



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

ENCLOSURE 1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATIVE TO APPENDIX R EXEMPTIONS REQUESTED FOR
COMMONWEALTH EDISON COMPANY
ZION STATION UNITS 1 AND 2
DOCKET NOS. 50-295 AND 50-304

1.0 INTRODUCTION

By letter dated July 30, 1982, Commonwealth Edison Company (CECo, the Licensee) submitted an evaluation of compliance to 10 CFR 50, Appendix R. The submittal requested six exemptions from the requirements of Appendix R, Section III.G. By a Safety Evaluation Report (SER) dated March 7, 1983, the NRC granted six exemption requests.

By letter dated July 27, 1984, the Licensee submitted a reassessment of the 1982 Appendix R evaluation. The results of the reassessment indicated that of the previously approved six exemptions, only the exemptions for the service water pumps within the crib house (Fire Zones 18.4A-0 and 18.4B-0) still apply.

In the July 27, 1984 reassessment, the Licensee requested new exemptions from Sections III.G and III.O of Appendix R. The Licensee revised Sections 1 and 6 of their Appendix R reassessment by letters dated August 31, 1984 and January 24, 1985. The Licensee provided additional information in support of the staff's review of these requests in letters dated February 18, 1986, January 21 and February 23, 1988. The July 27, 1984 submittal, as amended, is the subject of this evaluation.

Staff fire protection engineers and their consultants from Franklin Research Center (FRC) visited the site on December 11, 1985 to review the areas where exemptions from Appendix R have been requested and to gather additional information requested in a request for additional information issued on December 11, 1985.

This Safety Evaluation is based in part on the Technical Evaluation Report (TER) generated by FRC. The staff is in agreement with the conclusions reached in the FRC TER.

Section III.G.1 of Appendix R requires fire protection features to be provided for structures, systems, and components important to safe shutdown and capable of limiting fire damage so that:

- a. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and
- b. Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

Section III.G.2 of Appendix R requires that one train of cables and equipment outside of primary containment 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 nonsafety 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 nonsafety 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.
- c. Enclosure of cable and equipment and associated nonsafety 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 the above conditions are not met, Section III.G.3 requires that there be an alternative or dedicated shutdown capability independent of the fire area of concern. It also requires that fire detection and a fixed-suppression system be installed in the fire area of concern. These alternative requirements are not deemed to be equivalent; 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 rather than the design basis fire are specified in the rule. Plant-specific features may require protection different from 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 one train of systems and associated circuits necessary to achieve and maintain safe shutdown are free of fire damage. Either fire protection configurations must meet the specific requirements of Section III.G or an alternative fire protection configuration must be justified by a fire hazards analysis. Generally, the staff will accept an alternative fire protection configuration if:

- c. The alternative ensures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control station(s) is free of fire damage.

- ° The alternative ensures that fire damage to at least one train of equipment necessary to achieve cold shutdown is limited so that it can be repaired within a reasonable time (minor repairs using components stored on the site).
- ° Fire-retardant coatings are not used as fire barriers.
- ° Modifications required to meet Section III.G would not enhance fire protection safety levels above that provided by either existing or proposed alternatives.
- ° Modifications required to meet Section III.G would be detrimental to overall facility safety.

2.0 MAIN CONTROL ROOM (FIRE ZONE 2.0-0)

2.1 Exemption Requested

An exemption was requested from the requirements of Section III.G.3 to the extent that it requires a fixed-fire suppression system throughout the main control room (Fire Zone 2.0-0).

2.2 Discussion

The Licensee has committed to provide alternative shutdown capability independent of the main control room to safely shut down both units.

Fire Zone 2.0-0 is the main control room common to both units. It is located on the 642-foot elevation of the auxiliary building and contains the normal and engineered safety features (ESF) control boards for both units. It is continuously manned by trained operators. The control boards for the safe shutdown systems are in an opposite hand horseshoe arrangement.

The main control room has an approximate floor area of 5,062 square feet and is 23 feet high. The combustible materials consist primarily of cable insulation, ventilation duct insulation, and paper. The combustible loading is approximately 39,000 Btu per square foot, which translates into a fire severity of about 30 minutes on the ASTM E-119 time-temperature curve.

The boundaries of the main control room are reinforced concrete. The walls and floor are 3-hour fire rated. The roof is not fire rated because of exposed steel beams which form a portion of the barrier. Ventilation ducts which penetrate the control room boundary are provided with 3-hour rated fire dampers. Penetration seals are installed at cable penetrations. Fire doors in the boundary are 1-1/2- or 3-hour rated.

