



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE ALTERNATE SHUTDOWN CAPABILITY AND
EXEMPTIONS TO APPENDIX R TO 10 CFR 50
CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
DOCKET NOS. 50-325 AND 50-324

8701020210 861230
PDR ADOCK 05000324
F PDR

Table of Contents

	<u>Page</u>
1.0 Introduction	1
2.0 Evaluation	3
2.1 Alternate Shutdown Capability, Appendix R to 10 CFR 50	3
2.1.1 Systems Used for Post-Fire Safe Shutdown	4
2.1.2 Evaluation of Systems	5
2.1.3 Summary	7
2.2 Evaluation of Appendix R to 10 CFR 50, Section III.J Exemption Request	7
2.3 Evaluation of Appendix R to 10 CFR 50, Section III.G Exemption Requests	8
2.3.1 Reactor Building	10
2.3.2 Emergency Core Cooling System Room	12
2.3.3 Diesel Generator Basement	13
2.3.4 Service Water Building	15
2.3.5 Diesel Generator Building	17
2.3.6 Fixed Fire Suppression	18
2.3.7 East Yard Area	19
2.3.8 Control Building Extended	20
3.0 Summary	22

1.0 INTRODUCTION

By letter dated April 24, 1984, as supplemented December 21, 1984 and October 28, 1985, the Carolina Power & Light Company (the licensee) submitted an alternate shutdown capability assessment along with requests for certain exemptions from Appendix R to 10 CFR 50 Section III.G and J, for the Brunswick Steam Electric Plant, Units 1 and 2.

By letter dated March 6, 1981, the licensee requested exemptions from Section III.G.3 of Appendix R to 10 CFR 50 to the extent that it requires the installation of a fixed fire extinguishing system in the Control Room and the cable spreading rooms of both units. By letter dated June 30, 1982, the licensee requested additional exemptions from Section III.G of Appendix R to 10 CFR 50. By letters dated September 3, 1982, and October 1, 1982, the licensee provided additional information on these exemption requests. In January 1983, the licensee committed to provide clarifying information to explain why these exemptions were needed. We met with the licensee on January 5, 1983 and February 9, 1983 to resolve 44 exemption requests. Based on the information provided, we recommended by letter dated January 31, 1983 that 44 exemptions be denied.

By letter dated May 2, 1983, the licensee provided additional information regarding the exemption requests and the schedule for performing an alternate shutdown study. By letter dated July 27, 1983 an exemption was issued for seven of the exemption requests and 57 exemption requests were denied. The NRC indicated in the January 31, 1983 letter to the licensee transmitting the Draft Safety Evaluation, and confirmed in the July 27, 1983 letter, the licensee was given 6 months to provide the description of the modifications for the alternate shutdown capability for denied exemptions involving alternate shutdown capability. This was modified to include modifications to the diesel generator building equipment hatches, installation of suppression system in the cable spreading room, a preliminary description of the alternate shutdown modification within 6 months and a final alternate shutdown report in 9 months. By letter dated April 24, 1984, as supplemented on December 21, 1984, the alternate shutdown report was submitted along with 11 exemption requests. Additional information was provided and modifications proposed by letter dated October 28, 1985 to support 3 of these 11 exemption requests.

By the submittal dated April 24, 1984, as supplemented, the licensee requested exemptions from the requirements in Appendix R, Section III.G and J as follows:

7.2.1 Exemption from III.G.2 provisions for safe shutdown separation features on -17, 20, and 50 feet elevations in Unit 1 Reactor Building.

Justification is based upon automatic detection and suppression, separation zone considerations, physical separation of redundant trains, water curtain, venting paths precluding stratification, use of fire stop and 1-hour barriers on exposed cables, and addition of sprinklers.

- 7.2.2 Exemption from III.G.2 provisions in Unit 1 ECCS room for safe shutdown separation features and for unrated penetrations.

Justification is based upon low fire potential; lack of ignition sources; electrical cables inside conduit; sufficient propagation retardancy; adequate separation and detection; installation of wrap, fuses, and a "quick response" sprinkler head; an inerted primary containment; and features of existing seals.

- 7.2.3 Exemption from III.G.2 provisions for safe shutdown separation features on -17, 20 and 50 feet elevations in Unit 2 Reactor Building.

Justification is based upon automatic detection and suppression, separation zone considerations, physical separation of redundant trains, venting paths precluding stratification, use of fire stops and 1-hour barriers on exposed cables, and addition of sprinklers.

- 7.2.4 Exemption from III.G.2 provisions in Unit 2 ECCS room for safe shutdown separation features and for unrated penetrations.

Justification is based upon low fire potential; lack of ignition sources; electrical cables inside conduit; sufficient propagation retardancy; adequate separation and detection; installation of wrap, fuses, and a "quick response" sprinkler head; an inerted primary containment; and features of existing seals.

- 7.2.5 Exemption from III.G.2 provisions for safe shutdown system separation for the Diesel Generator Building basement.

Justification is based upon minimal personnel use of the basement; activities do not involve combustibles; fixed combustibles are self extinguishing; the proposed Halon automatic suppression system combined with the existing automatic suppression system will prevent a fire from damaging redundant trains or diesel pad seals; redundant alarms would mobilize the fire brigade promptly; and stairwells provide protected staging areas for initiating fire response activities.

- 7.2.6 Exemption from III.G.2 provisions for safe shutdown system separation (intervening combustibles) for Service Water Building, elevations 4 feet and 20 feet.

Justification is based upon lack of ignition sources; minimal fixed combustibles; existing suppression, detection, hose stations, and separation; and installation of barriers.

- 7.2.7 Exemption from III.G.2 provisions as necessary from full area suppression for Diesel Generator building, fire area DG-8.

