p> <p>The fire protection program shall be under the direction of an individual who has been delegated authority commensurate with the responsibilities of the position and who has available staff personnel knowledgeable in both fire protection and nuclear safety.</p>
<p><b>3.2.2.1*</b>                      The policy document shall designate the senior management position with immediate authority and responsibility for the fire protection program.</p>	<p><b><u>II.A Fire protection program</u></b>                      The fire protection program shall be under the direction of an individual who has been delegated authority commensurate with the responsibilities of the position and who has available staff personnel knowledgeable in both fire protection and nuclear safety.</p>
<p><b>3.2.2.2*</b>                      The policy document shall designate a position responsible for the daily administration and</p>	<p>No similar requirement in Appendix R.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>coordination of the fire protection program and its implementation.</p>	
<p><b>3.2.2.3*</b> The policy document shall define the fire protection interfaces with other organizations and assign responsibilities for the coordination of activities. In addition, this policy document shall identify the various plant positions having the authority for implementing the various areas of the fire protection program.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.2.2.4*</b> The policy document shall identify the appropriate AHJ for the various areas of the fire protection program.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.2.3* Procedures.</b> Procedures shall be established for implementation of the fire protection program. In addition to procedures that could be required by other sections of the standard, the procedures to accomplish the following shall be established:</p> <ol style="list-style-type: none"> <li>(1) * Inspection, testing, and maintenance for fire protection systems and features credited by the fire protection program</li> <li>(2) * Compensatory actions implemented when fire protection systems and other systems credited by the fire protection program and this standard cannot perform their intended function and limits on impairment duration</li> <li>(3) * Reviews of fire protection program — related performance and trends</li> <li>(4) Reviews of physical plant modifications and procedure changes for impact on the fire protection program</li> <li>(5) Long-term maintenance and configuration of the fire protection program</li> <li>(6) Emergency response procedures for the plant industrial fire brigade</li> </ol>	<p><b><u>II.C Fire prevention features</u></b> Fire protection features shall meet the following general requirements for all fire areas that contain or present a fire hazard to structures, systems, or components important to safety.</p> <p><b>7.</b> Surveillance procedures shall be established to ensure that fire barriers are in place and that fire suppression systems and components are operable.</p>
<p><b>3.3 Prevention.</b> A fire prevention program with the goal of preventing a fire from starting shall be established, documented, and implemented as part of the fire protection program. The two basic components of the fire prevention program shall consist of both of the following:</p> <ol style="list-style-type: none"> <li>(1) Prevention of fires and fire spread by controls on operational activities</li> <li>(2) Design controls that restrict the use of combustible materials</li> </ol>	<p><b><u>II.A. Fire protection program</u></b> The fire protection program shall extend the concept of defense-in-depth to fire protection in fire areas important to safety, with the following objectives:</p> <ul style="list-style-type: none"> <li>• To prevent fires from starting;</li> <li>• To detect rapidly, control, and extinguish promptly those fires that do occur;</li> <li>• To provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the</li> </ul>

The design control requirements listed in the remainder of this section shall be provided as described.

plant.

**II.C. Fire prevention features**

Fire protection features shall meet the following general requirements for all fire areas that contain or present a fire hazard to structures, systems, or components important to safety.

2. Transient fire hazards associated with normal operation, maintenance, repair, or modification activities shall be identified and eliminated where possible. Those transient fire hazards that can not be eliminated shall be controlled and suitable protection provided.
7. Surveillance procedures shall be established to ensure that fire barriers are in place and that fire suppression systems and components are operable.

**III.K. Administrative controls**

Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:

1. Govern the handling and limitation of the use of ordinary combustible materials, combustible and flammable gases and liquids, high efficiency particulate air and charcoal filters, dry ion exchange resins, or other combustible supplies in safety-related areas.
2. Prohibit the storage of combustibles in safety-related areas or establish designated storage areas with appropriate fire protection.
3. Govern the handling of and limit transient fire loads such as combustible and flammable liquids, wood and plastic products, or other combustible materials in buildings containing safety-related systems or equipment during all phases of operating, and especially during maintenance, modification, or refueling operations.
4. Designate the onsite staff member responsible for the in plant fire protection review of proposed work activities to identify potential transient fire hazards and specify required additional fire protection in the work activity procedure.
5. Govern the use of ignition sources by use of a flame permit system to control welding, flame cutting, brazing, or soldering operations. A separate permit shall be issued for each area where work is to be done. If work continues over more than one shift, the permit shall be valid for not more than 24 hours when the plant is operating or for the duration of a particular job during plant shutdown.

Appendix B-1: Appendix R Mapped to NFPA 805

	<ol style="list-style-type: none"> <li>6. Control the removal from the area of all waste, debris, scrap, oil spills, or other combustibles resulting from the work activity immediately following completion of the activity, or at the end of each work shift, whichever comes first.</li> <li>7. Maintain the periodic housekeeping inspections to ensure continued compliance with these administrative controls.</li> <li>8. Control the use of specific combustibles in safety-related areas. All wood used in safety-related areas during maintenance, modification, or refueling operations (such as lay-down blocks or scaffolding) shall be treated with a flame retardant. Equipment or supplies (such as new fuel) shipped in untreated combustible packing containers may be unpacked in safety-related areas if required for valid operating reasons. However, all combustible materials shall be removed from the area immediately following the unpacking. Such transient combustible material, unless stored in approved containers, shall not be left unattended during lunch breaks, shift changes, or other similar periods. Loose combustible packing material such as wood or paper excelsior, or polyethylene sheeting shall be placed in metal containers with tight-fitting self-closing metal covers.</li> </ol>
<p><b>3.3.1 Fire Prevention for Operational Activities.</b>          The fire prevention program activities shall consist of the necessary elements to address the control of ignition sources and the use of transient combustible materials during all aspects of plant operations. The fire prevention program shall focus on the human and programmatic elements necessary to prevent fires from starting or, should a fire start, to keep the fire as small as possible.</p>	<p><b>III.K. <u>Administrative controls</u></b>          Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:</p> <ol style="list-style-type: none"> <li>1. Govern the handling and limitation of the use of ordinary combustible materials, combustible and flammable gases and liquids, high efficiency particulate air and charcoal filters, dry ion exchange resins, or other combustible supplies in safety-related areas.</li> <li>2. Prohibit the storage of combustibles in safety-related areas or establish designated storage areas with appropriate fire protection.</li> <li>3. Govern the handling of and limit transient fire loads such as combustible and flammable liquids, wood and plastic products, or other combustible materials in buildings containing safety-related systems or equipment during all phases of operating, and especially during maintenance, modification, or refueling operations.</li> <li>4. Designate the onsite staff member responsible for the in plant fire protection review of proposed work activities to identify potential transient fire hazards and</li> </ol>