The existing fire protection for the main control room consists of fire extinguishers, detectors, and manual hose stations.

2.3 Evaluation

The fire protection in Fire Zone 2.0-0 does not comply with the technical requirements of Section III.G.3 of Appendix R because a fixed fire suppression system is not installed in a zone for which an alternative shutdown capability will be provided.

The staff's principal concern with the level of fire protection was that because of the absence of an area-wide fixed-suppression system, a fire of significant magnitude could damage redundant safe shutdown systems.

The combustible loading in the main control room is relatively low. The combustibles are primarily cable insulation. If a fire were to occur, it is expected that it would develop slowly with, initially, low heat release and slow rise in room temperature.

The main control room is protected by a fire detection system. The system consists of ionization smoke detectors mounted on the underside of the ceiling slab and on the bottom of ceiling beams and four detectors in the exhaust duct. The Licensee has committed to modify the existing smoke detection system to add one detector and relocate some existing detectors from the bottom of ceiling beams to the underside of the ceiling slab in accordance with the criteria of National Fire Protection Association (NFPA) 72E (Standard on Automatic Fire Detectors).

Because of the presence of these detectors and continuous manning by operators, a fire in the control room should be detected early and extinguished by the fire brigade.

Another factor that reduces the fire risk in this zone is that alternative shutdown capability independent of the main control room is to be provided by the Licensee.

The staff finds that the installation of an area-wide fixed fire suppression system would not significantly increase the level of fire protection in this zone.

2.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection features combined with alternate shutdown capability provide a level of fire protection equivalent to the technical requirements of Section III.G.3 of Appendix R. Therefore, the exemption request from providing area-wide fixed fire suppression system in the main control room should be granted.

3.0 AUXILIARY ELECTRIC EQUIPMENT ROOMS, FIRE AREAS 5.6-1 AND 5.6.2

3.1 Exemption Requested

An exemption was requested from the requirements of Section III.G.3 to the extent that it requires a fixed-fire suppression system throughout the auxiliary electric equipment rooms (AEERs) (Fire Areas 5.6-1 and 5.6-2).

3.2 Discussion

Fire Areas 5.6-1 and 5.6-2 are the AEERs for Units 1 and 2, respectively. Each fire area is located on the 642-foot elevation of the auxiliary building and contains one division of dc power distribution panels for safe shutdown components, inverters (which supply power to the normal instrumentation channels), and cabling for the inverters and the normal instrumentation channels. Fire Area 5.6-1 contains Division 19 dc distribution panels and associated cabling for the Unit 1 safe shutdown components, whereas Fire Area 5.6-2 contains the Division 29 components for Unit 2.

Each AEER has an approximate floor area of 2,220 square feet and is 24 feet high. The boundaries are concrete masonry units or reinforced concrete of sufficient thickness to qualify as 3-hour fire rated. The roof is supported in part by unprotected structural steel. Ventilation ducts which penetrate the boundary fire barriers are protected by 1 1/2-hour or 3-hour rated fire dampers. Seals are installed at cable penetrations. Fire doors in the boundary fire barriers are 1 1/2 hour or 3-hour fire rated.

The average combustible loading for Fire Areas 5.6-1 and 5.6-2 is about 63,000 Btu square foot, which translates into a fire severity of about 50 minutes based on the ASTM E-119 time-temperature curve. The combustibles consist primarily of cable insulation and interior finishes.

The existing fire protection for the AEERs consists of fire extinguishers, ionization smoke detectors, and manual hose stations.

The Licensee has committed to provide alternate indication for safe shutdown instrumentation for each of these areas by rerouting cable to the remote shutdown panels and providing transfer/isolation switches in each unit's inner cable spreading room. Alternate power will be provided for the instrumentation to ensure that process monitoring capability is maintained.

3.3 Evaluation

The fire protection in the AEERs (Fire Areas 5.6-1 and 5.6-2) does not comply with the technical requirements of Section III.G.3 of Appendix R because fixed-fire suppression is not installed in areas for which an alternative shutdown capability will be provided.

The staff was concerned that because an area-wide fixed suppression system was not installed, a fire of significant magnitude could damage redundant safe shutdown systems.

However, the combustibles in these areas consist primarily of cable insulation. If a fire were to occur, it is expected that it would develop slowly with, initially, low heat release and a slow rise in room temperature.