Justification is based upon small amount of fixed combustibles; unlikelihood of cable ignition; fire detection; and installation of rated barriers.

7.2.8 Exemption from III.G.3 provisions for fixed suppression for Turbine Building.

Justification is based upon automatic detection and early brigade response; existing automatic suppression over certain equipment and lack of ignition sources; ceiling penetrations providing venting paths; the ability to achieve safe shutdown; and additional suppression would not enhance safe shutdown capability.

7.2.9 Exemption from III.G.3 provision for suppression in any "area, room, or zone" where alternative shutdown capability is provided for rooms in the control and diesel generator buildings.

Justification is based upon automatic detection alarmed in the control room; availability of manual fire fighting equipment; alternative shutdown capability is provided; low fire hazards; the control room suppression exemption; and installation of suppression in two rooms in the Control Building.

7.2.10 Exemption from III.G.3 provisions for suppression and detection for the East Yard.

Justification is based upon constant patrols and closed circuit TV surveillance; the dike surrounding the diesel fuel tank; combustion products venting to atmosphere; low probability of radiant energy damage to CST level switches and AC power feeds; and alternative shutdown capability is provided to the RCIC logic circuits and for a fire in manholes.

7.2.11 Exemption from emergency lighting provisions of III.J for the East Yard.

Justification is based upon ready availability of hand lights that will be adequate for traversing East Yard and reading gages; also, additional modifications would not enhance safe shutdown capability.

2.0 EVALUATION

2.1 Alternate Shutdown Capability, Appendix R to 10 CFR 50

In its submittal dated April 24, 1984, as supplemented, the licensee provided the details of the alternate safe shutdown capabilities for the Brunswick Units 1 and 2 in order to meet the requirements of Section III.G.3 and III.L of Appendix R to 10 CFR 50. The fire areas containing equipment that requires the alternate safe shutdown capability are in the control building, diesel-generator building, turbine building and east yard. An evaluation of this capability is provided in the following section.

2.1.1 Systems Used for Post-Fire Safe Shutdown

Systems Required For Safe Shutdown

In the event of a fire concurrent with a loss of offsite power, reactor shutdown is initiated from the control room by a manual scram of the control rods, if an automatic scram has not occurred. Reactor coolant inventory and pressure control can be maintained by the use of safety relief valves and reactor core isolation cooling (RCIC) system during hot shutdown and by the use of the residual heat removal (RHR) system in the low pressure core injection (LPCI) mode during cold shutdown. Reactor decay heat removal is provided by the RHR system in the torus cooling or shutdown cooling modes during hot and cold shutdown. The post-fire control of these are provided at the RCIC and RHR alternative control station. Inadvertent opening of the pressure boundary valves is precluded to assure safe shutdown as discussed in Section 3.3.3 (Spurious Signals) in this Safety Evaluation (SE).

The support systems required for the safe shutdown include the onsite AC emergency power system (standby diesel-generator and associated components of the AC power distribution system), DC emergency power system and the service water system for the RHR and diesel-generator cooling. The post-fire control of these are provided at the diesel-generator and 4.16 KV emergency switchgear alternative control stations or locally at the equipment.

Areas Where Alternate Safe Shutdown Is Required

The licensee has provided alternate shutdown capability for the safe shutdown equipment located in the following fire areas in compliance with the requirements of Appendix R, Section III.G.3.

1. Control Building - Fire Areas CB-1a, 7, 8, 9, 10 and 23E.
2. Diesel Generator Building - Fire Areas DG-6, 7, 8, 9, 11, 12, 13 and 14.
3. Turbine Building - Fire Area TBJ
4. East Yard

The alternate shutdown will be accomplished by manual actions performed at the RCIC and RHR Alternate Control Stations (one per unit located in the southeast quadrant of each reactor building at the 20 foot elevation), Diesel Generator Alternative Control Stations (four common to both units located in the individual diesel generator cells in Diesel Generator Building), and 4.16 KV Emergency Switchgear Alternative Control Stations (four common to both units located at the existing 4.16 KV switchgear on the 50 foot elevation in the Diesel Generator Building) or locally at the equipment (valves).

Remaining Plant Areas

All other areas of the plant not required to have an alternate safe shutdown system will comply with the requirements of Section III.G.2 of Appendix R, unless an exemption request has been approved by the staff.

2.1.2 Evaluation

Performance Goals

The performance goals for post-fire safe shutdown can be met using the systems and equipment as contained in Section 2.1 above. The controls of these functions can be accomplished using the alternate shutdown methods or the control room depending upon the location of the fire. The alternate shutdown method relies on procedures and actions at the alternate control stations or locally at the equipment. The transfer of control capability between the control room and the alternate control stations will be accomplished via key locked transfer switches through redundant fuses.

The process monitoring instruments to be used for a post-fire shutdown includes reactor water level, reactor vessel pressure, suppression pool level and suppression pool temperature and are provided at the RCIC and RHR alternative control station.

The available support systems for the post-fire safe shutdown are the redundant diesel generators, emergency AC and DC buses and the nuclear service water systems for providing cooling to the RHR system and the diesel generators.

Repairs/72 Hour Requirement

The alternate shutdown methods have the capability of achieving cold shutdown conditions within 72 hours with no repairs after a fire event assuming no offsite power is available.

Associated Circuits and Isolation

To assure the availability of the safe shutdown systems following a fire, the licensee has identified associated circuits that could prevent or cause malfunction of the shutdown equipment. For identified associated circuits, protection for safe shutdown systems will be provided by the proposed alternate shutdown modifications for electrical circuit isolations, local control capability, addition of new control power fuse circuits and alternative power supply. These modifications are in accordance with the NRC guidelines in Generic Letter 81-12 as discussed below.