## Appendix B-1: Appendix R Mapped to NFPA 805

	<p>specify required additional fire protection in the work activity procedure.</p> <ol style="list-style-type: none"><li><b>5.</b> Govern the use of ignition sources by use of a flame permit system to control welding, flame cutting, brazing, or soldering operations. A separate permit shall be issued for each area where work is to be done. If work continues over more than one shift, the permit shall be valid for not more than 24 hours when the plant is operating or for the duration of a particular job during plant shutdown.</li><li><b>6.</b> Control the removal from the area of all waste, debris, scrap, oil spills, or other combustibles resulting from the work activity immediately following completion of the activity, or at the end of each work shift, whichever comes first.</li><li><b>7.</b> Maintain the periodic housekeeping inspections to ensure continued compliance with these administrative controls.</li><li><b>8.</b> Control the use of specific combustibles in safety-related areas. All wood used in safety-related areas during maintenance, modification, or refueling operations (such as lay-down blocks or scaffolding) shall be treated with a flame retardant. Equipment or supplies (such as new fuel) shipped in untreated combustible packing containers may be unpacked in safety-related areas if required for valid operating reasons. However, all combustible materials shall be removed from the area immediately following the unpacking. Such transient combustible material, unless stored in approved containers, shall not be left unattended during lunch breaks, shift changes, or other similar periods. Loose combustible packing material such as wood or paper excelsior, or polyethylene sheeting shall be placed in metal containers with tight-fitting self-closing metal covers.</li><li><b>9.</b> Control actions to be taken by an individual discovering a fire, for example, notification of control room, attempt to extinguish fire, and actuation of local fire suppression systems.</li><li><b>10.</b> Control actions to be taken by the control room operator to determine the need for brigade assistance upon report of a fire or receipt of alarm on control room annunciator panel, for example, announcing location of fire over PA system, sounding fire alarms, and notifying the shift supervisor and the fire brigade leader of the type, size, and location of the fire.</li><li><b>11.</b> Control actions to be taken by the fire brigade after notification by the control room operator of a fire, for example, assembling in a designated location,</li></ol>
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	<p>receiving directions from the fire brigade leader, and discharging specific fire fighting responsibilities including selection and transportation of fire fighting equipment to fire location, selection of protective equipment, operating instructions for use of fire suppression systems, and use of pre-planned strategies for fighting fires in specific areas.</p> <p>12. Define the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment. These strategies shall designate:</p> <ul style="list-style-type: none"> <li>a. Fire hazards in each area covered by the specific pre-fire plans.</li> <li>b. Fire extinguishants best suited for controlling the fires associated with the fire hazards in that area and the nearest location of these extinguishants.</li> <li>c. Most favorable direction from which to attack a fire in each area in view of the ventilation direction, access hallways, stairs, and doors that are most likely to be free of fire, and the best station or elevation for fighting the fire. All access and egress routes that involve locked doors should be specifically identified in the procedure with the appropriate precautions and methods for access specified.</li> <li>d. Plant systems that should be managed to reduce the damage potential during a local fire and the location of local and remote controls for such management (e.g., any hydraulic or electrical systems in the zone covered by the specific fire fighting procedure that could increase the hazards in the area because of over-pressurization or electrical hazards).</li> <li>e. Vital heat-sensitive system components that need to be kept cool while fighting a local fire. Particularly hazardous combustibles that need cooling should be designated.</li> </ul>
<p><b>3.3.1.1 General Fire Prevention Activities.</b>  The fire prevention activities shall include but not be limited to the following program elements:</p> <ul style="list-style-type: none"> <li>(1) Training on fire safety information for all employees and contractors including, as a minimum, familiarization with plant fire prevention procedures, fire reporting, and plant emergency alarms</li> <li>(2) * Documented plant inspections including provisions for corrective actions for conditions where unanalyzed fire hazards are identified</li> <li>(3) * Administrative controls addressing the review of plant modifications and maintenance to ensure that both fire hazards and the impact on</li> </ul>	<p><b>III.K. <u>Administrative controls</u></b></p> <ul style="list-style-type: none"> <li>6. Control the removal from the area of all waste, debris, scrap, oil spills, or other combustibles resulting from the work activity immediately following completion of the activity, or at the end of each work shift, whichever comes first.</li> <li>7. Maintain the periodic housekeeping inspections to ensure continued compliance with these administrative controls.</li> </ul>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>plant fire protection systems and features are minimized.</p>	
<p><b>3.3.1.2* Control of Combustible Materials.</b>          Procedures for the control of general housekeeping practices and the control of transient combustibles shall be developed and implemented. These procedures shall include but not be limited to the following program elements:          (1) * Wood used within the power block shall be listed pressure-impregnated or coated with a listed fire-retardant application.          Exception: Cribbing timbers 6 in. by 6 in. (15.2 cm by 15.2 cm) or larger shall not be required to be fire-retardant treated.          (2) Plastic sheeting materials used in the power block shall be fire-retardant types that have passed NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films, large-scale tests, or equivalent.          (3) Waste, debris, scrap, packing materials, or other combustibles shall be removed from an area immediately following the completion of work or at the end of the shift, whichever comes first.          (4) * Combustible storage or staging areas shall be designated, and limits shall be established on the types and quantities of stored materials.          (5) * Controls on use and storage of flammable and combustible liquids shall be in accordance with NFPA 30, Flammable and Combustible Liquids Code, or other applicable NFPA standards.          (6) * Controls on use and storage of flammable gases shall be in accordance with applicable NFPA standards.</p>	
<p><b>3.3.1.3 Control of Ignition Sources.</b>  <b>3.3.1.3.1*</b>          A hot work safety procedure shall be developed, implemented, and periodically updated as necessary in accordance with NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, and NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.</p>	<p><b><u>III.K Administrative controls</u></b>  <b>5.</b> Govern the use of ignition sources by use of a flame permit system to control welding, flame cutting, brazing, or soldering operations. A separate permit shall be issued for each area where work is to be done. If work continues over more than one shift, the permit shall be valid for not more than 24 hours when the plant is operating or for the duration of a particular job during plant shutdown.</p>
