WESTINGHOUSE CLASS 3

AMENDMENT 3 TO RESAR-SP/90 PDA MODULE 13
AUXILIARY SYSTEMS

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AUXILIARY SYSTEMS

INSTRUCTION SHEET

Replace current page x with revised page x.

Replace current pages 9.5-1 thru 9.5-18 with revised pages 9.5-1 thru 9.5-18.

Replace current page 9.5-20 with revised page 9.5-20.

Replace current page 9.5-22 with revised page 9.5-22.

Replace current page 9.5-29 with revised page 9.5-29.

Place remainder of package behind Amendment 2 in Module 13.

REQUEST FOR ADDITIONAL INFORMATION
SECTION 9.5.1 FIRE PROTECTION
WESTINGHOUSE ADVANCED PRESSURIZED WATER REACTOR DESIGN
RESAR - SP/90 OCTOBER 1986
TASK COMPLETION NO. 141213

280.1 Section 9.5.1.1.d, pages 9.5-3, -4

The staff position reflecting fire protection for redundant safe shutdown trains in advanced reactor designs is that such redundant trains will be completely separated by 3-hour fire rated barriers, or completely separated by a 1-hour fire rated barrier with fire detection and automatic fire suppression throughout the area containing 1-hour fire rated barrier separation. This protection is acceptable for redundant safe shutdown equipment located inside or outside primary containment. The staff does not recognize as acceptable for use in Advanced Reactor Design any methods which rely upon:

- o Spatial separation,
- o Use only of automatic detection and suppression, or
- o Separation by radiant energy shields

This is consistent with the guidance given in Section C.5 - General Plant Guidelines, Subsection a. Building Design, of Standard Review Plan, NUREG-0800, Branch Technical Position CMEB 9.5-1.

Section 9.5.1.1.d of the SSAR is inconsistent with this position. Provide clarification showing how RESAR SP/90 meets this position or provide justification for not doing so.

RESPONSE:

Subsection 9.5.1.1(d) has been modified to clarify our intent to meet the guidelines provided in BTP CMEB 9.5-1. Note that contrary to what is stated above, the use of spatial separation is considered acceptable per paragraph C.5.b(2)(b).

280.2 Section 9.5.1.1.e, page 9.5-4

The staff understands that one of the major goals of the APWR is to streamline the review process by eliminating requests for deviation and the subsequent need for staff review of such requests. The last sentence on page 9.5-4 reads, "The design basis fire approach will also be utilized as appropriate to determine if specific deviations [emphasis added] from the fire protection features approach will provide an equivalent level of fire safety." This sentence is not consistent with the above stated goal. Please clarify this issue. (NOTE: It is the staff position that PRA cannot provide the basis for exemptions to requirements).

RESPONSE:

Subsection 9.5.1.1(e) has been modified to remove the reference to "specific deviations"; deviations to the general separation philosophy are described in Subsection 9.5.1.3(a).

280.3 Section 9.5.1.3.a, page 9.5-7

The same concerns raised in Question 280.1 above apply here respecting spatial separation and use of one-hour fire rated barriers and fire detection and automatic fire suppression. In addition, we are confused by the wording in the second paragraph concerning the term "fire barriers." The commonly accepted definition of a fire area is a volume in a building that is bounded by barriers of some known fire resistance rating given in terms of hours. Please clarify the last sentence which reads, in part, "Similarly, fire barriers will be provided within a fire area to separate. . . ."

RESPONSE:

Revisions to Subsection 9.5.1.1(d) and 9.5.1.3(a) are provided to provide conformance with the requirements, and to clarify the definition of a fire area.

280.4 Section 9.5.1.3, pages 9.5-7,-8

The concerns raised in question 280.1 above reflecting spatial separation, and the concerns raised in question 280.3 above reflecting use of fire barriers within a fire area apply in Subsection a. Separation of Safe Shutdown Equipment. Please clarify this section.

RESPONSE:

Subsection 9.5.1.3(b) has been revised to provide clarification.

280.5 Section 9.5.1.4.1, page 9.5-8

Please explain how the flame and heat resistant characteristics of the passive fire protection features will be determined, and to what they will be compared.

RESPONSE:

It is expected that the flame and heat characteristics of the passive fire protection features included in the SP-90 plant can be demonstrated using existing test data. If not, additional tests will be performed during the Final Design Stage.

280.6 Section 9.5.1.4.1.a, page 9.5-9

Should the reference in the second line be to Subsection 9.5.1.3(a) rather than to 9.5.1.4(a) as shown?

RESPONSE:

Yes! The text has been revised to reflect Subsection 9.5.1.3(a) as the correct reference section.

