ENCLOSURE 1

APPENDIX A

TO

BRANCH TECHNICAL POSITION

APCSB 9.5-1

"GUIDELINES FOR FIRE PROTECTION

FOR NUCLEAR POWER PLANTS

DOCKETED PRIOR TO JULY 1, 1976"

AUGUST 23, 1976

SCOPE

This Appendix A provides guidance on the preferred and, where applicable, acceptable alternatives to fire protection design for those nuclear power plants for which applications for construction permits were docketed prior to July 1, 1976.

The provisions of this appendix will apply to the following categories of nuclear power plants:

(1) Plants for which applications for construction permits were docketed prior to July 1, 1976, but have not received a construction permit;

(2) Plants for which construction permits were issued prior to July 1, 1976, and operating plants.

This appendix modifies, as deemed appropriate, the guidelines in Branch Technical Position (BTP) APCSb 9.5-1, "Fire Protection for Nuclear Power Plants" which are intended for plants whose application for construction permit is docketed after July 1, 1976. The guidelines of the above cited BTP were adopted for this appendix and are preferred in all instances. Alternative acceptable fire protection guidelines are identified in this appendix for areas where, depending on the construction or operational status of a given plant, application of the guidelines per se could have significant impact, e.g., where the building and system designs are already finalized and construction is in progress, or where the plant is

in operation. These alternative guidelines are intended to provide adequate and acceptable fire protection consistent with safe plant shutdown requirements without a significant impact on plant design, construction, and operation.

Particular sections that are intended to apply only to plants under review, under construction or operating are identified under the appropriate column.

Although this appendix provides specific guidance, alternatives may be proposed by applicants and licensees. These alternatives will be evaluated by the NRC staff on a case-by-case basis where such departures are suitably justified. Among the alternatives that should be considered is the provision of a "dedicated" system for assuring continued safe shutdown of the plant. This dedicated system should be completely independent of other plant systems, including the power source; however, for fire protection, it is not necessary for the system to be designed to seismic Category I criteria or meet single failure criteria. Manual fire fighting capability to protect the other safety related systems would still be required.

APPLICATION DOCKETED BUT CONSTRUCTION PERMIT NOT RECEIVED AS OF 7/1/76	PLANTS UNDER CONSTRUCTION AND OPERATING PLANTS
Positions	Positions
A. Overall Requirements of Nuclear Plant Fire Protection Program	A. Overall Requirements of Nuclear Plant Fire Protection Program
1. Personnel	1. Personnel
Responsiblity for the overall fire protection program should be assigned to a designated person in the upper level of management. This person should retain ultimate responsibility even though formulation and assurance of program implementation is delegated. Such delegation of authority should be to staff personnel prepared by training and experience in fire protection and nuclear plant safety to provide a balanced approach in directing the fire protection programs for nuclear power plants. The qualification requirements for the fire protection engineer or consultant who will assist in the design and selection of equipment, inspect and test the completed physical aspects of the system, develop the fire protection program, and assist in the fire-fighting training for the operating plant should be stated. Subsequently, the FSAR should discuss the training and the updating provisions such as fire drills provided for maintaining the competence of the station fire-fighting and operating crew, including personnel responsible for maintaining and inspecting the fire protection equipment.	SAME
The fire protection staff should be responsible for:	
(a) coordination of building layout and systems design with fire area	

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requirements, including consideration of potential hazards associated with postulated design basis fires, (b) design and maintenance of fire detection, suppression, and extinguishing systems, (c) fire prevention activities, (d) training and manual fire-fighting activities of plant personnel and the fire brigade. (NOTE: NFPA 6 - Recommendations for Organization of Industrial Fire Loss Prevention, contains useful guidance for organization and operation of the entire fire loss prevention program.)	
2. Design Bases The overall fire protection program should be based upon evaluation of potential fire hazards throughout the plant and the effect of postulated design basis fires relative to maintaining ability to perform safety shutdown functions and minimize radioactive releases to the environment.	2. Design Bases SAME
3. Backup Total reliance should not be placed on a single automatic fire suppression system. Appropriate backup fire suppression capability should be provided.	3. Backup SAME
4. Single Failure Criterion A single failure in the fire suppression system should not impair both the primary and backup fire suppression capability. For example, redundant fire water pumps with independent power supplies and controls should be provided. Postulated fires or	4. Single Failure Criterion A single failure in the fire suppression system should not impair both the primary and backup fire suppression capability. For example, redundant fire water pumps with independent power supplies and

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fire protection system failures need not be considered concurrent with other plant accidents or the most severe natural phenomena. However, in the event of the most severe earthquake, i.e., the Safe Shutdown Earthquake (SSE), the fire suppression system should be capable of delivering water to manual hose stations located within hose reach of areas containing equipment required for safe plant shutdown. The fire protection systems should, however, retain their original design capability for (1) natural phenomena of less severity and greater frequency (approximately once in 10 years) such as tornadoes, hurricanes, floods, ice storms, or small intensity earthquakes which are characteristic of the site geographic region and (2) for potential man-created site related events such as oil barge collisions, aircraft crashes which have a reasonable probability of occurring at a specific plant site. The effects of lightning strikes should be included in the overall plant fire protection program.	controls should be provided. Postulated fires or fire protection system failures need not be considered concurrent with other plant accidents or the most severe natural phenomena. The effects of lightning strikes should be included in the overall plant fire protection program.
5. Fire Suppression Systems Failure or inadvertent operation of the fire suppression system should not incapacitate safety related systems or components. Fire suppression systems that are pressurized during normal plant operation should meet the guidelines specified in APCSB Branch Technical Position 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment."	5. Fire Suppression Systems SAME
6. Fuel Storage Areas The fire protection program (plans, personnel and equipment) for buildings storing new reactor fuel and for adjacent fire zones which could affect the fuel storage zone should be fully operational before fuel is received at the site.	6. Fuel Storage Areas Schedule for implementation of modifications, if any, will be established on a case-by-case basis.

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7. Fuel Loading The fire protection program for an entire reactor unit should be fully operational prior to initial fuel loading in that reactor unit.	7. Fuel Loading Schedule for implementation of modifications, if any, will be established on a case-by-case basis.
8. Multiple-Reactor Sites On multiple-reactor sites where there are operating reactors and construction of remaining units is being completed, the fire protection program should provide continuing evaluation and include additional fire barriers, fire protection capability, and administrative controls necessary to protect the operating units from construction fire hazards. The superintendent of the operating plant should have the lead responsibility for site fire protection.	8. Multiple-Reactor Sites SAME
9. Simultaneous Fires Simultaneous fires in more than one reactor need not be postulated, where separation requirements are met. A fire involving more than one reactor unit need not be postulated except for facilities shared between units.	9. Simultaneous Fires SAME
B. Administrative Procedures, Controls and Fire Brigade Administrative procedures consistent with the need for maintaining the performance of the fire protection system and personnel in nuclear power plants should be provided. Guidance is contained in the following publications: NFPA 4 - Organization for Fire Services	B. Administrative Procedures, Controls, and Fire Brigade SAME