<p><b>3.3.1.3.2</b>          Smoking and other possible sources of ignition shall be restricted to properly designated and supervised safe areas of the plant.</p>	<p>No similar requirement in Appendix R.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p><b>3.3.1.3.3</b> Open flames or combustion-generated smoke shall not be permitted for leak or air flow testing.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.1.3.4*</b> Plant administrative procedure shall control the use of portable electrical heaters in the plant. Portable fuel-fired heaters shall not be permitted in plant areas containing equipment important to nuclear safety or where there is a potential for radiological releases resulting from a fire.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.2 Structural.</b> Walls, floors, and components required to maintain structural integrity shall be of noncombustible construction, as defined in NFPA 220, Standard on Types of Building Construction.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.3 Interior Finishes.</b> Interior wall or ceiling finish classification shall be in accordance with NFPA 101®, Life Safety Code®, requirements for Class A materials. Interior floor finishes shall be in accordance with NFPA 101 requirements for Class I interior floor finishes.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.4 Insulation Materials.</b> Thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials shall be noncombustible or limited combustible.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.5 Electrical.</b> <b>3.3.5.1</b> Wiring above suspended ceiling shall be kept to a minimum. Where installed, electrical wiring shall be listed for plenum use, routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.5.2</b> Only metal tray and metal conduits shall be used for electrical raceways. Thin wall metallic tubing shall not be used for power, instrumentation, or control cables. Flexible metallic conduits shall only be used in short lengths to connect components.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.5.3*</b> Electric cable construction shall comply with a flame propagation test as acceptable to the AHJ. Exception: Existing cable in place prior to the adoption of this standard shall be permitted to remain as is.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.6 Roofs.</b> Metal roof deck construction shall be designed</p>	<p>No similar requirement in Appendix R.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>and installed so the roofing system will not sustain a self-propagating fire on the underside of the deck when the deck is heated by a fire inside the building. Roof coverings shall be Class A as determined by tests described in NFPA 256, Standard Methods of Fire Tests of Roof Coverings.</p>	
<p><b>3.3.7 Bulk Flammable Gas Storage.</b> Bulk compressed or cryogenic flammable gas storage shall not be permitted inside structures housing systems, equipment, or components important to nuclear safety.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.7.1</b> Storage of flammable gas shall be located outdoors, or in separate detached buildings, so that a fire or explosion will not adversely impact systems, equipment, or components important to nuclear safety. NFPA 50A, Standard for Gaseous Hydrogen Systems at Consumer Sites, shall be followed for hydrogen storage.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.7.2</b> Outdoor high-pressure flammable gas storage containers shall be located so that the long axis is not pointed at buildings.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.7.3</b> Flammable gas storage cylinders not required for normal operation shall be isolated from the system.</p>	<p><b>III.K. <u>Administrative controls</u></b> Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:</p> <ol style="list-style-type: none"> <li>1. Govern the handling and limitation of the use of ordinary combustible materials, combustible and flammable gases and liquids, high efficiency particulate air and charcoal filters, dry ion exchange resins, or other combustible supplies in safety-related areas.</li> </ol>
<p><b>3.3.8 Bulk Storage of Flammable and Combustible Liquids.</b> Bulk storage of flammable and combustible liquids shall not be permitted inside structures containing systems, equipment, or components important to nuclear safety. As a minimum, storage and use shall comply with NFPA 30, Flammable and Combustible Liquids Code.</p>	<p><b>III.K. <u>Administrative controls</u></b> Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:</p> <ol style="list-style-type: none"> <li>2. Prohibit the storage of combustibles in safety-related areas or establish designated storage areas with appropriate fire protection.</li> </ol>
<p><b>3.3.9* Transformers.</b> Where provided, transformer oil collection basins and drain paths shall be periodically inspected to ensure that they are free of debris and capable of performing their design function.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.10* Hot Pipes and Surfaces.</b></p>	<p>No similar requirement in Appendix R.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>Combustible liquids, including high flashpoint lubricating oils, shall be kept from coming in contact with hot pipes and surfaces, including insulated pipes and surfaces. Administrative controls shall require the prompt cleanup of oil on insulation.</p>	
<p><b>3.3.11 Electrical Equipment</b> Adequate clearance, free of combustible material, shall be maintained around energized electrical equipment.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.3.12* Reactor Coolant Pumps.</b> For facilities with non-inerted containments, reactor coolant pumps with an external lubrication system shall be provided with an oil collection system. The oil collection system shall be designed and installed such that leakage from the oil system is safely contained for off normal conditions such as accident conditions or earthquakes. All of the following shall apply.</p> <p>(1) The oil collection system for each reactor coolant pump shall be capable of collecting lubricating oil from all potential pressurized and nonpressurized leakage sites in each reactor coolant pump oil system.</p> <p>(2) Leakage shall be collected and drained to a vented closed container that can hold the inventory of the reactor coolant pump lubricating oil system.</p> <p>(3) A flame arrestor is required in the vent if the flash point characteristics of the oil present the hazard of a fire flashback.</p> <p>(4) Leakage points on a reactor coolant pump motor to be protected shall include but not be limited to the lift pump and piping, overflow lines, oil cooler, oil fill and drain lines and plugs, flanged connections on oil lines, and the oil reservoirs, where such features exist on the reactor coolant pumps.</p> <p>(5) The collection basin drain line to the collection tank shall be large enough to accommodate the largest potential oil leak such that oil leakage does not overflow the basin.</p>	<p><b><u>III.O. Oil collection system for reactor coolant pump</u></b> The reactor coolant pump shall be equipped with an oil collection system if the containment is not inerted during normal operation. The oil collection system shall be so designed, engineered, and installed that failure will not lead to fire during normal or design basis accident conditions and that there is reasonable assurance that the system will withstand the Safe Shutdown Earthquake.<sup>5</sup> Such collection systems shall be capable of collecting lube oil from all potential pressurized and unpressurized leakage sites in the reactor coolant pump lube oil systems. Leakage shall be collected and drained to a vented closed container that can hold the entire lube oil system inventory. A flame arrester is required in the vent if the flash point characteristics of the oil present the hazard of fire flashback. Leakage points to be protected shall include lift pump and piping, overflow lines, lube oil cooler, oil fill and drain lines and plugs, flanged connections on oil lines, and lube oil reservoirs where such features exist on the reactor coolant pumps. The drain line shall be large enough to accommodate the largest potential oil leak. <sup>5</sup> See <i>Regulatory Guide 1.29-“Seismic Design Classification”</i> paragraph C.2.</p>
<p><b>3.4 Industrial Fire Brigade.</b> <b>3.4.1 On-Site Fire-Fighting Capability.</b> All of the following requirements shall apply.</p>	<p><b><u>III.H. Fire brigade</u></b> A site fire brigade trained and equipped for fire fighting shall be established to ensure adequate manual fire</p>

