WOLF CREEK
NUCLEAR OPERATING CORPORATION

December 16, 2009

Terry J. Garrett
Vice President, Engineering

ET 09-0018

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Subject: Docket No. 50-482: License Amendment Request (LAR) for Use of Fire-Resistive Electrical Cable

Gentlemen:

Pursuant to 10 CFR 50.90, Wolf Creek Nuclear Operating Corporation (WCNOC) hereby requests an amendment to the Renewed Facility Operating License No. NPF-42 for the Wolf Creek Generating Station (WCGS). This license amendment request is seeking approval by the Commission, pursuant to License Condition 2.C(5), to make changes to the approved fire protection program as described in the Updated Safety Analysis Report (USAR). Specifically, a deviation from certain technical commitments to 10 CFR 50, Appendix R, Section III.G.2, as described in Appendix 9.5E of the WCGS Updated Safety Analysis Report (USAR), is requested regarding the use of fire-resistive cable at WCGS for certain power and control cables associated with two motor-operated valves on Train B Component Cooling Water System.

Based on the technical analysis described herein, WCNOC believes that the use of fire-resistive cables in the manner specified in this request will not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. However, since the approved WCGS Fire Protection Program does not specifically provide for fire-resistive cables as one of the approved methods to protect redundant safe shutdown components, this change could be interpreted as an adverse change. As such, WCNOC is submitting this request for approval in accordance with License Condition 2.C(5).

Attachment I provides the evaluation and justification for the proposed license amendment. Attachment II provides markups of the USAR including Appendix 9.5E. USAR Appendix 9.5E provides a design comparison to 10 CFR 50 Appendix R. Attachment III provides markups of E-1F9900, "Post Fire Safe Shutdown Manual Actions," E-1F9905, "Fire Hazard Analysis" and E-1F9910, "Post Fire Safe Shutdown Fire Area Analysis." E-1F9900, E-1F9905 and E-1F9910 are incorporated by reference in USAR Appendix 9.5.B, "Fire Hazards Analyses." Attachment IV provides a list of regulatory commitments.



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MRR

Enclosure I provides the Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-117047. Enclosure II provides the Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-121039. Enclosure III provides the WCGS Fire Rated Cable Installation Details.

It has been determined that this amendment application does not involve a significant hazard consideration as determined per 10 CFR 50.92. The amendment application was reviewed by the WCNOC Plant Safety Review Committee. In accordance with 10 CFR 50.91, a copy of this application is being provided to the designated Kansas State official.

WCNOC requests approval of this proposed amendment by July 1, 2010. Once approved, the amendment will be implemented within 180 days of receipt. This will allow sufficient time to implement the plant modification on the two motor-operated valves on Train B Component Cooling Water System.

If you have any questions concerning this matter, please contact me at (620) 364-4084, or Mr. Richard D. Flannigan at (620) 364-4117.

Sincerely,

Terry J. Garrett

TJG/rlt

Attachments: I Evaluation of Proposed Change
II Markup of USAR Pages
III Markups of E-1F9900, "Post Fire Safe Shutdown Manual Actions," E-1F9905, "Fire Hazard Analysis" and E-1F9910, "Post Fire Safe Shutdown Fire Area Analysis"
IV List of Regulatory Commitments

Enclosure: I Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-117047
II Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-121039
III WCGS Fire Rated Cable Installation Details

cc: E. E. Collins (NRC), w/a, w/e
T. A. Conley (KDHE), w/a, w/e
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B. K. Singal (NRC), w/a, w/e
Senior Resident Inspector (NRC), w/a, w/e

**STATE OF KANSAS )**
**) SS**
**COUNTY OF COFFEY )**

Terry J. Garrett, of lawful age, being first duly sworn upon oath says that he is Vice President Engineering of Wolf Creek Nuclear Operating Corporation; that he has read the foregoing document and knows the contents thereof; that he has executed the same for and on behalf of said Corporation with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By _____
Terry J. Garrett
Vice President Engineering

SUBSCRIBED and sworn to before me this 16th day of December, 2009.

NOTARY PUBLIC OFFICIAL SEAL STATE OF
RHONDA L. TIEMEYER
MY COMMISSION EXPIRES
January 11, 2010

Rhonda L. Tiemeyer
Notary Public

Expiration Date January 11, 2010

# EVALUATION OF PROPOSED CHANGE

Subject: License Amendment Request for Use of Fire-Resistive Electrical Cable

## 1. SUMMARY DESCRIPTION

This evaluation supports a request to amend Renewed Facility Operating License NPF-42 for the Wolf Creek Generating Station (WCGS). The proposed amendment would revise the Renewed Facility Operating License to deviate from certain WCGS Fire Protection Program requirements. The reason for this amendment is to allow the use of fire-resistive cable at WCGS for certain power and control cables associated with two motor-operated valves on Train B Component Cooling Water System in lieu of meeting the circuit separation protection commitments to 10 CFR 50, Appendix R, Section III.G.2 referenced in Appendix 9.5E of the Updated Safety Analysis Report (USAR).

Based on the technical analysis described herein, Wolf Creek Nuclear Operating Corporation (WCNOC) believes that the use of fire-resistive cables in the manner specified in this request will not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. However, since the approved WCGS Fire Protection Program does not specifically provide for fire-resistive cables as one of the approved methods to protect redundant safe shutdown components, this change could be interpreted as an adverse change. As such, WCNOC is submitting this request for approval in accordance with License Condition 2.C(5).

## 2. DETAILED DESCRIPTION

The WCGS Fire Protection Program is described in USAR Section 9.5.1 and Appendices 9.5A through 9.5E. Historically, Appendix 9.5B provided the Fire Hazards Analysis. The Fire Hazards Analysis is now located in E-1F9905. Appendix 9.5B of the USAR incorporates by reference the following:

- E-1F9905, Fire Hazards Analysis
- E-1F9900, Post-Fire Safe Shutdown Manual Actions
- E-1F9910, Post-Fire Safe Shutdown Fire Area Analysis
- XX-E-013, Post-Fire Safe Shutdown (PFSSD) Analysis
- M-663-00017A, Fire Protection Evaluations for Unique or Unbounded Fire Barrier Configurations

USAR Appendix 9.5E provides a design comparison to 10 CFR 50, Appendix R and how WCNOC compares with the specific requirements of 10 CFR 50 Appendix R.

The WCGS post-fire safe shutdown analysis (PFSSDA) identified that, in some fire areas, separation of redundant safe shutdown circuits is not in accordance with WCGS commitments to 10 CFR 50, Appendix R. As these issues were discovered, WCNOC entered them in the corrective action program, made the appropriate notifications, implemented compensatory measures and developed plans to correct the concern. Corrective actions so far have included installing 1-hour or 3-hour fire wrap around the applicable circuits, rerouting cables out of the affected fire areas, establishing combustible control zones, installing additional automatic fire detection, and addition of hand switches in the main control room. Over the last three years, WCNOC has implemented 14 plant modifications to improve the post-fire safe shutdown capability and bring the plant into compliance with its commitments to 10 CFR 50 Appendix R.

Based on the PFSSDA, the Train B Component Cooling Water System is the protected train of component cooling water if a fire occurs in Fire Area A-27 (Rod Drive/MG Set Room). However, the power and control cables for valves EGHV0016 and EGHV0054 are routed through Fire Area A-27. Damage to the power and control cables will prevent operation of the valves from the Main Control Room (MCR). Therefore, WCNOC is proposing to install 3-hour rated fire-resistive electrical cable manufactured by Meggitt Safety Systems, Inc. (hereinafter referred to as Meggitt) in lieu of the existing electrical cables, to provide an equivalent level of protection specified by 10 CFR 50, Appendix R Section III.G.2.a. The cables are purchased as safety related, seismically-qualified, environmentally-qualified, Class 1E cables, which meet the 3-hour fire endurance rating when tested per the requirements of Supplement 1 to Generic Letter 86-10, "Implementation of Fire Protection Requirements," (Reference 6.1). For the proposed application, the cables are not used in a harsh environment and therefore, are not required to be environmentally qualified.

Valve EGHV0016 is on the component cooling water return line from the service loop. Valve EGHV0054 is on the component cooling water supply line to the service loop. The service loop is required for post-fire safe shutdown to supply component cooling water to the seal water heat exchanger and the reactor coolant pump thermal barrier heat exchangers during hot standby and the excess letdown heat exchanger during cold shutdown. The seal water heat exchanger is used to cool seal leakoff prior to returning to the centrifugal charging pump (CCP) suction and is used to cool CCP recirculation flow when the CCPs are operating at low flow conditions.

If, at the onset of a fire in Fire Area A-27, valves EGHV0016 and EGHV0054 are closed, and the fire damages the circuits associated with these valves before the Train B Component Cooling Water System is lined up, there would be no component cooling water flow to the seal water heat exchanger for cooling seal leakoff and CCP recirculation flow. Installation of fire wrap on the cable tray carrying EGHV0016 and EGHV0054 power and control cables is not an option, as derating the cables in the tray would result in too low of an ampacity for some of the circuits. Rerouting of the electrical circuits is also not an option because all possible routes would cause the same concern in other fire areas. WCNOC is proposing to route the new fire-resistive cable from the valves to the motor control center, which would include installation of the cable in Fire Areas A-16 and A-21. This routing was chosen because it provides a direct route from the valves to the motor control center.

## 3. TECHNICAL EVALUATION

10 CFR 50.48 requires that all operating nuclear power plants have a fire protection program that satisfies Criterion 3 of Appendix A to 10 CFR Part 50, which reads "Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, ..."

The WCGS Renewed Facility Operating License NFP-42, Condition 2.C(5), "Fire Protection," states:

(a) The Operating Corporation shall maintain in effect all provisions of the approved fire protection program as described in the SNUPPs Final Safety Analysis Report for the facility through Revision 17, the Wolf Creek site addendum through Revision 15, and as approved in the SER through Supplement 5, subject to provisions b and c below.

(b) The licensee may make changes to the approved fire protection program without prior approval of the Commission only if those changes will not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

The WCGS Fire Hazards Analysis (FHA) is documented in document E-1F9905, which is incorporated into the USAR by reference and is part of the approved fire protection program. Section 4.6.1 of E-1F9905 reads, in part "The design goal for safety-related areas outside of the Containment was to provide the equivalent of a 3-hour rated fire barrier between redundant trains, as described in 10 CFR 50, Appendix R, Paragraph III.G.2.a. Where this was not possible, credit was taken for the detection and suppression systems installed in the plant, and compliance to the provisions of Appendix R, Paragraphs III.G.2.b and c, was addressed."

10 CFR 50, Appendix R Section III.G.2 states, in part: "... one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided:

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 combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

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

The WCGS USAR, Appendix 9.5E, provides a comparison of the WCGS Fire Protection Program against the requirements of Section III of Appendix R to 10 CFR 50. Although WCGS obtained its operating license after January 1, 1979, the NRC stated, in the WCGS SER (NUREG-0881) dated April, 1982, that they will condition the WCGS operating license to require WCGS to meet the technical requirements of Appendix R to 10 CFR 50, or provide equivalent protection. However, the Condition never appeared in the WCGS operating license when it was issued.

Table 9.5E-1 in Appendix 9.5E of the WCGS USAR indicates in response to the provisions in 10 CFR 50 Appendix R Section III.G that redundant trains of systems required to achieve and maintain hot standby are separated by 3-hour rated fire barriers or the equivalent provided by III.G.2. The Meggitt cable system has been demonstrated by testing and analysis as being capable of performing its intended function during and after the fire exposure as prescribed by Supplement 1 to Generic Letter 86-10, without the use of a fire barrier system.

Since the WCGS comparison to 10 CFR 50 Appendix R does not mention use of fire-resistant cable, the use of the Meggitt cable represents a deviation from the approved WCGS fire protection program, and approval from the NRC is being requested pursuant to License Condition 2.C(5).

Test Results

Two independent, three-hour fire qualification tests consistent with the WCNOC proposed applications were performed for the Shearon Harris Nuclear Plant, and both of these tests are used to bound the WCGS applications of Meggitt cable.

Enclosure II provides a copy of the fire test report, Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-121039, dated February 23, 2005, which demonstrates that, for the specific applications of this material proposed at WCGS, the fire-rated cable will perform its intended function during and after exposure to an American Society for Testing and Materials (ASTM) E-119, "Standard Test Methods for Fire Tests of Building Construction Materials," design basis fire.

Enclosure I provides a copy of an earlier test report, Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-117047, Revision 1, dated July 7, 2004, which provided acceptable insulation resistance data during the fire test and demonstrated the acceptability of the support designs tested. However, this earlier test did not successfully demonstrate continued electrical functionality for the complete duration of the fire test. During this fire test, the cable samples were installed on galvanized supports. At each location in which the cables came in contact with a horizontal support, the cable jacket was degraded as a result of liquid metal embrittlement of the stainless steel cable jacket from direct contact with galvanized material at high temperatures. The cable jacket failure did not reveal itself until the cables were subjected to the hose stream test at the end of the test, which subsequently resulted in water intrusion into the cables. Later testing (reference Enclosure II) used stainless steel support materials so that none of the cable samples were in direct contact with any galvanized material. No cable jacket degradation issues were encountered during this fire test.

Unlike the existing plant cables, the proposed cables described within this amendment request are designed to function during a fire exposure. The proposed cables are type Si2400 manufactured by Meggitt Safety Systems, Inc. This cable has demonstrated that it is capable of operating continuously for three hours during the most severe design basis fire, and it satisfies the other design considerations such as environmental qualification, seismic, and electrical characteristics. Testing of this fire-resistive cable has been conducted in accordance with Supplement 1 to Generic Letter 86-10 and ASTM E-119. This testing demonstrated that the cable is capable of providing an equivalent level of protection as would be provided by a 3-hour and 1-hour rated fire barrier as described by 10 CFR 50, Appendix R Section III.G.2.

Cable Routing and Supports

The fire testing performed on the fire-resistive cable (reference Enclosures I and II) also tested the support systems and attachment methods. All supports and connections were successfully tested and remained firm and secure. The support systems and attachment methods to be

used at WCGS for routing the fire resistive cables are designed to be consistent with those tested.

The WCGS design specifies that fire-resistive cables required to only withstand a 1-hour fire are to be routed with the most practical routes along walls and ceilings. Fire detectors and automatic fire suppression systems are installed in the 1-hour fire areas, which mitigate the possibility of damage from equipment or material failing and falling onto the fire-resistive cable.

The WCGS design specifies that fire-resistive cables are to be routed with a minimum of one inch separation. Testing confirms ½ inch separation was sufficient to prevent damage from adjacent cables. A representative sample of cable types were seismically tested by Trentec, Inc., under the SQURTS Program and is documented under Trentec Inc., Test Report No. 4S002.0. During the seismic testing, the sample cables were installed with ½ inch of cable jacket to cable jacket separation at the support locations. During the seismic testing, cable electrical functionality was successfully demonstrated. Using a minimum of one inch will be conservative and afford additional protection to the cables.