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NFPA 4A - Organization for Fire Department NFPA 6 - Industrial Fire Loss Prevention NFPA 7 - Management of Fire Emergencies NFPA 8 - Management Responsibility for Effects of Fire on Operations NFPA 27 - Private Fire Brigades	
2. Effective administrative measures should be implemented to prohibit bulk storage of combustible materials inside or adjacent to safety related buildings or systems during operation or maintenance periods. Regulatory Guide 1.39, "Housekeeping Requirements for Water-Cooled Nuclear Power Plants", provides guidance on housekeeping, including the disposal of combustible materials.	2. SAME
3. Normal and abnormal conditions or other anticipated operations such as modifications (e.g., breaking fire stops, impairment of fire detection and suppression systems) and refueling activities should be reviewed by appropriate levels of management and appropriate special actions and procedures such as fire watches or temporary fire barriers implemented to assure adequate fire protection and reactor safety. In particular: (a) Work involving ignition sources such as welding and flame cutting should be done under closely controlled conditions. Procedures governing such work should be reviewed and approved by persons	3. SAME

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trained and experienced in fire protection. Persons performing and directly assisting in such work should be trained and equipped to prevent and combat fires. If this is not possible, a person qualified in fire protection should directly monitor the work and function as a fire watch.	
(b) Leak testing, and similar procedures such as air flow determination, should use one of the commercially available aeresol techniques. Open flames or combustion generated smoke should not be permitted.	
(c) Use of combustible material, e.g., HEPA and charcoal filters, dry ion exchange resins or other combustible supplies, in safety related areas should be controlled. Use of wood inside buildings containing safety related systems or equipment should be permitted only when suitable non-combustible substitutes are not available. If wood must be used, only fire retardant treated wood (scaffolding, lay down blocks) should be permitted. Such materials should be allowed into safety related areas only when they are to be used immediately. Their possible and probable use should be considered in the fire hazard analysis to determine the adequacy of the installed fire protection systems.	
4. Nuclear power plants are frequently located in remote areas, at some distance from public fire departments. Also, first response fire departments are often volunteer. Public fire department response should be con-	4. SAME

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sidered in the overall fire protection program. However, the plant should be designed to be self-sufficient with respect to fire fighting activities and rely on the public response only for supplemental or backup capability.	
5. The need for good organization, training and equipping of fire brigades at nuclear power plant sites requires effective measures be implemented to assure proper discharge of these functions. The guidance in Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants", should be followed as applicable.	5. SAME
(a) Successful fire fighting requires testing and maintenance of the fire protection equipment, emergency lighting and communication, as well as practice as brigades for the people who must utilize the equipment. A test plan that lists the individuals and their responsibilities in connection with routine tests and inspections of the fire detection and protection systems should be developed. The test plan should contain the types, frequency and detailed procedures for testing. Procedures should also contain instructions on maintaining fire protection during those periods when the fire protection system is impaired or during periods of plant maintenance, e.g., fire watches or temporary hose connections to water systems.	(a) SAME

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(b) Basic training is a necessary element in effective fire fighting operation. In order for a fire brigade to operate effectively, it must operate as a team. All members must know what their individual duties are. They must be familiar with the layout of the plant and equipment location and operation in order to permit effective fire-fighting operations during times when a particular area is filled with smoke or is insufficiently lighted. Such training can only be accomplished by conducting drills several times a year (at least quarterly) so that all members of the fire brigade have had the opportunity to train as a team, testing itself in the major areas of the plant. The drills should include the simulated use of equipment in each area and should be preplanned and post-critiqued to establish the training objective of the drills and determine how well these objectives have been met. These drills should periodically (at least annually) include local fire department participation where possible. Such drills also permit supervising personnel to evaluate the effectiveness of communications within the fire brigade and with the on scene fire team leader, the reactor operator in the control room, and the offsite command post.	(b) SAME
3. To have proper coverage during all phases of operation, members of each shift crew should be trained in fire protection. Training of the plant fire brigade should be coordinated with the	3. SAME

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local fire department so that responsibilities and duties are delineated in advance. This coordination should be part of the training course and implemented into the training of the local fire department staff. Local fire departments should be educated in the operational precautions when fighting fires on nuclear power plant sites. Local fire departments should be made aware of the need for radioactive protection of personnel and the special hazards associated with a nuclear power plant site.	
4. NFPA 27, "Private Fire Brigade" should be followed in organization, training, and fire drills. This standard also is applicable for the inspection and maintenance of fire fighting equipment. Among the standards referenced in this document, the following should be utilized: NFPA 194, "Standard for Screw Threads and Gaskets for Fire Hose Couplings", NFPA 196, "Standard for Fire Hose," NFPS 197, "Training Standard on Initial Fire Attacks", NFPA 601, "Recommended Manual of Instructions and Duties for the Plant Watchman on Guard." NFPA booklets and pamphlets listed on page 27-11 of Volume 8, 1971-72 are also applicable for good training references. In addition, courses in fire prevention and fire suppression which are recognized and/or sponsored by the fire protection industry should be utilized.	4. SAME

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C. Quality Assurance Program Quality assurance (QA) programs of applicants and contractors should be developed and implemented to assure that the requirements for design, procurement, installation, and testing and administrative controls for the fire protection program for safety related areas as defined in this Branch Position are satisfied. The program should be under the management control of the QA organization. The QA program criteria that apply to the fire protection program should include the following: 1. Design Control and Procurement Document Control Measures should be established to assure that all design-related guidelines of the Branch Technical Position are included in design and procurement documents and that deviations therefrom are controlled. 2. Instructions, Procedures and Drawings Inspections, tests, administrative controls, fire drills and training that govern the fire protection program should be prescribed by documented instructions, procedures or drawings and should be accomplished in accordance with these documents. 3. Control of Purchased Material, Equipment and Services Measures should be established to assre that purchased material, equipment and services conform to the procurement documents.	C. Quality Assurance Program SAME

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4. Inspection A program for independent inspection of activities affecting fire protection should be established and executed by, or for, the organization performing the activity to verify conformance with documented installation drawings and test procedures for accomplishing the activities.	
5. Test and Test Control A test program should be established and implemented to assure that testing is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. The tests should be performed in accordance with written test procedures; test results should be properly evaluated and acted on.	
6. Inspection, Test and Operating Status Measures should be established to provide for the identification of items that have satisfactorily passed required tests and inspections.	
7. Non-Conforming Items Measures should be established to control items that do not conform to specified requirements to prevent inadvertent use of installation.	
8. Corrective Action Measures should be established to assure that conditions adverse to fire protection, such as failures, malfunctions, deficiencies, deviations, defective components, uncontrolled combustible material and non-conformances are promptly identified, reported and corrected.	

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9. Records Records should be prepared and maintained to furnish evidence that the criteria enumerated above are being met for activities affecting the fire protection program.	
10. Audits Audits should be conducted and documented to verify compliance with the fire protection program including design and procurement documents; instructions; procedures and drawings; and inspection and test activities.	
D. General Guidelines for Plant Protection	D. General Guidelines for Plant Protection
1. Building Design	1. Building Design
(a) Plant Layouts should be arranged to:	
(1) Isolate safety related systems from unacceptable fire hazards, and	(1) SAME
(2) Separate redundant safety related systems from each other so that both are not subject to damage from a single fire hazard.	(2) Alternatives: (a) Redundant safety related systems that are subject to damage from a single fire hazard should be protected by a combination of fire retardant coatings and fire detection and suppression systems, or (b) a separate system to perform the safety function should be provided.