<sup>5</sup> See Regulatory Guide 1.29-“Seismic Design Classification” paragraph C.2.

Appendix B-1: Appendix R Mapped to NFPA 805

<p>(a) A fully staffed, trained, and equipped fire-fighting force shall be available at all times to control and extinguish all fires on site. This force shall have a minimum complement of five persons on duty and shall conform with the following NFPA standards as applicable:</p> <p>(1) NFPA 600, Standard on Industrial Fire Brigades (interior structural fire fighting)</p> <p>(2) NFPA 1500, Standard on Fire Department Occupational Safety and Health Program</p> <p>(3) NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians</p> <p>(b) * Industrial fire brigade members shall have no other assigned normal plant duties that would prevent immediate response to a fire or other emergency as required.</p> <p>(c) During every shift, the brigade leader and at least two brigade members shall have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on nuclear safety performance Exception: Sufficient training and knowledge shall be permitted to be provided by an operations advisor dedicated to industrial fire brigade support criteria.</p> <p>(d) * The industrial fire brigade shall be notified immediately upon verification of a fire.</p> <p>(e) Each industrial fire brigade member shall pass an annual physical examination to determine that he or she can perform the strenuous activity required during manual fire-fighting operations. The physical examination shall determine the ability of each member to use respiratory protection equipment.</p>	<p>fighting capability for all areas of the plant containing structures, systems, or components important to safety. The fire brigade shall be at least five members on each shift. The brigade leader and at least two brigade members shall have sufficient training in or knowledge of plant safety-related systems to understand the effects of fire and fire suppressants on safe shutdown capability. The qualification of fire brigade members shall include an annual physical examination to determine their ability to perform strenuous fire fighting activities. The shift supervisor shall not be a member of the fire brigade. The brigade leader shall be competent to assess the potential safety consequences of a fire and advise control room personnel. Such competence by the brigade leader may be evidenced by possession of an operator's license or equivalent knowledge of plant safety-related systems. The minimum equipment provided for the brigade shall consist of personal protective equipment such as turnout coats, boots, gloves, hard hats, emergency communications equipment, portable lights, portable ventilation equipment, and portable extinguishers. Self-contained breathing apparatus using full-face positive-pressure masks approved by NIOSH (National Institute for Occupational Safety and Health--approval formerly given by the U.S. Bureau of Mines) shall be provided for fire brigade, damage control, and control room personnel. At least 10 masks shall be available for fire brigade personnel. Control room personnel may be furnished breathing air by a manifold system piped from a storage reservoir if practical. Service or rated operating life shall be a minimum of one-half hour for the self-contained units.</p> <p><b>III.K. <u>Administrative controls</u></b></p> <p>Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:</p> <p><b>10.</b> Control actions to be taken by the control room operator to determine the need for brigade assistance upon report of a fire or receipt of alarm on control room annunciator panel, for example, announcing location of fire over PA system, sounding fire alarms, and notifying the shift supervisor and the fire brigade leader of the type, size, and location of the fire.</p>
<p><b>3.4.2* Pre-Fire Plans.</b></p> <p>Current and detailed pre-fire plans shall be available to the industrial fire brigade for all areas in which a fire could jeopardize the ability to</p>	<p><b>III. K. <u>Administrative controls</u></b></p> <p>Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>meet the performance criteria described in Section 1.5.</p>	<p>establish procedures to:  <b>12.</b> Define the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment. These strategies shall designate:  <b>a.</b> Fire hazards in each area covered by the specific pre-fire plans.</p>
<p><b>3.4.2.1*</b>  The plans shall detail the fire area configuration and fire hazards to be encountered in the fire area, along with any nuclear safety components and fire protection systems and features that are present.</p>	<p><b>III.K. <u>Administrative controls</u></b>  Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:    <b>12.</b> Define the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment. These strategies shall designate:  <b>a.</b> Fire hazards in each area covered by the specific pre-fire plans.  <b>b.</b> Fire extinguishants best suited for controlling the fires associated with the fire hazards in that area and the nearest location of these extinguishants.  <b>d.</b> Plant systems that should be managed to reduce the damage potential during a local fire and the location of local and remote controls for such management (e.g., any hydraulic or electrical systems in the zone covered by the specific fire fighting procedure that could increase the hazards in the area because of over-pressurization or electrical hazards).  <b>e.</b> Vital heat-sensitive system components that need to be kept cool while fighting a local fire. Particularly hazardous combustibles that need cooling should be designated.</p>
<p><b>3.4.2.2</b>  Pre-fire plans shall be reviewed and updated as necessary.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.4.2.3*</b>  Pre-fire plans shall be available in the control room and made available to the plant industrial fire brigade.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.4.2.4*</b>  Pre-fire plans shall address coordination with other plant groups during fire emergencies.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.4.3 Training and Drills.</b>  Industrial fire brigade members and other plant personnel who would respond to a fire in conjunction with the brigade shall be provided with training commensurate with their emergency responsibilities.  (a) Plant Industrial Fire Brigade Training. All of the following requirements shall apply.</p>	<p><b>III.I. <u>Fire brigade training</u></b>  The fire brigade training program shall ensure that the capability to fight potential fires is established and maintained. The program shall consist of an initial classroom instruction program followed by periodic classroom instruction, fire fighting practice, and fire drills:  <b>1. <u>Instruction</u></b></p>

## Appendix B-1: Appendix R Mapped to NFPA 805

- (1) Plant industrial fire brigade members shall receive training consistent with the requirements contained in NFPA 600, Standard on Industrial Fire Brigades, or NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, as appropriate.
- (2) Industrial fire brigade members shall be given quarterly training and practice in fire fighting, including radioactivity and health physics considerations, to ensure that each member is thoroughly familiar with the steps to be taken in the event of a fire.
- (3) A written program shall detail the industrial fire brigade training program.
- (4) Written records that include but are not limited to initial industrial fire brigade classroom and hands-on training, refresher training, special training schools attended, drill attendance records, and leadership training for industrial fire brigades shall be maintained for each industrial fire brigade member.
  - (b) Training for Non-Industrial Fire Brigade Personnel. Plant personnel who respond with the industrial fire brigade shall be trained as to their responsibilities, potential hazards to be encountered, and interfacing with the industrial fire brigade.
  - (c) \* Drills. All of the following requirements shall apply.
    - (1) Drills shall be conducted quarterly for each shift to test the response capability of the industrial fire brigade.
    - (2) Industrial fire brigade drills shall be developed to test and challenge industrial fire brigade response, including brigade performance as a team, proper use of equipment, effective use of pre-fire plans, and coordination with other groups. These drills shall evaluate the industrial fire brigade's abilities to react, respond, and demonstrate proper fire-fighting techniques to control and extinguish the fire and smoke conditions being simulated by the drill scenario.
    - (3) Industrial fire brigade drills shall be conducted in various plant areas, especially in those areas identified to be essential to plant operation and to contain significant fire hazards.
    - (4) Drill records shall be maintained detailing the drill scenario, industrial fire brigade member response, and ability of the industrial fire brigade

- a. The initial classroom instruction shall include:
    - (1) Indoctrination of the plant fire fighting plan with specific identification of each individual's responsibilities.
    - (2) Identification of the type and location of fire hazards and associated types of fires that could occur in the plant.
    - (3) The toxic and corrosive characteristics of expected products of combustion.
    - (4) Identification of the location of fire fighting equipment for each fire area and familiarization with the layout of the plant, including access and egress routes to each area.
    - (5) The proper use of available fire fighting equipment and the correct method of fighting each type of fire. The types of fires covered should include fires in energized electrical equipment, fires in cables and cable trays, hydrogen fires, fires involving flammable and combustible liquids or hazardous process chemicals, fires resulting from construction or modifications (welding), and record file fires.
    - (6) The proper use of communication, lighting, ventilation, and emergency breathing equipment.
    - (7) The proper method for fighting fires inside buildings and confined spaces.
    - (8) The direction and coordination of the fire fighting activities (fire brigade leaders only).
    - (9) Detailed review of fire fighting strategies and procedures.
    - (10) Review of the latest plant modifications and corresponding changes in fire fighting plans.

NOTE: Items (9) and (10) may be deleted from the training of no more than two of the non-operations personnel who may be assigned to the fire brigade.
  - b. The instruction shall be provided by qualified individuals who are knowledgeable, experienced, and suitably trained in fighting the types of fires that could occur in the plant and in using the types of equipment available in the nuclear power plant.
  - c. Instruction shall be provided to all fire brigade members and fire brigade leaders.
  - d. Regular planned meetings shall be held at least every 3 months for all brigade members to review changes in the fire protection program and other subjects as necessary.
  - e. Periodic refresher training sessions shall be held to repeat the classroom instruction program for all brigade members over a two-year period. These sessions may be concurrent with the regular planned meetings.
- 3. Drills**

## Appendix B-1: Appendix R Mapped to NFPA 805

to perform as a team.

(5) A critique shall be held and documented after each drill.

**a.** Fire brigade drills shall be performed in the plant so that the fire brigade can practice as a team.

**b.** Drills shall be performed at regular intervals not to exceed 3 months for each shift fire brigade. Each fire brigade member should participate in each drill, but must participate in at least two drills per year.

A sufficient number of these drills, but not less than one for each shift fire brigade per year, shall be unannounced to determine the fire fighting readiness of the plant fire brigade, brigade leader, and fire protection systems and equipment. Persons planning and authorizing an unannounced drill shall ensure that the responding shift fire brigade members are not aware that a drill is being planned until it is begun. Unannounced drills shall not be scheduled closer than four weeks.