Installation requirements for the cable and supports at WCGS are bounded by the tested configurations. The following table provides a comparison between the tested parameters and the WCGS design requirements for support of the Meggitt cable. For WCGS design details, see Enclosure III.

| **Parameter** | **Tested Configuration** | **WCGS Design Configuration** | **Conclusion** | **Applicable Test Report[1]** |
|---|---|---|---|---|
| Minimum cable bend radius | 6" | 6" | The tested configuration bounds the design configuration | 121039 |
| Support type/material | B-Line B54 Strut (1 5/8" wide x 13/16" high, 0.97 lb/ft) 304 Stainless Steel<br><br>Unistrut P1000 Strut (1 5/8" wide x 1 5/8" high, 1.90 lb/ft) galvanized | Unistrut P1000 (1 5/8" wide x 1 5/8" high, 1.90 lb/ft) 304 stainless steel<br><br>Unistrut P3300 (1 5/8" wide x 7/8" high, 1.35 lb/ft) 304 stainless steel | The tested configuration bounds the design configuration | 121039<br><br>117047 |
| Support attachment method | Welded to embed plate or steel member or anchored to concrete ceiling | Welded to existing steel member or anchored to concrete wall or ceiling | The tested configuration bounds the design configuration | 117047<br>121039 |

| Parameter | Tested Configuration | WCGS Design Configuration | Conclusion | Applicable Test Report[1] |
|---|---|---|---|---|
| Concrete anchors | 3/8" Stainless Steel Hilti Kwik II Bolt 2 ½" min embedment | 3/8" Stainless Steel Hilti Kwik Bolt III, 2 ½" min embedment | The tested configuration bounds the design configuration | 117047 |
| Maximum support span | 81" | 81" | The tested configuration bounds the design configuration | 121039 |
| Cable securement method | B-Line B2000, 304 Stainless Steel 3/8" electrical metallic tubing (EMT) conduit clamp or B2088, 304 Stainless Steel one hole 5/8" O.D. tubing clamp | Unistrut P1425, 304 Stainless Steel 3/8" EMT conduit clamp or P2014, 304 Stainless Steel one hole 5/8" O.D. tubing clamp | The Unistrut clamps are equivalent to the B-Line clamps in materials and thickness. Therefore, there is reasonable assurance the Unistrut clamps will perform the safe as the B-Line clamps during a fire. | 121039 |
| Clamp torque force | B2000 conduit clamp - 25 in-lbs<br><br>B2088 O.D. tubing clamp - 4 ft-lbs | P1425 conduit clamp - 25 in-lbs<br><br>P2014 O.D. tubing clamp - 4 ft-lbs | The tested configuration bounds the design configuration | 121039 |

1. Test reports are as follows:

   117047 - Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-117047, Revision 1, dated July 7, 2004 (Enclosure I)

   121039 - Omega Point Laboratories Test Report for Meggitt Safety Systems, Inc. Cable Test, Project No. 14980-121039, dated February 23, 2005 (Enclosure II)

Consistent with NRC Information Notice 2006-02, "Use of Galvanized Supports and Cable Trays with Meggitt Si 2400 Stainless-Steel-Jacketed Electrical Cables," (Reference 6.2) the WCGS design specifies that Meggitt stainless steel cable is not to be installed in direct contact with galvanized materials. In addition, the design for the Meggitt cable routing considers other potential design basis impacts that may affect the ability to achieve safe shutdown after a design basis accident. These impacts include, but are not limited to, pipe whip, missiles, high energy line breaks and falling objects.

Electrical Evaluation

The Meggitt Si 2400 fire-resistive cables are an acceptable replacement for normal cables with organic insulation and jackets. The cables have a slightly increased linear resistance due to the nickel cladded copper conductors, and significantly increased linear resistance during a fire due to high temperatures.

**Electrical Evaluation Methodology**

Each application of the cables has been analyzed to verify acceptable total resistance along the entire circuit length, typically twice the cable length for control circuits. Cable routing, which dictates the cable length, and conductor size was selected to ensure the total circuit resistance, and hence the circuit's voltage drop, are acceptable and will not adversely impact the OPERABILITY of the circuit and the equipment associated with the circuit.

Additionally, during a fire, the higher temperatures of up to 1925 °F will decrease the value of insulation resistance. Due to lower insulation resistance, leakage current to other conductors and the grounded stainless steel jacket will increase. This increased leakage current is additive to the circuit's normal current. Each application of the fire-resistive cable was analyzed to ensure that leakage current during a fire remains below an acceptable level.

The manufacturer provides a minimum insulation resistance of 1 meg-ohm per foot. Fire tests of the cable show a higher value of insulation resistance at 1925 °F, using the manufacturer's value of 1 meg-ohm per foot is conservative and will ensure the cable insulation is more than adequate.

Applicable WCNOC calculations have been revised, as necessary, to show the acceptability of the fire-resistive cables. At a minimum the results of the calculations have been shown to envelope the voltage drops of the fire-resistive cables and verify that the cable exceeds OPERABILITY requirements during normal operation and during a fire.

The WCGS design specifies that stainless steel jacket of the fire-resistive cables are to be grounded through their connection to terminal boxes that provide a fault current return path to the power source. A fault in one cable will be contained by its stainless steel jacket, the jacket itself returning the fault current to the power source and causing the circuit protective device to clear the fault before extensive damage can occur. This is similar to cases involving conduits, which are installed with a minimum of one inch separation

**Electrical Evaluation for Valve EGHV0016**

The power and control circuits for valve EGHV0016 will be made up of a combination of fire-resistance rated cable and conventional cable. Approximately 64 feet of 3 conductor #6 American Wire Gauge (AWG) fire-resistive cable and 34 feet of 3 conductor #12 AWG conventional cable will be used for the power circuit. Approximately 64 feet of 7 conductor #12 AWG fire-resistive cable and 220 feet of 7 conductor #14 AWG conventional cable will be used for the control circuit. The linear electrical resistance of the fire-resistive cables is 0.0021 ohms per foot for #12 AWG conductors, and 0.0005 ohms per foot for #6 AWG conductors; both at 70 °F. At 1925 °F, the resistance values increase to 0.0114 ohms per foot for #12 AWG

conductors, and 0.00266 ohms per foot for #6 AWG conductors. In comparison, the conventional cables currently used for power and control of the valve has linear resistance values at 194 °F of 0.00310 ohms per foot for the #14 AWG conductors and 0.00215 ohms per foot for the #12 AWG conductors.

The EGHV0016 motor power circuit is required to deliver the minimum motor terminal voltage necessary to operate the valve. Using the fire-resistive cable lengths provided above as well as linear resistance values for conventional cable in the equations from WCNOC calculation XX-E-004, "AC Motor Operated Valve Minimum Terminal Voltage," the minimum motor terminal voltage for EGHV0016 would be 380.25 volts during a fire that will heat the Si 2400 cable to 1925 °F. This is a slight improvement over the current application where only conventional cable is used and the existing minimum motor terminal voltage of 378.979 volts from calculation XX-E-004 is identified. For normal non-fire 70 °F conditions of the cable, the conductor resistance will be significantly lower and the motor terminal voltage will be higher. Therefore, the use of the Si 2400 cable for the power circuit is acceptable, as it will actually improve motor terminal voltage in the proposed configuration.

WCNOC calculation XX-E-012, "Safety-Related MCC Control Circuit Allowable Wire Lengths," evaluates a control circuit having a 100 volt amp control power transformer and a size 1 starter. These control circuit components are equivalent to the ones for EGHV0016, though the calculation is more conservative as it includes an auxiliary relay, whereas EGHV006's circuit does not have the relay. Calculation XX-E-012 shows that the size 1 starter will energize and pick up with a control circuit length of 3580, having a resistance of 11.098 ohms.

The EGHV0016 control circuit will have a total circuit length of 568 feet. This total length consists of 440 feet of existing #14 AWG conductors and 128 feet of #12 AWG fire-resistive conductors. As was done for other similar valve motors in calculation XX-E-012, 400 feet of #14 AWG conventional cable is added to account for internal wire length, fuse and relay/switch contacts in the motor control center (MCC), main control board (MCB) and the motor.

Using the resistance values of 3.1 ohms per 1000 feet (per calculation XX-E-012) for the existing #14 AWG conventional cables (840 feet total length), and 1.14 ohms per 100 feet at 1925 °F for the #12 AWG fire-resistive cable (128 feet total length), the total circuit resistance is 4.06 ohms. This value of 4.06 ohms is significantly lower than the allowable value of 11.098 ohms determined by calculation XX-E-012. Therefore, the use of the Si 2400 cable in the control circuit of EGHV0016 is acceptable.

The insulation resistance for the fire-resistive cables is 1,000,000 ohms foot. Using a minimum MCC voltage of 423.2 volts and the aforementioned length of 64 feet, the maximum leakage current for the power cable will be 0.0156 amperes during a fire. With the leakage current the motor terminal voltage is still 380.25 volts, which is higher than the present 378.979 volts with the existing cables.

The control circuit with 2 conductors at line voltage will have a maximum leakage current of 0.0141 amperes in the fire-resistive cable at 1925 °F. Using the methodology of calculation XX-E-012 and accounting for the insulation leakage current as another load on the circuit, the available starter coil voltage will be 95.93 volts. This voltage is above the minimum 88.8 volts necessary for pick-up of a size 1 starter.

**Electrical Evaluation for Valve EGHV0054**

The power and control circuits for valve EGHV0054 will be made up of a combination of fire-resistance rated cable and conventional cable. Approximately 64 feet of 3 conductor #6 AWG fire-resistive cable, 28 feet of 3 conductor #8 AWG conventional cable and 90 feet of 3 conductor #12 AWG conventional cable will be used for the power circuit. Approximately 64 feet of 7 conductor #12 AWG fire-resistive cable and 302 feet of #14 AWG conventional cable will be used for the control circuit. The linear electrical resistance of the fire-resistive cables is 0.0021 ohms per foot for #12 AWG conductors, and 0.0005 ohms per foot for 6 AWG conductors; both at 70 °F. At 1925 °F, the resistance values increase to 0.0114 ohms per foot for #12 AWG conductors, and 0.00266 ohms per foot for #6 AWG conductors. In comparison, the conventional cables currently used for power and control of the valve has linear resistance values at 194 °F of 0.00310 ohms per foot for the #14 AWG conductors and 0.00215 ohms per foot for the #12 AWG conductors.

The EGHV0054 motor power circuit is required to deliver the minimum motor terminal voltage necessary to operate the valve. Using the fire-resistive cable lengths provided above as well as linear resistance values for conventional cable in the equations from calculation XX-E-004, the minimum motor terminal voltage for EGHV0054 would be 379.38 volts, during a fire that will heat the Si 2400 cable to 1925 °F. This is a slight improvement over the current application where only conventional cable is used and the existing minimum motor terminal voltage of 379.340 volts given in the results of calculation XX-E-004 is identified. For normal non-fire 70 °F conditions of the cable, the conductor resistance will be significantly lower and the motor terminal voltage will be higher. Therefore, the use of Si 2400 cable for the power circuit is acceptable, as it will actually improve motor terminal voltage in the proposed configuration.

Calculation XX-E-012 evaluates a control circuit having a 100 VA control power transformer and a size 1 starter. These control circuit components are equivalent to the ones for EGHV0054. Calculation XX-E-012 shows that the size 1 starter will energize and pick up with a control circuit length of 3580, having a resistance of 11.098 ohms.

The EGHV0054 control circuit will have a total circuit length of 732 feet. This total length consists of 604 feet of existing #14 AWG conductors and 128 feet of #12 AWG fire-resistive conductors. As was done for other similar valve motors in calculation XX-E-012, 400 feet of #14 AWG conventional cable is added to account for internal wire length, fuse and relay/switch contacts in the MCC, MCB and the motor.

Using the resistance values of 3.1 ohms per 1000 feet (per calculation XX-E-012) for the existing #14AWG conventional cables (1,004 feet total length), and 1.14 ohms per 100 feet at 1925 °F for the #12 AWG fire-resistive cable (128 feet total length), the total circuit resistance is 4.57 ohms. This value of 4.57 ohms is significantly lower than the allowable value of 11.098 ohms determined by calculation XX-E-012. Therefore, the use of the Si 2400 cable in the control circuit of EGHV0054 is acceptable.

The insulation resistance for the fire-resistive cables is 1,000,000 ohms foot. Using a minimum MCC voltage of 423.2 volts and the aforementioned length of 64 feet, the maximum leakage current for the power cable will be 0.0156 amperes during a fire. With the leakage current the motor terminal voltage becomes 379.377 volts, which is still higher than the present 379.340 volts with the existing cables.

The control circuit with 2 conductors at line voltage will have a maximum leakage current of 0.0155 amperes in the fire resistive cable at 1925 °F. Using the methodology of calculation XX-E-012 and accounting for the insulation leakage current as another load on the circuit, the available starter coil voltage will be 91.45 volts. This voltage is above the minimum 88.8 volts necessary for pick-up of a size 1 starter.

Conclusion

Based on the above evaluation, the use of fire-resistive cable in the configuration described for the power and control circuits for valves EGHV0016 and EGHV0054 does not affect the function of the valves and is therefore acceptable.

## 4. REGULATORY EVALUATION

### 4.1 Applicable Regulatory Requirements/Criteria

10 CFR 50, Section 48, Fire Protection, states in paragraph (a) that "Each operating nuclear power plant must have a fire protection plan that satisfies Criterion 3 of Appendix A of this part." Paragraph (e) states "Nuclear power plants licensed to operate after January 1, 1979, shall...satisfy Criterion 3 of Appendix A to this part in accordance with the provisions of their licenses."

10 CFR 50, Appendix A, General Design Criterion 3, Fire Protection, requires that structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

10 CFR 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979", Section III.G.2 requires that cables whose fire damage could prevent the operation or cause mal-operation of safe shutdown functions be physically protected from fire damage by one of three methods.

Since WCGS was licensed after January 1, 1979, WCNOC is not obligated to meet the requirements of Section III.G.2. However, USAR Appendix 9.5E provides a comparison of the WCGS design to Appendix R. The NRC has not previously reviewed the use of fire-resistive cable at WCGS proposed in this amendment request.

### 4.2 Precedent

Amendment No. 123 to Shearon Harris Nuclear Power Plant, Unit 1 Facility Operating License No. NPF-62 approved the use of fire-resistive electrical cables in lieu of alternatives specified in Section C5.b.2 of Branch Technical Position Chemical Engineering Branch 9.5-1 for certain volume control tank outlet valves. (Reference 6.3)

### 4.3 Significant Hazards Consideration

The proposed amendment allows the use fire-resistive cable at the Wolf Creek Generating Station (WCGS) for certain power and control cables associated with two motor-operated valves on Train B Component Cooling Water System in lieu of meeting the circuit separation

protection commitments to 10 CFR 50, Appendix R, Section III.G.2 referenced in Appendix 9.5E of the Updated Safety Analysis Report (USAR).

WCNOC has evaluated whether or not a significant hazards consideration is involved with the proposed amendment(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   **Response:** No.

   The design function of structures, systems and components are not impacted by the proposed change. The proposed change involves the use of fire-resistive cable at WCGS for certain power and control cables associated with two motor-operated valves (EGHV0016 and EGHV0054) on Train B Component Cooling Water System and will not initiate an event. The proposed change does not alter or prevent the ability of structures, systems, and components (SSCs) from performing their intended function to mitigate the consequences of an initiating event within the assumed acceptance limits. The Meggitt Si 2400 fire-resistive cable has been independently tested to applicable requirements and the implementation design reflects the test results. Therefore, the probability of any accident previously evaluated is not increased. Equipment required to mitigate an accident remains capable of performing the assumed function.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   **Response:** No.