280.7 Section 9.5.1.4.1.b and c, page 9.5-11

- See Question 280.1 above for comments on radiant energy shields.

- We have two questions concerning the last sentence in 9.5.1.4.1.b which reads, "Each fire barrier component will be tested or analyzed to assure adequate fire resistance ratings."

  a. We assume that "component" refers to such things as doors, dampers, penetration seals and cable wraps (we have already stated that radiant energy shields are not acceptable), and that such "components" will be tested in configurations like those to be used in this advanced reactor design. The staff finds this concept acceptable. If "component" refers to individual structural portions of total barriers (i.e. columns and beams or portions of concrete slabs used in the construction of fire wall or ceiling-floor assemblies), then this concept is not acceptable. Clarify what is meant by "component."

  b. The staff generally does not accept analysis in lieu of full scale testing for determining the adequacy of barrier fire resistance rating. How will such analysis be accomplished to assure that the results will be acceptable in place of actual full scale testing?

This position is consistent with Section C.5.a of BTP CMEB 9.5-1 of the Standard Review Plan, NUREG-0800.

RESPONSE:

With regard to part a. of the question, the staff's assumption with regard to the definition of 'component' is correct.

In response to part b., it is the intent to utilize, where practical, proven components and materials (see also response to Question 280.5). In some cases, additional analysis may be required to determine the adequacy of barrier fire resistance rating. If such analysis cannot be executed in an acceptable manner, additional testing will be performed during the Final Design stage.

280.8 Section 9.5.1.4.1.d, pages 9.5-11, -12

a. The second paragraph ("Where door assemblies . . . devices, and hardware.") appears to be an error. Should this be deleted? If not, clarify your position.

b. The first paragraph at the top of page 9.5-12 is not clear. Specifically:

- What are the qualifications and responsibilities of the person who will review and evaluate each configuration?
- What code or standard does "analyzed" refer to?
- Will the criteria used in these analyses be that in ASTM E-152 and NFPA 80 or will other criteria be used?

RESPONSE:

a. The paragraph in question was in error and has been deleted.

b. Page 9.5-12 has been revised for clarification purposes.

280.9 Section 9.5.1.4.2.b, pages 9.5-13, -14

Will each fire pump be equipped for automatic and remote manual start, and manual stop only at the fire pump location (no remote stop capability), or automatic stop capability that conforms to the requirements of National Fire Protection Association Standard No. 20, "Standard for the Installation of Centrifugal Fire Pumps?" Also, NFPA 20 is not referenced along with other NFPA standards at the end of this section. Is this an oversight, or does Westinghouse not intend to follow this standard with respect to their fire pump installations?

RESPONSE:

Exclusion of NFPA 20 here was an error of omission (this standard is referenced throughout Subsection 9.5.1). The SP/90 will conform to this standard with respect to fire pump installations.

280.10 Section 9.5.1.4.3.c.2, page 9.5-17

Why has self-contained breathing apparatus (SCBA) for control room personnel who may have to leave the control room during a fire not been provided? (See Section C.3.c of BTP CMEB 9.5-1 of Standard Review Plan, NUREG-0800.)

RESPONSE:

Subsection 9.5.1.4.3(c)2 has been modified to provide control personnel sufficient access to self-contained breathing apparatus for leaving the control room during a fire.

280.11 Section 9.5.1.6, page 9.5-20

Why are the words "suggested" rather than "required," and "recommendations" rather than "requirements" used when referring to National Fire Protection Association Standards 20 and 24?

RESPONSE:

Subsection 9.5.1.6 has been revised as suggested.

280.12 Section 9.5.1.7.a.2, page 9.5-22

Should the second sentence read, "Upon completion of a task, and at the end of each work shift . . .?" This will assure clean-up of a work area immediately when a task is completed rather than waiting until the end of a shift. Also, if a task extends into other shifts, the work area will be cleaned up at least at the end of each shift. Please clarify.

RESPONSE:

The word "and" has been added to clarify this issue.

280.13 Section 9.5.1.7.d.4, page 9.5-29

The third paragraph states that randomly selected unannounced drills will be critiqued by independent individuals. Who are these individuals and what are their qualifications?

RESPONSE:

The "independent individuals" will be selected by each utility and will be independent of the licensee's staff. Qualification will be based on each individual's knowledge, gained through training and experience, in the areas of fire protection, fire detection and fire suppression.