At least one drill per year shall be performed on a “back shift” for each shift fire brigade.

**c.** The drills shall be preplanned to establish the training objectives of the drill and shall be critiqued to determine how well the training objectives have been met.

Unannounced drills shall be planned and critiqued by members of the management staff responsible for plant safety and fire protection. Performance deficiencies of a fire brigade or of individual fire brigade members shall be remedied by scheduling additional training for the brigade or members. Unsatisfactory drill performance shall be followed by a repeat drill within 30 days.

**d.** At 3-year intervals, a randomly selected unannounced drill must be critiqued by qualified individuals independent of the licensee's staff. A copy of the written report from these individuals must be available for NRC review and shall be retained as a record as specified in section III.I.4 of this appendix.

**e.** Drills shall as a minimum include the following:

**(1)** Assessment of fire alarm effectiveness, time required to notify and assemble fire brigade, and selection, placement and use of equipment, and fire fighting strategies.

**(2)** Assessment of each brigade member's knowledge of his or her role in the fire fighting strategy for the area assumed to contain the fire. Assessment of the brigade member's conformance with established plant fire fighting procedures and use of fire fighting equipment, including self-contained emergency breathing apparatus, communication equipment, and ventilation equipment, to the extent practicable.

**(3)** The simulated use of fire fighting equipment required to cope with the situation and type of fire selected for the drill. The area and type of fire chosen for the drill should

Appendix B-1: Appendix R Mapped to NFPA 805

	<p>differ from those used in the previous drill so that brigade members are trained in fighting fires in various plant areas. The situation selected should simulate the size and arrangement of a fire that could reasonably occur in the area selected, allowing for fire development due to the time required to respond, to obtain equipment, and organize for the fire, assuming loss of automatic suppression capability.</p> <p>(4) Assessment of brigade leader's direction of the fire fighting effort as to thoroughness, accuracy, and effectiveness.</p>
<p><b>3.4.4 Fire-Fighting Equipment.</b> Protective clothing, respiratory protective equipment, radiation monitoring equipment, personal dosimeters, and fire suppression equipment such as hoses, nozzles, fire extinguishers, and other needed equipment shall be provided for the industrial fire brigade. This equipment shall conform with the applicable NFPA standards.</p>	<p><b>III.H <u>Fire Brigade</u></b> The minimum equipment provided for the brigade shall consist of personal protective equipment such as turnout coats, boots, gloves, hard hats, emergency communications equipment, portable lights, portable ventilation equipment, and portable extinguishers. Self-contained breathing apparatus using full-face positive-pressure masks approved by NIOSH (National Institute for Occupational Safety and Health--approval formerly given by the U.S. Bureau of Mines) shall be provided for fire brigade, damage control, and control room personnel. At least 10 masks shall be available for fire brigade personnel.</p>
<p><b>3.4.5 Off-Site Fire Department Interface.</b> <b>3.4.5.1 Mutual Aid Agreement.</b> Off-site fire authorities shall be offered a plan for their interface during fires and related emergencies on site.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.4.5.2* Site-Specific Training.</b> Fire fighters from the off-site fire authorities who are expected to respond to a fire at the plant shall be offered site-specific training and shall be invited to participate in a drill at least annually.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.4.5.3* Security and Radiation Protection.</b> Plant security and radiation protection plans shall address off-site fire authority response.</p>	<p><b>III.K <u>Administrative Controls</u></b> <b>12.f.</b> Organization of fire fighting brigades and the assignment of special duties according to job title so that all fire fighting functions are covered by any complete shift personnel complement. These duties include command control of the brigade, transporting fire suppression and support equipment to the fire scenes, applying the extinguishant to the fire, communication with the control room, and coordination with outside fire departments.</p>
<p><b>3.4.6* Communications.</b> An effective emergency communications capability shall be provided for the industrial fire brigade.</p>	<p><b>III.H <u>Fire Brigade</u></b> The minimum equipment provided for the brigade shall consist of personal protective equipment such as turnout coats, boots, gloves, hard hats, emergency communications equipment, portable lights, portable</p>