   The proposed change will not alter the requirements or function for systems required during accident conditions. The design function of structures, systems and components are not impacted by the proposed change. No new or different accidents result from implementing Meggitt Si 2400 fire-resistive cable in Fire Areas A-16 and A-21. The Meggitt Si 2400 fire-resistive cable has been independently tested to applicable requirements and the implementation design reflects the test results. The use of Meggitt Si 2400 fire-resistive cable is not a significant change in the methods governing normal plant operation.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   **Response:** No.

   The proposed change does not alter the manner in which safety limits, limiting safety system settings or limiting conditions for operation are determined. The safety analysis

acceptance criteria are not affected by this change. The proposed change will not result in plant operation in a configuration outside the design basis for an unacceptable period of time without mitigating actions. The proposed change does not affect systems that respond to safely shutdown the plant and to maintain the plant in a safe shutdown condition.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, WCNOC concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

### 4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

## 5. ENVIRONMENTAL CONSIDERATION

WCNOC has evaluated the proposed changes and determined that the changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

## 6. REFERENCES

6.1 Supplement 1 to Generic Letter 86-10, "Fire Endurance Acceptance Criteria for Fire Barrier Systems Used to Separate Redundant Safe Shutdown Trains Within the Same Fire Area (Supplement 1 to Generic Letter 86-10, "Implementation of Fire Protection Requirements")," March 24, 1994

6.2 NRC Information Notice 2006-02, "Use of Galvanized Supports and Cable Trays with Meggitt Si 2400 Stainless-Steel-Jacketed Electrical Cables," January 16, 2006.

6.3 "Shearon Harris Nuclear Power Plant, Unit 1 – Issuance of Amendment on Use of Fire Resistive Cable (TAC NO. MC8134)," May 1, 2006. (ADAMS Accession number ML0061140227)

**Markup of USAR Pages**

REGULATORY GUIDE 1.130 REVISION 1 DATED 10/78

Service Limits and Loading Combinations for Class 1 Plate-and-Shell-Type Component Supports

DISCUSSION:

According to the NRC implementation guidance for this regulatory guide, it is not applicable to WCGS. However, the following discussion is provided for information purposes.

For ASME Section III components not furnished with the NSSS, the Class 1 supports are of the linear type and not the plate and shell type. Therefore, this regulatory guide does not apply.

The Westinghouse position with respect to this regulatory guide is as follows.

a. Paragraph B.1 states that increases are not allowed for bolted connections for emergency and faulted conditions. The Westinghouse position is that it is reasonable to allow an increase in the limits for bolted connections for these conditions. Further justification concerning this position can be found in Item 1 of the discussion on Regulatory Guide 1.124.

b. The method described in Paragraph C.7(b) of the Regulatory Guide is overly conservative and inconsistent with the stress limits presented in Appendix F. Westinghouse will use the provisions of F-1370(d) to determine service level D allowable loads for supports designed by the load rating method.

REGULATORY GUIDE 1.131 REVISION 0 DATED 8/77

Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants

DISCUSSION:

The recommendations of this regulatory guide are met with the exceptions noted in Section 8.1.4.3.

REGULATORY GUIDE 1.132 REVISION 1 DATED 3/79

Site Investigations for Foundations of Nuclear Power Plants

Stainless steel clad fire-resistive cables are type tested to ensure qualification for use in safety-related circuits. Due to the materials and construction of the fire-resistive cables, the guidance in Regulatory Guide 1.131 is not applicable to these cables.

TABLE 3.2-1 (Sheet 23)

CLASSIFICATIONS OF STRUCTURES, COMPONENTS, AND SYSTEMS (14)

| | System/Component | Seismic Category I (1) | Quality Group Classification (2) | ANS Safety Class (3) | Quality Assurance (4) | Principal Construction Codes and Standards (5) | Location (6) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 10.2 | Class 1E Low Voltage System | | | | | | | |
| | Load center unit substations | Y | NA | NA | Y-B | IEEE-308, 336 | C/A/I | |
| | Motor control centers | Y | NA | NA | Y-B | IEEE-308, 336 | C/A/D/I | |
| | 600 Volt power and control cable | Y | NA | NA | Y-B | IEEE-308, 336 | A/C/D/F/ I/R | |
| | Integral and fractional hp induction motors | Y | NA | NA | Y-B | IEEE-308, 336, 344 NEMA MG-1 | A/C/D/F/ I/R | |
| 10.3 | Class 1E 125 V DC System | | | | | | | |
| | Batteries and battery charger | Y | NA | NA | Y-B | IEEE-308, 336 | C | |
| | DC distribution panels | Y | NA | NA | Y-B | IEEE-308, 336 | C | |
| | Emergency lighting dc | Y | NA | NA | Y-B | MS | C | |
| 10.4 | Class 1E Instrument AC Power | | | | | | | |
| | Vital ac power supply | Y | NA | NA | Y-B | IEEE-308, 336 | C | |
| | 120 V ac vital panels | Y | NA | NA | Y-B | IEEE-308, 336 | C | |
| | 600 V instrument cable | Y | NA | NA | Y-B | IEEE-308, 336 | A/C/D/ F/I | |
| 10.5 | Reactor Building Cable Penetrations | Y | B | 2 | Y-B | IEEE-317, 336 | A/C | |
| 10.6 | Conduit Supports and Tray Supports | Y | NA | NA | Y-B | ASTM | All | |
| 10.7 | Raceway Installation | Y | NA | NA | Y-B | IEEE-336 | All | |
| 10.8 | Load Shedding and Emergency Load Sequencing | Y | NA | NA | Y-B | IEEE-308, 336 | C | |
| 10.9 | Auxiliary Relay Racks | Y | NA | NA | Y-B | ICEA, NEMA IEEE-336 | A/C | |
| 10.10 | Transformers | | | | | | | |
| | Essential service water | Y | NA | NA | Y-B | IEEE-308 | I | |
| | Regulating | Y | NA | NA | Y-B | IEEE-308 | C | |
| 10.11 | Status Indicating Systems | Y | NA | NA | Y-B/W3 | IEEE-308, 336 | C | |
| 10.12 | Local Control Stations | Y | NA | NA | Y-B | IEEE-308, 336 | A/D/F | |
| | 600 Volt fire-resistive power and control cable | Y | NA | NA | N | IEEE-344 | A/B/D/E/F I/O/R/T/U | |

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conservative 20 percent value. However, in the interest of conservatism, a bilinear curve, which effectively bounds the lower end of nearly all the points, was utilized. This curve is given in Figure 3.7(B)-21. This curve represents the recommended design values of equivalent viscous damping.

In addition to the determination of equivalent viscous damping, as described in the test report, linear analysis was performed on finite element models of several of the tray system test setups. These analyses confirmed that a very high viscous damping was required in order to predict responses similar to those recorded during the dynamic testing. These analyses confirmed that the application of the damping values recommended for design in a linear analysis was consistent with the results of the test program and, therefore, would result in a conservative design of support systems.

3.7(B).4 SEISMIC INSTRUMENTATION

3.7(B).4.1 Comparison with Regulatory Guide 1.12, Rev. 1 (April, 1974)

The seismic instrumentation program complies with Regulatory Guide 1.12, Rev. 1, except for the items listed below:

a. Response spectrum recorders are not supplied as discrete instruments except on the containment base mat. A spectrum analyzer permanently installed in the control room presents more complete information than that presented by response spectrum recorders. Data from the strong motion accelerometers are fed into the spectrum analyzer to produce earthquake spectra immediately following an earthquake. All locations where response spectrum recorders are required by the regulatory guide are monitored by strong motion accelerometers. This system achieves the intent of Regulatory Guide 1.12, Rev. 1.

b. The seismic trigger designed for in the free field have an actuated level adjustable over a minimum range of 0.01g to 0.03g, in lieu of the minimum sensitivity level of 0.005g specified in ANSI N18.5. Triggering levels below 0.01g are likely to produce spurious triggering.

Stainless steel 600 volt fire-resistive control and power cables are routed independent of raceways. Fire-resistive cable will be supported by stainless steel unistrut attached to the concrete walls at intervals governed by span loading. Generally, the supports will be standard design used for small conduit, except for the use of stainless steel unistrut and clamps. Seismic testing and analysis verify the adequacy of the supports for fire-resistive cable.

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TABLE 3.11(B)-3 (Sheet 68)

| COMPONENT NUMBER | DESCRIPTION | LOCATION ROOM No. | SPEC. NUMBER | (4) SHUTDN HOT | SHUTDN COLD | CATEGORY LOCA | CATEGORY MSLB | CATEGORY HELB | NORM ENV | ACCIDENT ENVIRONMENT T | P | R | H | SP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZSI219 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI219 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI233 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI233 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI234 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI234 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI243 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI243 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI249 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI249 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI250 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI250 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI258 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZSI258 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZTB-1 | TERMINAL BOXES | (7) (8) | E-028 | | | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZTB-2 | TERMINAL BOXES | (5) | E-028 | | | A | A | A | T1 | F25 | F39 | T2 | T2 | NA |
| ZZB | 5 KV POWER CABLES | (5) | E-029 | X | X | A | D | D | T1 | F25 | F39 | T2 | T2 | NA |
| ZZC1 | 600 VOLT COPPER CONTROL CABLE | (2) | E-057 | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZC2 | 600 VOLT COPPER CONTROL CABLE | (2) | E-057A | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZC3 | 600 VOLT COPPER CONTROL CABLE | (2) | E-057B | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZG | 600 VOLT POWER CABLE | (2) | E-058 | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZJ | 600 VOLT SHIELDED INSTRUMENTATION CABLE | (2) | E-062 | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZJ1 | 600 VOLT SHIELDED INSTRUMENTATION CABLE | (2) | E-062A | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZP | PREFABRICATED CABLE ASSEMBLIES | (2) (9) | E-095 | X | X | A | A | D | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZR | CABLE BREAKOUT KIT | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZS | 600 VOLT SHIELDED INSTRUMENTATION CABLE | (2) | E-062 | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZT | THERMOCOUPLE EXTENSION CABLE | (2) | E-061 | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZU | 5 KV CABLE SPLICE MATERIAL | (5) | E-029 | X | X | A | D | D | T1 | F25 | F39 | T2 | T2 | NA |
| ZZV | CABLE END SEAL KIT | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZW | NUCLEAR MOTOR CONNECTION KITS | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZX | COAXIAL & TRIAXIAL CABLE | (2) | E-060 | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZY | 600 V CABLE TERMINATION MATERIAL | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZY | HEAT SHRINK FLD. SPLICING SYSTEM | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZZ | STUB CONNECTION KIT | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZZ | TERMINAL LUGS | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZZ | TRANSITION SPLICE KIT | (2) | (1) | X | X | A | A | A | T1 | F3 | F6 | T4 | T2 | T5 |
| ZZC4 | 600 VOLT FIRE-RESISTIVE CONTROL AND POWER CABLE | (5) | E-057C | X | X | D | D | A | T1 | F25 | F39 | T2 | T2 | NA |

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TABLE 3.11(B)-7

SPECIFICATIONS REVIEWED UNDER THE NUREG-0588 PROGRAM

| SPECIFICATION | DESCRIPTION |
|---|---|
| E01013-1 | Termination Material (stub conn. kits) |
| E01013-2 | Termination Material (ht. shrink fld spl.) |
| E01013-3 | Termination Material (motor conn. kits) |
| E01013-4 | Termination Material (end sealing kits) |
| E009 | Switchgear Potential Transformer Cubicles (1) |
| E018 | Motor Control Centers (2) |
| E028 | Local Control Stations/Terminal Boxes |
| E028A | Switches (2) |
| E029 | 5 kV Power Cable |
| E035 | Electrical Penetrations |
| E035B | Electrical Penetration Modules |
| E057 | 600 V Control Cable |
| E057A | 600 V Control Cable |
| E057B | 600 V Control Cable |
| E058 | 600 V Power Cable |
| E060-1 | Triaxial and Coaxial Cable |
| E060-2 | Triaxial Cable Assembly (nuclear detectors) (1) |
| E061 | Thermocouple Cable |
| E062 | 600 V Instrumentation Cable |
| E062A | 600 V Instrumentation Cable |
| E093 | Auxiliary Relay Racks |
| J301-1 | Pressure Transmitters (IC) |
| J301-2 | Pressure Transmitters (OC) |
| E057C | 600V Fire-Resistive Cable |

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Within a cabinet or panel associated and identified with a single safety-related separation group, no identification of the safety-related wiring is required. The separation group of the panel or cabinet, however, is clearly identified.

Within a panel or cabinet otherwise associated and identified with a single safety-related separation group, nonsafety-related wiring is clearly identified. However, provided such nonsafety-related wiring is maintained at a small quantity, identification of the safety-related wiring is not required.

All noncabinet-mounted protective equipment and components are provided with an identification tag or nameplate. Small electrical components, such as relays, have nameplates on the enclosure which houses them. All cables are numbered with identification tags. In congested areas, such as under or over the control boards, instrument racks, etc., cable trays and conduits containing redundant circuits shall be identified, using permanent markings. The purpose of such markings is to facilitate cable routing identification for future modifications or additions. Positive permanent identification of cables and/or conductors are made at all terminal points. There are also identification nameplates on the input panels of the solid state protection system.

7.1.2.4 Conformance to Criteria

A listing of applicable criteria and the sections where conformance is discussed is given in Table 7.1-2.

7.1.2.5 Conformance to NRC Regulatory Guides

7.1.2.5.1 General

Conformance of BOP equipment to Regulatory Guides 1.22, 1.53, 1.62, 1.105, and 1.118 is addressed in Tables 7.1-3, 4, 5, 6, and 7, respectively.

Other regulatory guides pertinent to this section are: 1.7, 1.11, 1.21, 1.26, 1.29, 1.30, 1.40, 1.45, 1.47, 1.63, 1.68, 1.73, 1.75, 1.80, 1.89, 1.97, 1.100, 1.106 and 1.139. References to discussions of these regulatory guides are provided in Appendix 3A.

An additional discussion of the NSSS conformance to Regulatory Guide 1.22 and IEEE-338 and -379 is given in the following sections.

Fire-resistive cables, with stainless steel jacketing, are routed as separate conduits, and numbered with permanent identification.