The AEERs are protected by a fire detection system consisting of ionization-type smoke detectors located at the ceiling. During a plant walkdown the staff expressed concern that small electrical panel rooms which are adjacent to the AEER's (designated as area 5.6A-1 and 5.6A-2) were not provided with smoke detectors. The licensee responded to this concern in a letter dated February 23, 1988 by committing to install additional detectors in these areas. Based on the existing detectors in the AEER's and the proposed detectors referenced above, the staff has reasonable assurance that a fire will be detected in its incipient stage, before significant flame propagation or room temperature rise occurs. The alarm from these detectors would be annunciated in the main control room. The fire brigade would be dispatched to extinguish the fire manually using the hose lines or portable extinguishers provided.

Another factor which mitigates the fire risk is the alternate shutdown capability which is independent of the AEERs.

The staff finds that the installation of an area-wide fixed-fire suppression system would not significantly increase the level of fire protection in these areas.

3.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection features combined with alternate shutdown capability provide a level of fire protection equivalent to the technical requirements of Section III.G.3 of Appendix R. Therefore, the exemption request from providing an area-wide fixed fire suppression system in these areas should be granted.

4.0 AUXILIARY BUILDING, RESIDUAL HEAT REMOVAL PUMP AREA, ELEVATION 542 FEET

4.1 Exemption Requested

An exemption was requested from the requirements of Section III.G.2.b to the extent that it requires area-wide automatic suppression and detection systems and 20 feet of separation between redundant safe shutdown components for the auxiliary building fire area at elevation 542 feet.

The 542-foot elevation of the auxiliary building fire area contains nine fire zones. Safe shutdown components on this elevation consist only of Units 1 and 2 residual heat removal (RHR) pumps and associated cables. The Unit 1 pumps are located in Fire Zones 11.1A-1 and 11.1B-1, and the Unit 2 pumps are in Fire Zones 11.1A-2 and 11.1B-2. Each RHR pump is located in a separate cubicle with 24-inch-thick reinforced concrete walls. Each cubicle has a combustible loading of approximately 1,200 Btu per square foot, which translates into a fire severity of less than 1 minute on the ASTM E-119 time-temperature curve.

The existing fire protection for the cubicles consists of one ionization smoke detector over each RHR pump. Portable extinguishers and manual hose stations are provided outside of the cubicles.

The Unit 1 RHR pumps share a common T-shaped wall having a 3-hour fire rating. This wall is penetrated by a ventilation duct that is provided with a 3-hour rated fire damper. No other penetrations exist in this barrier. The same configuration exists for the Unit 2 RHR pumps.

Cables associated with the RHR pumps are routed outside of the pump cubicles in Fire Zone 11.1-0. The redundant power cables for each unit's RHR pumps are routed next to each other (less than 20 feet of separation). The minimum separation between Units 1 and 2 RHR pump power cables is approximately 50 feet. Fire Zone 11.1-0 is an open space with a floor area of approximately 17,300 square feet. It has a combustible loading of approximately 5,000 Btu per square foot and a fire severity of four minutes.

The existing fire protection for Fire Zone 11.1-0 consists of portable extinguishers, manual hose stations, and ionization smoke detectors at various locations. Detectors are not provided throughout the area containing the cables associated with the RHR pumps.

The Licensee has committed to maintain sufficient qualified cable onsite and to formulate repair procedures to replace the power cable of one RHR pump for the affected unit after a fire, before the pumps are needed for cold shutdown.

4.3 Evaluation

The Licensee has committed to maintain sufficient qualified cable onsite and to formulate repair procedures so that the cables of one RHR pump for each unit can be repaired after a fire, before the RHR pumps will be needed for cold shutdown. The Licensee has stated that only one RHR pump is required for cold shutdown for each unit.

The Licensee's commitment to formulate repair procedures using onsite capabilities meets the requirements of Section III.G.1.b and related staff guidance.

4.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection features in conjunction with cold shutdown repair procedures meet the technical requirements of Section III.G.1.b of Appendix R and related staff guidance. Therefore, the exemption request for providing area-wide automatic suppression and detection systems and 20 feet of separation between redundant RHR pump power cables on the 542-foot elevation of the auxiliary building is not necessary.

5.0 AUXILIARY BUILDING, COMPONENT COOLING WATER PUMP AREA, ELEVATION 560 FEET

5.1 Exemption Requested

An exemption was requested from the requirements of Section III.G.2.b to the extent that it requires area-wide automatic suppression and detection systems and 20 feet of separation between redundant safe shutdown components located at the 560-foot elevation of the auxiliary building fire area.