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(b) In order to accomplish 1.(a) above, safety related systems and fire hazards should be identified throughout the plant. Therefore, a detailed fire hazard analysis should be made. The fire hazards analysis should be reviewed and updated as necessary.	(b) SAME - Additional fire hazards analysis should be done after any plant modification.
(c) For multiple reactor sites, cable spreading rooms should not be shared between reactors. Each cable spreading room should be separated from other areas of the plant by barriers (walls and floors) having a minimum fire resistanee of three hours. Cabling for redundant safety divisions should be separated by walls having three hour fire barriers.	(c) Alternative guidance for constructed plants is shown in Section E.3, "Cable Spreading Room."
(d) Interior wall and structural components, thermal insulation materials and radiation shielding materials and sound-proofing should be non-combustible. Interior finishes should be non-combustible or listed by a nationally recognized testing laboratory, such as Factory Mutual or Underwriters' Laboratory, Inc. for flame spread, smoke and fuel contribution of 25 or less in its use configuration (ASTM E-84 Test), "Surface Burning Characteristics of Building Materials").	(d) SAME
(e) Metal deck roof construction should be non-combustible (see the building materials directory of the Underwriters Laboratory, Inc.) or listed as Class I by Factor Mutual System Approval Guide.	(e) SAME. Where combustible material is used in metal deck roofing design, acceptable alternatives are (i) replace combustibles with non-combustible materials, (ii) provide an automatic sprinkler system, or (iii) provide ability to cover roof exterior and interior with adequate water volume and pressure.

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(f) Suspended ceilings and their supports should be of non-combustible construction. Concealed spaces should be devoid of combustibles.	(f) SAME. Adequate fire detection and suppression systems should be provided where full implementation is not practicable.
(g) High voltage - high amperage transformers installed inside buildings containing safety related systems should be of the dry type or insulated and cooled with non-combustible liquid.	(g) SAME. Safety related systems that are exposed to flammable oil filled transformers should be protected from the effects of a fire by: (i) replacing with dry transformers or transformers that are insulated and cooled with non-combustible liquid; or (ii) enclosing the transformer with a three-hour fire barrier and installing automatic water spray protection.
(h) Buildings containing safety related systems should be protected from exposure or spill fires involving oil filled transformers by: °locating such transformers at least 50 feet distant; or °ensuring that such building walls within 50 feet of oil filled transformers are without openings and have a fire resistance rating of at least three hours.	(h) Buildings containing safety related systems, having openings in exterior walls closer than 50 feet to flammable oil filled transformers should be protected from the effects of a fire by: (i) closing of the opening to have fire resistance equal to three hours, (ii) constructing a three-hour fire barrier between the transformers and the wall openings; or

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	(iii) closing the opening and providing the capability to maintain a water curtain in case of a fire.
(i) Floor drains, sized to remove expected fire fighting water flow should be provided in those areas where fixed water fire suppression systems are installed. Drains should also be provided in other areas where hand hose lines may be used if such fire fighting water could cause unacceptable damage to equipment in the area. Equipment should be installed on pedestals, or curbs should be provided as required to contain water and direct it to floor drains. (See NFPA 92M, "Waterproofing and Draining of Floors.") Drains in areas containing combustible liquids should have provisions for preventing the spread of the fire throughout the drain system. Water drainage from areas which may contain radioactivity should be sampled and analyzed before discharge to the environment.	(i) SAME. In operating plants or plants under construction, if accumulation of water from the operation of new fire suppression systems does not create unacceptable consequences, drains need not be installed.
(j) Floors, walls and ceilings enclosing separate fire areas should have minimum fire rating of three hours. Penetrations in these fire barriers, including conduits and piping, should be sealed or closed to provide a fire resistance rating at least equal to that of the fire barrier itself. Door openings should be protected with equivalent rated doors, frames and hardware that have been tested and approved by a nationally recognized laboratory. Such doors	(j) SAME. The fire hazard in each area should be evaluated to determine barrier requirements. If barrier fire resistance cannot be made adequate, fire detection and suppression should be provided, such as: (i) water curtain in case of fire, (ii) flame retardant coatings, (iii) additional fire barriers.

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should be normally closed and locked or alarmed with alarm and annunciation in the control room. Penetrations for ventilation system should be protected by a standard "fire door damper" where required. (Refer to NFPA 80, "Fire Doors and Windows.")	
2. Control of Combustibles	2. Control of Combustible
(a) Safety related systems should be isolated or separated from combustible materials. When this is not possible because of the nature of the safety system or the combustible material, special protection should be provided to prevent a fire from defeating the safety system function. Such protection may involve a combination of automatic fire suppression, and construction capable of withstanding and containing a fire that consumes all combustibles present. Examples of such combustible materials that may not be separable from the remainder of its system are: (1) Emergency diesel generator fuel oil day tanks (2) Turbine-genrator oil and hydraulic control fluid systems (3) Reactor coolant pump lube oil system	(a) SAME
(b) Bulk gas storage (either compressed or cryogenic), should not be permitted inside structures housing safety-related equipment. Storage of flammable gas such as hydrogen, should be located outdoors or in separate detached buildings so that a fire or explosion will not adversely affect any safety related systems or equipment.	(b) SAME

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(Refer to NFPA 50A, "Gaseous Hydrogen Systems.") Care should be taken to locate high pressure gas storage containers with the long axis parallel to building walls. This will minimize the possibility of wall penetration in the event of a container failure. Use of compressed gases (especially flammable and fuel gases) inside buildings should be controlled. (Refer to NFPA 6, "Industrial Fire Loss Prevention.")	
(c) The use of plastic materials should be minimized. In particular, halogenated plastics such as polyvinyl chloride (PVC) and neoprene should be used only when substitute non-combustible materials are not available. All plastic materials, including flame and fire retardant materials, will burn with an intensity and BTU production in a range similar to that of ordinary hydrocarbons. When burning, they produce heavy smoke that obscures visibility and can plug air filters, especially charcoal and HEPA. The halogenated plastics also release free chlorine and hydrogen chloride when burning which are toxic to humans and corrosive to equipment.	(c) SAME
(d) Storage of flammable liquids should, as a minimum, comply with the requirements of NFPA 30, "Flammable and Combustible Liquids Code."	(d) SAME

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3. Electric Cable Construction, Cable Trays and Cable Penetrations	3. Electric Cable Construction, Cable Trays and Cable Penetrations
(a) Only non-combustible materials should be used for cable tray construction.	(a) SAME
(b) See Section E.3 for fire protection guidelines for cable spreading rooms.	(b) SAME
(c) Automatic water sprinkler systems should be provided for cable trays outside the cable spreading room. Cables should be designed to allow wetting down with deluge water without electrical faulting. Manual hose stations and portable hand extinguishers should be provided as backup. Safety related equipment in the vicinity of such cable trays, that does not itself require water fire protection, but is subject to unacceptable damage from sprinkler water discharge, should be protected from sprinkler system operation of malfunction.	(c) SAME. When safety related cables do not satisfy the provisions of Regulatory Guide 1.75, all exposed cables should be covered with an approved fire retardant coating and a fixed automatic water fire suppression system should be provided.
(d) Cable and cable tray penetration of fire barriers (vertical and horizontal) should be sealed to give protection at least equivalent to that fire barrier. The design of fire barriers for horizontal and vertical cable trays should, as a minimum, meet the requirements of ASTM E-119, "Fire Test of Building Construction and Materials," including the hose stream test.	(d) SAME. Where installed penetration seals are deficient with respect to fire resistance, these seals may be protected by covering both sides with an approved fire retardant material. The adequacy of using such material should be demonstrated by suitable testing.
(e) Fire breaks should be provided as deemed necessary by the fire hazards analysis. Flame or flame retardant coatings may be used as a fire break for grouped electrical cables to limit spread of fire in cable ve.tings. (Possible cable derating owing to use of such	(e) SAME

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coating materials must be considered during design.)	
(f) Electric cable constructions should as a minimum pass the current IEEE No. 383 flame test. (This does not imply that cables passing this test will not require additional fire protection.)	(f) SAME. For cable installation in operating plants and plants under construction that do not meet the IEEE No. 383 flame test requirements, all cables must be covered with an approved flame retardant coating and properly derated.
(g) To the extent practical, cable construction that does not give off corrosive gases while burning should be used.	(g) Applicable to new cable installations.
(h) Cable trays, raceways, conduit, trenches, or culverts should be used only for cables. Miscellaneous storage should not be permitted, nor should piping for flammable or combustible liquids or gases be installed in these areas.	(h) SAME. Installed equipment in cable tunnels or culverts, need not be removed if they present no hazard to the cable runs as determined by the fire hazards analysis.
(i) The design of cable tunnels, culverts and spreading rooms should provide for automatic or manual smoke venting as required to facilitate manual fire fighting capability.	(i) SAME
(j) Cables in the control room should be kept to the minimum necessary for operation of the control room. All cables entering the control room should terminate there. Cables should not be installed in floor trenches or culverts in the control room.	(j) SAME. Existing cabling installed in concealed floor and ceiling spaces should be protected with an automatic total flooding halon system.