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TABLE 7.4-6 (Sheet 40)

| Component ID | Component name | Room No | Spec No | Hot SD | Cold SD |
|---|---|---|---|---|---|
| ZSE215 | ELECTRICAL PENETRATION MODULES (ENCAPSULATION) | 1204 | E-035B | X | X |
| ZSE216 | ELECTRICAL PENETRATION ASSY (ENCAPSULATION) | 1203 | E-035 | X | X |
| ZSE216 | ELECTRICAL PENETRATION MODULES (ENCAPSULATION) | 1203 | E-035B | X | X |
| ZSE217 | ELECTRICAL PENETRATION ASSY (ENCAPSULATION) | 1203 | E-035 | X | X |
| ZSE217 | ELECTRICAL PENETRATION MODULES (ENCAPSULATION) | 1203 | E-035B | X | X |
| ZSE218 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE218 | ELECTRICAL PENETRATION MODULES | 1409 | E-035B | X | X |
| ZSE219 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE219 | ELECTRICAL PENETRATION MODULES | 1409 | E-035B | X | X |
| ZSE233 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE233 | ELECTRICAL PENETRATION MODULES | 1409 | E-035B | X | X |
| ZSE234 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE234 | ELECTRICAL PENETRATION MODULES | 1409 | E-035B | X | X |
| ZSE243 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE243 | ELECTRICAL PENETRATION MODULES | 1409 | E-035B | X | X |
| ZSE249 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE249 | ELECTRICAL PENETRATION MODULES | 1409 | E-035B | X | X |
| ZSE250 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE250 | ELECTRICAL PENETRATION MODULES | 1409 | E-035B | X | X |
| ZSE258 | ELECTRICAL PENETRATION ASSY | 1409 | E-035 | X | X |
| ZSE258 | ELECTRICAL PENETRATION MODULE | 1409 | E-035B | X | X |
| ZSI215 | VALVE TERMINAL BOX | 1204 | E-028 | | X |
| ZSI215 | ELECTRICAL PENETRATION MODULE | 1204 | E-035B | | X |
| ZSI216 | VALVE TERMINAL BOX | 1203 | E-028 | | X |
| ZSI216 | ELECTRICAL PENETRATION MODULE | 1203 | E-035B | | X |
| ZSI218 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI218 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZSI219 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI219 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZSI233 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI233 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZSI234 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI234 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZSI243 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI243 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZSI249 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI249 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZSI250 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI250 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZSI258 | ELECTRICAL PENETRATION ASSY | 2000 | E-035 | X | X |
| ZSI258 | ELECTRICAL PENETRATION MODULE | 2000 | E-035B | X | X |
| ZZB | 5 KV POWER CABLES | (5) | E-029 | X | X |
| ZZC1 | 600 VOLT COPPER CONTROL CABLE | (2) | E-057 | X | X |
| ZZC2 | 600 VOLT COPPER CONTROL CABLE | (2) | E-057A | X | X |
| ZZC3 | 600 VOLT COPPER CONTROL CABLE | (2) | E-057B | X | X |
| ZZG | 600 VOLT POWER CABLE | (2) | E-058 | X | X |
| ZZJ | 600 VOLT SHIELDED INSTRUMENTATION CABLE | (2) | E-062 | X | X |
| ZZJ1 | 600 VOLT SHIELDED INSTRUMENTATION CABLE | (2) | E-062A | X | X |
| ZZP | PREFABRICATED CABLE ASSEMBLIES | (2) | E-095 | X | X |
| ZZC4 | 600 VOLT FIRE-RESISTIVE CONTROL AND POWER CABLE | (5) | E-057C | X | X |

b. Where small control or instrument devices are supplied with short pigtails, the field cable may be terminated to the pigtail by means of an approved connection, which is adequately insulated, located close to the device, and enclosed in the connecting conduit.

c. Another possible area would be in the event of cable damage in an operating plant where a splice might be preferable over total replacement of the cable. Such instances are resolved on a case-by-case basis.

d. In cases in which field-run cables are incompatible with the terminal size on the devices to which they must terminate, a splice to a short, appropriate pigtail may be made to permit the required termination. Such instances are approved on a case-by-case basis, where the adequacy of the pigtail is confirmed and splices are made with qualified materials and are restricted to enclosures such as MCCs, termination compartments, and panels.

e. Splices made with qualified materials are used within enclosures where specified by design.

Paragraph 5.1.2

Exposed Class 1E raceways are marked in a distinct, permanent manner at intervals not exceeding 15 feet and at points of entry to and exit from enclosed areas.

In addition, separate color identification is provided for each separation group of field wired, safety-related cables.

As stated in reference to Paragraph 4.5, associated circuits are identified the same as their related Class 1E circuits, and are, therefore, distinguished from one another as stated above.

See Section 8.3.1.1.3.

Paragraph 5.1.3

Section 8.3.1.1.4.1.1 satisfies this paragraph.

Paragraph 5.1.4

Section 8.3.1.1.4.1.1 satisfies this paragraph.

Paragraph 5.2.1

Sections 8.3.1.1.1.3 satisfy this paragraph.

f. The 600 volt fire-resistive control and power cables are fitted with termination kits on both ends that are either factory installed or field installed. The termination kits provide transition from solid cable conductors to stranded pigtails suited for making cable terminations. The kits, along with the fire-resistive cables are covered by specification E-057C. Splices for terminating the fire-resistive cables will be in accordance with paragraphs b, d and e above.

g. The 600 volt fire-resistive control and power cables typically have a maximum manufactured length of 100 feet. Factory installed or field installed splices provide for increased cable length. The splices are covered in the fire-resistive cable specification E-057C, and maintain the fire rating and structural integrity of the cables.

REGULATORY GUIDE 1.118, PERIODIC TESTING OF ELECTRIC POWER AND PROTECTION SYSTEMS - Refer to Appendix 3A for the response to this regulatory guide.

REGULATORY GUIDE 1.131, QUALIFICATION TESTS OF ELECTRIC CABLES, FIELD SPLICES, AND CONNECTIONS FOR LIGHT-WATER-COOLED NUCLEAR POWER PLANTS - The requirements of IEEE Standard 383, 1974 have been used for the qualification of cables, field splices, and connections.

The cable, field splices, and connections are qualified to the environmental conditions and all design basis events (e.g., steam line break) by testing and/or analysis.

Type tests for design basis event conditions consist of subjecting nonaged and aged cables, field splices, and connections to a sequence of environmental extremes that simulate the most severe postulated conditions of a design basis event and specified conditions of installation. Type tests demonstrate margin by application of multiple transients or increased level. Electrical and physical performance of the cable is measured during and following the environmental cycle. All environmental conditions are enveloped by the qualification program. However, the factors for margin given in Section 6.3.1.5 of IEEE 323 are not used.

Testing data is provided to establish the long-term performance of the insulation. Data is evaluated using the Arrhenius technique, using a minimum of three data points including 136 C and two others at least 10 C apart in temperature. No on-going qualification is used.

The recommendations of Regulatory Guide 1.89 are discussed later in this section.

Vertical tray flame testing is performed in accordance with IEEE 383, Paragraph 2.5. However, aged samples are not used.

No field splices are used in the cable trays.

Fire tests are performed with the vertical tray perpendicular to the plane of the horizon.

A gas burner flame source releasing approximately 70,000 Btu/hr is used.

The ribbon gas burner flame source is mounted in accordance with the requirements of the regulatory guide, except that the flame is directed from the back side of the cable tray.

The 600 volt fire-resistive control and power cables are type tested to 1925 F to verify 1 hour and 3 hour fire ratings, and to verify environmental qualifications in accordance with NRC Generic Letter 86-10, Supplement 1. The fire testing requirements of NRC Generic Letter 86-10, Supplement 1, exceed the flame test requirements of IEEE 383.

8.3.1.3 Physical Identification of Safety-Related Equipment

Each circuit (scheme) and raceway is given a unique alphanumeric identification. This identification provides a means of distinguishing a circuit or raceway association with a particular channel or load group, and is assigned on the basis of the following criteria:

SEPARATION GROUP 1 - A safety-related instrumentation, control, or power scheme/raceway associated with safety-related load group 1 or protection system channel 1.

SEPARATION GROUP 2 - A safety-related instrumentation, control, or power scheme/raceway associated with protection system channel 2.

SEPARATION GROUP 3 - A safety-related instrumentation, power, or control scheme/raceway associated with protection system channel 3.

SEPARATION GROUP 4 - A safety-related instrumentation, control, or power scheme/raceway associated with safety-related load group 2 or protection system channel 4.

Nonsafety-related cables and raceways associated with normal plant (non-Class IE) equipment are uniquely identified and separately routed from safety-related cables and raceways, as described in Section 8.1.4.3.

The unique identification afforded all nonsafety-related cables is generally black; however, other colors (other than Red, White, Blue and Yellow) may be used for non-safety related cable in isolated cases.

Nameplates with colored backgrounds are provided for all IEEE 308 Class 1E equipment (such as transformers, motors, motor control centers, switchgear, panels, and switchboards) under A/E scope. Each separation group has its distinguishing color. The applicable channel or load group designation is marked on each nameplate. For the identification of instrumentation and control equipment, refer to Section 7.1.2.3.

Raceways are marked in a distinct, permanent manner at intervals not to exceed 15 feet and at points of entry to, and exit from, enclosed areas.

Color identification is provided for each separation group of field-wired, safety-related cables.

Within control panels where more than one separation group is present, wiring is identified by separation group designation or, if enclosed by conduit, the conduit is identified by separation group designation.

The 600 volt fire-resistive control and power cables are routed independent of raceways. The fire-resistive cables are distinctly and permanently marked in the same manner as described above for raceways.

The 600 volt fire-resistive control and power cables are routed independent of raceways. The fire-resistive cables are routed in the same manner as conduits.

b. Cables associated with each safety-related separation group, as defined in Section 8.3.1.3, are run in separate conduits, cable trays, ducts, and penetrations.

c. The arrangement of electrical equipment and cabling minimizes the possibility of a fire in one separation group from propagating to another separation group.

In the absence of confirming analyses to support less stringent requirements, the following rules apply to those areas in which the only source of fire is electrical. Areas in which the only source of fire is electrical are divided into two groups--cable spreading rooms and general plant areas. (See Section 8.3.1.4.1.4 for exemptions) Table 8.3-5 contains analyses of alternate minimum separation distances as allowed by RG 1.75.

GENERAL - Routing of instrumentation, control, or power cables through rooms or spaces where there is a potential for accumulation of large quantities of combustible fluids is avoided. Where such routing is unavoidable, only cables of one separation group are allowed. In addition, the cables are enclosed in conduit. Openings in solid floors for vertical runs of cables are sealed with fire resistant material.

GENERAL PLANT AREAS - In plant areas from which equipment with potential hazards such as missiles, external fires, and pipe whip are excluded, the separation criteria are as follows:

a. Cable trays of different separation groups have a minimum horizontal separation of 3 feet if no physical barrier exists between the trays. In the limited number of areas where horizontal separation of 3 feet is unattainable, a fire barrier is installed extending at least 1 foot above the top of the tray (or to the ceiling) and 1 foot below the bottom of the tray (or to the floor).

b. For cable trays of different separation groups, there is a minimum vertical separation of 5 feet between open-top trays stacked vertically. In the limited number of areas where trays of different separation groups are stacked with less than 5 feet of vertical separation, a fire barrier is placed between the two separation groups. The barrier extends 1 foot to each side of the tray system (or to the wall).

with the exception of 600 volt fire-resistive control and power cables which are routed independent of raceways.

c. In the case where a tray of one separation group crosses over a tray of a different separation group and the vertical separation is less than 5 feet, a fire barrier is installed extending 1 foot from each side of each tray and 5 feet along each tray from the crossover.

d. Where it is necessary that cables of different separation groups approach the same or adjacent control panels with less than 3-foot horizontal or 5-foot vertical spacing, isolation is maintained by installing both separation groups in steel conduit or enclosed wireway or by installing fire barriers between the separation groups. In the case of horizontal separation, the barrier extends 1 foot below the bottom of the tray (or to the floor) to 1 foot above the top of the tray (or to the ceiling). In the case of vertical spacing, the barrier extends 1 foot on each side of the tray system (or to the wall).

e. Isolation between separation groups is considered to be adequate where physical separation is less than that indicated in Items a, b, and c above, provided the circuits of different separation groups are run in enclosed raceways that qualify as barriers or other barriers are installed between the different separation groups. The minimum distance between these enclosed raceways and between barriers and raceways is 1 inch. The barriers are installed as described in a through d above.

In cases of open trays containing safety-related cables and totally enclosed conduits containing non-safety-related cables, the safety design basis is to protect the safety-related cables from failure of the non-safety-related circuits, and not vice-versa. In consideration of this limit, enclosing the non-safety circuits in raceway and maintaining at least one inch separation provides an acceptable level of protection. The conduit can contain only a limited quantity of combustible material (cable insulation and jacket). Furthermore, there is insufficient oxygen inside the conduit to support combustion of more than a fraction of the available material.

Based on these considerations, it is established that one-inch separation between a conduit containing non-safety-related circuits and an open tray containing safety-related circuits is sufficient to assure that any failure within the non-safety related circuits will not propagate into and compromise the integrity of the safety related circuits.

Additionally, 600 volt fire-resistive control and power cables are capable of withstanding fire and can be routed with 1 inch isolation distance from other separation groups and non-safety raceways.

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, with the exception of stainless steel fire-resistive cables,

The Electrical Raceway Separation Verification Test reports for Limerick Units 1 & 2 are applicable to WCNOC for the following reasons:

1. WCNOC uses similar cables made by the same manufactures as the cables used in the test. Cables used by WCNOC made by different manufactures than those used in the test use the same type of insulation material (cross-linked polyethylene or cross-linked ethylene propylene rubber) and jacket material (chlorosulfonated polyethylene or neoprene). In addition, all class 1E cables are qualified to the same standards such as IEEE-323 and IEEE-383 and are manufactured to the same IPCEA standards.

2. The WCNOC electrical raceway configurations are similar to the electrical raceway configurations used in the test.

3. The fault current used in the test is very conservative compared to the maximum credible fault current that could develop for the configuration of circuits described above in this section.

Physical separation between transient electrical cables and Class 1E raceway/cables/equipment may on a temporary basis fail to meet the 3 foot - 5 foot requirement per Reg. Guide 1.75 Rev. 1 and IEEE 384-1974.

Transient electrical cables are defined as follows: transient electrical cables are those non-safety related cables used on a temporary basis in support of field work activities or testing/monitoring which will remain in place for a short duration of time and which do not require a permanent plant modification or a temporary modification for their use. Transient cables typically include but are not limited to: extension cords, temporary power leads, temporary lighting cords, hand power tool cords, welding leads, communication cables, computer cables, video cables, test leads, (DMM's, recorders, data acquisition equipment, etc.) and instrumentation leads.

Transient cable separation requirements are delineated in plant administrative procedures. All deviations from the administrative procedures will require an engineering evaluation.

Physical separation between Local Area Network (LAN) cable and Class 1E raceway may on a limited basis, fail to meet the 3 foot horizontal and 5 foot vertical requirement of R.G. 1.75 and IEEE 384-1974. These cables are installed in "free air". Physical separation of 1 inch horizontal and 3 inches vertical is maintained between the "free air" cables and Class 1E raceway.

LAN cables consist of fiber optic cables and 4 pair - 24 AWGUTP, Category 5/5e cables, both of which meet the flame spread requirements of IEEE 383-1974. The fiber optic cable carries no electrical energy, cannot conduct electrical current and will not propagate a flame. Consequently these cables pose no risk to Class 1E electrical circuits. The 24 AWGUTP Category 5 copper conductor cables carry digital computer data only and consequently do not pose a risk with respect to degrading the functions of Class 1E electrical circuits.

Stainless steel fire-resistive cables have been type tested for exceeding the standards of IEEE-323 and IEEE-383.