Appendix B-1: Appendix R Mapped to NFPA 805

	<p>ventilation equipment, and portable extinguishers. Self-contained breathing apparatus using full-face positive-pressure masks approved by NIOSH (National Institute for Occupational Safety and Health--approval formerly given by the U.S. Bureau of Mines) shall be provided for fire brigade, damage control, and control room personnel. At least 10 masks shall be available for fire brigade personnel.</p>
<p><b>3.5 Water Supply.</b>  <b>3.5.1</b>  A fire protection water supply of adequate reliability, quantity, and duration shall be provided by one of the two following methods.  (a) Provide a fire protection water supply of not less than two separate 300,000-gal (1,135,500-L) supplies.  (b) Calculate the fire flow rate for 2 hours. This fire flow rate shall be based on 500 gpm (1892.5 L/min) for manual hose streams plus the largest design demand of any sprinkler or fixed water spray system(s) in the power block as determined in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, or NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection. The fire water supply shall be capable of delivering this design demand with the hydraulically least demanding portion of fire main loop out of service.</p>	<p><b><u>III.A Water Supplies for Fire Suppression Systems</u></b>  Two separate water supplies shall be provided to provide necessary water volume and pressure to the fire main loop.</p> <p>Each supply shall consist of a storage tank, pump, piping, and appropriate isolation and control valves.</p> <p>Each supply of the fire water distribution system shall be capable of providing for a period of 2 hours the maximum expected water demands as determined by the fire hazards analysis for safety-related areas or other areas that present a fire exposure hazard to safety-related areas.</p>
<p><b>3.5.2*</b>  The tanks shall be interconnected such that fire pumps can take suction from either or both. A failure in one tank or its piping shall not allow both tanks to drain. The tanks shall be designed in accordance with NFPA 22, Standard for Water Tanks for Private Fire Protection.</p> <p>Exception No. 1: Water storage tanks shall not be required when fire pumps are able to take suction from a large body of water (such as a lake), provided each fire pump has its own suction and both suction and pumps are adequately separated.</p> <p>Exception No. 2: Cooling tower basins shall be an acceptable water source for fire pumps when the volume is sufficient for both purposes and water quality is consistent with the demands of the fire service.</p>	<p><b><u>III.A Water Supplies for Fire Suppression Systems</u></b>  Two separate redundant suction in one or more intake structures from a large body of water (river, lake, etc.) will satisfy the requirement for two separated water storage tanks. These supplies shall be separated so that failure of one supply will not result in failure of the other supply.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p><b>3.5.3*</b> Fire pumps, designed and installed in accordance with NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, shall be provided to ensure that 100 percent of the required flow rate and pressure are available assuming failure of the largest pump or pump power source.</p>	<p><b><u>III.A Water Supplies for Fire Suppression Systems</u></b> Each supply shall consist of a storage tank, pump, piping, and appropriate isolation and control valves.</p>
<p><b>3.5.4</b> At least one diesel engine-driven fire pump or two more seismic Category I Class IE electric motor-driven fire pumps connected to redundant Class IE emergency power buses capable of providing 100 percent of the required flow rate and pressure shall be provided.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.5</b> Each pump and its driver and controls shall be separated from the remaining fire pumps and from the rest of the plant by rated fire barriers.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.6</b> Fire pumps shall be provided with automatic start and manual stop only.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.7</b> Individual fire pump connections to the yard fire main loop shall be provided and separated with sectionalizing valves between connections.</p>	<p><b><u>III.B. Sectional isolation valves</u></b> Sectional isolation valves such as post indicator valves or key operated valves shall be installed in the fire main loop to permit isolation of portions of the fire main loop for maintenance or repair without interrupting the entire water supply.</p>
<p><b>3.5.8</b> A method of automatic pressure maintenance of the fire protection water system shall be provided independent of the fire pumps.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.9</b> Means shall be provided to immediately notify the control room, or other suitable constantly attended location, of operation of fire pumps.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.10</b> An underground yard fire main loop, designed and installed in accordance with NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, shall be installed to furnish anticipated water requirements.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.11</b> Means shall be provided to isolate portions of the yard fire main loop for maintenance or repair without simultaneously shutting off the supply to both fixed fire suppression systems and fire hose</p>	<p><b><u>III.B Sectional Isolation Valves</u></b> Sectional isolation valves such as post indicator valves or key operated valves shall be installed in the fire main loop to permit isolation of portions of the fire main loop for maintenance or repair without interrupting the entire</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>stations provided for manual backup. Sprinkler systems and manual hose station standpipes shall be connected to the plant fire protection water main so that a single active failure or a crack to the water supply piping to these systems can be isolated so as not to impair both the primary and backup fire suppression systems.</p>	<p>water supply.</p>
<p><b>3.5.12</b> Threads compatible with those used by local fire departments shall be provided on all hydrants, hose couplings, and standpipe risers. Exception: Fire departments shall be permitted to be provided with adapters that allow interconnection between plant equipment and the fire department equipment if adequate training and procedures are provided.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.13</b> Headers fed from each end shall be permitted inside buildings to supply both sprinkler and standpipe systems, provided steel piping and fittings meeting the requirements of ANSI B31.1, Code for Power Piping, are used for the headers (up to and including the first valve) supplying the sprinkler systems where such headers are part of the seismically analyzed hose standpipe system. Where provided, such headers shall be considered an extension of the yard main system. Each sprinkler and standpipe system shall be equipped with an outside screw and yoke (OS&amp;Y) gate valve or other approved shutoff valve.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.14*</b> All fire protection water supply and fire suppression system control valves shall be under a periodic inspection program and shall be supervised by one of the following methods. (a) Electrical supervision with audible and visual signals in the main control room or other suitable constantly attended location. (b) Locking valves in their normal position. Keys shall be made available only to authorized personnel. (c) Sealing valves in their normal positions. This option shall be utilized only where valves are located within fenced areas or under the direct control of the owner/operator.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.5.15</b> Hydrants shall be installed approximately every 250 ft (76 m) apart on the yard main system. A hose house equipped with hose and combination</p>	<p>No similar requirement in Appendix R.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>nozzle and other auxiliary equipment specified in NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances shall be provided at intervals of not more than 1000 ft (305 m) along the yard main system. Exception: Mobile means of providing hose and associated equipment, such as hose carts or trucks, shall be permitted in lieu of hose houses. Where provided, such mobile equipment shall be equivalent to the equipment supplied by three hose houses.</p>	
<p><b>3.5.16*</b> The fire protection water supply system shall be dedicated for fire protection use only.  Exception No. 1: Fire protection water supply systems shall be permitted to be used to provide backup to nuclear safety systems, provided the fire protection water supply systems are designed and maintained to deliver the combined fire and nuclear safety flow demands for the duration specified by the applicable analysis.  Exception No. 2: Fire protection water storage can be provided by plant systems serving other functions, provided the storage has a dedicated capacity capable of providing the maximum fire protection demand for the specified duration as determined in this section.</p>	<p><b><u>III.A Water Supplies for Fire Suppression Systems</u></b> When storage tanks are used for combined service-water/fire water uses the minimum volume for fire uses shall be ensured by means of dedicated tanks or by some physical means such as a vertical standpipe for other water service. Administrative controls, including locks for tanks outlet valves, are unacceptable as the only means to ensure minimum water volume.</p>
<p><b>3.6 Standpipe and Hose Stations.</b> <b>3.6.1</b> For all power block buildings, Class III standpipe and hose systems shall be installed in accordance with NFPA 14, Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems.</p>	<p>No similar requirement in Appendix R that standpipes be Class III nor installed in accordance with NFPA 14.  <b><u>IIC Fire prevention features</u></b> Fire protection features shall meet the following general requirements for all fire areas that contain or present a fire hazard to structures, systems, or components important to safety. <b>3.</b> Fire detection systems, portable extinguishers, and standpipe and hose stations shall be installed. <b><u>IIID Manual fire suppression</u></b> Standpipe and hose systems shall be installed so that at least one effective hose stream will be able to reach any location that contains or presents an exposure fire hazard to structures, systems, or components important to safety.  Standpipe and hose stations shall be inside PWR containments and BWR containments that are not inerted. Standpipe and hose stations inside containment</p>

Appendix B-1: Appendix R Mapped to NFPA 805

	<p>may be connected to a high quality water supply of sufficient quantity and pressure other than the fire main loop if plant-specific features prevent extending the fire main supply inside containment. For BWR drywells, standpipe and hose stations shall be placed outside the dry well with adequate lengths of hose to reach any location inside the dry well with an effective hose stream.</p> <p><b>III E <u>Hydrostatic hose tests</u></b></p> <p>Fire hose shall be hydrostatically tested at a pressure of 150 psi or 50 psi above maximum fire main operating pressure, whichever is greater. Hose stored in outside hose houses shall be tested annually. Interior standpipe hose shall be tested every three years.</p>
<p><b>3.6.2</b></p> <p>A capability shall be provided to ensure an adequate water flow rate and nozzle pressure for all hose stations. This capability includes the provision of hose station pressure reducers where necessary for the safety of plant industrial fire brigade members and off-site fire department personnel.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.6.3</b></p> <p>The proper type of hose nozzle to be supplied to each power block area shall be based on the area fire hazards. The usual combination spray/straight stream nozzle shall not be used in areas where the straight stream can cause unacceptable damage or present an electrical hazard to fire-fighting personnel. Listed electrically safe fixed fog nozzles shall be provided at locations where high-voltage shock hazards exist. All hose nozzles shall have shutoff capability and be able to control water flow from full open to full closed.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.6.4</b></p> <p>Provisions shall be made to supply water at least to standpipes and hose stations for manual fire suppression in all areas containing systems and components needed to perform the nuclear safety functions in the event of a safe shutdown earthquake (SSE).</p> <p><del>Exception: For existing plants that are not capable of meeting this requirement, provisions to restore a water supply and distribution system for manual fire-fighting purposes shall be made. This provisional manual fire-fighting standpipe/hose station system shall be capable of providing manual fire-fighting protection to the various plant locations important to supporting and</del></p>	<p>No similar requirement in Appendix R.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p><del>maintaining the nuclear safety function. The provisions for establishing this provisional system shall be preplanned and be capable of being implemented in a timely manner following an SSE.</del></p>	
<p><b>3.6.5</b> Where the seismic required hose stations are cross-connected to essential seismic non-fire protection water supply systems, the fire flow shall not degrade the essential water system requirement.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.7 Fire Extinguishers.</b> Where provided, fire extinguishers of the appropriate number, size, and type shall be provided in accordance with NFPA 10, Standard for Portable Fire Extinguishers. Extinguishers shall be permitted to be positioned outside of fire areas due to radiological conditions.</p>	<p>No similar requirement in Appendix R.</p> <p>The only discussion in Appendix R related to fire extinguishers are found in the following sections:</p> <p><b>II.C Fire prevention features</b> Fire protection features shall meet the following general requirements for all fire areas that contain or present a fire hazard to structures, systems, or components important to safety.</p> <p><b>3.</b> Fire detection systems, portable extinguishers, and standpipe and hose stations shall be installed.</p> <p><b>III.H Fire Brigade</b> The minimum equipment provided for the brigade shall consist of personal protective equipment such as turnout coats, boots, gloves, hard hats, emergency communications equipment, portable lights, portable ventilation equipment, and portable extinguishers.</p>
<p><b>3.8 Fire Alarm and Detection Systems.</b> <b>3.8.1 Fire Alarm.</b> Alarm initiating devices shall be installed in accordance with NFPA 72, National Fire Alarm Code<sup>®</sup>. Alarm annunciation shall allow the proprietary alarm system to transmit fire-related alarms, supervisory signals, and trouble signals to the control room or other constantly attended location from which required notifications and response can be initiated. Personnel assigned to the proprietary alarm station shall be permitted to have other duties. The following fire-related signals shall be transmitted:</p> <ol style="list-style-type: none"> <li>(1) Actuation of any fire detection device</li> <li>(2) Actuation of any fixed fire suppression system</li> <li>(3) Actuation of any manual fire alarm station</li> <li>(4) Starting of any fire pump</li> <li>(5) Actuation of any fire protection</li> </ol>	<p>No similar requirement in Appendix R.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