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4. Ventilation	4. Ventilation
(a) The products of combustion that need to be removed from a specific fire area should be evaluated to determine how they will be controlled. Smoke and corrosive gases should generally be automatically discharged directly outside to a safe location. Smoke and gases containing radioactive materials should be monitored in the fire area to determine if release to the environment is within the permissible limits of the plant Technical Specifications.	(a) SAME. The products of combustion which need to be removed from a specific fire area should be evaluated to determine how they will be controlled.
(b) Any ventilation system designed to exhaust smoke or corrosive gases should be evaluated to ensure that inadvertent operation or single failures will not violate the controlled areas of the plant design. This requirement includes containment functions for protection of the public and maintaining habitability for operations personnel.	(b) SAME
(c) The power supply and controls for mechanical ventilation systems should be run outside the fire area served by the system.	(c) SAME
(d) Fire suppression systems should be installed to protect charcoal filters in accordance with Regulatory Guide 1.52, "Design Testing and Maintenance Criteria for Atmospheric Cleanup Air Filtration."	(d) SAME
(e) The fresh air supply intakes to areas containing safety related equipment or systems should be located remote from the exhaust air outlets and smoke vents of other fire areas to minimize the possibility of contaminating the intake air with the products of combustion.	(e) SAME

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(f) Stairwells should be designed to minimize smoke infiltration during a fire. Staircases should serve as escape routes and access routes for fire fighting. Fire exit routes should be clearly marked. Stairwells, elevators and chutes should be enclosed in masonry towers with minimum fire rating of three hours and automatic fire doors at least equal to the enclosure construction, at each opening into the building Elevators should not be used during fire emergencies.	(f) SAME. Where stairwells or elevators cannot be enclosed in three-hour fire rated barrier with equivalent fire doors, escape and access routes should be established by pre-fire plan and practiced in drills by operating and fire brigade personnel.
(g) Smoke and heat vents may be useful in specific areas such as cable spreading rooms and diesel fuel oil storage areas and switchgear rooms. When natural-convection ventilation is used, a minimum ratio of 1 sq. foot of venting area per 200 sq. feet of floor area should be provided. If forced-convection ventilation is used, 300 CFM should be provided for every 200 sq. feet of floor area. See NFPA No. 204 for additional guidance on smoke control.	(g) SAME
(h) 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) should be provided for fire brigade, damage control and control room personnel. Control room personnel may be furnished breathing air by a manifold	(h) SAME

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system piped from a storage reservoir if practical. Service or operating life should be a minimum of one half have for the self-contained units. At least two extra air bottles should be located onsite for each self-contained breathing unit. In addition, an onsite 6-hour supply of reserve air should be provided and arranged to permit quick and complete replenishment of exhausted supply air bottles as they are returned. If compressors are used as a source of breathing air, only units approved for breathing air should be used. Special care must be taken to locate the compressor in areas free of dust and contaminants.	
(i) Where total flooding gas extinguishing systems are used, area intake and exhaust ventilation dampers should close upon initiation of gas flow to maintain necessary gas concentration. (See NFPA 12, "Carbone Dioxide Systems", and 12A, "Halon 1301 Systems.")	(i) SAME
5. Lighting and Communication Lighting and two way voice communication are vital to safe shutdown and emergency response in the event of fire. Suitable fixed and portable emergency lighting and communication devices should be provided to satisfy the following requirements:	5. Lighting and Communication SAME
(a) Fixed emergency lighting should consist of sealed beam units with individual 8-hour minimum battery power supplies.	

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(b) Suitable sealed beam battery powered portable hand lights should be provided for emergency use.	
(c) Fixed emergency communication should use voice powered head sets at pre-selected stations.	
(d) Fixed repeaters installed to permit use of portable radio communication units should be protected from exposure fire damage.	
C. Fire Detection and Suppression	C. Fire Detection and Suppression
1. Fire Detection	1. Fire Detection
(a) Fire detection systems should as a minimum comply with NFPA 72D, "Standard for the Installation, Maintenance and Use of Proprietary Protective Signaling Systems."	SAME. Deviations from the requirements of NFPA 72D should be identified and justified.
(b) Fire detection system should give audible and visual alarm and annunciation in the control room. Local audible alarms should also sound at the location of the fire.	
(c) Fire alarms should be distinctive and unique. They should not be capable of being confused with any other plant system alarms.	
(d) Fire detection and actuation systems should be connected to the plant emergency power supply.	
2. Fire Protection Water Supply Systems	2. Fire Protection Water Supply Systems
(a) An underground yard fire main loop should be installed to furnish anticipated fire water requirements. NFPA 24 - Standard for Outside Protection - gives necessary guidance for such installation. It references other design	(a) SAME. Visible location marking signs for underground valves is acceptable. Alternative valve position indicators should also be provided.

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codes and standards developed by such organizations as the American National Standards Institute (ANSI) and the American Water Works Association (AWWA). Lined steel or cast iron pipe should be used to reduce internal tuberculation. Such tuberculation deposits in an unlined [illegible] a period of years can significantly reduce water flow [illegible] the combination of increased friction and reduced pipe diameter. Means for treating and flushing the systems should be provided. Approved visually indicating sectional control valves, such as Post Indicator Valves, should be provided to isolate portions of the main for maintenance or repair without shutting off the entire system.	
The fire main system piping should be separate from service or sanitary water system piping.	For operating plants, fire main system piping that can be isolated from service or sanitary water system piping is acceptable.
(b) A common yard fire main loop may serve multi-unit nuclear power plant sites, if cross-connected between units. Sectional control valves should permit maintaining independence of the individual loop around each unit. For such installations, common water supplies may also be utilized. The water supply should be sized for the largest single expected flow. For multiple reactor sites with widely separated plants (approaching 1 mile or more), separate yard fire main loops should be used.	(b) SAME. Sectionalized systems are acceptable.