TABLE 9.5A-1 (Sheet 30)

| APCSB 9.5-1 Appendix A | WCGS |
|---|---|
| 3. Electrical Cable Construction, Cable Trays and Cable Penetrations | |
| a) Only non-combustible materials should be used for cable tray construction. | Galvanized steel is used for cable tray construction. |
| b) See Section E.3 for fire protection guidelines for cable spreading rooms. | See Section E.3. |
| c) Automatic water sprinkler systems should be provided for cable trays outside the cable spreading room. Cables should be designed to allow wetting down with deluge water without electrical faulting. Manual hose stations and portable hand extinguishers should be provided as backup. Safety-related equipment in the vicinity of such cable trays does not itself require water fire protection but is subject to unacceptable damage from sprinkler water discharge, should be protected from sprinkler system operation or malfunction. | Automatic sprinkler systems are provided for vertical cable chases, the cable area above the suspended ceiling in the access control area which contain Class 1E cables, and zones in the auxiliary building with cable concentrations. Manually charged, closed head sprinkler systems are provided for the two cable penetration areas inside the containment. Cables are designed to allow wetting down without electrical faulting. Manual hose stations and portable hand extinguishers are provided as backup. Sprinkler systems are not installed in areas where sprinkler operation would cause damage to safe shutdown equipment. |
| When safety-related cables do not satisfy the provisions of Regulatory Guide 1.75, all exposed cables should be covered with an approved fire retardant coating and a fixed automatic water fire suppression system should be provided. | Safety-related cables satisfy the provisions of Regulatory Guide 1.75.<br>Safety-related fire-resistive cables exceed the intent of the provisions of Regulatory Guide 1.75. |

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TABLE 9.5A-1 (Sheet 32)

| APCSB 9.5-1 Appendix A | | WCGS |
|---|---|---|
| | cables to limit spread of fire in cable ventings. (Possible cable derating owing to use of such coating materials must be considered during design.) | |
| f) | Electrical cable constructions should as a minimum pass the current IEEE No. 383 flame test. (This does not imply that cables passing this test will not require additional fire protection.)<br><br>For cable installation in operating plants and plants under construction that do not meet the IEEE No. 383 flame test requirements, all cables must be covered with an approved flame retardant coating and properly derated. | Safety-related electrical cable passes the IEEE 383-1974 flame test or meet the intent of this requirement as discussed in Appendix 9.5B.<br><br>Fire-resistive cables are constructed from non-flammable materials: silicon dioxide insulation, copper nickel conductors and stainless steel jacketing, and are tested to exceed any flame test requirements of IEEE 383. |
| g) | To the extent practical, cable construction that does not give off corrosive gases while burning should be used. (Applicable to new cable installations.) | See response to D.2(c) above. |

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TABLE 9.5E-1 (Sheet 6)

| 10CFR50 Appendix R | | WCGS |
|---|---|---|
| | | batteries are served by a battery charger that can be manually connected to the plant emergency ac power supply.<br><br>The ESW pumphouse also complies. |
| III. G. | Fire Protection of Safe Shutdown Capability | |
| | 1. Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire danger so that: | USAR Appendix 9.5B provides an area-by-area analysis of the power block that demonstrates that no single fire can prevent safe shutdown. |
| | 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 | Redundant trains of systems required to achieve and maintain hot standby are separated by 3-hour-rated fire barriers, or the equivalent provided by III.G.2, or else a diverse means of providing the safe shutdown capability exists and is unaffected by the fire. |
| | 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. | For redundant trains of systems required to achieve and maintain cold shutdown that could potentially be affected by |
| | 2. Except as provided for in paragraph G.3 of this section, | |

Fire-resistive cable, which has been successfully tested per the requirements of NRC Generic Letter 86-10, Supplement 1, may be used in lieu of the rated fire barrier requirement in III.G.2.a and c.

**Markups of**

**E-1F9900, "Post Fire Safe Shutdown Manual Actions"**

**E-1F9905, "Fire Hazards Analysis"**

**and**

**E-1F9910, "Post Fire Safe Shutdown Fire Area Analysis"**

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| **POST-FIRE SAFE SHUTDOWN MANUAL ACTIONS** | | | |
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communication to be lost in the auxiliary building. However, procedure OFN-KC-016 allows various means of emergency communication. This loss of radio communication is addressed in PIR 2002-2502.

The local Gaitronics unit in the main steam tunnel may also be lost. The manual action in the auxiliary building is in the main steam tunnel. It is expected that radio communication would be available in the main steam tunnel due to its proximity to the turbine building antenna. If it is not, a local maintenance jack (MJ 100) is available that is unaffected by a fire in A-27. However, this action is not an action that requires constant communication with the control room.

If SGK05A and SGK05B spuriously stop or cannot be started due to loss of power to the associated fire signal isolation relay, manually start SGK05B by closing GKHS0103, located in room 1501. This may require entering SYS GK-200 to supply cooling to Train A electrical equipment rooms. Per SYS GK-200, this action should be completed within 2-hours, which gives operators sufficient time to perform the action.

~~It may be necessary to manually open valve EGHV0016 to ensure return flow to the CCW Train B pump suction. It may also be necessary to locally monitor the Train B CCW pump discharge pressure due to damage to pressure transmitter EGPT0078 cable. These actions may require a dedicated operator at the CCW Train B area to monitor CCW pump discharge pressure. Due to the potential loss of radio and Gai-Tronics communication, a telephone or runner may be necessary to communicate with the control room. Continuous communication is not required for this action.~~

The room cooler for the B train CCW pumps may be lost. Calculation GL-M-006 has shown that the room cooler for the A train CCW pumps can provide sufficient cooling for the B pumps due to the open corridor between the two trains. The A train room cooler will be available.

### 5.13 Fire Area A-28, Auxiliary Shutdown Panel Room

This fire area is divided into two distinct areas by 3-hour fire rated construction. The North room contains the Train A Auxiliary Shutdown Panel (ASP) and the South room contains the Train B ASP.

A fire in the North room (fire area A-28N) requires two manual actions. Steam generator A ARV ABPV0001 may need to be failed closed by closing KAV1364 and KAV1435 and bleeding air from the regulator to isolate air and nitrogen to the valve. These valves are located in fire area A-23. In addition, steam generator C ARV ABPV0003 may need to be closed using local controller ABFHC0003 in fire area A-23. These actions can be performed by the same operator. Access is available to fire area A-23 without having to traverse area A-28. Emergency lighting is provided.

A fire in the South room (fire area A-28S) requires two manual actions. Steam generator B ARV ABPV0002 may need to be closed using local controller ABFHC0002 in fire area A-23. In addition, steam generator D ARV ABPV0004 may need to be failed closed by closing KAV1365 and KAV1429 and bleeding air from the regulator to isolate air and nitrogen to the valve. These actions can be performed by the same operator. Access is available to fire area A-23 without having to traverse area A-28. Emergency lighting is provided.

### 5.14 Fire Area C-10, Train B NB Switchgear Room

Two manual actions may be required if a fire occurs in area C-10. ARVs ABPV0002 and ABPV0004 may need to be locally controlled or isolated. One operator would be needed to perform these actions and may be required to remain close to area A-23 to control ABPV0002. Another operator may need to exit the control room to open breaker PA0201 using the local push button. This is feasible since the breaker is on the 2033 elevation of the Turbine Building, which is easily accessed from the control room.

| FIRE LOCATION | COMPONENT MANUALLY OPERATED | OPEN/STOP | CLOSE/RUN | FIRE AREA WHERE MANUAL ACTION PERFORMED | ROOM WHERE MANUAL ACTION PERFORMED | HOT STANDBY | COLD SHUTDOWN | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| **FIRE AREA A-27, GENERAL SCHEME: USE TRAIN B EQUIPMENT, COMPLETE LOSS OF OFFSITE POWER, BOTH TRAINS OF ONSITE POWER AVAILABLE. AUTOMATIC SUPPRESSION AND DETECTION INSTALLED.** | | | | | | | | |
| ~~A-27~~ | ~~EGHV0016~~ | ~~X~~ | | ~~A-16~~ | ~~1402~~ | ~~X~~ | ~~X~~ | ~~It may be necessary to manually open valve EGHV0016 to ensure return flow to the CCW Train B pump suction. It may also be necessary to locally monitor the Train B CCW pump discharge pressure due to damage to pressure transmitter EGPT0078 cable. These actions may require a dedicated operator at the CCW Train B area to monitor CCW pump discharge pressure. Due to the potential loss of radio and Gai-Tronics communication, a telephone or runner may be necessary to communicate with the control room. Continuous communication is not required for this action. Emergency lighting on EGHV0016 is available.~~ |

4.5 Fire Effects on Electrical Equipment and Safe Shutdown Information

4.5.1 The following discussions provide information on the WCGS plant design and nomenclature, the assumed effects of fire, and the response of certain devices.

1. Redundant PFSSD mechanical systems are referred to in the analysis as Train A and Train B. Train A is served by electrical separation groups 1 and 3, while Train B is served by electrical separation groups 2 and 4. Electrical separation groups 5 and 6 are typically for non-safety related equipment. However, in limited cases these groups also provide a PFSSD success path.

2. The FHA and supporting documents XX-E-013 and E-1F9910 include the effects of a postulated fire hazard on PFSSD cables, exposed conduit and instrumentation. Embedded conduits are not considered due to the heat sink provided by the encasing barrier. Section 8.3.1.4 of the USAR provides the basis and criteria for the interdependence of redundant systems.

3. If a fire is postulated to cause a short in a circuit and that circuit is protected by an individual overcurrent protection device, that device is assumed to function to clear the fault without further degradation of the power source.

4. Separation of the devices for nuclear safety-related controls and instrumentation is achieved by physical separation or barriers between separation groups for the same protective function, in accordance with Regulatory Guide 1.75.

, use of fire-resistive material

4.6 General Information on Design Features

4.6.1 Redundant equipment and circuits required for safe shutdown are also protected against the effects of potential exposure fires. These protection features include fixed fire detection and suppression systems, fire barriers, control of combustibles, and physical separation. The design goal for safety-related areas outside of the Containment was to provide the equivalent of a 3-hour rated fire barrier between redundant trains, as described in 10 CFR 50, Appendix R, Paragraph III.G.2.a. Where this was not possible, credit was taken for the detection and suppression systems installed in the plant, and compliance to the provisions of Appendix R, Paragraphs III.G.2.b and c, was addressed.

use of fire-resistive material,

, the use of fire-resistive material,

4.6.2 In most fire areas, the boundaries are defined by walls, floors, and ceilings. In the Reactor Building, however, such natural boundaries do not completely enclose localized fire hazards. For the Fire Areas inside of the Containment, the provisions of 10 CFR 50 Appendix R, Paragraphs III.G.2.d, e, and f were addressed.

4.6.3 Emergency lighting is provided for areas required for operation of safe shutdown equipment and for access and egress to those areas. It consists of sealed beam units with individual 8-hour minimum battery power supplies.

4.6.4 Safety-related cable in the general plant area is qualified to IEEE-383-1974. All single conductors inside control panels meet the flame resistance requirements of IPCEA S-19-81 or S-61-402.

, or Military Specification MIL-W-810044B

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generator atmospheric relief valves (ARVs) are available to control RCS temperature during hot standby. Main feedwater is isolated by closing the main feedwater isolation valves (MFIVs) from the control room. Diagnostic instrumentation is available to verify RCS temperature and pressure. Both Trains of residual heat removal (RHR) are available for transition from hot standby to cold shutdown, however RHR pump suction may have to be lined up locally.

A fire in this area will not prevent safe shutdown of the plant.

## 8.26 FIRE AREA A-26 (STORAGE AND I&C HOT TOOL SHOP 2026 ELEVATION)

There are no 20 foot combustible and fire hazard free zones in fire area A-26. Fire area A-26 has automatic fire detection installed.

PFSSD is assured using Train A safety related and non-safety related equipment.

Reactivity control is achieved by tripping the reactor from the control room. Boration is available using Train A centrifugal charging pump (CCP) taking suction from the refueling water storage tank (RWST) and injecting borated water through the reactor coolant pump (RCP) seals. Main steam isolation is accomplished by closing the main steam isolation valves (MSIVs) from the control room. Steam generator atmospheric relief valve (ARV) control is accomplished by controlling all four steam generator ARVs from the control room. Steam generator blowdown is isolated by closing all four blowdown valves from the control room. All four source range neutron flux monitors are available.

Reactor coolant makeup is achieved using Train A CCP taking suction from the refueling water storage tank (RWST) and injecting water through the reactor coolant pump (RCP) seals and boron injection tank (BIT). Pressurizer level reduction due to uncontrolled cooldown through steam generator blowdown lines, steam generator atmospheric relief valves and main steam lines would not be caused by a fire in this area. No inventory reduction paths are affected by a fire in this area.

Decay heat removal is achieved using all three auxiliary feedwater pumps (AFPs), taking suction from the condensate storage tank (CST), and supplying all four steam generators. All four steam generator ARVs are available to control RCS temperature during hot standby. Main feedwater is isolated by closing the main feedwater isolation valves (MFIVs) from the control room. Diagnostic instrumentation is available to verify RCS temperature and pressure. Train A residual heat removal (RHR) system is available for transition from hot standby to cold shutdown.

A fire in this area will not prevent a safe shutdown of the plant.

## 8.27 FIRE AREA A-27 (ROD DRIVE/MG SET ROOM)

There are no 20 foot combustible and fire hazard free zones in fire area A-27. Fire area A-27 has automatic fire detection and a fixed automatic Halon fire suppression system installed.

PFSSD is assured using primarily Train B safety related and non-safety related equipment. However, since this area contains cables and equipment for both trains, Train A equipment may also be used.

Reactivity control is achieved by tripping the reactor from the control room. Boration is available using the Train B centrifugal charging pump (CCP) taking suction from the refueling water storage tank (RWST) and injecting borated water through the reactor coolant pump (RCP) seals. ~~However, Train B component cooling water (CCW) may need to be lined up manually to ensure return flow to the CCW Train B pump suction.~~ Main steam isolation is accomplished by closing the main steam isolation valves (MSIVs) from the control room. Steam generators A and D

atmospheric relief valve (ARV) control is accomplished using hand switches in the control room. Steam generators B and C ARVs may need to be controlled using the local controllers. Steam generator blowdown is isolated by closing all four blowdown valves from radwaste control room panel BM157. Source range neutron flux monitoring is available.

Reactor coolant makeup is achieved using the Train B CCP taking suction from the RWST and injecting water through the RCP seals and boron injection tank (BIT). ~~However, Train B component cooling water (CCW) may need to be lined up manually to ensure return flow to the CCW Train B pump suction.~~ Pressurizer level reduction could occur due to uncontrolled cooldown through all four steam generator blowdown lines and two steam generator atmospheric relief valves until operator action is taken to isolate these flow paths. Both pressurizer PORVs may spuriously open. One pressurizer PORV block valve can be closed from the control room. The other PORV will need to be closed by disconnecting 125 VDC power to fail close the PORV. No other inventory reduction paths are affected by a fire in this area.