9.5 OTHER AUXILIARY SYSTEMS

9.5.1 Fire Protection System

9.5.1.1 Design Basis

The Fire Protection Program is developed to assure, through a defense-in-depth matrix, that fire will not affect redundant components required to achieve safe shutdown and to prevent an increased risk of radioactive releases to the environment. In addition, the Fire Protection Program is intended to minimize property damage and protect personnel from injury due to fire. The defense-in-depth protection matrix is based on recognition of potential fire hazards in safety-related areas and the need to protect redundant safe shutdown equipment from a common mode fire-related failure.

a. A Fire Hazards Analysis will be conducted to assess vulnerability of plant safety-related equipment to damage by fire. The study will include an inventory of in situ flammable/combustible material and a review of anticipated plant activities such as storage areas, radwaste step-off pads, oil quantities in various pieces of equipment, and oil transport and handling methods to determine locations in which a serious fire may occur.

   Based on this information, the following features of plant general arrangement will be reviewed:

   - Access and egress routes
   - Equipment locations
   - Structural design features which separate or isolate redundant safety-related systems.
   - Floor drains
   - Ventilation

- Construction materials.

This review will assess potential for damage to safety-related equipment and the effect of postulated fires relative to maintaining the ability to perform safe shutdown functions and minimize radioactive releases to the environment.

b. Active and passive fire protection features will be provided in combination as a means for assuring defense-in-depth against fire.

In order to preclude a single fire resulting in an unacceptable release of radioactivity, passive fire protection features with appropriate fire resistance qualification will be provided to separate redundant systems and equipment required to achieve safe shutdown.

In areas where plant processes or presence of combustible material result in potential for fire ignition and significant fire propagation or personal injury, appropriate fixed fire suppression and detection systems will be installed to promptly notify plant personnel and provide fire suppression capabilities.

Additional fire barriers, fire detection equipment, fire hose stations, and portable fire suppression equipment will be provided based on results of the Fire Hazards Analysis and professional judgment of an engineer experienced in fire protection.

c. Fire protection concepts for the WAPWR consider fire concurrent with loss of off-site power such that safe shutdown is achievable following loss of systems, equipment, and components in any one fire area without use of off-site power. Fire is considered concurrently with other Design Basis Events or Accidents only when one may initiate the other. Examples are as follows:

- Fire induced by a Design Basis Accident (such as earthquake).
- Loss of Coolant Accident (LOCA) induced by fire.

Where the possibility exists for fire to be induced by a Design Basis Accident, the hazard will be mitigated by system equipment design (such as a seismically-qualified oil collection system for reactor coolant pumps). Where a loss of equipment function or malfunction due to fire may result in a LOCA, vulnerable equipment and components will be protected from the effects of a fire to preclude a LOCA.

If a fire is not initiated by or does not initiate another Design Basis Event or Accident, a fire is not considered to occur concurrent with and coincidental to Design Basis Events such as:

- o Design Basis Earthquake
- o Tornado
- o Flood
- o LOCA

d. In Nuclear Power Block (NPB) areas outside containment separation of safety related equipment will be achieved by three hour fire barriers.

Inside containment, separation by three hour fire barriers is not practical because all compartments need to be in communication with each other in order to relieve pressure following a high energy line break. For this reason, fire protection is achieved by one or more of the following parameters:

- o Separation by existing structural walls (note that these may be 3 hour fire barriers, but they do not fully enclose the equipment requiring separation). 3

- o Separation by horizontal distance of more than 20 feet with no intervening combustibles or fire hazards, coupled with fire detection and automatic fire suppression.

Fire barriers will also be utilized to separate safety related areas from non-safety related areas as dictated by the Fire Hazards

Analysis. Similarly, fire barriers will be provided within a fire area to separate components which present a fire hazard to other components or cable concentrations within the area. For example, each diesel generator is separated from the remainder of its associated safety related area. 3

e. In order to determine appropriate combination of active and passive fire protection features for property conservation and personnel safety considerations, the design basis fire approach will be used, employing professional judgment of engineers experienced in fire protection and use of validated analytical techniques existing in the public domain or developed specifically for the APWR. 3

f. Fire protection fluid systems will be arranged by piping network and provision of sectional isolation valves, such that a single failure or system impairment will not remove primary and secondary protection from service (i.e., fixed and manual suppression systems).

g. The ultimate objective of the WAPWR Fire Protection Program is to minimize uncontrolled release of radioactive material to meet requirements of 10CFR100.

9.5.1.2 Codes and Standards

a. Nuclear Regulatory Commission NUREG-0800, Standard Review Plan

Section 9.5.1 of the Standard Review Plan refers to Branch Technical Position (BTP) CMEB 9.5.1 as the technical basis of the Nuclear Power Plant Fire Protection Program which is implemented for the WAPWR. BTP 9.5.1 addresses Fire Protection Programs for safety-related systems and equipment and for other plant areas containing fire hazards that could adversely affect safety-related systems.