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(c) If pumps are required to meet system pressure or flow requirements, a sufficient number of pumps should be provided so that 100% capacity will be available with one pump inactive (e.g., three 50% pumps or two 100% pumps). The connection to the yard fire main loop from each fire pump should be widely separated, preferably located on opposite sides of the plant. Each pump should have its own driver with independent power supplies and control. At least one pump (if not powered from the emergency diesels) should be driven by non-electrical means, preferably diesel engine. Pumps and drivers should be located in rooms separated from the remaining pumps and equipment by a minimum three-hour fire wall. Alarms indicating pump running, driver availability, or failure to start should be provided in the control room. Details of the fire pump installation should as a minimum conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."	(c) SAME
(d) Two separate reliable water supplies should be provided. If tanks are used, two 100% (minimum of 300,000 gallons each) system capacity tanks should be installed. They should be so interconnected that pumps can take suction from either or both. However, a leak in one tank or its piping should not cause both	(d) SAME

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tanks to drain. The main plant fire water supply capacity should be capable of refilling either tank in a minimum of eight hours. Common tanks are permitted for fire and sanitary or service water storage. When this is done, however, minimum fire water storage requirements should be dedicated by means of a vertical standpipe for other water services.	
(e) The fire water supply (total capacity and flow rate) should be calculated on the basis of the largest expected flow rate for a period of two hours, but not less than 300,000 gallons. This flow rate should be based (conservatively) on 1,000 gpm for manual hose streams plus the greater of: (1) all sprinkler heads opened and flowing in the largest designed fire area; or (2) the largest open head deluge system(s) operating.	(e) SAME
(f) Lakes or fresh water ponds of sufficient size may qualify as sole source of water for fire protection, but require at least two intakes to the pump supply. When a common water supply is permitted for fire protection and the ultimate heat sink, the following conditions should also be satisfied:	(f) SAME

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(1) The additional fire protection water requirements are designed into the total storage capacity; and (2) Failure of the fire protection system should not degrade the function of the ultimate heat sink.	
(g) Outside manual hose installation should be sufficient to reach any location with an effective hose stream. To accomplish this hydrants should be installed approximately every 250 feet on the yard main system. The lateral to each hydrant from the yard main should be controlled by a visually indicating or key operated (curb) valve. A hose house, equipped with hose and combination nozzle, and other auxiliary equipment recommended in NFPA 24, "Outside Protection", should be provided as needed but at least every 1,000 feet. Threads compatible with those used by local fire departments should be provided on all hydrants, hose couplings and standpipe risers.	(g) SAME
3. Water Sprinklers and Hose Standpipe Systems	3. Water Sprinklers and Hose Standpipe Systems
(a) Each automatic sprinkler system and manual hose station standpipe should have an independent connection to the plant underground water main. Headers fed from each end are permitted inside buildings to supply multiple sprinkler and standpipe systems. When provided, such headers are considered an extension of the yard main system. The header arrangement should be such that no single failure can impair both the	(a) SAME

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primary and backup fire protection systems. Each sprinkler and standpipe system should be equipped with OS&Y (outside screw and yoke) gate valve, or other approved shut off valve, and water flow alarm. Safety related equipment that does not itself require sprinkler water fire protection, but is subject to unacceptable damage if wetted by sprinkler water discharge should be protected by water shields or baffles.	
(b) All valves in the fire water systems should be electrically supervised. The electrical supervision signal should indicate in the control room and other appropriate command locations in the plant (See NFPA 26, "Supervision of Valves.")	(b) SAME. When electrical supervision of fire protection valves is not practicable, an adequate management supervision program should be provided. Such a program should include locking valves open with strict key control; tamper proof seals; and periodic, visual check of all valves.
(c) Automatic sprinkler systems should as a minimum conform to requirements of appropriate standards such as NFPA 13, "Standard for the Installation of Sprinkler Systems", and NFPA 15, "Standard for Water Spray Fixed Systems."	(c) SAME
(d) Interior manual hose installation should be able to reach any location with at least one effective hose stream. To accomplish this, standpipes with hose connections, equipped with a maximum of 75 feet of 1-½-inch	(d) Interior manual hose installation should be able to reach any location with at least one effective hose steam. To accomplish this, standpipes with hose connections

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woven jacket-lined fire hose and suitable nozzles should be provided in all buildings, including containment, on all floors and should be spaced at not more than 100-foot intervals. Individual standpipes should be of at least 4-inch diameter for multiple hose connections and 2-½-inch diameter for single hose connections. These systems should follow the requirements of NFPA 14, "Standpipe and Hose Systems" for sizing, spacing and pipe support requirements.	equipped with a maximum of 75 feet of 1-½ inch woven jacket lined fire hose and suitable nozzles should be provided in all buildings, including containment, on all floors and should be spaced at not more than 100-foot intervals. Individual standpipes should be of at least 4-inch diameter for multiple hose connections and 2-½-inch diameter for single hose connections. These systems should follow the requirements of NFPA No. 14 for sizing, spacing and pipe support requirements (NELPIA).
Hose stations should be located outside entrances to normally unoccupied areas and inside normally occupied areas. Standpipes serving hose stations in areas housing safety related equipment should have shut off valves and pressure reducing devices (if applicable) outside the area.	Hose stations should be located outside entrances to normally unoccupied areas and inside normally occupied areas. Standpipes serving hose stations in areas housing safety related equipment should have shut off valves and pressure reducing devices (if applicable) outside the area.
Provisions should be made to supply water at least to standpipes and hose connections for manual fire fighting in areas within hose reach of equipment required for safe plant shutdown in the event of a Safe Shutdown Earthquake (SSE). The standpipe system serving such hose stations should be analyzed for SSE loading and should be provided with supports to assure system pressure integrity. The piping and valves	

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for the portion of hose standpipe system affected by this functional requirement should at least satisfy ANSI Standard B31.1, "Power Piping." The water supply for this condition may be obtained by manual operator actuation of valve(s) in a connection to the hose standpipe header from a normal Seismic Category I water system such as Essential Service Water System. The cross connection should be (a) capable of providing flow to at least two hose stations (approximately 75 gpm/ hose station), and (b) designed to the same standards as the seismic Category I water system; it should not degrade the performance of the Seismic Category I water system.	
(e) The proper type of hose nozzles to be supplied to each area should be based on the fire hazard analysis. The usual combination spray/straight-stream nozzle may cause unacceptable mechanical damage (for example, the delicate electronic equipment in the control room) and be unsuitable. Electrically safe nozzles should be provided at locations where electrical equipment or cabling is located.	(e) SAME
(f) Certain fires such as those involving flammable liquids respond well to foam suppression. Consideration should be given to use of any of the available foams for such specialized protection application. These include the more common chemical and mechanical low expansion foams, high expansion foam and the relatively new aqueous film forming foam (AFFF).	(f) SAME

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4. Halon Suppression Systems The use of Halon fire extinguishing agents should as a minimum comply with the requirements of NFPA 12A and 12B, "Halogenated Fire Extinguishing Agent Systems - Halon 1301 and Halon 1211." Only UL or FM approved agents should be used. In addition to the guidelines of NFPA 12A and 12B, preventative maintenance and testing of the systems, including check weighing of the Halon cylinders should be done at least quarterly. Particular consideration should also be given to: (a) minimum required Halon concentration and soak time (b) toxicity of Halon (c) toxicity and corrosive characteristics of thermal decomposition products of Halon.	4. Halon Suppression Systems SAME
5. Carbon Dioxide Suppression Systems The use of carbon dioxide extinguishing systems should as a minimum comply with the requirements of NFPA 12, "Carbon Dioxide Extinguishing Systems." Particular consideration should also be given to: (a) minimum required CO_2 concentration and soak time; (b) toxicity of CO_2; (c) possibility of secondary thermal shock (cooling) damage; (d) offsetting requirements for venting during CO_2 injection to prevent overpressurization versus sealing to prevent loss of agent;	5. Carbon Dioxide Suppression Systems SAME