5.2 Discussion

The 560-foot elevation of the auxiliary building fire area contains 16 fire zones. Safe shutdown components consist of the five component cooling water (CCW) pumps and associated cables, steam generator instrumentation cables, and cables associated with the RHR pumps.

The five CCW pumps (OA through OE) are located side-by-side along the east wall of Fire Zone 11.2-0. Two of the five pumps are required to shut down both units simultaneously. The two most remote CCW pumps and associated cables are separated by more than 50 feet.

The cables for the CCW pumps are routed in conduits from the pumps into separate solid bottom cable trays located above the pumps and approximately 1 to 5 feet below the ceiling.

The cables for pumps OA and OB are routed in cable trays through the northern half of the 560-foot elevation. The cables for pumps OC, OD, and OE are routed in conduits into separate solid bottom cable trays through the southern half of the elevation. The trays run at least 60 feet away from the pumps and enter into separate vertical metal enclosed risers and exit through sealed penetrations in the ceiling at the 579-foot elevation.

Fire Zone 11.2-0 has a combustible loading of approximately 20,900 Btu per square foot and a fire severity of 16 minutes. Intervening combustibles near the CCW pumps consist of two groups of four cable trays parallel to and over the middle three pumps. Each tray is provided with a solid bottom and two fire stops are located 10 feet apart to prevent fire from spreading along intervening combustibles. The fire stops consisting of penetration seal material are applied to 2-foot-long sections of the trays.

A local application carbon dioxide fire suppression system is provided over the five CCW pumps. The suppression system is automatically actuated by heat detectors located over each pump.

Ionization smoke detectors are also provided over the CCW pumps. The Licensee has committed to expand the existing detection on the 560-foot elevation of the auxiliary building to provide coverage over the cable trays containing power cables in the vicinity of the CCW pumps. The additional detectors will be installed in accordance with the longitudinal spacing requirement of NFPA Standard No. 72E. Additionally, portable extinguishers and manual hose stations are provided in the area. Manual control of the CCW pumps is not required in the event of a fire on this elevation.

Steam generator pressure instrumentation cables for Units 1 and 2 enter the auxiliary building on this elevation. The minimum separation between the cables for Units 1 and 2 is approximately 100 feet on all levels of the auxiliary building. The minimum separation between the redundant steam generator pressure instrumentation cabling on all levels of the auxiliary building is less than 20 feet. The Licensee has committed to install a mechanical pressure gauge on the loop A main steam piping outside of the auxiliary building fire area for alternate indication.

Ionization smoke detectors on this elevation are located in the areas of and between the steam generator pressure instrumentation cables. The cables associated with the Units 1 and 2 RHR pumps on the 560-foot elevation are separated by approximately 95 feet. The minimum separation between redundant RHR pump cables of Units 1 and 2 is less than 20 feet. The Licensee has committed to maintain sufficient qualified cable onsite and to formulate repair procedures to replace the cables of one RHR pump for the affected unit after a fire, before the pumps are needed for cold shutdown.

5.3 Evaluation

The fire protection for the auxiliary building fire area does not comply with requirements of Section III.G.2.b because automatic fire detection and suppression is not installed throughout the area on the 560-foot elevation of the auxiliary building.

The staff's principal concern with the level of fire protection was that because of the absence of an area-wide automatic suppression system, a fire of significant magnitude could damage all five CCW pumps.

However, the combustible loading in zones containing safe shutdown equipment is relatively low. If a fire were to occur, it is expected that it would develop slowly with, initially, low heat release. Additionally, ionization smoke detectors are provided over the CCW pumps. The Licensee has committed to expand the existing detection on the 560-foot elevation to provide ionization detectors over the cable trays containing the power feeds for the CCW pumps.

Because of the presence of these detectors, a fire in these areas should be detected in its incipient stage. The alarms from these detectors are annunciated in the main control room. The fire brigade would be dispatched to extinguish the fire manually, using hose lines or portable extinguishers provided.

A local CO₂ fire suppression system is provided over the five CCW pumps. The system is automatically actuated by heat detectors located over each pump. This system should provide fire control for a fire at the pumps until the fire brigade arrives. Manual control at the CCW pumps is not required for control of the individual CCW pumps during a fire in this area.