Common Power Source

The licensee indicated that all power circuits which have a common bus with the power circuits of the alternative shutdown equipment are or will be provided isolation via electrically coordinated circuit breakers, fuses or similar devices.

Common Enclosure

The licensee indicated that associated circuits for power and control cables that share a common enclosure with safe shutdown circuits will be electrically protected by appropriate isolation devices (e.g., circuit breakers, protection relays or fuses). Additionally, these cables will be physically protected by appropriate fire protection measures (e.g., cable insulation, conduits and rated fire seals). For instrument circuits located in the instrumentation racks and control panels, the licensee indicated that these circuits are protected by inherent barriers which reduces the probability of a high-energy (120V AC) short to an instrument circuit. For instrument circuits located in raceways, the licensee indicated that separation of instrument circuits in dedicated raceways (instrument circuits only) reduces the probability of high-energy short, and shorts within the instrument circuits will be of insufficient energy to produce an ignition source.

Spurious Signals

The devices whose inadvertent operation by spurious signals could adversely affect safe shutdown have been identified and remedial action proposed as indicated below.

1. Devices which would affect proper safe shutdown system operation - These devices have been included in the list of required equipment and will be separated or protected in accordance with Section III.G.2 of Appendix R.
2. Devices which could cause an uncontrolled loss of primary coolant - These devices were analyzed on a case by case basis and the resolutions fall into one or a combination of the following:
 - a. Prefire Actions - By maintaining open circuit breakers for RHR high-low pressure interface valves and reactor vessel head vent valves during normal operation to prevent spurious operation during a fire.
 - b. Prefire plant modifications - By replacing single-pole circuit breakers with new two-pole circuit breakers. Local control capability will be provided for reactor water cleanup system isolation.
 - c. Post-fire operator actions - Operator will close MSIVs before leaving control room and spurious opening of MSIVs and steam relief valves will be prevented by opening circuit breakers. Controls of three steam relief valves will be provided at the RCIC and RHR alternate control station for pressure control.

Safe Shutdown Procedures and Manpower

The licensee has provided a summary of the anticipated operator actions required for the alternative shutdown systems for those areas requiring alternative shutdown and has indicated that these actions will be developed into detailed operating procedures following completion of the modification. The manpower necessary for accomplishing the operations required for the alternative shutdown will be available at the plant at all times. Members of the fire brigade will not be included in the shutdown manpower requirements.

2.1.3 Summary

We have reviewed the licensee's proposed alternate shutdown capability for Brunswick, Units 1 and 2 in accordance with Appendix R criteria. Based on that review, we conclude that the performance goals for accomplishing safe shutdown in the event of fire, i.e., reactivity control, reactor coolant inventory control, decay heat removal, pressure control, process monitoring and support functions will be met by the proposed alternate shutdown. Therefore, we conclude that the requirements of Appendix R, Section III.G.3 and III.L are satisfied for these fire areas for which alternative shutdown capability is being provided.

2.2 Evaluation of Appendix R, Section III.J Exemption Request (licensee Item 7.2.11)

Section III.J of Appendix R to 10 CFR 50 states, "Emergency lighting units with at least an 8-hour battery power supply shall be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto." By letter dated April 30, 1984, the licensee requested an exemption from the 10 CFR 50, Appendix R, Section III.J requirement for 8-hour battery powered emergency lighting for East Yard.

The East Yard contains condensate tank level gauges which may be used occasionally to manually monitor condensate tank level when maintaining hot shutdown. Furthermore the East Yard has access paths to the service water intake and diesel generator structures. The East Yard is normally provided with adequate yard lighting to accommodate access during non-daylight hours.

In the event of loss of power to this lighting in conjunction with fire requiring alternate shutdown, the licensee committed to provide portable hand lights in the control room for use in the East Yard in lieu of 8-hour emergency lighting due to the following reasons.

1. Lack of commercially available self-contained 8-hour emergency lights, suitable for outdoor use.

2. Excessive number of fixed emergency lighting units requirement due to the length and number of potential access pathways. Associated cable routing and power requirements to establish this redundant lighting is not practicable.

The portable hand lights will provide a degree of independence to the operator, sufficient illumination to access/egress routes across the East Yard and permit reading of the condensate storage tank level gauges. The accumulative time period to perform these activities that may require emergency lighting is significantly less than 8 hours and within the capability of a portable hand light. Additional modifications to meet the specific requirements of Section III.J for this area will not enhance safe shutdown capabilities.

Summary

Based on the above, the staff concludes that the portable hand lights are adequate to ensure safe operator access in the yard to the diesel-generator and service water structures and for reading condensate storage tank level gauge. The licensee will store the hand lights outside the fire area for which the alternate shutdown is being provided. The exemptions from the 8 hour battery powered emergency lighting requirement of Section III.J of Appendix R to 10 CFR 50 for the East Yard is justified and should be granted (licensee item 7.2.11).

2.3 Evaluation of Appendix R Section III.G Exemption Request

By letter dated April 24, 1984, as supplemented December 21, 1984, the licensee submitted its Alternative Shutdown Capability Assessment (ASCA) Report and requested ten exemptions from the technical requirements of Appendix R to 10 CFR 50 Section III.G

Section III.G.2 of Appendix R to 10 CFR 50 requires that one train of cables and equipment necessary to achieve and maintain safe shutdown be maintained free of fire damage by one of the following means:

- a. Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier;
- b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

- c. Enclosure of cables and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

If these conditions are not met, Section III.G.3 requires alternative shutdown capability independent of the fire area of concern. It also requires a fixed suppression system in the fire area of concern if it contains a large concentration of cables or other combustibles.