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(e) design requirements from over-pressurization; and	
(f) possibility and probability of CO_2 systems being out-of-service because of personnel safety consideration. CO_2 systems are disarmed whenever people are present in an area so protected. Areas entered frequently (even though duration time for any visit is short) have often been found with CO_2 systems shut off.	
6. Portable Extinguishers	6. Portable Extinguishers
Fire extinguishers should be provided in accordance with guidelines of NFPA 10 and 10A, "Portable Fire Extinguishers, Maintenance and Use." Dry chemical extinguishers should be installed with due consideration given to cleanup problems after use and possible adverse effects on equipment installed in the area.	SAME
D. Guidelines for Specific Plant Areas	D. Guidelines for Specific Plant Areas
1. Primary and Secondary Containment	1. Primary and Secondary Containment
(a) Normal Operation	(a) SAME except as noted.
Fire protection requirements for the primary and secondary containment areas should be provided on the basis of specific identified hazards. For example:	
°Lubricating oil or hydraulic fluid system for the primary coolant pumps	
°Cable tray arrangements and cable penetrations	
°Charcoal filters	

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Because of the general inaccessability of these areas during normal plant operations, protection should be provided by automatic fixed systems. Automatic sprinklers should be installed for those hazards identified as requiring fixed suppression.	Fire suppression systems should be provided based on the fire hazards analysis. Fixed fire suppression capability should be provided for hazards that could jeopardize safe plant shutdown. Automatic sprinklers are preferred. An acceptable alternate is automatic gas (Halon or CO_2) for hazards identified as requiring fixed suppression protection.
Operation of the fire protection systems should not compromise integrity of the containment or the other safety related systems. Fire protection activities in the containment areas should function in conjunction with total containment requirements such as control of contaminated liquid and gaseous release and ventilation.	An enclosure may be required to confine the agent if a gas system is used. Such enclosures should not adversel affect safe shutdown, or other operating equipment in containment.
Fire detection systems should alarm and annunciate in the control room. The type of detection used and the location of the detectors should be most suitable to the particular type of fire that could be expected from the identified hazard. A primary containment general area fire detection capability should be provided as backup for the above described hazard detection. To accomplish this, suitable smoke detection (e.g., visual obscuration, light scattering and particle counting) should be installed in the air recirculation system ahead of any filters.	Automatic fire suppression capability need not be provided in the primary containment atmospheres that are inerted during normal operation. However, special fire protection requirements during refueling and maintenance operations should be satisfied as provided below

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Automatic fire suppression capability need not be provided in the primary containment atmospheres that are inerted during normal operation. However, special fire protection requirements during refueling and maintenance operations should be satisifed as provided below.	
(b) Refueling and Maintenance	(b) Refueling and Maintenance
Refueling and maintenance operations in containment may introduce additional hazards such as contamination control materials, decontamination supplies, wood planking, temporary wiring, welding and flame cutting (with portable compressed fuel gas supply). Possible fires would not necessarily be in the vicinity of fixed detection and suppression systems.	SAME
Management procedures and controls necessary to assure adequate fire protection are discussed in Section 3a.	
In addition, manual fire fighting capability should be permanently installed in containment. Standpipes with hose stations, and portable fire extinguishers, should be installed at strategic locations throughout containment for any required manual fire fighting operations.	Equivalent protection from portable systems should be provided if it is impractical to install standpipes with hose stations.
Adequate self-contained breathing apparatus should be provided near the containment entrances for fire fighting and damage control personnel. These units should be independent of any breathing apparatus or air supply systems provided for general plant activities.	

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2. Control Room The control room is essential to safe reactor operation. It must be protected against disabling fire damage and should be separated from other areas of the plant by floors, walls and roofs having minimum fire resistance ratings of three hours. Control room cabinets and consoles are subject to damage from two distinct fire hazards: (a) Fire originating within a cabinet or console; and (b) Exposure fire involving combustibles in the general room area. Manual fire fighting capability should be provided for both hazards. Hose stations and portable water and Halon extinguishers should be located in the control room to eliminate the need for operators to leave the control room. An additional hose piping shut off valve and pressure reducing device should be installed outside the control room. Hose stations adjacent to the control room with portable extinguishers in the control room are acceptable. Nozzles that are compatible with the hazards and equipment in the control room should be provided for the manual hose station. The nozzles chosen should satisfy actual fire fighting needs, satisfy electrical safety and minimize physical damage to electrical equipment from hose stream impingement.	2. Control Room SAME Hose stations adjacent to the control room with portable extinguishers in the control room are acceptable.

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Fire detection in the control room cabinets, and consoles should be provided by smoke and heat detectors in each fire area. Alarm and annunciation should be provided in the control room. Fire alarms in other parts of the plant should also be alarmed and annunciated in the control room.	
Breathing apparatus for control room operators should be readily available. Control room floors, ceiling, supporting structures, and walls, including penetrations and doors, should be designed to a minimum fire rating of three hours. All penetration seals should be air tight.	
The control room ventilation intake should be provided with smoke detection capability to automatically alarm locally and isolate the control room ventilation system to protect operators by preventing smoke from entering the control room. Manually operated venting of the control room should be available so that operators have the option of venting for visibility.	Manually operated ventilation systems are acceptable
Cables should not be located in concealed floor and ceiling spaces. All cables that enter the control room should terminate in the control room. That is, no cabling should be simply routed through the control room from one area to another.	If such concealed spaces are used, however, they should have fixed automatic total flooding halon protection.
Safety related equipment should be mounted on pedestals or the control room should have curbs and drains to direct water away from such equipment. Such drains should be provided with means for closing to maintain integrity of the control room in the event of other accidents requiring control room isolation.	Not applicable.

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3. Cable Spreading Room The primary fire suppression in the cable spreading room should be an automatic water system such as closed head sprinklers, open head deluge, or open directional spray nozzles. Deluge and open spray systems should have provisions for manual operation at a remote station; however, there should be provisions to preclude inadvertent operation. Location of sprinkler heads or spray nozzles should consider cable tray sizing and arrangements to assure adequate water coverage. Cables should be designed to allow wetting down with deluge water without electrical faulting. Open head deluge and open directional spray systems should be zoned to that a single failure will not deprive the entire area of automatic fire suppression capability. The use of foam is acceptable, provided it is of a type capable of being delivered by a sprinkler or deluge system, such as an Aqueous Film Forming Foam (AFFF). An automatic water suppression system with manual hoses and portable extinguisher backup is acceptable, provided: (a) At least two remote and separate entrances are provided to the room for access by fire brigade personnel; and (b) Aisle separation provided between tray stacks should be at least three feet wide and eight feet high.	3. Cable Spreading Room (a) The preferred acceptable methods are: 1. Automatic water system such as closed head sprinklers, open head deluge, or open directional spray nozzles. Deluge and open spray systems should have provisions for manual operation at a remote station; however; there should also be provisions to preclude inadvertent operation. Location of sprinkler heads or spray nozzles should consider cable tray sizing and arrangements to assure adequate water coverage. Cables should be designed to allow wetting down with deluge water without electrical faulting. Open head deluge and open directional spray systems should be zoned so that a single failure will not deprive the entire area of automatic fire suppression capability. The use of foam is acceptable, provided it is of a type capable of being delivered by a sprinkler or deluge system, such as an Aqueous Film Forming Foam (AFFF).