The steam generator pressure instrumentation cables for Units 1 and 2 are separated by approximately 100 feet. Ionization smoke detectors are located in the areas of and between these cables. The minimum separation between redundant steam generator pressure instrumentation cables is less than 20 feet. The Licensee has committed to install a mechanical pressure gauge outside of the auxiliary building fire area to provide alternate steam generator pressure indication.

The cables associated with the RHR pumps on the 560-foot elevation are separated by 95 feet. The minimum separation between redundant RHR pump power cables for Units 1 and 2 is less than 20 feet. The Licensee has committed to institute post-fire repair procedures and have qualified cable available to replace the power cable for one RHR pump.

5.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection in conjunction with additional ionization detectors provide a level of fire protection equivalent to the technical requirements of Section III.G.2.b of Appendix R. Therefore, the exemption request from providing area-wide automatic suppression and detection systems and 20 feet of separation on the 560-foot elevation of the auxiliary building fire area should be granted.

6.0 AUXILIARY BUILDING AUXILIARY FEEDWATER PUMP AREA, ELEVATION 579 FEET

6.1 Exemption Requested

An exemption was requested from the requirements of Section III.G.2.b to the extent that it requires area-wide automatic suppression and detection systems and 20 feet of separation between redundant safe shutdown components for the 579-foot elevation of the auxiliary building fire area.

6.2 Discussion

The 579-foot elevation of the auxiliary building fire area contains 16 fire zones. Safe shutdown components consist of both unit's centrifugal

charging and auxiliary feedwater (AFW) pumps. The remote shutdown panels, the power feeds for the service water pumps, and cables associated with the RHR and CCW pumps are also located on this elevation.

Combustible loadings for fire zones located on this elevation range from negligible to approximately 30,000 Btu per square foot. The majority of the combustibles are confined to the centrifugal and reciprocating charging pump cubicles located in Fire Zones 11.3A-1, 11.3A-2, 11.3B-1, 11.3B-2, 11.3C-1, and 11.3C-2. The combustibles consist primarily of 55 gallons of lubricating oil inside each pump cubicle. The pump cubicles are separated from the remainder of the elevation by 24-inch-thick reinforced concrete walls and unrated hollow metal access doors. The combustible loading for Fire Zone 11.3-0, which contains all AFW pumps, is approximately 20,000 Btu per square foot and is equivalent to a 14-minute fire severity.

The Unit 1 centrifugal charging pumps (1A and 1B) are located in Fire Zones 11.3A-2 and 11.3B-2. The Unit 2 centrifugal charging pumps are in Fire Zones 11.3A-2 and 11.3B-2. Each charging pump is located in a separate cubicle. Within each unit, the charging pump cubicles are located side-by-side with the walls of each cubicle constructed of 18-inch-thick reinforced concrete. An unrated door with a metal transom provides access into each cubicle. The charging pumps for each unit are separated by a 3-hour rated wall. The only penetration through each of these walls is a ventilation duct. The Licensee has committed to install a 3-hour rated fire damper in these penetrations.

Outside of the Unit 1 charging pump cubicles, the power cables for pump 1A will be rerouted in conduits with approximately 2 feet of separation from the power feeds for pump 1B in Fire Zone 11.3-0. Intervening combustibles between redundant centrifugal charging pump power feeds in Fire Zone 11.3-0 consist of the remote shutdown panels and an open cable tray. The power feeds are located in the area of the Unit 1 AFW pumps (see Section 6.2.2). The Licensee has committed to provide a 1-hour wrap on the power feeds for charging pump 1A from the point where they exit the pump cubicle throughout their entire run on the 579-foot elevation (Fire Zone 11.3-0).

Outside of the Unit 2 charging pump cubicle, the power feeds for charging pump 2A will be rerouted in conduits, and more than a 20-foot separation free of intervening combustibles and/or unrated barriers will be maintained between the power feeds for pumps 2A and 2B.

One centrifugal charging pump per unit is required to achieve and maintain hot shutdown. The closest charging pump cubicle and power feed separation distance between Units 1 and 2 is more than 50 feet.

The Unit 1 AFW pumps are located side-by-side in the south part of Fire Zone 11.3-0. They are orientated with the two motor-driven pumps to the south and a turbine-driven pump to the north. The Unit 2 AFW pumps are

in a similar orientation in the north part of Fire Zone 11.3-0. The minimum separation distance between the most remote motor-driven pump and the turbine-driven pump for Unit 1 is approximately 23 feet; for Unit 2 it is approximately 16 feet. The Units 1 and 2 AFW pump areas are separated by more than 31 feet with no intervening combustibles.