Decay heat removal is achieved using the Train B motor driven auxiliary feedwater pump (MDAFP), taking suction from the condensate storage tank (CST), and supplying steam generators A and D. Steam generators A and D ARVs are available to control RCS temperature during hot standby. Main feedwater is isolated by closing the main feedwater isolation valves (MFIVs) from the control room. Diagnostic instrumentation is available to verify RCS temperature and pressure. Train B residual heat removal (RHR) is available for transition from hot standby to cold shutdown, however RHR pump suction may have to be lined up locally.

A fire in this area will not prevent safe shutdown of the plant.

## 8.28 FIRE AREA A-28 (AUXILIARY SHUTDOWN PANEL ROOM)

There are no 20 foot combustible and fire hazard free zones in fire area A-28. Fire area A-28 has automatic fire detection installed.

This fire area consists of two rooms that are separated by a 3-hour fire rated barrier. The North room contains the Train A auxiliary shutdown panel and the South room contains the Train B auxiliary shutdown panel. A fire in one room could impact the ability to achieve safe shutdown on the associated train, but the redundant train will remain available.

### 8.28.1 Fire Area A-28 North

PFSSD is assured using Train A and Train B safety related and non-safety related equipment.

Reactivity control is achieved by tripping the reactor from the control room. Boration is available using either Train A or Train B centrifugal charging pump (CCP) taking suction from the refueling water storage tank (RWST) and injecting borated water through the reactor coolant pump (RCP) seals. Main steam isolation is accomplished by closing the main steam isolation valves (MSIVs) from the control room. Steam generators B and D atmospheric relief valve (ARV) control is accomplished using the hand switches in the control room. Steam generators A and C ARVs may need to be closed locally. Steam generator blowdown is isolated by closing all four blowdown valves from the control room. All four source range neutron flux monitors are available.

Reactor coolant makeup is achieved using either the Train A or Train B CCP taking suction from the refueling water storage tank (RWST) and injecting water through the reactor coolant pump (RCP) seals or the boron injection tank (BIT). Pressurizer level reduction could occur due to uncontrolled cooldown through two steam generator ARVs until operator action is taken to isolate this flow path. A fire in this area could cause a loss of inventory through the letdown flow path. Letdown will automatically isolate when pressurizer level reaches 17%.
No other inventory reduction paths are affected by a fire in this area.

**Table A-16-3**
**Summary of Post Fire Safe Shutdown (PFSSD) Capability for Fire Area A-16 South**

| System | System Name | PFSSD Function* | Comments |
|---|---|---|---|
| AB | Main Steam | R, M, H, P, S | All PFSSD functions associated with the main steam system are satisfied.<br>ABHS0080 is available to close the MSIVs and MSIV bypass valves. |
| AC | Main Turbine | R, H | The PFSSD function(s) associated with this system is(are) not affected by a fire in area A-16 South. |
| AE | Main Feedwater | H, P | All PFSSD functions associated with the main feedwater system are satisfied.<br>A number of level indicators on all four steam generators could be affected. Level indication is available using the following indicators: SG A: AELI0501, AELI0518, AELI0551; SG B: AELI0502, AELI0528, AELI0529, AELI0552; SG C: AELI0503, AELI0538, AELI0539, AELI0553; SG D: AELI0548, AELI0554. |
| AL | Aux. Feedwater System | H, P | The PFSSD function(s) associated with this system is(are) not affected by a fire in area A-16 South. |
| AP | Condensate Storage System | H | The PFSSD function(s) associated with this system is(are) not affected by a fire in area A-16 South. |
| BB | Reactor Coolant System | R, M, H, P, S | All PFSSD functions associated with the reactor coolant system are satisfied.<br>Boration through all four RCP seals is unaffected. Loss of inventory through the head vent valves is prevented by maintaining valves BBHV8001A and BBHV8001B closed.<br>Pressurizer level indication is available using BBLI0459A. RCS wide range hot leg temperature element BBTE423A (Steam Generator B) and wide range cold leg temperature element BBTE433B (Steam Generator C) are available. RCS pressure indication is available using BBPI0405.<br>When transferring to RHR, valve BBPV8702A may need to be manually opened to provide a suction source from the RCS to RHR pump A.<br>A spurious SIS due to low pressurizer pressure on two out of four pressurizer pressure transmitters is averted by entering the EMG procedure network and, if necessary, placing EMHIS0004 and EMHIS0005 in pull-to-lock.<br>To mitigate a spurious opening of PORV BBPCV0456A and failure of block valve BBHV8000B to close, open breakers NK0404 and NK0405 to fail close the PORV. |
| BG | Chemical and Volume Control System | R, M, S | All PFSSD functions associated with the chemical and volume control system are satisfied.<br>Train A Centrifugal Charging Pump (CCP) is available to provide charging flow from the RWST to the RCP seals. Flow from the VCT can be isolated by closing either BGLCV0112B or BGLCV0112C. Valves BGHV8154A and BGHV8153B are maintained closed to isolate excess letdown.<br>Valve BGHV8112 may need to be isolated to prevent overheating the CCP. This may be necessary due to the potential for EGHV0053 to remain closed if swapping from Train B CCW to Train A CCW. |

**Table A-16-3**
**Summary of Post Fire Safe Shutdown (PFSSD) Capability for Fire Area A-16 South**

| System | System Name | PFSSD Function* | Comments |
|---|---|---|---|
| BM | Steam Generator Blowdown System | R, M, H | All PFSSD functions associated with the steam generator blowdown system are satisfied.<br>Steam generator blowdown is isolated by closing valves BMHV0001, BMHV0002, BMHV0003 and BMHV0004 using BMHIS0001C, BMHIS0002C, BMHIS0003C and BMHIS0004C, located on the BM157 panel in the radwaste control room. |
| BN | Borated Refueling Water Storage System | R, M, H | The RWST is available to provide a suction source to Centrifugal Charging Pump A via valve BNLCV0112D.<br>RWST level indicators BNLI0930 and BNLI0931 are available. When initiating RHR, flow from the RWST to RHR pump A can be isolated using BNHV8812A. |
| EF | Essential Service Water System | H, S | All PFSSD functions associated with the Essential Service Water (ESW) system are satisfied.<br>Train A ESW is available to supply cooling water to Auxiliary Feedwater Pump room cooler SGF02A, Containment Air Coolers SGN01A and SGN01C, Train A Component Cooling Water (CCW) Heat Exchanger, CCW A pump room cooler SGL11A, CCP A room cooler SGL12A and RHR A room cooler SGL10A. |
| EG | Component Cooling Water System | S | All PFSSD functions associated with the Component Cooling Water (CCW) system are satisfied.<br>Train A CCW is available to provide cooling water to the RHR A heat exchanger, the CCP A oil cooler, and the RHR pump A seal cooler. Either CCW pumps PEG01A or PEG01C are available. Temperature control valve EGTV0029 is unaffected by the fire.<br>Train A CCW flow to the service loop valve EGHV0053 may be affected. If the valve was closed at the time of the fire, it may not open using the control room hand switch. If this occurs operators should follow OFN EG-004 and maintain minimum flow through the RCP seals. In addition, operators should close seal return containment isolation valve BGHV8112 to prevent overheating the Train A CCP. |
| EJ | Residual Heat Removal System | M, H, P | All PFSSD functions associated with the Residual Heat Removal (RHR) system are satisfied.<br>Loss of RCS inventory through the RHR flow path is prevented by maintaining valves EJHV8701A and EJHV8701B closed.<br>RHR Train A is available via RCS suction valve EJHV8701A and discharge valves EJHCV0606 and EJHV8809A.<br>RHR pump A mini-flow valve EJFCV0610 is available.<br>RHR system flow diagnostic instrumentation is available using various available temperature indicators. |
| EM | High Pressure Coolant Injection | R, M | All PFSSD functions associated with the High Pressure Coolant Injection system are satisfied.<br>A spurious SI signal is averted by entering the EMG procedure network and, if necessary, placing EMHIS0004 and EMHIS0005 in pull-to-lock. |
| EN | Containment Spray | R, M | The PFSSD function(s) associated with this system is(are) not affected by a fire in area A-16 South. |

panel RL017. Indication in the Control Room for SI and CS pump operation is unaffected by a fire in A-16.

### 3.2.3 Mitigation of RWST Draindown to Containment Sump

If a fire occurs in area A-16 South, it may be necessary to close valve BNHV8812B from the control room using BNHIS8812B to mitigate draindown of the RWST into the containment sump. This condition could occur due to EJHV8811B spuriously opening and valve BNHV8812B not responding to an automatic close signal, as indicated by a reducing inventory in the RWST.

### 3.2.4 Main Steam Isolation Valves (MSIVs) and MSIV Bypass Valves

If a fire occurs in area A-16 North or South, cables for fast close hand switch ABHS0079 may be damaged by the fire. Cables for redundant fast close hand switch ABHS0080 are unaffected. Use ABHS0080 to fast close the MSIVs and MSIV bypass valves.

### 3.2.5 Charging Pumps to Regenerative Heat Exchanger Isolation

Valve BGHV8105 may not function due to a fire in the North section. Valve BGHV8106, and its hand switch (BGHIS8106), are unaffected by a fire in area A-16 and can be used to isolate flow to the regenerative heat exchanger and therefore satisfy the PFSSD requirement.

### 3.2.6 Main Feedwater Isolation Valves (MFIVs)

If a fire occurs in area A-16 North, cables for fast close hand switch AEHS0081 may be damaged. Cables for redundant fast close hand switch AEHS0080 are unaffected. Use AEHS0080 to fast close the MFIVs.

### 3.2.7 Seal Water Return Flow

If the fire is in A-16 South and Train B CCW is operating at the time of the fire, it may be necessary to swap to Train A CCW. In this case, valve EGHV0053 may not open. Operators should maintain 32 gpm flow to the RCP seals and isolate seal return containment isolation valve BGHV8112 using BGHIS8112 per OFN EG-004.

## 3.3 Actions to Achieve and Maintain Cold Shutdown

### 3.3.1 RHR

If either valve BBPV8702A (fire in A-16 South) or BBPV8702B (fire in A-16 North) fails to respond when initiating RHR for cold shutdown, make a containment entry to manually open the valve or perform a cold shutdown repair to fix the damaged circuit.

### 3.3.2 SI Accumulators

A fire in area A-16 South may require a containment entry to close SI Accumulator injection valves EPHV8808B and EPHV8808D if these valves are unresponsive from the control room.

## 4.0 CONCLUSION

With some exceptions, redundant Post-Fire Safe Shutdown capability exists if a severe fire occurs in this area. For those exceptions, feasible manual actions are available and are unaffected by the fire. Manual actions are documented in Section 3.0.

## 5.0 DETAILED ANALYSIS

This section describes the detailed component-by-component and cable-by-cable analysis for a fire in area A-16.

References: E-15000, XX-E-013, M-12EG02, E-1F9401A, E-1R1413B, E-1R1413D, E-1R1423C, E-13EG07

### 5.1.9 Component Cooling Water Common Header Return Valves

Valve EGHV0015 is the Train A CCW Common Header Return Valve. Valve EGHV0016 is the Train B CCW Common Header Return Valve. PFSSD requires that the valve on the operating CCW Train be open.

Valve EGHV0015 is located in area A-16 North in room 1408. Cables 11EGG05AA and 11EGG05AB are power and control cables, respectively, for EGHV0015 and are run in area A-16 North. Consequently, a fire in area A-16 North could cause a loss of the A Train CCW common header return valve but the B Train CCW common header return valve (EGHV0016) remains available.

Valve EGHV0016 is located in area A-16 South in room 1402. Cables 14EGG05BD, 14EGG05BE, 14EGG05BF and 14EGG05BG, associated with EGHV0016, are run in area A-16 South. Cables 14EGG05BD and 14EGG05BE are also run in the combustible free zone between areas A-16 South and A-16 North as well as A-16 North. These cables are fire resistive and will not be affected by a postulated exposure fire. Cables 14EGG05BF and 14EGG05BG are not fire resistive and could be damaged by an exposure fire. Consequently, a fire in area A-16 South could cause a loss of the B Train CCW common header return valve but the A Train CCW common header return valve (EGHV0015) remains available.

It may not be possible to isolate one train from the other due to cable damage, but per calculation M-EG-24, the system will continue to operate with no damage to the pumps if the opposite train valve is not closed.

Based on the above discussion, a fire in this area will not adversely impact CCW common header return valve on the credited train.

References: E-15000, XX-E-013, E-13EG05A, E-1F9401A, E-1R1413B, E-1R1413D, E-1R1423C, M-12EG01, Calculation M-EG-24, CP 12418

### 5.1.10 Auxiliary Relay Rack RP210

RP210 is an Auxiliary Relay Rack located in room 1402. This relay rack houses PFSSD relays 3XBM9, 3XBM10, 3XBM11, 3XBM12 and 94XAB6. Relays 3XBM9, 3XBM10, 3XBM11 and 3XBM12 are associated with the Steam Generator Blowdown to Blowdown Flash Tank Isolation Valves BMHV0001, BMHV0002, BMHV0003 and BMHV0004, respectively. Relay 94XAB6 is associated with Main Steam Isolation Bypass Valves ABHV0012, ABHV0015, ABHV0018 and ABHV0021.

Redundant relay rack RP209 is located in a different fire area (A-8) and is unaffected by a fire in A-16. In addition, relay rack RP211 is located in fire area A-1 and is unaffected by a fire in A-16.

For an evaluation of the cables associated with these components, see Section 5.2.

References: E-15000, XX-E-013, E-1F9101

### 5.1.13 Auxiliary Relay Rack RP333

RP333 is an Auxiliary Relay Rack located in area A-16 South in room 1408. This relay rack houses PFSSD relay 62TDENB03, Degraded Voltage Trip Block Relay. PFSSD requires that either this relay or relay K617 be available to ensure off-site power is available to NB02.

Relay K617 is located in panel SB032C in fire area C-27 (room 3605) and is unaffected by a fire in area A-16.

Based on Calculation XX-E-013, Appendix 2, off-site power is available using NB01 or NB02 for a fire in area A-16.

For an evaluation of the cables associated with this component, see Section 5.2.

References: E-15000, XX-E-013

### 5.1.14 Component Cooling Water to Nuclear Auxiliary Components

Valve EGHV0053 is the Train A CCW supply to the service loop. Valve EGHV0054 is the Train B CCW supply to the service loop. The valve on the operating CCW train is required to be open to ensure CCW flow to the seal water heat exchanger and thermal barrier cooling coils on all four reactor coolant pumps. The valve on the non-operating CCW train can remain open because check valves EGV0036 and EGV0061 will prevent flow diversion to the non-operating train.

Valve EGHV0053 is located in area A-16 South. Valve EGHV0054 is also located in area A-16 South. Therefore, a fire in area A-16 South could prevent operation of one or both valves.

If the fire occurs in A-16 North, valves EGHV0053 and EGHV0054 are unaffected. Cables 14EGG05DE and 14EGG05DF, associated with EGHV0054, are run in area A-16 North but these cables are fire resistance rated (see CP 12418) and have been tested to maintain their integrity during a postulated fire. Consequently, Train B CCW can be used, valve EGHV0054 can be opened and EGHV0053 can be closed.

If the fire occurs in area A-16 South and Train A CCW is operating at the time of the fire, the valves will be in their proper lineup (EGHV0053 open and EGHV0054 closed) and damage to cables 11EGG05CA and 11EGG05CB will not cause EGHV0053 to close. Therefore, in this case, PFSSD is assured.