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Alternately, gas systems (Halon or CO_2) may be used for primary fire suppression if they are backed up by an installed water spray system and hose stations and portable extinguishers immediately outside the room and if the access requirements stated above are met. Electric cable construction should, as a minimum, pass the flame test in IEEE Std 383, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations." Drains to remove fire fighting water should be provided with adequate seals when gas extinguishing systems are also installed. Redundant safety related cable division should be separated by walls with a three-hour fire rating.	(2) Manual hoses and portable extinguishers should be provided as backup. (3) Each cable spreading room of each unit should have divisional cable separation, and be separated from the other and the rest of the plant by a minimum three-hour rated fire wall (Refer to NFPA 251 or ASTM E-119 for fire test resistance rating). (4) At least two remote and separate entrances are provided to the room for access by fire brigade personnel; and (5) Aisle separation provided between tray stacks should be at least three feet wide and eight feet high. b. For cable spreading rooms that do not provide divisional cable separation of a(3), in addition to meeting a(1), (2), (4), and (5) above, the following should also be provided: (1) Divisional cable separation should meet the guidelines of Regulatory Guide 1.75, "Physical Independence of Electric Systems." (2) All cabling should be covered with a suitable fire retardant coating. (3) As an alternate to a(1) above, automatically initiated gas systems (Halon or CO_2) may be

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	used for primary fire suppression, provided a fixed water system is used as a backup. (4) Plants that cannot meet the guidelines of Regulatory Guide 1.75, in addition to meeting a(1), (2), (4), and (5) above, an auxiliary shutdown system with all cabling independent of the cable spreading room should be provided.
For multiple-reactor unit sites, cable spreading rooms should not be shared between reactors. Each cable spreading room of each unit should have divisional cable sepration as stated above and be separated from the other and the rest of the plant by a wall with a minimum fire rating of three hours. (See NFPA 251, "Fire Tests, Building Construction and Materials", or ASTM E-119, "Fire Test of Building Construction and Materials", for fire test resistance rating.) The ventilation system to the cable spreading room should be designed to isolate the area upon acutation of any gas extinguishing system in the area. In addition, smoke venting of the cable spreading room may be desirable. Such smoke venting systems should be controlled automatically by the fire detection or suppression system as appropriate. Capability for remote manual control should also be provided.	
4. Plant Computer Room Safety related computers should be separated from other areas of the plant by barriers having a minimum three-hour fire resistant rating. Automatic fire detection	4. Plant Computer Room SAME

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should be provided to alarm and annunciate in the control room and alarm locally. Manual hose stations and portable water and halon fire extinguishers should be provided.	
5 Switchgear Rooms	5. Switchgear Rooms
Switchgear rooms should be separated from the remainder of the plant by minimum three-hour rated fire barriers, if practicable. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Fire hose stations and portable extinguishers should be readily available.	Switchgear rooms should be separated from the remainder of the plant by minimum three-hour rated fire barriers to the extent practicable. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Fire hose stations and portable extinguishers should be readily available.
Acceptable protection for cables that pass through the switchgear room is automatic water or gas agent suppression. Such automatic suppression must consider preventing unacceptable damage to electrical equipment and possible necessary containment of agent following discharge.	Acceptable protection for cables that pass through the switchgear room is automatic water or gas agent suppression. Such automatic suppression must consider preventing unacceptable damage to electrical equipment and possible necessary containment of agent following discharge.
6. Remote Safety Related Panels	6. Remote Safety Related Panels
The general area housing remote safety related panels should be provided with automatic fire detectors that alarm locally and alarm and annunciate in the control room. Combustible materials should be controlled and limited to those required for operation. Portable extinguishers and manual hose stations should be provided.	SAME

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7. Station Battery Rooms Battery rooms should be protected against fire explosions. Battery rooms should be separated from each other and other areas of the plant by barriers having a minimum fire rating of three-hours inclusive of all penetrations and openings. (See NFPA 69, "Standard on Explosion Prevention Systems.") Ventilation systems in the battery rooms should be capable of maintaining the hydrogen concentration well below 2 vol. % hydrogen concentration. Standpipe and hose and portable extinguishers should be provided. Alternatives: (a) Provide a total fire rated barrier enclosure of the battery room complex that exceeds the fire load contained in the room. (b) Reduce the fire load to be within the fire barrier capability of 1-1/2 hours. OR (c) Provide a remote manual actuated sprinkler system in each room and provide the 1-1/2 hour fire barrier separation.	7. Station Battery Rooms SAME
8. Turbine Lubrication and Control Oil Storage and Use Areas A blank fire wall having a minimum resistance rating of three hours should separate all areas containing safety related systems and equipment from the turbine oil system	8. Turbine Lubrication and Control Oil Storage and Use Areas SAME. When a blank wall is not present, open head deluge protection should be provided for the turbine oil hazards and automatic open head water curtain protection should be provided for wall openings.

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9. Diesel Generator Areas Diesel generators should be separated from each other and other areas of the plant by fire barriers having a minimum fire resistance rating of three hours. Automatic fire suppression such as AFFF foam, or sprinklers should be installed to combat any diesel generator or lubricating oil fires. Automatic fire detection should be provided to alarm and annunciate in the control room and alarm locally. Drainage for fire fighting water and means for local manual venting of smoke should be provided. Day tanks with total capacity up to 1100 gallons are permitted in the diesel generator area under the following conditions: (a) The day tank is located in a separate enclosure, with a minimum fire resistance rating of three hours, including doors or penetrations. These enclosures should be capable of containing the entire contents of the day tanks. The enclosure should be ventilated to avoid accumulation of oil fumes. (b) The enclosure should be protected by automatic fire suppression systems such as AFFF or sprinklers.	9. Diesel Generator Areas SAME When day tanks cannot be separated from the diesel-generator one of the following should be provided for the diesel generator area: (a) Automatic open head deluge or open head spray nozzle system(s) (b) Automatic closed head sprinklers (c) Automatic AFFF that is delivered by a sprinkler deluge or spray system (d) Automatic gas system (Halon or CO_2) may be used in lieu of foam or sprinklers to combat diesel generator and/or lubricating oil fires.
10. Diesel Fuel Oil Storage Areas Diesel fuel oil tanks with a capacity greater than 1100 gallons should not be located inside the	10. Diesel Fuel Oil Storage Areas SAME

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buildings containing safety related equipment. They should be located at least 50 feet from any building containing safety related equipment, or if located within 50 feet, they should be housed in a separate building with construction having a minimum fire resistance rating of three hours. Buried tanks are considered as meeting the three hour fire resistance requirements. See NFPA 30, "Flammable and Combustible Liquids Code", for additional guidance. When located in a separate building, the tank should be protected by an automatic fire suppression system such as AFFF or sprinklers. Tanks, unless buried, should not be located directly above or below safety related systems or equipment regardless of the fire rating of separating floors or ceilings.	In operating plants where tanks are located directly above or below the diesel generators and cannot reasonably be moved, separating floors and main structural members should, as a minimur, have fire resistance rating of three hours. Floors should be liquid tight to prevent leaking of possible oil spills from one level to another. Drains should be provided to remove possible oil spills and fire fighting water to a safe location. One of the following acceptable methods of fire protection should also be provided: (a) Automatic open head deluge or open head spray nozzle system(s)