<p>supervisory device (6) Indication of alarm system trouble condition</p>	
<p><b>3.8.1.1</b> Means shall be provided to allow a person observing a fire at any location in the plant to quickly and reliably communicate to the control room or other suitable constantly attended location.</p>	<p>No similar requirement in Appendix R.</p> <p>The only discussion in Appendix R related to notifying the control room of a fire is found in section <b>III. K. <u>Administrative controls</u></b> - Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:</p> <p><b>9.</b> Control actions to be taken by an individual discovering a fire, for example, notification of control room, attempt to extinguish fire, and actuation of local fire suppression systems.</p>
<p><b>3.8.1.2</b> Means shall be provided to promptly notify the following of any fire emergency in such a way as to allow them to determine an appropriate course of action:</p> <ul style="list-style-type: none"> <li>(1) General site population in all occupied areas</li> <li>(2) Members of the industrial fire brigade and other groups supporting fire emergency response</li> <li>(3) Off-site fire emergency response agencies. Two independent means shall be available (e.g., telephone and radio) for notification of off-site emergency services</li> </ul>	<p>No similar requirement in Appendix R.</p>
<p><b>3.8.2 Detection.</b> If automatic fire detection is required to meet the performance or deterministic requirements of Chapter 4, then these devices shall be installed in accordance with NFPA 72, National Fire Alarm Code, and its applicable appendixes.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.9 Automatic and Manual Water-Based Fire Suppression Systems.</b> <b>3.9.1*</b> If an automatic or manual water-based fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system shall be installed in accordance with the appropriate NFPA standards including the following:</p> <ul style="list-style-type: none"> <li>(1) NFPA 13, Standard for the Installation</li> </ul>	<p>No similar requirement in Appendix R.</p>

**Appendix B-1: Appendix R Mapped to NFPA 805**

<p>of Sprinkler Systems</p> <p>(2) NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection</p> <p>(3) NFPA 750, Standard on Water Mist Fire Protection Systems</p> <p>(4) NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems</p>	
<p><b>3.9.2</b> Each system shall be equipped with a water flow alarm.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.9.3</b> All alarms from fire suppression systems shall annunciate in the control room or other suitable constantly attended location.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.9.4</b> Diesel-driven fire pumps shall be protected by automatic sprinklers.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.9.5</b> Each system shall be equipped with an OS&amp;Y gate valve or other approved shutoff valve.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.9.6</b> All valves controlling water-based fire suppression systems required to meet the performance or deterministic requirements of Chapter 4 shall be supervised as described in 3.5.14.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10 Gaseous Fire Suppression Systems.</b> <b>3.10.1</b> If an automatic total flooding and local application gaseous fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system shall be designed and installed in accordance with the following applicable NFPA codes: (1) NFPA 12, Standard on Carbon Dioxide Extinguishing Systems (2) NFPA 12A, Standard on Halon 1301 Fire Extinguishing Systems (3) NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems</p>	<p>No similar requirement in Appendix R.</p> <p>The only discussion in Appendix R relative to gaseous suppression systems is found in <b>III.N Fire doors</b> - Areas protected by automatic total flooding gas suppression systems shall have electrically supervised self-closing fire doors or shall be kept closed and electrically supervised at a continuously manned location.</p>
<p><b>3.10.2</b> Operation of gaseous fire suppression systems shall annunciate and alarm in the control room or other constantly attended location identified.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10.3</b> Ventilation system design shall take into account prevention from over-pressurization during agent injection, adequate sealing to prevent loss of</p>	<p>No similar requirement in Appendix R.</p>

**Appendix B-1: Appendix R Mapped to NFPA 805**

<p>agent, and confinement of radioactive contaminants.</p>	
<p><b>3.10.4*</b> In any area required to be protected by both primary and backup gaseous fire suppression systems, a single active failure or a crack in any pipe in the fire suppression system shall not impair both the primary and backup fire suppression capability.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10.5</b> Provisions for locally disarming automatic gaseous suppression systems shall be secured and under strict administrative control.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10.6*</b> Total flooding carbon dioxide systems shall not be used in normally occupied areas.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10.7</b> Automatic total flooding carbon dioxide systems shall be equipped with an audible pre-discharge alarm and discharge delay sufficient to permit egress of personnel. The carbon dioxide system shall be provided with an odorizer.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10.8</b> Positive mechanical means shall be provided to lock out total flooding carbon dioxide systems during work in the protected space.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10.9</b> The possibility of secondary thermal shock (cooling) damage shall be considered during the design of any gaseous fire suppression system, but particularly with carbon dioxide.</p>	<p>No similar requirement in Appendix R.</p>
<p><b>3.10.10</b> Particular attention shall be given to corrosive characteristics of agent decomposition products on safety systems.</p>	<p>No similar requirement in Appendix R. The only discussion of corrosive characteristics in Appendix R is related to instructing the fire brigade of the toxic and corrosive characteristics of expected products of combustion, not necessarily the potential decomposition of Halon 1301.</p>
<p><b>3.11 Passive Fire Protection Features.</b> This section shall be used to determine the design and installation requirements for passive protection features. Passive fire protection features include wall, ceiling, and floor assemblies, fire doors, fire dampers, and through fire barrier penetration seals. Passive fire protection features also include electrical raceway fire barrier systems (ERFBS) that are provided to protect cables and electrical components and equipment from the effects of fire.</p>	
<p><b>3.11.1 Building Separation.</b></p>	<p>No similar requirement in Appendix R.</p>