Technical requirements of BTP CMEB 9.5.1 are utilized as the basis for the WAPWR Fire Protection Programs. Specific features which deviate from technical requirements of BTP CMEB 9.5.1 will provide equivalent protection as determined by analysis as stated in Subsection 9.5.1.1(e).

b. National Fire Codes

National Fire Protection Association (NFPA) Code editions current at the time of the PDA module submittal will be used as design standards for systems and features referenced in the codes. The following NFPA codes are utilized in development of the fire protection program for the WAPWR:

- NFPA 10 - Portable Fire Extinguishers
- NFPA 12 - Carbon Dioxide Extinguishing Systems
- NFPA 12A - Halon 1301 Fire Extinguishing Systems
- NFPA 13 - Installation of Sprinkler Systems
- NFPA 14 - Installation of Standpipe and Hose Systems
- NFPA 15 - Water Spray Fixed Systems
- NFPA 20 - Installation of Centrifugal Fire Pumps
- NFPA 22 - Water Tanks for Private Fire Protection
- NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances
- NFPA 30 - Flammable and Combustible Liquid Code

- NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines
- NFPA 50 - Bulk Oxygen Systems at Consumer Sites
- NFPA 50A - Gaseous Hydrogen Systems at Consumer Sites
- NFPA 72D - Installation, Maintenance and Use of Proprietary Protective Signaling Systems
- NFPA 72E - Automatic Fire Detectors
- NFPA 78 - Lightning Protection Code
- NFPA 80 - Fire Doors and Windows
- NFPA 90A - Installation of Air Conditioning and Ventilation Systems
- NFPA 101 - Safety to Life from Fires in Buildings and Structures.
- NFPA 232 - Records
- NFPA 803 - Light Water Nuclear Power Plants

Where deviations from NFPA codes exist, the Fire Hazard Analysis will describe the deviation and determine that equivalent protection is provided.

9.5.1.3 Protection of Safe Shutdown Related Equipment

a. Separation of Safe Shutdown Equipment

3 Safety related redundant components which may be required to function to achieve safe shutdown will be protected as described in Subsection 9.5.1.1(d), with the exception of the Main Steam and Feedwater Tunnel

and the Main Control Room outside containment, and the pressurizer relief system inside containment.

The Main Steam & Feedwater Tunnel contains the safety class portions of the main steam and feedwater lines outside containment in a single area. The probability of fire initiation in this area is low because of the low density of cabling in this area. In addition, the steam generator power operated relief valves, which may be required to achieve cold shutdown and which are located in the Main Steam and Feedwater Tunnel are backed up by the relief valves of the Steam Generator Overfill Protection System, which are located inside containment.

With regard to the Main Control Room, the probability of fire initiation is low because of the following features:

- The extensive use of multiplexed interconnection, which has eliminated the need for cable spreading rooms. 3

- The use of low voltage (24V) within the control boards.

- The use of fire retardant materials

Moreover, fire detection and mitigation are enhanced by the continuous presence of plant operators in the Main Control Room by the incorporation of automatically actuated fire extinguishing systems, and by the availability of portable fire extinguishers.

Nevertheless, because a fire in the Main Control Room cannot be excluded, two emergency panel rooms are provided for in the SP-90 design. Each of these two emergency panel rooms is located in one of the redundant safety related areas and includes the capability to bring the reactor to cold shutdown using one of the redundant trains of engineered safety features.

The pressurizer power operated relief valves (PORV's) are a safety grade means to depressurize the Reactor Coolant System (RCS) to allow injection of borated water by the High Head Safety Injection Pumps. The redundant pressurizer PORV's, which are safety grade, are located in a single area above the pressurizer. This exception is judged acceptable for the following reasons:

- o The probability of a fire in this area is extremely remote due to the absence of significant quantities of combustible material 3

- o The charging pumps would normally be available to inject borated water into the RCS without the need for depressurization

- o RCS depressurization is achievable without reliance on pressurizer PORV's (i.e. using the safety grade hot leg letdown valves), although this would be a less desirable mode of operation due to the complex operator action required.

b. Protection of Safe Shutdown Power and Control Cables

Redundant safe shutdown cables and associated circuits will be protected as described in 9.5.1.1(d), except as noted in 9.5.1.3.(a) above. 3

c. Fire Barrier Rating

Barriers will be rated in accordance with criteria as stated in Subsection 9.5.1.1(d).