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	(b) Automatic closed head sprinklers; or (c) Automatic AFFF that is delivered by a sprinkler system or spray system
11. Safety Related Pumps Pump houses and rooms housing safety related pumps or other safety related equipment should be separated from other areas of the plant by fire barriers having at least three-hour ratings. These rooms should be protected by automatic sprinkler protection unless a fire hazards analysis can demonstrate that a fire will not endanger other safety related equipment required for safe plant shutdown. Early warning fire detection should be installed with alarm and annunciation locally and in the control room. Local hose stations and portable extinguishers should also be provided. Equipment pedestals or curbs and drains should be provided to remove and direct water away from safety related equipment. Provisions should be made for manual control of the ventilation system to facilitate smoke removal if required for manual fire fighting operation.	11. Safety Related Pumps Pump houses and rooms housing safety related pumps should be protected by automatic sprinkler protection unless a fire hazards analysis can demonstrate that a fire will not endanger other safety related equipmen required for safe plant shutdown. Early warning fire detection should be installed with alarm and annunciation locally and in the control room. Local hose stations and portable extinguishers should also be provided.
12. New Fuel Area Hand portable extinguishers should be located within this area. Also, local hose stations should be located outside but within hose reach of this area. Automatic fire detection should	12. New Fuel Area SAME

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alarm and annunciate in the control room and alarm locally. Combustibles should be limited to a minimum in the new fuel area. The storage area should be provided with a drainage system to preclude accumulation of water. The storage configuration of new fuel should always be so maintained as to preclude criticality for any water density that might occur during fire water application.	
13. Spent Fuel Pool Area Protection for the spent fuel pool area should be provided by local hose stations and portable extinguishers. Automatic fire detection should be provided to alarm and annunciate in the control room and to alarm locally.	13. Spent Fuel Pool Area SAME
14. Radwaste Building The radwaste building should be separated from other areas of the plant by fire barriers having at least three-hour ratings. Automatic sprinklers should be used in all areas where combustible materials are located. Automatic fire detection should be provided to annunciate and alarm in the control room and alarm locally. During a fire, the ventilation systems in these areas should be capable of being isolated. Water should drain to liquid radwaste building sumps. Acceptable alternative fire protection is automatic fire detection to alarm and annunciate in the control room, in addition to manual hose stations and portable extinguishers consisting of hand held and large wheeled units.	14. Radwaste Building SAME

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15. Decontamination Areas The decontamination areas should be protected by automatic sprinklers if flammable liquids are stored. Automatic fire detection should be provided to annunciate and alarm in the control room and alarm locally. The ventilation system should be capable of being isolated. Local hose stations and hand portable extinguishers should be provided as backup to the sprinkler system.	15. Decontamination Areas SAME
16. Safety Related Water Tanks Storage tanks that supply water for safe shutdown should be protected from the effects of fire. Local hose stations and portable extinguishers should be provided. Portable extinguishers should be located in nearby hose houses. Combustible materials should not be stored next to outdoor tanks. A minimum of 50 feet of separation should be provided between outdoor tanks and combustible materials where feasible.	16. Safety Related Water Tanks SAME
17. Cooling Towers Cooling towers should be of non-combustible construction or so located that a fire will not adversely affect any safety related systems or equipment. Cooling towers should be of non-combustible construction when the basins are used for the ultimate heat sink or for the fire protection water supply.	17. Cooling Towers SAME. Cooling towers of combustible construction, so located that a fire in them could adversely affect safety related systems or equipment should be protected with an open head deluge system installation with hydrants and hose houses strategically located.

APPLICATION DOCKETED BUT CONSTRUCTION PERMIT NOT RECEIVED AS OF 7/1/76	PLANTS UNDER CONSTRUCTION AND OPERATING PLANTS
18. Miscellaneous Areas Miscellaneous areas such as records storage areas, shops, warehouses, and auxiliary boiler rooms should be so located that a fire or effects of a fire, including smoke, will not adversely affect any safety related systems or equipment. Fuel oil tanks for auxiliary boilers should be buried or provided with dikes to contain the entire tank contents.	18. Miscellaneous Areas SAME
E. Special Protection Guidelines	E. Special Protection Guidelines
1. Welding and Cutting, Acetylene - Oxygen Fuel Gas Systems This equipment is used in various areas throughout the plant. Storage locations should be chosen to permit fire protection by automatic sprinkler systems. Local hose stations and portable equipment should be provided as backup. The requirements of NFPA 51 and 51B are applicable to these hazards. A permit system should be required to utilize this equipment. (Also refer to 2f herein.)	1. Welding and Cutting, Acetylene - Oxygen Fuel Gas Systems SAME
2. Storage Areas for Dry Ion Exchange Resins Dry ion exchange resins should not be stored near essential safety related systems. Dry unused resins should be protected by automatic wet pipe sprinkler installations. Detection by smoke and heat detectors should alarm and annunciate in the control room and alarm locally. Local hose stations and portable extinguishers should provide backup for these areas. Storage areas of dry resin should have curbs and drains. (Refer to NFPA 92M, "Waterproofing and Draining of Floors.")	2. Storage Areas for Dry Ion Exchange Resins SAME

APPLICATION DOCKETED BUT CONSTRUCTION PERMIT NOT RECEIVED AS OF 7/1/78	PLANTS UNDER CONSTRUCTION AND OPERATING PLANTS
3. Hazardous Chemicals Hazardous chemicals should be stored and protected in accordance with the recommendations of NFPA 49, "Hazardous Chemicals Data." Chemicals storage areas should be well ventilated and protected against flooding conditions since some chemicals may react with water to produce ignition.	3. Hazardous Chemicals
4. Materials Containing Radioactivity Materials that collect and contain radioactivity such as spent ion exchange resins, charcoal filters, and HEPA filters should be stored in closed metal tanks or containers that are located in areas free from ignition sources or combustibles. These materials should be protected from exposure to fires in adjacent areas as well. Consideration should be given to requirements for removal of isotopic decay heat from entrained radioactive materials.	4. Materials Containing Radio-Activity SAME

ENCLOSURE 2

SUPPLEMENTARY GUIDANCE ON INFORMATION NEEDED FOR FIRE PROTECTION PROGRAM EVALUATION

In order to perform a proper fire hazards analysis, the services of a qualified fire protection engineer should be utilized. To demonstrate the results of the fire hazards analysis the following information must be provided:

1. Provide plan and elevation views of the plant that show the plant as divided into distinct fire areas. Provide a description of the various systems, both safety-related and non-safety-related, which occupy the fire area and could provide cooling to the core to safely shutdown the reactor, including decay heat removal. Provide a description of areas of the plant that contain radioactive material that may be released to the exclusion area or beyond should a fire occur in those areas.

   For each fire area, provide the following:

   a) Describe the fire barrier that defines the fire area; the consequences of the design basis fire for that area; the consequences of the fire if the fire protection system functions as designed.

   b) Identify the safety related equipment and associated cabling. Provide the design criteria for the fire protection related to such equipment. Provide the design criteria for protection of such equipment against inadvertent operation, careless operation or rupture of extinguishing systems.

   c) Provide a list of the type, quantity, and other pertinent characteristics of combustible materials associated with each fire area.

   d) Provide a list of the fire loadings which represent the combustibles identified in (c) above for each fire area.

   e) Describe all the extinguishing and detection capabilities within each fire area. Discuss all means for containing and inhibiting the progress of a fire, e.g., the use of fire stops, coatings, curbs, walls, etc. Describe the extinguishing equipment outside an area which has access to the area.

   NOTE: If large fire areas are divided into fire zones for the purpose of fire protection, the above information should be provided for each zone.

2. Where redundant safety related equipment or cabling is located in a given fire area, describe the design features which prevent the loss of both redundant trains in a common fire, e.g., the separation provided by distance, physical barriers, and electrical isolation. Where control, power, or instrument cables of redundant systems used for bringing the reactor to safe, cold shutdown are located in the same cable trays, either provide a bounding analysis demonstrating that the worst consequences as a result of a fire in the cable trays are acceptable or show that redundant systems required to achieve and maintain a cold shutdown are adequately protected against damage by the fire.