Intervening combustibles near the AFW pumps consist of cables in trays. The Licensee has committed to provide each intervening cable tray with fire stops to prevent fire spread along the cables. The fire stops, consisting of penetration seal material are to be installed in 2-foot-long sections along the trays.

Located between the motor-driven and turbine-driven pumps of each unit is a 7-foot-high part-height, part-width concrete wall. Each pump is surrounded by a dike. The dike area is provided with a drain leading directly out of the 579-foot elevation for removal of lube oil spills from the base of each pump.

Each AFW pump is protected by a local application Co₂ fire suppression system that is actuated by a heat detector located directly over each pump. Ionization smoke detectors are provided over the motor driven AFW pumps and in the vicinity of the turbine driven AFW pumps; portable extinguishers and manual hose stations are also provided in the area.

The Licensee has committed to reroute the power cables for motor-driven AFW pumps 1C and 2C in conduits and to protect the cables with a 1-hour fire rated wrap on the 579-foot elevation.

AFW pump control circuits are not protected on this elevation. The Licensee stated that the motor-driven AFW pumps can be started manually by closing the 4-kV switchgear breaker in the switchgear room after disconnecting the dc control power. The turbine-driven AFW pumps can be manually started locally.

Also located on the 579-foot elevation are the remote shutdown panels (RSPs). There are four RSPs per unit, with three containing functions important to safe shutdown and the fourth containing balance of plant functions.

The RSPs are adjacent to the redundant charging pump cubicles of each unit discussed in Section 6.2.1. A minimum of 80 feet of separation exists between Units 1 and 2 panels. The RSPs are unit-specific and are not redundant to each other.

There is alternate shutdown capability should a fire occur near the RSPs; however, the alternate shutdown capability is based on the operability of at least one AFW pump per unit. The minimum separation between the motor-driven AFW pumps and the RSPs is approximately 20 feet, whereas the distance between the turbine-driven pumps and the RSPs is approximately 30 feet.

The power feeds for the service water (SW) pumps enter on the 579-foot elevation in Fire Zone 11.3-0. They are routed in metal enclosed risers along the turbine/auxiliary building interface prior to entering the cable spreading room on the 630-foot elevation.

A minimum of 147 feet separates the SW power feeds, of which at least 20 feet is free of intervening combustibles. Ionization smoke detectors are provided in specific locations between the power feeds on the 579-foot elevation.

Cabling for redundant steam generator pressure transmitters is routed along the south wall of this elevation up to the cable spreading room on the 630-foot elevation. A minimum of 120 feet of separation exists between the cabling, of which at least 20 feet is free of intervening combustibles. Ionization smoke detectors are provided in specific locations between the power feeds on the 579-foot elevation. The Licensee has committed to provide alternate indication for steam generator pressure via a mechanical gauge that will be installed in Fire Zones 18.5-1 and 18.5-2.

The cables associated with the RHR pumps on the 579-foot elevation are separated by approximately 200 feet. The Licensee has committed to maintain sufficient qualified cable onsite and to formulate repair procedures to replace the cables of one RHR pump after a fire, before the pumps are needed for cold shutdown.

The power cables associated with CCW pumps OA and OB are routed in vertical risers along the north wall of Fire Zone 11.3-0 on this elevation. Power cables for CCW pumps OC, OD and OE are routed in vertical risers along the south wall of this elevation in Fire Zone 14.2A-0. Redundant CCW pump power cables are separated by approximately 200-feet and unrated barriers. Ionization smoke detectors are provided in specific locations between the power feeds in Fire Zone 11.3-0 on the 579-foot elevation.

6.3 Evaluation

The staff's concern regarding Fire Zone 11.3-0 was the effects of an exposure fire in the area of the AFW pumps. Specifically, given the congested nature in the areas of these pumps, a fire, in certain areas around the perimeter of the pumps, has the potential for damaging all three pumps.

By letter dated February 9, 1987, the licensee proposed to modify the existing height of the wall which separates the turbine driven auxiliary feedwater pump from the motor driven pumps so as to ensure that a fire would not simultaneously damage the turbine-driven and motor-driven pumps. It is the staff's judgment that a postulated fire in this area will not affect all three pumps with the proposed extension of the wall between these pumps. This modification adequately mitigates the above concern.