**Appendix B-1: Appendix R Mapped to NFPA 805**

<p>Each major building within the power block shall be separated from the others by barriers having a designated fire resistance rating of 3 hours or by open space of at least 50 ft (15.2 m) or space that meets the requirements of NFPA 80A, Recommended Practice for Protection of Buildings from Exterior Fire Exposures. Exception: Where a performance-based analysis determines the adequacy of building separation, the requirements of 3.11.1 shall not apply.</p>	
<p><b>3.11.2 Fire Barriers.</b> Fire barriers required by Chapter 4 shall include a specific fire-resistance rating. Fire barriers shall be designed and installed to meet the specific fire resistance rating using assemblies qualified by fire tests. The qualification fire tests shall be in accordance with NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials, or ASTM E 119, Standard Test Methods for Fire Tests of Building Construction and Materials.</p>	<p><b><u>III.G Fire protection of safe shutdown capability</u></b>  <b>2.a.</b> Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier.   <b>2.c.</b> Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.</p> <p>No similar requirement in Appendix R to test fire barriers to NFPA 251 or ASTM E-119. The only inference to fire testing is in section <b><u>III. M Fire barrier cable penetration seal qualification</u></b>  Penetration seal designs shall utilize only noncombustible materials and shall be qualified by tests that are comparable to tests used to rate fire barriers.</p>
<p><b>3.11.3* Fire Barrier Penetrations.</b> Penetrations in fire barriers shall be provided with listed fire-rated door assemblies or listed rated fire dampers having a fire resistance rating consistent with the designated fire resistance rating of the barrier as determined by the performance requirements established by Chapter 4. (See 3.11.3.4 for penetration seals for through penetration fire stops.) Passive fire protection devices such as doors and dampers shall conform with the following NFPA standards, as applicable:</p> <p>(1) NFPA 80, Standard for Fire Doors and Fire Windows  (2) NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems  (3) NFPA 101, Life Safety Code</p>	<p><b><u>III.N Fire door</u></b>  Fire doors shall be self-closing or provided with closing mechanisms and shall be inspected semiannually to verify that automatic hold-open, release, and closing mechanisms and latches are operable.  One of the following measures shall be provided to ensure they will protect the opening as required in case of fire:</p> <ol style="list-style-type: none"> <li><b>1.</b> Fire doors shall be kept closed and electrically supervised at a continuously manned location;</li> <li><b>2.</b> Fire doors shall be locked closed and inspected weekly to verify that the doors are in the closed position;</li> <li><b>3.</b> Fire doors shall be provided with automatic hold-open and release mechanisms and inspected daily to verify that doorways are free of obstructions; or</li> <li><b>4.</b> Fire doors shall be kept closed and inspected daily to</li> </ol>

**Appendix B-1: Appendix R Mapped to NFPA 805**

<p>Exception: Where fire area boundaries are not wall-to-wall, floor-to-ceiling boundaries with all penetrations sealed to the fire rating required of the boundaries, a performance-based analysis shall be required to assess the adequacy of fire barrier forming the fire boundary to determine if the barrier will withstand the fire effects of the hazards in the area. Openings in fire barriers shall be permitted to be protected by other means as acceptable to the AHJ.</p>	<p>verify that they are in the closed position. The fire brigade leader shall have ready access to keys for any locked fire doors. Areas protected by automatic total flooding gas suppression systems shall have electrically supervised self-closing fire doors or shall satisfy option 1 above.</p>
<p><b>3.11.4* Through Penetration Fire Stops.</b> Through penetration fire stops for penetrations such as pipes, conduits, bus ducts, cables, wires, pneumatic tubes and ducts, and similar building service equipment that pass through fire barriers shall be protected as follows.</p> <p>(a) The annular space between the penetrating item and the through opening in the fire barrier shall be filled with a qualified fire-resistive penetration seal assembly capable of maintaining the fire resistance of the fire barrier. The assembly shall be qualified by tests in accordance with a fire test protocol acceptable to the AHJ or be protected by a listed fire-rated device for the specified fire-resistive period.</p> <p>(b) Conduits shall be provided with an internal fire seal that has an equivalent fire-resistive rating to that of the fire barrier through opening fire stop and shall be permitted to be installed on either side of the barrier in a location that is as close to the barrier as possible.</p> <p>Exception: Openings inside conduit 4 in. (10.2 cm) or less in diameter shall be sealed at the fire barrier with a fire-rated internal seal unless the conduit extends greater than 5 ft (1.5 m) on each side of the fire barrier. In this case the conduit opening shall be provided with noncombustible material to prevent the passage of smoke and hot gases. The fill depth of the material packed to a depth of 2 in. (5.1 cm) shall constitute an acceptable smoke and hot gas seal in this application.</p>	<p><b><u>III.M. Fire barrier cable penetration seal qualification</u></b> Penetration seal designs shall utilize only noncombustible materials and shall be qualified by tests that are comparable to tests used to rate fire barriers. The acceptance criteria for the test shall include:</p> <ol style="list-style-type: none"> <li><b>1.</b> The cable fire barrier penetration seal has withstood the fire endurance test without passage of flame or ignition of cables on the unexposed side for a period of time equivalent to the fire resistance rating required of the barrier;</li> <li><b>2.</b> The temperature levels recorded for the unexposed side are analyzed and demonstrate that the maximum temperature is sufficiently below the cable insulation ignition temperature; and</li> <li><b>3.</b> The fire barrier penetration seal remains intact and does not allow projection of water beyond the unexposed surface during the hose stream test.</li> </ol>
<p><b>3.11.5* Electrical Raceway Fire Barrier Systems (ERFBS).</b> ERFBS required by Chapter 4 shall be capable of resisting the fire effects of the hazards in the area.</p>	<p>No specific requirement in Appendix R – Supplement 1 to NRC Generic Letter 86-10 was issued in 1999 to specifically address the acceptance criteria for testing of Electrical Raceway Fire Barriers.</p>

Appendix B-1: Appendix R Mapped to NFPA 805

ERFBS shall be tested in accordance with and shall meet the acceptance criteria of NRC Generic Letter 86-10, Supplement 1, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Trains Within the Same Fire Area." The ERFBS needs to adequately address the design requirements and limitations of supports and intervening items and their impact on the fire barrier system rating. The fire barrier system's ability to maintain the required nuclear safety circuits free of fire damage for a specific thermal exposure, barrier design, raceway size and type, cable size, fill, and type shall be demonstrated.

Exception No. 1: When the temperatures inside the fire barrier system exceed the maximum temperature allowed by the acceptance criteria of Generic Letter 86-10, "Fire Endurance Acceptance Test Criteria for Fire Barrier Systems Used to Separate Redundant Safe Shutdown Training Within the Same Fire Area," Supplement 1, functionality of the cable at these elevated temperatures shall be demonstrated. Qualification demonstration of these cables shall be performed in accordance with the electrical testing requirements of Generic Letter 86-10, Supplement 1, Attachment 1, "Attachment Methods for Demonstrating Functionality of Cables Protected by Raceway Fire Barrier Systems During and After Fire Endurance Test Exposure."

Exception No. 2: ERFBS systems employed prior to the issuance of Generic Letter 86-10, Supplement 1, are acceptable providing that the system successfully met the limiting end point temperature requirements as specified by the AHJ at the time of acceptance.