These alternative requirements are not deemed to be equivalent for all configurations, however, they provide equivalent protection for those configurations in which they are accepted.

Because it is not possible to predict the specific conditions under which fires may occur and propagate, the design basis protective features are specified in the rule rather than the design basis fire. Plant specific features may require protection different than the measures specified in Section III.G. In such a case, the licensee must demonstrate, by means of a detailed fire hazards analysis, that existing protection or existing protection in conjunction with proposed modifications will provide a level of safety equivalent to the technical requirements of Section III.G of Appendix R.

In summary, Section III.G is related to fire protection features for ensuring that systems and associated circuits used to achieve and maintain safe shutdown are free of fire damage. Fire protection configuration must either meet the specific requirement of Section III.G or alternative fire protection configurations must be justified by a fire hazards analysis.

Our general criteria for accepting alternative fire protection configurations are the following:

- o The alternative assures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control stations is free of fire damage.
- o The alternative assures that fire damage to at least one train of equipment necessary to achieve cold shutdown is limited such that it can be repaired within a reasonable time (minor repairs with components stored onsite).
- o Modifications required to meet Section III.G would not enhance fire protection safety above that provided by either existing or proposed alternatives.
- o Modifications required to meet Section III.G could be detrimental to overall facility safety.

2.3.1 Reactor Building Units 1 and 2 (Fire Areas RB1-1 and RB2-1, licensee items 7.2.1 and 7.2.3)

Exemption Requested

The licensee requests exemption from Section III.G.2 of Appendix R to 10 CFR 50 to the extent that it requires separation of safe shutdown components by 3-hour fire rated barriers.

Discussion

By letters dated April 24, 1984 and December 21, 1984, the licensee requested exemption from the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50 for these fire areas. Based on our evaluation, we concluded that the existing protection with the proposed modifications would not provide a level of protection equivalent to that provided by Section III.G of Appendix R to 10 CFR 50. Therefore, by letter dated September 13, 1985, we requested additional information to support this exemption request. By letter dated October 28, 1985, the licensee proposed additional fire protection modifications.

These fire areas consist of the Unit 1 and Unit 2 Reactor Buildings except for the Emergency Core Cooling System (ECCS) rooms. Safe shutdown systems are located on the -17, 20, and 50 foot elevations. Separation within these fire areas is provided horizontally by floor/ceiling assemblies. Vertical separation of each building by physical structures into northern and southern segments is provided by the main steam tunnel, the drywell, and the torus walls. Train A systems are located in the northern segment and Train B systems in the southern segment.

The -17 foot elevation, which is the lowest elevation of each Reactor Building, contains the core spray rooms, the reactor core isolation cooling (RCIC) system, the Trains A and B residual heat removal (RHR) systems, and the high pressure coolant injection (HPCI) system for each unit.

The south section of each unit's 20 foot elevation contains the remote shutdown panel, the B Train raceways, and motor control centers for RHR and RCIC. The north section of each unit's 20 foot elevation contains the A Train raceways and motor control centers for RHR and HPCI.

The 50 foot elevation contains the safe shutdown divisions for the Trains A and B reactor instrument racks and four service water system valves per unit required for alternate shutdown.

Open stairways, open pipe chases and an open refueling hatchway extend from the 20 foot elevation to the refueling deck on the 117 foot elevation.

Existing fire protection includes an areawide ionization-type fire detection system in each Reactor Building, portable extinguishers, and hose stations.

Total flooding automatic carbon dioxide systems are installed in the HPCI rooms, and partial automatic sprinkler protection is provided in the -17, 20 and 50 foot elevations.

The licensee proposes to (1) establish 20 foot wide separation zones free of significant quantities of intervening combustibles between the redundant safe shutdown trains on the -17, 20 and 50 foot elevations, (2) reroute exposed electrical cables in the separation zones out of the zone, place the cables in conduit, enclose the cables in noncombustible enclosures, or wrap the cables in 1-hour fire rated barriers, and (4) install closely spaced closed sprinklers and draft stops across each separation zone to serve as water curtains.

Evaluation

The technical requirements of Section III.G.2 of Appendix R are not met in these areas because redundant safe shutdown components (1) are not separated by 3-hour fire rated barriers, (2) are not separated by more than 20 feet free of intervening combustibles with areawide fixed automatic suppression, or (3) are not enclosed in 1-hour fire rated barriers with areawide fixed automatic suppression. Our concern is that a Reactor Building fire may spread from one side of the building to the other resulting in damage to redundant safe shutdown systems such that safe shutdown could not be achieved and maintained.

Because these fire areas are protected by area-wide fire detection systems, we have reasonable assurance that any fire would be detected in its early stages and extinguished by the plant fire brigade before damaging redundant safe shutdown systems. Should rapid fire growth occur in one of the locations provided with a partial automatic sprinkler system or in either of the HPCI rooms prior to fire brigade arrival, the fire suppression system in the location would operate and control the fire. In this event, we have reasonable assurance that the fire would be confined to one side of the Reactor Building and, therefore, redundant safe shutdown systems would not be damaged.

The licensee has proposed to establish 20 foot wide separation zones free of significant intervening combustibles between redundant safe shutdown trains and to install water curtains and draft stops across each separation zone. The draft stops and water curtain will be designed and installed to limit horizontal fire spread from one side of the separation zone to the other regardless of which side of the zone the fire starts on. Such systems have been used successfully to protect conveyor openings in fire walls and vertical openings in buildings. Should a fire spread to a separation zone, the lack of intervening combustibles would limit its spread and the close spaced sprinklers would operate and establish a water curtain across the separation zone. Because this is a water barrier rather than a continuous fire rated barrier, we expect some smoke and heat to pass through the water curtain. However, the smoke and hot gases would be cooled and dispersed throughout the large open areas of the Reactor Building. Therefore, we have reasonable assurance that a fire will not spread across a separation zone and that damage to shutdown components on both sides of the zone will not occur.