6.4 Conclusion

Based on the above evaluation, the staff concludes that the proposed modifications and the existing fire protection will provide a level of fire protection equivalent to the technical requirements of Section III.G.2.C of Appendix R. Therefore, the exemption request from providing area-wide automatic suppression and detection on the 579-foot elevation of the auxiliary building should be granted.

7.0 AUXILIARY BUILDING, ELEVATION 592, 617, and 642 FEET

7.1 Exemption Requested

Exemptions were requested from the requirements of Section III.G.2.b to the extent that it requires area-wide automatic suppression and detection systems and 20 feet of separation free of intervening combustibles between redundant safe shutdown components.

7.2 Discussion

Elevation 592 feet of the auxiliary building contains 12 fire zones. Safe shutdown components consist of cabling associated with the Units 1 and 2 RHR, CCW, AFW, centrifugal charging, and SW pumps, and steam generator pressure instrumentation.

Cabling for these components passes through this elevation prior to entering the cable spreading room. A minimum separation of 20 feet without intervening combustibles exists between the cables of redundant components as the cables pass through this elevation, with the exception of the steam generator pressure instrumentation. The Licensee has committed to install a mechanical steam generator pressure gauge outside of this area and to implement a repair procedure for RHR pump power cables. The Licensee also committed to provide a one-hour fire rated barrier for the power feed of CVCS charging pump 1A where it runs on the 592-foot elevation of the auxiliary building.

Ionization smoke detectors are provided in the area of these cables on the 592-foot elevation.

Elevation 617 feet of the auxiliary building contains 13 fire zones. This elevation contains the same cabling as the 592-foot elevation. Ionization smoke detectors are provided in the areas of and between the redundant cables. The redundant cables are separated by 20 feet free of intervening combustibles and/or unrated barriers on this elevation.

Fire Zone 11.7-0 is the only fire zone on the 642-foot elevation of the auxiliary building fire area. No safe shutdown components are located on this elevation of the fire area.

7.3 Evaluation

The fire protection for auxiliary building elevations 592, 617, and 642 feet does not comply with the requirements of Section III.G.2.b because automatic fire suppression and detection are not installed throughout the fire zones.

The staff's principal concern with the level of fire protection was that because of the absence of an area-wide automatic suppression system, a fire of significant magnitude could damage redundant safe shutdown systems.

Fire detectors which alarm the main control room are located in the areas of and between redundant safe shutdown cables on these elevations. Upon detection of a fire, the fire brigade would be dispatched to extinguish the fire with the hose lines or portable extinguishers that are provided.

Significant spatial separation free of intervening combustibles exists between redundant cabling at these elevations. Also, there are intermediate noncombustible barriers. Until the fire is extinguished, the spatial separation and intermediate barriers between safe shutdown cables, the low combustible loadings, and the ionization smoke detectors provide sufficient protection to ensure that one safe shutdown division would remain free of fire damage.

7.4 Conclusion

Based on the above evaluation, the staff concludes that the existing level of fire protection on the 592-, 617-, and 642-foot elevations of the auxiliary building fire area provides a level of fire protection equivalent to the technical requirements of Section III.G.2.b of Appendix R. Therefore, the exemption request for these elevations of the auxiliary building fire area should be granted.

8.0 MAIN STEAM PIPE TUNNEL (FIRE ZONES 18.5-1 and 18.5-2)

8.1 Exemption Requested

Exemptions were requested from the requirements of Section III.G.2.b to the extent that it requires automatic suppression and detection systems throughout the main steam pipe tunnels (Fire Zones 18.5-1 and 18.5-2).

8.2 Discussion

Fire Zones 18.5-1 and 18.5-2 are the main steam pipe tunnels (1 per unit) and main steam valve houses (2 per unit) for Units 1 and 2, respectively. Each zone contains redundant divisions of steam generator pressure transmitters and associated cabling.

The pressure transmitters for loops A and C are located in the lower level of the east main steam valve house; and loops B and D are in the lower level of the west main steam valve house. Also contained in each zone are the main steam lines, the main steam isolation valves (MSIVs), the atmospheric steam dump valves, and the main steam code safety valves.

The main steam pipe tunnels and the upper sections of the main steam valve house of Fire Zones 18.5-1 and 18.5-2 are free of combustible material. The combustible loading in these two zones is contained

entirely within the lower sections of each main steam valve house. The combustibles consist of 30 gallons of hydraulic fluid in the MSIV hydraulic units. This results in an equivalent fire severity of 21 minutes in the lower MSIV compartments.