9.5.1.4 Fire Protection System and Feature Descriptions

9.5.1.4.1 Passive Fire Protection Features

Passive fire protection features are considered to be building assemblies and insulating materials which have flame and heat resistant characteristics.

Passive fire protection features consist of fire rated structural assemblies, (i.e., walls, floors or ceilings), which have penetrations protected by fire rated devices (i.e., dampers, doors or firestops). Insulating materials consist of cable wraps and heat resistant coatings. The fire rating of these structural assemblies, penetration protection devices and insulating materials is determined by appropriate test procedures.

Passive fire protection features, henceforth referred to as fire barriers, are used to separate safety-related systems from nonsafety-related areas, redundant safety-related divisions or trains from each other and safety-related components which may present a fire hazard from other safety-related components. This separation will ensure that a single fire cannot cause loss of ability to achieve safe shutdown.

a. Location of Fire Barriers

Fire barriers will be provided on each elevation of safety-related areas to meet the criteria stated in Subsection 9.5.1.3(a). The following is an elevation-by-elevation list of redundant safety-related equipment which will be separated from its counterpart by three-hour fire rated barriers. | 3

Elevation 72.0

Turbine-Driven Emergency Feedwater Pumps
Motor-Driven Emergency Feedwater Pumps
Residual Heat Removal Pumps
High Head Safety Injection Pumps | 3

Elevation 77.4

Component Cooling Water Pumps
Emergency Feedwater Storage Tanks
Turbine-Driven Emergency Feedwater Pump Valves
Motor-Driven Emergency Feedwater Pump Valves

Elevation 84.8

Component Cooling Water Heat Exchangers
Emergency Feedwater Storage Tanks

Elevation 92.8

Diesel Generator Auxiliary Rooms
Switchgear Rooms
Battery Rooms
Emergency Panel Rooms

Elevation 100.0

Diesel Generator Rooms
Diesel Generator Contr Rooms
Relay Rooms

The following rooms, areas, and equipment will be separated from the remainder of the plant by three-hour fire rated barriers.

Control Room
Computer Room
Control Rod Drive Mechanism Room
Motor Control Center Room
Fuel Storage and Handling Area
Nonsafety-Related Battery Room
Stair Towers
Elevator Shafts
Duct Shafts
Cable Shafts
Containment Area

The floors which separate each elevation of safety-related areas will be constructed and maintained as three-hour fire rated barriers.

The exterior walls of safety-related areas which are above grade level and are threatened by potential fire exposure from adjacent buildings, storage tanks, etc., will be constructed and maintained as three-hour fire rated barriers. Walls, floors or ceilings which separate safety-related systems from nonsafety-related areas will also be constructed and maintained as three-hour fire barriers.

b. Components of Fire Barriers

Fire barriers are composed of structural assemblies (walls, floors and ceilings), materials which protect openings in structural assemblies (doors, dampers and penetration seals), and fire rated insulating materials (cable wraps, radiant energy shields). Each fire barrier component will be tested or analyzed to assure adequate fire resistance ratings.

c. Structural Assemblies

Wall, floor, and ceiling assemblies constructed as fire barrier units meet the criteria established by ASTM E 119, "Fire Tests of Building and Construction Materials" for the hourly fire rating required.

d. Door Assemblies

Door assemblies installed in fire barriers meet the criteria established in ASTM E 152, "Fire Tests of Door Assemblies" and NFPA 80, "Fire Doors and Windows" for the hourly fire rating required. Door assemblies include door leafs, door frames, latching devices, closure devices, and hardware.

Where door assemblies in fire barriers must be modified for other design requirements, such as pressure differential or security requirements, each configuration will be analyzed or tested, in accordance with applicable codes and standards, to assure that door units will withstand potential fire exposure for the specific configuration.

e. Dampers

HVAC fire dampers installed in fire barriers meet the criteria established in UL555, "Fire Dampers" and NFPA 90A, "Installation of Air Conditioning and Ventilation System" for the hourly fire rating required. Maintenance access is provided to the installed fire dampers, as stated in NFPA 90A.

f. Penetration Seals

Mechanical and electrical penetration fire stop assemblies installed in fire barriers meet the criteria established in ASTM E 814, "Fire Tests of Through-Penetration Fire Stops." Mechanical and electrical penetrations include cable, cable trays, piping, and conduit.

Openings inside conduits larger than four inches will be sealed at the fire barrier assembly. Openings inside conduits less than four inches will be sealed at the fire barrier unless the conduit extends more than five feet on either side of the fire barrier, in which case the conduit will be either sealed at the fire barrier or at each end by a noncombustible material to prevent passage of smoke and hot gases.

g. Fire Insulating Material

Fire insulating materials may be of either a spray on application or a blanket type material. These insulating materials are used to protect components threatened by potential fire exposure. Components protected by fire insulating materials may include structural steel, redundant safety-related cable trays, and pieces of safety-related equipment. Fire insulating materials meet the criteria of ASTM E 119, "Standard Time and Temperature Curve" for the specific hourly rating required.