Conclusion

Based on our evaluation, we conclude that the existing fire protection with the proposed modifications provides a level of protection equivalent to the requirements of Section III.G.2 of Appendix R to 10 CFR 50. Therefore, the licensee's request for exemption in the Units 1 and 2 Reactor Buildings should be granted.

2.3.2 Emergency Core Cooling System Rooms, Units 1 and 2 (Fire Areas RB1-6 and RB2-6, licensee item 7.2.2 and 7.2.4)

Exemption Requested

The licensee requests exemption from Section III.G.2 of Appendix R to 10 CFR 50 to the extent that it requires separation of redundant safe shutdown components by a horizontal distance of more than 20 feet free of intervening combustibles with automatic fire detection and fire suppression systems.

Discussion

These fire areas are enclosed rooms on the 20 foot elevation of the Unit 1 and Unit 2 Reactor Buildings. A partial height concrete wall separates each area into north and south zones along the centerline of the rooms.

With the exception of fire pipe penetrations in the east wall of each room and six pipe penetrations in the west wall of each room, the area boundaries are 3-hour fire rated. The penetrations in the east wall of each room enter a pipe chase which is void of fixed combustibles. The penetrations in the west wall of each room are to be drywell and are designed in accordance with nuclear safety requirements for primary containments. The drywells are inerted with nitrogen during operation.

The redundant safe shutdown equipment in the areas are motor operated valves for the HPCI, RCIC and RHR systems.

The fuel load of combustible conduit jacket material yields an equivalent fire severity on the ASTM E-119 time-temperature curve of approximately 1 minute for each area.

Existing fire protection includes an area-wide ionization detection system in each area and portable extinguishers and hose stations adjacent to each area.

The licensee proposed to protect the RCIC isolation valve cables with 1-hour fire rated barriers and to protect the RCIC isolation valve and the RHR suction valve with automatic sprinklers.

Evaluation

The technical requirements of Section III.G.2 are not met because redundant shutdown components are not separated by 20 feet free of intervening combustible and because each fire area is not protected by a fixed automatic fire suppression system.

We were concerned that a fire originating either outside of or within either of the ECCS rooms would result in loss of safe shutdown capability. However, because of the low fuel load, we do not expect a fire of significant magnitude or duration to occur in either fire area. Should a fire occur in either area, we have reasonable assurance that it would be detected by the ionization detectors, and extinguished by the plant fire brigade before damaging the redundant valves. If rapid fire growth occurs, the fire rated cable protection, partial height wall, and partial sprinkler coverage would all contribute to protection of the redundant valves until the fire brigade arrived. Therefore, we have reasonable assurance that loss of shutdown capability would not occur.

Because of the lack of combustibles in the pipe chase, we do not expect a fire to spread through the chase and threaten the redundant valves in the ECCS room. If a fire occurs on the -17 foot elevation, we have reasonable assurance that it would be detected by the area-wide ionization detectors in the elevation and extinguished by the fire brigade. Moreover, because the drywell is inerted during operations, we do not expect a fire to originate in the drywell and spread into the ECCS room through the nonfire rated pipe penetration seals. Therefore, we have reasonable assurance that loss of shutdown capability will not occur.

Conclusion

Based on our evaluation, we conclude that the existing fire protection with the proposed modifications provides a level of protection equivalent to the requirements of Section III.G.2. Therefore, the licensee's request for exemption in the Units 1 and 2 ECCS rooms should be granted (licensee item 7.2.2 and 7.2.4).

2.3.3 Diesel Generator Building Basement (Fire Area DG-1, licensee item 7.2.5)

Exemption Requested

The licensee requests exemption from Section III.G.2 of Appendix R to 10 CFR 50 to the extent that it requires separation of redundant safe shutdown components by a horizontal distance greater than 20 feet free of intervening combustibles.

Discussion

By letter dated June 20, 1982, the licensee requested an exemption from the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50 for this fire area to the extent that it requires the separation of redundant components by fire rated barriers or distance. Based on our evaluation, we concluded that the existing level of protection in the fire area did not provide a level of fire protection equivalent to that required by Section III.G.2 of Appendix R. By letter dated November 22, 1982, we, therefore, recommended that the exemption requested for this fire area be denied.

By letters dated April 24, 1984 and December 21, 1984, the licensee submitted their Alternative Shutdown Capability Assessment (ASCA) Report. This report contained another licensee request for exemption from the requirements of Section III.G.2 of Appendix R for this fire area. The licensee justified the exemption, in part, on the basis of their proposal to install an automatic halon fire suppression system in the area.

On August 6 and 7, 1985, we conducted conference calls with the licensee during which they provided additional information. On August 27, 1985, we met with the licensee at the plant site to discuss the exemption request and to tour the fire area. By letter dated September 13, 1985, we requested additional information and by letter dated October 28, 1985, the licensee submitted the requested information.

This fire area is located on the 2 foot elevation of the Diesel Generator Building. It contains the concrete pedestals for the four emergency diesel generators. The diesel generators are located in separate fire areas on the 23 foot elevations.

The fire area contains Train A and Train B electrical cable raceways for the high pressure coolant injection system, reactor core isolation cooling system, automatic depressurization system, residual heat removal (torus cooling and shutdown cooling) systems, service water system, plant monitoring instrumentation, and the diesel generators and their associated switchgear. There are a number of divisional crossover points and proximate locations of redundant safe shutdown system cables within the fire area.