If the fire occurs in area A-16 South and Train B CCW is operating at the time of the fire, it may be necessary for operators to swap to Train A CCW. However, valve EGHV0053 would be in the closed position and may not be operable because of cable damage. The Train A CCW system is unaffected but CCW flow to the seal water heat exchanger may not be available.

PIR 2003-1925 evaluated the case where CCW to the seal water heat exchanger is unavailable. Based on the results of the evaluation, the CCP would remain operable as long as the seal return flowpath is isolated and CCW is available to the CCP oil cooler. In this scenario, the CCP is flowing minimum flow to the RCP seals and excess flow is re-circulating back to the pump suction. A fire in area A-16 South does not affect valve BGHV8112. Therefore, operators could isolate seal return using BGHIS8112 in the control room.

Based on the above discussion, a fire in area A-16 will not adversely impact the ability to achieve and maintain safe shutdown.

~~Valves EGHV0053 and EGHV0054 provide isolation capability of Train A and Train B CCW flow to Radwaste Building and Containment Building CCW loads, as well as the letdown heat exchanger. The valve on the operating CCW train is required to be open only if RCP thermal~~

~~barrier cooling is needed in the event of a loss of seal injection. Otherwise, the position of these valves is not critical to PFSSD since isolation of CCW is accomplished by alternative means.~~

~~A fire in area A-16 will not impact seal injection. Therefore, thermal barrier cooling is not required and spurious operation of EGHV0053 or EGHV0054 will have no adverse impact on PFSSD.~~

References: E-15000, XX-E-013, E-13EG05B, E-13EG05D, E-1F9303, M-12BG01, M-12EG02, PIR 2003-1925, CP 12418

## 5.2 PFSSD CABLE EVALUATION

Table A-16-5 lists all the PFSSD cables (S. in E-15000) located in fire area A-16. The applicable evaluation section is listed in Table A-16-5.

**Table A-16-5**
**PFSSD Cables Located in Fire Area A-16**

| Cable # | Location (N) North (S) South | Primary PFSSD Equipment | Cable Function (P) Power, (C) Control (I) Instrumentation | Eval. Sect. | Comments |
|---|---|---|---|---|---|
| 14EFG04BA | S | EFHV0060 | P | 5.1.4 | ESW B Return from CCW B |
| 14EFG04BB | S | EFHV0060 | C | 5.1.4 | ESW B Return from CCW B |
| 14EFG05BA | S | EFHV0052 | P | 5.1.4 | ESW B to CCW B |
| 14EFG05BB | S | EFHV0052 | C | 5.1.4 | ESW B to CCW B |
| 14EFG07BC | S | EFHV0032 | C | 5.2.23 | Train B Containment Cooler |
| 14EFG08BC | S | EFHV0050 | C | 5.2.23 | Train B Containment Cooler |
| 14EFG09BC | S | EFHV0034 | C | 5.2.23 | Train B Containment Cooler |
| 14EFG09DC | S | EFHV0046 | C | 5.2.23 | Train B Containment Cooler |
| 14EGB01BA | S | DPEG01B | P | 5.1.1 | CCW Pump B Motor |
| 14EGB01DA | S | DPEG01D | P | 5.1.1 | CCW Pump D Motor |
| ~~14EGG05BA~~ | ~~S~~ | ~~EGHV0016~~ | ~~P~~ | ~~5.1.9~~ | ~~CCW B Common Header Return~~ |
| ~~14EGG05BB~~ | ~~S~~ | ~~EGHV0016~~ | ~~C~~ | ~~5.1.9~~ | ~~CCW B Common Header Return~~ |
| **14EGG05BD** | **S** | **EGHV0016** | **P** | **5.1.9** | **CCW B Common Header Return** |
| **14EGG05BE** | **S** | **EGHV0016** | **C** | **5.1.9** | **CCW B Common Header Return** |
| **14EGG05BF** | **S** | **EGHV0016** | **P** | **5.1.9** | **CCW B Common Header Return** |
| **14EGG05BG** | **S** | **EGHV0016** | **C** | **5.1.9** | **CCW B Common Header Return** |
| ~~14EGG05DA~~ | ~~S~~ | ~~EGHV0054~~ | ~~P~~ | ~~5.1.14~~ | ~~CCW B to Nuclear Aux Components~~ |
| ~~14EGG05DB~~ | ~~S~~ | ~~EGHV0054~~ | ~~C~~ | ~~5.1.14~~ | ~~CCW B to Nuclear Aux Components~~ |
| **14EGG05DE** | **S** | **EGHV0054** | **C** | **5.1.14** | **CCW B to Nuclear Aux Components** |
| **14EGG05DF** | **S** | **EGHV0054** | **P** | **5.1.14** | **CCW B to Nuclear Aux Components** |
| **14EGG05DG** | **S** | **EGHV0054** | **P** | **5.1.14** | **CCW B to Nuclear Aux Components** |
| **14EGG05DH** | **S** | **EGHV0054** | **C** | **5.1.14** | **CCW B to Nuclear Aux Components** |

**Table A-21-4**
**PFSSD Cables Located in Fire Area A-21**

| Cable # | Location | Primary PFSSD Equipment | Cable Function (P) Power (C) Control (I) Instrumentation | Evaluation Section | Comments |
|---|---|---|---|---|---|
| 14EFG05BC | 1501 | EFHV0052 | C | 5.2.16 | ESW B to CCW Hx B Isolation Valve |
| 14EGG05BA | 1501 | EGHV0016 | P | 5.2.17 | CCW B Return from Nuclear Aux Components |
| 14EGG05BB | 1501 | EGHV0016 | C | 5.2.17 | CCW B Return from Nuclear Aux Components |
| 14EGG05BC | 1501 | EGHV0016 | C | 5.2.17 | CCW B Return from Nuclear Aux Components |
| **14EGG05BD** | **1501** | **EGHV0016** | **P** | **5.2.17** | **CCW B Return from Nuclear Aux Components** |
| **14EGG05BE** | **1501** | **EGHV0016** | **C** | **5.2.17** | **CCW B Return from Nuclear Aux Components** |
| 14EGG05DA | 1501 | EGHV0054 | P | 5.2.17 | CCW B to Nuclear Aux Components |
| 14EGG05DB | 1501 | EGHV0054 | C | 5.2.17 | CCW B to Nuclear Aux Components |
| 14EGG05DC | 1501 | EGHV0054 | C | 5.2.17 | CCW B to Nuclear Aux Components |
| **14EGG05DE** | **1501** | **EGHV0054** | **C** | **5.2.17** | **CCW B to Nuclear Aux Components** |
| **14EGG05DF** | **1501** | **EGHV0054** | **P** | **5.2.17** | **CCW B to Nuclear Aux Components** |
| 14EGG07BA | 1501 | EGHV0102 | P | 5.2.17 | CCW B to RHR B Heat Exchanger |
| 14EGG07BB | 1501 | EGHV0102 | C | 5.2.17 | CCW B to RHR B Heat Exchanger |
| 14EGG07BC | 1501 | EGHV0102 | C | 5.2.17 | CCW B to RHR B Heat Exchanger |
| 14EGG09CA | 1501 | EGHV0071 | P | 5.2.17 | CCW to RCP Thermal Barrier |
| 14EGG09CB | 1501 | EGHV0071 | C | 5.2.17 | CCW to RCP Thermal Barrier |
| 14EGG09CC | 1501 | EGHV0071 | C | 5.2.17 | CCW to RCP Thermal Barrier |
| 14EGG18BA | 1501 | EGHV0127 | P | 5.2.17 | CCW to RCP Thermal Barrier |
| 14EGG18BB | 1501 | EGHV0127 | C | 5.2.17 | CCW to RCP Thermal Barrier |
| 14EGG18DA | 1501 | EGHV0133 | P | 5.2.17 | CCW from RCP Thermal Barrier |
| 14EGG18DB | 1501 | EGHV0133 | C | 5.2.17 | CCW from RCP Thermal Barrier |

Cables associated with Train A ESW to/from CCW valves are run in a different fire area and are unaffected by a fire in area A-21.

Based on the above discussion, at least one Train of ESW to CCW valves will be available if a fire occurs in area A-21.

References: E-15000, XX-E-013, E-13EF04, E-13EF05, M-12EF02

### 5.2.17 Component Cooling Water

Cables associated with components on the Train B CCW system run through area A-21. Damage to these cables due to a fire could prevent operation of the associated equipment and prevent operation of Train B CCW. Cables associated with redundant Train A CCW are run in a different fire area and are unaffected by the fire.

As discussed in Section 5.2.10, RCP seal injection may be lost if a fire occurs in this area. The CCW system is an alternate means of providing seal cooling. Therefore, the CCW to thermal barrier cooling coil flow path needs to be available if a fire occurs in area A-21 to ensure adequate seal cooling. To ensure an operable flow path, either valves EGHV0071 or EGHV0126 must be open and either EGHV0058 or EGHV0127 must be open. In addition, either valves EGHV0062 or EGHV0132 must be open and either EGHV0061 or EGHV0133 must be open. Also, valves EGHV0015 and EGHV0053 need to be open when operating the Train A CCW system and valves EGHV0016 and EGHV0054 need to be open when operating the Train B CCW system to ensure a flow path to and from the service loop.

Cables associated with valves EGHV0016, EGHV0054, EGHV0071, EGHV0127 and EGHV0133 run through area A-21. Cables associated with other thermal barrier cooling flow path valves are unaffected by the fire. If the fire affects cables associated with EGHV0071, the valve may spuriously close. If seal injection is lost and valve EGHV0071 closes, then a loss of all seal cooling has occurred. Operators need to immediately open valve EGHV0126 or use natural circulation cooldown. Valve EGHV0126 and hand switch EGHIS0126 are unaffected by the fire.

If natural circulation cooldown is used, operators will need to isolate the CCW system from the thermal barrier to prevent steam voids in the CCW piping that could result in rupture of the piping due to water hammer. The CCW return flowpath can be isolated by closing valve EGHV0062 and maintaining valve EGHV0132 closed. These valves are unaffected by the fire.

Cables associated with Train B CCW pump room cooler SGL11B are run in area A-21. Damage to these cables could cause a loss of capability to cool the Train B CCW pumps. The Train A CCW pump room cooler is unaffected by the fire since cables for this unit are not run in area A-21.

Based on the above discussion, Train A CCW is available to provide cooling to essential PFSSD components.

References: E-15000, XX-E-013, E-1F9303, E-13EG05A, E-13EG05B, E-13EG07, E-13EG09, E-13EG16, E-13EG18, E-13EG18A, E-13GL06

**Table A-27-2**
**Summary of Post Fire Safe Shutdown (PFSSD) Capability for Fire Area A-27**

| System | System Name | PFSSD Function* | Comments |
|---|---|---|---|
| EF | Essential Service Water System | H, S | All PFSSD functions associated with the Essential Service Water (ESW) system are satisfied.<br>Train A ESW is available to supply cooling water to Containment Air Coolers SGN01A and SGN01C. Train B ESW is available to supply cooling to the Train B Component Cooling Water (CCW) Heat Exchanger, Train B Motor Driven Auxiliary Feedwater (MDAFW) pump room cooler, CCW B pump room cooler SGL11B, Train B Centrifugal Charging Pump (CCP) room cooler SGL12B and Train B Residual Heat Removal (RHR) pump room cooler SGL10B. |
| EG | Component Cooling Water System | S | Train B CCW is available. Train A pumps could be lost due to damage to the power cables.<br>~~In the event of a fire in area A-27, valve EGHV0016 can be manually opened locally, if necessary, to ensure return flow to the CCW Train B pump suction.~~<br>~~In the event of a fire in area A-27, valve EGHV0054 can be manually opened locally, if necessary, to ensure CCW flow to the seal water heat exchanger.~~<br>It may be necessary to either perform a cold shutdown repair or manually open valve EGHV0102 when transitioning to RHR Train B.<br>A spurious low discharge pressure on Train B discharge pressure transmitter may cause transfer to the standby CCW pump on Train B. If this occurs, both pumps will continue to operate. Since the pressure transmitter may be lost, it may be necessary to have an operator monitor the discharge pressure using a local pressure indicator.<br>Train B temperature control valve EGTV0030 may not close as desired for PFSSD. However, this valve is designed to modulate based on CCW outlet temperature, which is acceptable for PFSSD. |
| EJ | Residual Heat Removal System | M, H, P | All PFSSD functions associated with the Residual Heat Removal (RHR) system are satisfied.<br>Loss of RCS inventory through the RHR flow path is prevented by maintaining valves EJHV8701A and EJHV8701B closed.<br>RHR Train B is available via RCS suction valve EJHV8701B and discharge valve EJHV8809B.<br>Valve EJHCV0607 may need to be manually re-opened if the fire causes the valve to close.<br>A cold shutdown repair or manual action may be necessary to control valve EJFCV0611.<br>RHR system flow diagnostic instrumentation is available using various available temperature indicators. |
| EM | High Pressure Coolant Injection | R, M | All PFSSD functions associated with the High Pressure Coolant Injection system are satisfied.<br>A spurious SI signal is averted by entering the EMG procedure network and, if necessary, placing EMHIS0004 and EMHIS0005 in pull-to-lock. |

## 3.0 ACTIONS TO ACHIEVE AND MAINTAIN PFSSD

This section describes operator actions that may need to be performed inside or outside the control room to achieve and maintain hot standby if a fire occurs in area A-27. This section also describes cold shutdown repairs that may need to be made to achieve and maintain cold shutdown conditions. Operator actions are proceduralized in OFN KC-016.

## 3.1 ACTIONS OUTSIDE THE MCR TO ACHIEVE AND MAINTAIN HOT STANDBY

### 3.1.1 Class 1E A/C Units

If SGK05A and SGK05B spuriously stop or cannot be started due to loss of power to the associated fire signal isolation relay, manually start SGK05B by closing GKHS0103, located in room 1501. This may require entering SYS GK-200 to supply cooling to Train A electrical equipment rooms.

### ~~3.1.2 Component Cooling Water~~

~~It may be necessary to manually open valve EGHV0016 to ensure return flow to the CCW Train B pump suction. It may also be necessary to locally monitor the Train B CCW pump discharge pressure due to damage to pressure transmitter EGPT0078 cable.~~

### 3.1.3 Steam Generator Atmospheric Relief Valves

Cables associated with SGARVs ABPV0002 and ABPV0003 may be damaged, preventing control of these valves from the control room. Local controllers ABFHC0002 and ABFHC0003, located in fire area A-23, can be used to close ARVs ABPV0002 and ABPV0003, respectively.

### 3.1.4 Pressurizer PORV/Block Valve

A spuriously open PORV BBPCV0456A and stuck open block valve BBHV8000B can be mitigated by removing power to the PORV by opening breakers NK0404 and NK0405 to fail the PORV closed and prevent an external cable hot short from opening the PORV. These breakers are located in the Control Building elevation 2016-0.

### 3.1.5 Steam Generator Blowdown to Blowdown Flash Tank Isolation

If a fire occurs in area A-27, cables for BMHIS0001A, BMHIS0002A, BMHIS0003A and BMHIS0004A may be damaged by the fire. Therefore, use BMHIS0001C, BMHIS0002C, BMHIS0003C and BMHIS0004C located on the BM157 panel in the Radwaste Control Room to close valves BMHV0001, BMHV0002, BMHV0003, and BMHV0004.