Where protected by fire insulating material, electrical components will have ampere capacity derated accordingly.

9.5.1.4.2 Active Fire Protection Features

a. Fire Detection and Alarm Systems

Automatic fire detectors will be provided over all significant hazards and over major safe shutdown components as dictated by the Fire Hazards Analysis. The detection system will be designed and installed in accordance with current editions of National Fire Protection Association Standards 72-D and 72-E.

Detector coverage will include major cable concentrations, safe shutdown related major pumps, switchgear, motor control centers, battery and inverter areas, relay rooms, fuel areas, and all other areas containing appreciable in situ or potential transient combustibles.

Detector devices will be selected based on the type of fire anticipated and positioned considering ventilation, ceiling height, ambient conditions, and burning characteristics of the materials involved. Detection system alarms will be annunciated in the Control Room and will sound locally in the fire area involved.

b. Fire Protection Water Supply

A dedicated fire protection water supply and distribution system will be provided to meet the anticipated needs for fixed water suppression systems and manual hose streams. The water supply will consist of a 100 percent capacity electric motor-driven fire pump, powered by on-site emergency power buses and a 100 percent capacity diesel-driven fire pump. Each pump will take suction from an assured water source with a minimum of 300,000 gallons. (If ground level suction tanks are utilized, redundancy will be provided.)

The water distribution system will be sized to supply the largest fixed water suppression system demand, including a hose stream demand

of 1000 GPM, with the shortest portion of the water distribution piping out of service. The system will be equipped with interior and exterior sectional control valves to meet single failure criteria as stated in Subsection 9.5.1.1(f). The system will also be arranged such that yard fire hydrants may be repaired or serviced without loss of interim water suppression capability. The water distribution system will be designed and installed in accordance with National Fire Protection Association Standards 13, 14, 15, 20, and 24. 3

c. Water Suppression Systems

Fixed water suppression systems will be provided over major fire hazards where appropriate as dictated by the Fire Hazards Analysis. These systems will be designed and installed in accordance with National Fire Protection Association Standards 13 and 15. Water shields or buffers will be utilized as necessary to shield safety-related equipment requiring protection from water discharge.

d. Gaseous Suppression Systems

Fixed Halon 1301 or carbon dioxide fire extinguishing systems will be installed to protect selected hazards which may not practically or effectively be protected by water suppression systems. These systems will be provided as detailed by the Fire Hazards Analysis and will consider the characteristics of each extinguishing system with respect to effects on equipment and personnel. These systems will be designed and installed in accordance with National Fire Protection Association Standards 12 and 12A.

e. Hydrants and Hose Standpipes

Manual fire fighting capability utilizing hose streams will be provided through an arrangement of exterior fire hydrants and interior hose standpipes. Fire hydrants will be provided in accordance with National Fire Codes or as dictated by the Fire Hazards Analysis.

Exterior hose houses or hose cabinets will be provided and equipped in accordance with the recommendations of National Fire Protection Association Standard 24.

Interior 1 1/2" hose stations fed from standpipe systems will be provided in accordance with National Fire Codes or as dictated by the Fire Hazards Analysis. Each hose station will be equipped with a maximum of 100 feet of listed fire hose and an adjustable spray nozzle. Pressure reducing orifices will be used as necessary to assure that each hose has proper pressure. The standpipe systems will be designed and installed in accordance with the current edition of National Fire Protection Association Standard 14.

f. Fire Extinguishers

Portable fire extinguishers will be provided in areas which contain fixed or potential transient combustibles. Extinguishers will be chosen considering the anticipated types of fire and the effect of the extinguishing agent on equipment. Spacing, selection, and maintenance will be performed in accordance with the current edition of National Fire Protection Association Standard 10.