By letter dated October 28, 1985, the licensee informed us that the cables for redundant safe shutdown divisions either meet the separation criteria found acceptable by the staff in Supplement 2 to the Fire Protection Safety Evaluation Report, dated June 11, 1980, or have alternative capabilities independent of the fire area.

The electrical cables are uniformly distributed throughout the area and yield an equivalent fire severity of about 50 minutes. Except for a limited number of locations away from the divisional crossover points, the cables are coated with a fire retardant mastic.

Existing fire protection includes an area-wide ionization-type fire detection system, an area-wide automatic sprinkler system, portable fire extinguishers, and hose stations. Fire resistant wraps or plume impingement shields and local sprinklers are provided at divisional crossover points.

The licensee now proposes to install an automatic, total flooding Halon 1301 fire suppression system in the fire area.

Major redesign and rerouting and/or fire wrapping of cable trays and conduits in the basement, adjacent fire areas, and interfacing yard duct banks would be required to achieve verbatim compliance with Sections III.G.2 or III.G.3 of Appendix R to 10 CFR 50.

Evaluation

The technical requirements of Section III.G.2 of Appendix R to 10 CFR 50 are not met in this area because redundant safe shutdown cables are not separated by more than 20 feet free of intervening combustibles, or redundant cables are not enclosed in 1-hour fire rated barriers.

We were concerned that if a fire occurred in this area, redundant shutdown systems would be damaged, resulting in loss of safe shutdown capability.

Because this area is equipped with a fire detection system, we have reasonable assurance that any fire will be detected in its incipient stage, before significant propagation or temperature rise occurs. The fire brigade would then extinguish the fire using available equipment.

If the fire brigade is delayed or rapid fire growth occurs, the automatic halon system and/or the automatic sprinkler system would operate, resulting in fire control, reduced room temperatures, and protection of the redundant cables.

The existing cable separation, fire resistant wraps, plume impingement shields, and fire retardant cable coating will provide passive protection, and provide reasonable assurance that one train of redundant circuits will be maintained free of damage until the fire is extinguished. Therefore, we have reasonable assurance that loss of safe shutdown capability would not occur as the result of a fire in the diesel generator building basement.

Conclusion

Based on our evaluation, we conclude that the existing fire protection with the proposed modifications provides reasonable assurance that loss of post-fire safe shutdown capability will not occur. Therefore, the licensee's request for exemption for the diesel generator building basement should be granted (licensee item 7.2.5).

2.3.4 Service Water Building (Fire Area SW-1, licensee item 7.2.6)

Exemption Requested

The licensee requests an exemption from Section III.G.2 of Appendix R to 10 CFR 50 to the extent that it requires the separation of redundant safe shutdown components by a horizontal distance of more than 20 feet free of intervening combustibles with automatic fire detection and fire suppression systems.

Discussion

This fire area is a single story building with a basement and lower sump. The fire area contains the service water pumps that support the ultimate heat sink for both units. Five pumps are provided for each unit. One pump per unit is required for safe shutdown.

The Unit 1 pumps are located in the northeast half of the 20 foot elevation. There is a separation of approximately 3 feet of clear space between adjacent pumps. The Unit 2 pumps are located in the southeast half of the elevation and are also spaced approximately 3 feet apart. The A and B Trains power feeds have a minimum separation distance of approximately 20 feet for Unit 1 and 18 feet for Unit 2 with negligible intervening combustibles.

The cables for the service water system, the motor operated valves, and the lube water pumps are located on the 4 foot elevation.

The fuel load of lubrication oil in sumps, electrical cable insulation and rubber hoses on the 20 foot elevation yields an equivalent fire severity of less than 15 minutes. The fuel load of electrical cable insulation on the 4 foot elevation yields an equivalent fire severity of approximately 30 minutes.

Existing fire protection for the 4 foot and 20 foot elevations includes elevation-wide ionization detectors and automatic sprinklers, portable extinguishers, and hose stations.

The licensee proposes to protect one train of power feeds for both Unit 1 and Unit 2 with 1-hour fire rated barriers on the 4 foot elevation.

Evaluation

The technical requirements of Section III.G.2 are not met because redundant safe shutdown components are not separated by a horizontal distance of more than 20 feet free of intervening combustibles.

We were concerned that a fire would damage redundant safe shutdown components resulting in loss of safe shutdown capability.

The detection system provides reasonable assurance that a fire would be detected before significant flame propagation or temperature rise occurs. The fire brigade would then extinguish the fire using available equipment before redundant components are damaged.

If the fire brigade response is delayed or rapid fire growth occurs, the automatic sprinkler system would operate, resulting in fire control, reduced temperatures, and protection of redundant components. The 1-hour fire rated cable protection will provide passive protection and provide reasonable assurance that one train of redundant circuits will remain free of fire damage.

Conclusion

Based on our evaluation, we conclude that the existing fire protection with the proposed modifications provides reasonable assurance that one train of safe shutdown components located in the Service Water Building will be free of fire damage following a fire. Therefore, the licensee's request for exemption in the Service Water Building should be granted (licensee item 7.2.6).

2.3.5 Diesel Generator Building (Fire Area DG-8, licensee item 7.2.7)

Exemption Requested

The licensee requested an exemption from Section III.G.2 of Appendix R to 10 CFR 50 to the extent that it requires the separation of redundant safe shutdown components by a horizontal distance of more than 20 feet free of intervening combustibles with automatic fire detection and fire suppression systems.

Discussion

This fire area is located in the southwest corner of the Diesel Generator Building on the 23 foot elevation.

The fire area contains Train A switchgear and cables, and Train A dry substation transformer and Train B cables. The Train A switchgear is separated from the Train B cables by approximately 18 feet free of intervening combustibles.