The lower level of the east main steam valve house contains the steam generator pressure transmitters for loops A and C, and the lower level of the west main steam valve house contains those for loops B and D. The pressure transmitters and associated cabling for loops A and D are considered redundant. Cabling for the pressure transmitters are routed from their respective main steam valve house into the main steam pipe tunnel and enter the auxiliary building. The cabling for redundant pressure transmitters is routed within close proximity to each other in the main steam pipe tunnel.

The main steam valve houses, which contain the pressure transmitters, are separated by approximately 150 feet. Should a fire originating in a valve house propagate into the main steam pipe tunnel, there is potential for damage to all pressure transmitter cables.

To ensure that the steam generator pressure indication is maintained, the Licensee has committed to install a mechanical gauge to provide alternate steam generator pressure indication. The gauge will be located such that access is available in the event of a fire in these zones.

8.3 Evaluation

Fire Zones 18.5-1 and 18.5-2 do not comply with the technical requirements of Section III.G.2.b because full area automatic suppression and detection systems are not installed in the zones.

The staff's principal concern with the level of fire protection was that because of the absence of fire detection and suppression systems, a fire of significant magnitude could damage redundant steam generator pressure indication transmitters and cables.

However, the combustible loading in these zones is low. The principal combustible is hydraulic fluid located within the lower portion of the main steam valve houses. There are no intervening combustibles between the valve houses and the main steam pipe tunnel containing cabling for all four steam generator transmitters. Redundant pressure transmitters are separated by over 150 feet with no intervening combustibles.

The Licensee has committed to install a mechanical pressure gauge to provide alternate steam generator pressure indication in a location that assures access in the event of a fire in these zones.

8.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection combined with proposed modifications provide a level of protection equivalent to the technical requirements of Section III.G.2.b

of Appendix R. Therefore, the exemption request from the requirement for automatic fire suppression and detection systems throughout Fire Zones 18.5-1 and 18.5-2 should be granted.

9.0 SUMMARY

Based on the evaluation, the staff finds that the level of fire safety in the areas listed below is equivalent to that achieved by compliance with the technical requirements of Section III.G of Appendix R; therefore, the Licensee's request for the following exemptions should be granted:

1. Main Control Room, Fire Zone 2.0-0.

Lack of a fixed-fire suppression system throughout the main control room. Refer to Section 2.0 for detailed information.

2. Auxiliary Electric Equipment Rooms, Fire Areas 5.6-1 and 5.6-2.

Lack of a fixed-fire suppression system throughout each AEER. Refer to Section 3.0 for additional information.

3. Auxiliary Building, Component Cooling Water Pump Area, Elevation 560 Feet.

Lack of area-wide automatic suppression and detection systems and 20 feet of separation free of intervening combustibles between redundant safe shutdown equipment for 560-foot elevation of the auxiliary building fire area. Refer to Section 5.0 for additional information.

4. Auxiliary Building, Elevations 592, 617, and 642 Feet.

Lack of area-wide automatic fire suppression and detection systems and 20 feet of separation free of intervening combustibles between redundant safe shutdown components. See Section 7.0 for details.

5. Main Steam Pipe Tunnels (Fire Zones 18.5-1 and 18.5-2).

Lack of full area detection and automatic fire suppression. Refer to Section 8.0 for more details.

6. Auxiliary Building, Auxiliary Feedwater Pump Area, Elevation 579 Feet.

Lack of area-wide automatic fire suppression and detection systems and 20 feet of separation between redundant safe shutdown components on the 579-foot elevation of the auxiliary building fire area. Refer to Section 6.0 for additional information.

Based on the evaluation, the staff also finds that the level of fire safety in the area listed below meets the technical requirements of

Section III.G.1.b of Appendix R and, therefore, the Licensee's request for exemption from Section III.G.2.b is not necessary.

1. Auxiliary Building, Residual Heat Removal Pump Area, Elevation 542 feet.

Lack of automatic fire suppression and detection systems and 20 feet of separation free of intervening combustibles between redundant safe shutdown components on the 542-foot elevation of the auxiliary building fire area. Refer to Section 4.0 for additional information.

Principal Contributors:

This safety evaluation was prepared by John Stang and Amarjit Singh based on a technical evaluation report prepared by Franklin Research Center (FRC) under the contract with the U.S. Regulatory Commission (NRC).

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