9.5.1.4.3 Support Systems

Support systems include systems and equipment which are not directly involved in fire detection, suppression, or containment, but aid in fire fighting and plant operations during a fire incident.

a. Fire Brigade Radios

Portable radio communications will be provided for fire brigade and plant operations personnel during a fire incident. This communication system will have a distinct and separate frequency such that plant security force communications and actuation of protection relays are not affected. The portable radio communication system will utilize

fixed repeaters, as necessary, to assure communications capability with any location in the station from the Control Room. The fixed repeaters will be arranged and protected such that exposure to fire damage will not disable the entire system.

b. Emergency Lights

Sealed-beam emergency lights with individual eight-hour battery supplies will be provided in areas which must be occupied for safe shutdown and routes used for access and egress to these locations. The lighted areas will include areas where operator actions occur if the Control Room is evacuated. In addition to the sealed-beam eight-hour emergency lights, portable sealed-beam battery-powered hand lights will be provided for use by fire brigade and plant operations personnel during a fire incident.

c. Fire Brigade Emergency Breathing Air

Emergency breathing air will be provided for fire brigade and Control Room personnel. The breathing air will be delivered by a self-contained apparatus or a storage reservoir. Full-face positive-pressure masks approved by the National Institute for Occupational Safety and Health will be utilized by all personnel required to use emergency breathing air.

1. Fire Brigade Personnel Equipment

A minimum of ten self-contained breathing units will be provided for fire brigade use. Each unit will be provided with two extra air bottles located on site. Rated service life for the self-contained units will be a minimum of one half-hour. In addition to the two extra bottles for each self-contained unit, compressors will be provided so that exhausted air bottles may be quickly replenished. The compressors will operate in areas free of dust and contaminants and will be powered from a vital power bus so that breathing air is available if off-site power is lost.

2. Control Room Personnel Equipment

Emergency breathing air will be provided for Control Room personnel by a manifold system piped from a storage reservoir. The storage reservoir will have the capacity to supply emergency breathing air for six hours. In addition, self-contained breathing apparatus (SCBA) is located in the control room to allow personnel to leave this area during a fire. 3

9.5.1.4.4 Curbs and Drains

Floor drains and curbs which are sized to remove expected fire fighting water flow will be provided in areas protected by fixed water fire suppression systems or hand-held hose lines if water accumulation will cause unacceptable damage to safety-related equipment. Water drained from areas which may contain radioactivity will be properly collected, analyzed, and treated before being discharged to the environment.

In areas protected by gas suppression systems, either the floor drains will be designed with adequate liquid seals or the suppression agent supply will be sized to compensate for agent loss through the drainage system.

Floor drains located in areas containing combustible liquids will be designed such that these liquids cannot backflow into safety-related areas through the drainage system.

9.5.1.4.5 Reactor Coolant Pump Oil Collection System

Seismically-qualified oil collection systems will be provided for reactor coolant pump motor oil systems. These oil collection systems will protect all potential pressurized and non-pressurized leakage points in the pump lube oil system. A drain line will be provided to transport the largest potential oil leak to a vented closed container. The vent on the closed container will be provided with a flame arrestor if the oil flash point characteristics and proximity of hot surfaces present a flashback hazard.

The Reactor Coolant Pump Oil Collection System will be designed so that failure will not lead to a fire during normal or Design Basis Accident conditions. The oil collection system will also be designed to withstand a safe shutdown earthquake.

9.5.1.4.6 Smoke Control

Smoke will be removed from each fire area by ventilation systems. The removal of smoke by ventilation systems may be achieved either directly or via manual portable smoke venting devices. When using the manual smoke venting devices, smoke is removed from the fire-involved room or area and placed in an area where exhaust ventilation is provided. Release of smoke which may contain radioactive materials is monitored to ensure compliance with applicable guidelines.

9.5.1.4.7 Access/Egress

Clearly marked fire exit routes will be provided for each fire area. These routes will be designed to comply with applicable life safety codes and standards.

9.5.1.4.8 Construction Materials and Combustible Contents

Noncombustible materials having radiant energy heat flux of equal to or more than 50 kW/CM^2 will be used for interior wall and structural components, thermal insulation, radiation shielding, soundproofing, interior finishes, and suspended ceilings.

Transformers located inside fire areas containing safety-related equipment will be of the dry type, insulated with noncombustible liquid or separated from safety-related equipment by three-hour fire rated construction.

9.5.1.5 Interaction with Other Systems

a. Water Spray on Safety Related Equipment

Potential for water spray from fire protection water suppression system piping will be reviewed based on the Pipe Rupture Analysis Criteria. Where potential for water spray may result in damage to safety-related equipment, one of the following options will be utilized to assure that equipment is not damaged:

- Rerouting of fire protection piping.
- Installation of water spray shields.
- Qualifying safety-related equipment to withstand effects of water spray.

b. Flood

Pipe rupture criteria will be used to assure that the flood inventory in fire protection piping will not cause damage to safety-related equipment. Drains and sumps in the NPB will be sized to control maximum flood inventory of fire protection piping.

9.5.1.6 Preoperational Testing

a. Pumps

1. Controls

3 | Fire pump controls will be initially tested as required in National Fire Protection Association Standard 20.