The combustible loading of electrical cable insulation yields an equivalent fire severity of approximately 7 minutes.

Existing fire protection includes area-wide ionization detectors, portable extinguishers, and hose stations.

The licensee proposed to provide 20 foot separation zones which are free of intervening combustibles by protecting one train of redundant cables with 1-hour fire rated barriers at locations where redundant trains are within 20 feet of one another.

Evaluation

The technical requirements of Section III.G.2 are not met because an automatic suppression system is not installed in the fire area.

We were concerned that a fire would damage redundant safe shutdown components. Because the fuel load is low, we do not expect a fire of significant magnitude or duration to occur. If a fire does occur, it would be detected by the ionization detectors and extinguished by the plant fire brigade before damaging redundant components. The 1-hour fire rated cable protection will provide passive protection for one of the redundant trains until the fire is extinguished. Therefore, we have reasonable assurance that loss of shutdown capability will not occur as the result of a fire in this area.

Conclusion

Based on our evaluation, we conclude that the existing fire protection with the proposed modifications provides a level of protection equivalent to the requirements of Section III.G.2. Therefore, the licensee's request for exemption in Fire Area DG-8 should be granted (licensee item 7.2.7)

2.3.6 Fixed Fire Suppression Systems For Alternate Shutdown Areas (Fire Areas TB-1, CB-1, CB-7, CB-8, CB-9, CB-10, DG-6, DG-7, DG-9, DG-11, DG-12, DG-13 and DG-14, licensee items 7.2.8 and part of 7.2.9)

Exemption Requested

The licensee requests exemption from Section III.G.3 of Appendix R to 10 CFR 50 to the extent that it requires the installation of a fixed suppression system in an area, room or zone for which alternative shutdown capability is provided.

Discussion

Fire Area TB-1 comprises all elevations of the Turbine Building for Units 1 and 2. The building contains redundant safe shutdown cables in the access corridor on the 20 foot elevation.

Fire Zone CB-1a is a cable access way located in the northeast corner of the Control Building, Fire Area CB-1, at elevation 23 feet. The combustible load of flexible conduit jackets yields an equivalent fire severity of approximately 50 minutes on the ASTM E-119 time-temperature curve.

Fire Areas CB-7, CB-8, CB-9 and CB-10 are battery rooms located on the 23 foot elevation of the Control Building.

The Diesel Generator Building is a separate structure located east of the Reactor Buildings. Fire Areas DG-6, DG-7 and DG-9 are switchgear rooms located in the northeast, northwest, and southeast corners of the 23 foot elevation of the building respectively. Fire Areas DG-11, DG-12, DG-13 and DG-14 are switchgear rooms located in a north-south orientation side by side on the 50 foot elevation of the building along the west exterior wall.

All of these fire areas and zones contain components required for safe shutdown. However, safe shutdown can be accomplished using alternate shutdown capabilities independent of the areas or zones.

Each of the areas and zones are equipped with an area-wide ionization detection system. Portable fire extinguishers and hose stations are provided in or adjacent to each area and zone. Partial automatic suppression is provided in Fire Area TB-1 and carbon dioxide hose stations are provided in the Control Building.

Evaluation

The technical requirements of Section III.G.3 are not met in each of these fire areas because of the lack of an area-wide fixed fire suppression system.

A fire in any of the areas would result in the loss of normal safe shutdown capability.

All of these fire zones and areas are equipped with ionization detection systems and manual fire fighting equipment. Therefore, we have reasonable assurance that a fire in any of the locations will be detected during its early stages and extinguished by the fire brigade before adjacent safety related areas are threatened.

If a fire damages any shutdown components in any one of these areas before the fire brigade extinguishes the fire, the alternate shutdown capability will be used to achieve and maintain safe shutdown. Therefore, we have assurance that a fire in any of these fire areas will not result in the loss of safe shutdown capability.

Conclusion

Based on our evaluation, we conclude that the existing fire protection in conjunction with the alternate shutdown capability for Fire Areas TB-1, CB-1, CB-7, CB-8, CB-9, CB-10, DG-6, DG-7, DG-9, DG-11, DG-12, DG-13 and DG-14 provides a level of safety equivalent to that achieved by compliance with Section III.G.3. Therefore, the licensee's request for exemption in these fire areas should be granted (licensee items 7.2.8 and part of 7.2.9).

2.3.7 East Yard Area (licensee item 7.2.10)

Exemption Requested

The licensee requests exemption from Section III.G.3 of Appendix R to 10 CFR 50 to the extent that it requires the installation of fire detection and a fixed fire suppression system in an area for which alternate shutdown capability is provided.

Discussion

The East Yard area extends from the Reactor Building east to the intake canal and contains the Diesel Generator and Service Water Buildings and the Intake Structure.

One condensate storage tank (CST) per unit is located 140 feet east of its respective Reactor Building. The tanks are 305 feet apart. A 225,000 gallon diesel fuel oil tank is located approximately equidistant between the CSTs. This tank is enclosed by a 6-foot high dike.

There are 13 manholes in the East Yard area that serve as pull-boxes for cables running from the Diesel Generator Building to other plant locations.

Alternative shutdown capability which is independent of any one manhole is provided.

The East Yard area is monitored through the use of roving patrols and remote cameras and is equipped with hydrants and hose houses.

Evaluation

The technical requirements of Section III.G.3 are not met in the East Yard area because of the lack of fire detection and a fixed suppression system.