2. Capacity

The fire pumps will be flow tested to assure that each pump is capable of pumping to 150 percent of rated capacity at appropriate
3 | pressures. The testing method will follow the requirements of National Fire Protection Association Standard 20.

b. Piping

Water distribution system piping will be flushed and hydrostatically tested to assure full operability. These tests will follow the
3 | requirements of the National Fire Protection Association Standard 24.

c. Valves

Each automatic and manual valve of the water distribution system will be cycled to verify proper operation.

d. Detectors/Alarms

Each fire detector and all related circuitry will be functionally tested to assure full system operability. Detector, alarm, and power supply functions will be tested in accordance with National Fire Protection Association Standards 72-D and 72-E.

e. Dampers

Each fire rated damper will be inspected to verify proper installation and will be cycled to assure proper operation.

f. Water Suppression Systems

Each water suppression system will be tested in accordance with the applicable National Fire Protection Association Standard. These tests will verify proper valve operation, local and Control Room alarm, and control functions. All system piping will be flushed and hydrostatically tested to assure integrity. Airflow tests will be performed on open head/nozzle systems to assure that all heads/nozzles are unobstructed.

g. Gaseous Suppression Systems

Each Halon 1301 and carbon dioxide system will be functionally tested in accordance with the applicable National Fire Protection Association Standards. This testing will include full discharge concentration tests.

h. Radio System

The portable radio system will be verified as fully operable through a functional test of the entire system. This testing will verify proper antenna placement and repeater operability to assure full coverage.

i. Emergency Lights

Self-contained eight-hour emergency lighting units will be inspected to verify proper aiming of beams and coverage for access and equipment manipulation. Individual units will be load tested on a sampling basis to verify design duration.

9.5.1.7 Administrative Controls, Quality Assurance, Personnel Qualification, and Training

a. Administrative Controls

Administrative controls will be used to limit fire fuel and ignition sources inside safety-related areas. These limits will be accomplished by controlling the type, quantity, and length of presence of combustible materials inside safety-related areas and establishing a hot work permit system.

1. Control of Combustible Materials

The permanent bulk storage of combustible materials inside or adjacent to safety-related areas will be prohibited; however, to accomplish certain tasks the use of combustible materials is unavoidable. Administrative controls will be established to govern the handling and use of ordinary combustibles such as:

- o Combustible/flammable gases and liquids
- o Flame retardant wood
- o plastic products
- o dry ion exchange resins

2. Transient Combustible Material

Administrative controls will minimize the amount of transient combustible material in safety-related areas during all phases of plant operation. Upon completion of a task and at the end of each work shift, all waste combustible material will be removed to a designated storage location. 3

An on-site staff organization will be designated to review proposed work activities. This review will identify potential

4. Fire Drills

Fire drills will be performed in the plant at intervals not to exceed three months for the fire brigade for each shift. A minimum of one drill per year for each fire brigade will be unannounced. Also one drill per year for each fire brigade will be performed on a back shift. Local fire department participation will be provided at least once each year.

Each fire brigade member will be required to participate in a minimum of two drills per year, and records of each member's training will be maintained for a minimum of three years.

The drills will have preplanned training objectives and will be critiqued to determine if these objectives were met. Unsatisfactory drill performance will be followed by a repeat drill within 30 days and by additional training. At intervals of 3 years, randomly selected unannounced drills will be critiqued by qualified independent individuals, selected by the utility. | 3

Drills, as a minimum, will assess the following:

- o Fire alarm effectiveness.
- o Time required to assemble the brigade.
- o Selection, placement, and simulated use of equipment.
- o Fire fighting strategies
- o Knowledge of each brigade member of his/her role in the fire fighting strategy.

- o Conformance of the brigade member with established fire fighting procedures and use of fire fighting equipment, to the extent practicable.

- o Direction of the brigade leader of the fire fighting effort as to thoroughness, accuracy and effectiveness.

e. Fire Fighting Procedures

Procedures will be developed that outline actions to be taken by the following:

- o the individual discovering the fire

- o control room personnel upon report of the fire or receipt of an alarm

- o fire brigade personnel after notification of a fire

- o plant manager after notification of a fire

- o staff after notification of a fire

The fire fighting procedures will also outline the actions to be taken to coordinate fire fighting activities with off-site fire departments.

f. Fire Fighting Strategies

Strategies will be developed for fighting fires in all safety-related areas presenting hazards to safety-related equipment. Specific strategies will include the following subjects for each plant zone:

- o Identification of combustibles.

- o Optimum methods for controlling a fire and the nearest location of these extinguishants.