The most significant fire hazard in the East Yard area is the diesel fuel oil storage tank. We were concerned that a fire involving this tank could result in damage to redundant safe shutdown systems. Because of the location of the tank with respect to the CSTs and the manholes, and because of the surrounding dike, we have reasonable assurance that a fire involving the tank will not adversely impact on either the CSTs or the manholes. The effects of the fire will largely vent to atmosphere, but radiant energy may impact on the CSTs. However, the level switches for each tank are located on the side of the tank away from the diesel fuel oil storage tank and, therefore, will not be affected by the radiant energy.

If redundant safe shutdown components located in the East Yard area manholes are damaged by a fire, an alternate shutdown path is available. Therefore, we have reasonable assurance that safe shutdown can be achieved and maintained.

Conclusion

Based on our evaluation, we conclude that the existing fire protection provides a level of safety equivalent to that achieved by compliance with Section III.G.3 of Appendix R. Therefore, the licensee's requests for exemption in the East Yard should be granted (licensee item 7.2.10).

2.3.8 Control Building Extended (Fire Area CB-23E, part of licensee item 7.2.9)

Exemption Requested

The licensee requests exemption from Section III.G.3 of Appendix R to 10 CFR 50 to the extent that it requires the installation of a fixed suppression system in an area for which alternate shutdown capability is provided.

Discussion

Section D.1.(c) of Appendix R to BTP APCSB 9.5-1 states that cable spreading rooms be separated from other areas of the plant by walls and floors having a minimum fire resistance of 3 hours. Section D.2 of Appendix A to BTP APCSB 9.5-1 states that control room floors, including penetrations, be designed to a minimum fire resistance rating of 3 hours. In Sections IV.C.3.f.2 and .3 of their Fire Protection Program Review dated January 1, 1979, the licensee committed to comply with our guidelines. Based on that commitment, we concluded that the cable spreading rooms and the Control Room met Appendix A to BTP APCSB 9.5-1 and are, therefore, acceptable.

By letter dated March 6, 1981, the licensee requested exemption from the requirements of Section III.G.3 of Appendix R to 10 CFR 50 to the extent that it required the installation of a fixed suppression system in the Control Room. The licensee justified the exemption, in part, on the basis that the Control Room was separated from adjacent areas by 3-hour fire rated barriers.

By memo dated May 21, 1981, based on the information that was provided, we recommended that the licensee's exemption request in the Control Room be granted. By letter dated November 10, 1981, we granted the exemption.

After the exemption from Section III.G.3 of Appendix R was granted for the Control Room, the licensee identified a number of penetrations in the floor/ceiling assemblies separating the Unit 1 and Unit 2 cable spreading rooms from the Control Room that could not be inspected. Consequently, the licensee (1) no longer credits this floor/ceiling assembly as a fire area boundary; (2) has redefined the Control Building Fire Area-23E to include the Control Room, Unit 1 and Unit 2 cable spreading rooms, stairwells, elevator shaft, computer rooms, HVAC room, air conditioning condenser room, and elevator machinery room; (3) has provided alternative shutdown capability independent of the entire fire area.

By letter dated April 24, 1984, the licensee submitted their Alternative Shutdown Capability Assessment Report. This report contains the licensee's request for exemption from the requirements of Section III.G.3 of Appendix R for the newly redefined Fire Area CB-23E.

Because each cable spreading room has a fixed fire suppression system and because we previously granted an exemption for the Control Room, the licensee states that the focus of this exemption request is on the lack of a fixed fire suppression system for the stairwells, elevator shafts, computer room, HVAC room, air conditioning condenser room, and the elevator machinery room.

Evaluation

The technical requirements of Section III.G.3 of Appendix R are not met in this area because of the lack of an area-wide fixed fire suppression system.

The exemption we granted from Section III.G.3 for the Control Room by letter dated November 10, 1981, was based, in part, on the licensee's commitment to separate the Control Room from adjacent areas with 3-hour fire rated barriers in accordance with our guidelines. The licensee is maintaining the 3-hour fire rated barrier between the cable spreading rooms and the Control Room even though the Control Building fire area has been redefined. Therefore, the exemption we granted for the Control Room is still valid.

The stairwells, elevator shafts, computer room, HVAC room, air conditioning room and the elevator machinery room do not contain safe shutdown cables or equipment; therefore, Section III.G. does not apply to those zones.

Conclusion

Based on our evaluation, we conclude that an exemption for the subject zones of Fire Area CB-23E, i.e., the stairwells, elevator shafts, computer room, HVAC room, air conditioning room and the elevator machinery room is not needed (part of licensee item 7.2.9).

3.0 Summary

Based on our evaluation we conclude that the following exemptions should be granted:

1. Reactor Buildings, Units 1 and 2 (Fire Areas RB1-1 and RB2-1, licensee items 7.2.1 and 7.2.3)
2. Emergency Core Cooling System Rooms, Units 1 and 2 (Fire Areas RB1-6, and RB2-6, licensee items 7.2.2 and 7.2.4)
3. Diesel Generator Building Basement (Fire Area DG-1, licensee item 7.2.5)
4. Service Water Building (Fire Area SW-1, licensee item 7.2.6)
5. Diesel Generator Building (Fire Area DG-8, licensee item 7.2.7)
6. Fixed Fire Suppression System For Alternative Shutdown Areas (Fire Areas TB-1, CB-1, CB-7, CB-8, CB-9, CB-10, DG-6, DG-7, DG-9, DG-11, DG-12, DG-13 and DG-14, licensee items 7.2.8 and part of 7.2.9)
7. East Yard Area (licensee items 7.2.10 and 7.2.11)

Based on our evaluation, we also conclude that the exemption request for Control Building Extended (Fire Area CB-23E) is not needed (part of licensee item 7.2.9).

Principal Contributors: K. West, R. Goel and M. Grotenhuis

Dated: December 30, 1986