## 3.2 ACTIONS INSIDE THE MCR TO ACHIEVE AND MAINTAIN HOT STANDBY

### 3.2.1 Pressurizer PORV/Block Valve

If PORV BBPCV0455A spuriously opens, as evidenced by an unexpected reduction in pressure or level in the pressurizer, close block valve BBHV8000A using BBHIS8000A.

### 3.2.2 Reactor Trip Switchgear

If the reactor does not trip using SBHS0001 or SBHS0042, enter EMG FR-S1 to trip the reactor.

**Table A-27-4**
**PFSSD Cables Located in Fire Area A-27**

| Cable # | Location | Primary PFSSD Equipment | Cable Function (P) Power (C) Control (I) Instrumentation | Evaluation Section | Comments |
|---|---|---|---|---|---|
| 14BMK06CC | 1403 | BMHV0003 | C | 5.2.23 | SG C to Blowdown Flash Tank Isolation Valve |
| 14BMK06DC | 1403 | BMHV0004 | C | 5.2.23 | SG D to Blowdown Flash Tank Isolation Valve |
| 14BNG03BE | 1403 | BNHV8812B | C | 5.2.18 | RWST to RHR Pump B Suction Valve |
| 14BNI07FA | 1403 | BNLT0933 | I | 5.2.18 | RWST Level Transmitter |
| 14EFG07BC | 1403 | EFHV0032 | C | 5.2.24 | Service Water to Train B Containment Coolers |
| 14EFG08BC | 1403 | EFHV0050 | C | 5.2.24 | Service Water to Train B Containment Coolers |
| 14EFG09BC | 1403 | EFHV0034 | C | 5.2.24 | Service Water to Train B Containment Coolers |
| 14EFG09DC | 1403 | EFHV0046 | C | 5.2.24 | Service Water to Train B Containment Coolers |
| 14EGB01BA | 1403 | DPEG01B | P | 5.2.3 | CCW Pump B Motor (Embedded in concrete) |
| 14EGB01DA | 1403 | DPEG01D | P | 5.2.3 | CCW Pump D Motor (Embedded in concrete) |
| ~~14EGG05BA~~ | ~~1403~~ | ~~EGHV0016~~ | ~~P~~ | ~~5.2.4~~ | ~~CCW B Common Header Return~~ |
| ~~14EGG05BB~~ | ~~1403~~ | ~~EGHV0016~~ | ~~C~~ | ~~5.2.4~~ | ~~CCW B Common Header Return~~ |
| ~~14EGG05DA~~ | ~~1403~~ | ~~EGHV0054~~ | ~~P~~ | ~~5.2.28~~ | ~~CCW B to Nuclear Aux Components~~ |
| ~~14EGG05DB~~ | ~~1403~~ | ~~EGHV0054~~ | ~~C~~ | ~~5.2.28~~ | ~~CCW B to Nuclear Aux Components~~ |
| 14EGG07BA | 1403 | EGHV0102 | P | 5.2.5 | CCW To RHR Heat Exchanger B Isolation Valve |
| 14EGG07BB | 1403 | EGHV0102 | C | 5.2.5 | CCW To RHR Heat Exchanger B Isolation Valve |
| 14EGG10AC | 1403 | EGHV0062 | C | 5.2.6 | CCW Return from RCP Thermal Barrier |
| 14EGG18BC | 1403 | EGHV0127 | C | 5.2.6 | CCW HX Out to RCS Bypass Isolation |
| 14EGG18BD | 1403 | EGHV0127 | C | 5.2.6 | CCW HX Out to RCS Bypass Isolation |
| 14EGG18DC | 1403 | EGHV0133 | C | 5.2.6 | EGHV0061 Bypass Valve |
| 14EGG18DD | 1403 | EGHV0133 | C | 5.2.6 | EGHV0061 Bypass Valve |

### 5.2.3 Component Cooling Water Pumps and Room Coolers

DPEG01A, DPEG01B, DPEG01C and DPEG01D are motors for Component Cooling Water (CCW) Pumps A (PEG01A), B (PEG01B), C (PEG01C) and D (PEG01D). PEG01A and PEG01C circulate cooling water to essential components through the Train A Component Cooling Water (CCW) heat exchanger (EEG01A). PEG01B and PEG01D circulate cooling water to essential components through the Train B Component Cooling Water (CCW) heat exchanger (EEG01B). Each CCW Pump can supply 100 percent of the required cooling water to selected Engineered Safety Features (ESF) components.

Cables 11EGB01AA and 11EGB01CA are power cables for the Train A CCW pump motors and run in cable tray through fire area A-27. A fire in area A-27 could damage these cables and prevent operation of one or both pump motors. Damage to any of these cables will result in a breaker trip and loss of power to the associated CCW pump. Loss of power will be indicated in the Control Room on panel RK045A. Operators can use hand switches on RL019 to start another pump. Cables associated with Control Room alarms (11EGR13NA, 11EGR13PA) and hand switches (11EGB01AB, 11EGB01CB) do not run through area A-27.

Power cables for redundant Train B pump motors (14EGB01BA and 14EGB01DA) are run in two separate conduits that are embedded in the concrete wall between the Auxiliary Building and the Control Building. The conduits and cables are sufficiently protected by the concrete embedment such that a fire in area A-27 will not damage either of the cables. Therefore, power to the Train B CCW pumps is available if a fire occurs in area A-27.

Power and control cables for Train B CCW pump room coolers are run in tray in the far South portion of area A-27. Damage to these cables will result in the loss of room cooling for the Train B CCW pump motors. Since Train B CCW is relied on for a fire in area A-27, the Train B CCW pumps need to be operable. PIR 2000-2646 was written to document and evaluate this condition. Calculation GL-M-006 was prepared to evaluate the area temperature on the 2026'-0" elevation of the Auxiliary Building in the event of a loss of the Trains A and B CCW pump room coolers. The calculation also assumes a loss of non-safety related ventilation in the area.

Based on Calculation GL-M-006, the maximum temperature on the 2026'-0" elevation of the auxiliary building, under the conditions stated above, is 123.7°F. Each CCW pump motor is designed to operate continuously at 122°F. The PIR evaluation states that a room temperature less than 2°F higher than the operating temperature of the motor will not have a significant impact on the operation of the motor. Consequently, based on Calculation GL-M-006 and PIR 2000-2646, a loss of CCW pump room cooling will not result in a loss of CCW.

References: E-15000, XX-E-013, E-1F9401A, E-0R1422, E-1R1421, E-1R1423B, E-13GL06, E-13EG01C, E-13EG01D, E-13NB02, E-13NB05, M-12EG01, GL-M-006, PIR 2000-2646, E-012.2-015-04

### 5.2.4 Deleted

~~**Component Cooling Water (CCW) Train B Common Header Return Isolation Valve**~~

~~Valve EGHV0016 is the CCW Train B common header return isolation valve to the suction side of both Train B CCW pumps. This valve is required to be open when using Train B CCW. Power and control cables for this valve are run through fire area A-27 in a common cable tray at the South end of the area.~~

~~Cable 14EGG05BA is the power cable for valve EGHV0016. Damage to this cable could prevent operation of the valve from the control room. Cable 14EGG05BB is a control cable for valve EGHV0016. Damage to this cable could either prevent operation of the valve from the control room or bypass the limit switch, possibly causing damage to the valve motor.~~

~~As discussed in Section 5.2.3, power for the Train A CCW pumps could be lost if a fire occurs in area A-27. The cable tray carrying power cables for Train A CCW pumps is located between column lines A3 and A4. The cable tray carrying power and control cables for valve EGHV0016 is located at column line A6. There is approximately 50 feet of horizontal separation between the trays. The room is provided with automatic fire suppression (Halon) and detection. The fire hazard classification in the area, given the maximum quantity of transient combustibles, is low. Intervening combustibles consist of the rod drive control cabinets and reactor trip switchgear. This equipment is enclosed in metal cabinets and presents a limited intervening combustible hazard. In addition, cable trays provided with metal enclosures are run through this area. The metal enclosures are sufficient to eliminate the combustible hazard presented by the enclosed cables.~~

~~Based on the above discussion, there is reasonable assurance that a single credible fire in area A-27 will not result in the loss of both trains of CCW. If the fire is on the North end of the room, it is unlikely that it will affect the power and control cables for EGHV0016, based on the fire protection features discussed above. If the fire occurs on the south end, power and control cables for EGHV0016 could be damaged but the valve can be manually opened in area A-16, if necessary.~~

~~In the event of a fire in area A-27, valve EGHV0016 can be manually opened, if necessary, to ensure return flow to the CCW pump suction.~~

~~References: E-15000, XX-E-013, E-1F9401A, E-13EG05A, E-1R1421, M-12EG01~~

### 5.2.5 Train B CCW to RHR Heat Exchanger Control Valve

Valve EGHV0102 is the Train B CCW to RHR Heat Exchanger Control Valve. This valve is required to be open when using Train B CCW to supply cooling water to the Train B RHR heat exchanger during cold shutdown. The valve is normally closed during power operations.

Cable 14EGG07BA is the power cable for valve EGHV0102. Damage to this cable could prevent operation of the valve from the control room. Cable 14EGG07BB is a control cable for valve EGHV0102. Damage to this cable could either prevent operation of the valve from the control room or bypass the limit switch, possibly causing damage to the valve motor.

Damage to either cable will not cause valve EGHV0102 to spuriously open. This valve is not a Hi/Low pressure interface valve, so consideration of a 3-phase hot short is not required. Damage to the control cable in any manner is not sufficient to spuriously open the valve.

During cold shutdown, it may be necessary to either perform a cold shutdown repair or manually open valve EGHV0102 in fire area A-16 when transitioning to RHR Train B.

References: E-15000, XX-E-013, E-1F9401A, E-13EG07, E-1R1421, M-12EG02

### 5.2.6 Thermal Barrier Cooling Isolation Valves

PFSSD requires isolation of the CCW system from each RCP thermal barrier whenever a fire-induced loss of all seal cooling occurs. However, as long as at least one seal cooling method (seal injection or thermal barrier cooling) is available and is unaffected by the fire, the CCW system can remain lined-up to the RCP thermal barriers with no adverse impact on PFSSD.

A fire in area A-27 may cause a loss of Train A CCW due to damage to power cables associated with the CCW pumps. Both trains of CCPs remain available. If Train A CCW is operating at the time of the fire, the Train B CCW system can be lined up from the control room. The Normal Charging Pump (NCP) would likely be operating at the time of the fire. Although the NCP is not a PFSSD component, a review of associated cable (15BGB37BA,

Since the breakers for these valves are normally open, damage to these cables will not cause the valve to spuriously change position. However, damage to the cables will prevent closing the associated valve from the control room, when necessary, after power is restored.

The SI accumulators need to be isolated during cold shutdown, prior to the RCS reaching 1000 psig. If necessary, a containment entry can be made to manually close the valves.

A fire in area A-27 may require a containment entry to close valves EPHV8808B and EPHV8808D if these valves are unresponsive from the control room.

References: E-15000, XX-E-013, E-13EP02A, M-12EP01

### 5.2.27 PFSSD Equipment Power Availability

PFSSD requires that one train of electrical systems required to power PFSSD components be available and be unaffected by a fire. Cable 14NBB14AD is a control cable for relay 62TDENB03. Damage to this cable could cause a spurious degraded voltage signal which could result in a loss of off-site power to bus NB02. If this occurs, the Train B Emergency Diesel Generator is available to power NB02.

A fire in area A-27 could result in a loss of off-site power. The Train B diesel generator is available to supply power to Train B safety-related and non-safety related PFSSD equipment.

References: E-15000, XX-E-013, E-1F9426, E-13NB14

### ~~5.2.28 Component Cooling Water to Nuclear Auxiliary Components~~

~~Valves EGHV0053 and EGHV0054 provide isolation capability of Train A and Train B CCW flow to Radwaste Building and Containment Building CCW loads, as well as the letdown heat exchanger. The valve on the operating CCW train is required to be open only if RCP thermal barrier cooling is needed in the event of a loss of seal injection. Otherwise, the position of these valves is not critical to PFSSD since isolation of CCW is accomplished by alternative means.~~

~~Power and control cables associated with Train B CCW valve EGHV0054 are run in area A-27. As stated earlier, Train A CCW may not be available due to damage to Train A CCW pump power cables. Damage to the power and control cables will prevent operation of the valve but will not cause the valve to spuriously operate.~~

~~A fire in area A-27 will not impact seal injection. Therefore, thermal barrier cooling is not required and spurious operation of EGHV0054 will have no adverse impact on PFSSD.~~

~~References: E-15000, XX-E-013, E-13EG05B, E-1F9303, M-12EG02~~

**Table C-23-3**
**PFSSD Cables Located in Fire Area C-23**

| Cable # | Location | Primary PFSSD Equipment | Cable Function (P) Power (C) Control (I) Instrumentation | Evaluation Section | Comments |
|---|---|---|---|---|---|
| 14EFI11FA | 3505 | EFFT0054 | I | 5.2.21 | Train B ESW Flow Transmitter |
| 14EGB01BB | 3505 | DPEG01B | C | 5.2.10 | CCW Pump B Motor |
| 14EGB01BC | 3505 | DPEG01B | C | 5.2.10 | CCW Pump B Motor |
| 14EGB01BD | 3505 | DPEG01B | C | 5.2.10 | CCW Pump B Motor |
| 14EGB01BG | 3505 | DPEG01B | C | 5.2.10 | CCW Pump B Motor |
| 14EGB01BK | 3505 | DPEG01B | C | 5.2.10 | CCW Pump B Motor |
| 14EGB01DB | 3505 | DPEG01D | C | 5.2.10 | CCW Pump D Motor |
| 14EGB01DC | 3505 | DPEG01D | C | 5.2.10 | CCW Pump D Motor |
| 14EGB01DD | 3505 | DPEG01D | C | 5.2.10 | CCW Pump D Motor |
| 14EGB01DG | 3505 | DPEG01D | C | 5.2.10 | CCW Pump D Motor |
| ~~14EGG05BA~~ | ~~3505~~ | ~~EGHV0016~~ | ~~P~~ | ~~5.2.10~~ | ~~CCW B Common Header Return~~ |
| ~~14EGG05BB~~ | ~~3505~~ | ~~EGHV0016~~ | ~~C~~ | ~~5.2.10~~ | ~~CCW B Common Header Return~~ |
| ~~14EGG05DA~~ | ~~3505~~ | ~~EGHV0054~~ | ~~P~~ | ~~5.2.10~~ | ~~CCW B to Common Header~~ |
| ~~14EGG05DB~~ | ~~3505~~ | ~~EGHV0054~~ | ~~C~~ | ~~5.2.10~~ | ~~CCW B to Common Header~~ |
| 14EGG07BA | 3505 | EGHV0102 | P | 5.2.10 | CCW to RHR HX B Isolation |
| 14EGG07BB | 3505 | EGHV0102 | C | 5.2.10 | CCW to RHR HX B Isolation |
| 14EGG10AC | 3505 | EGHV0062 | C | 5.2.10 | CCW Return from RCP Thermal Barrier |
| 14EGG18BC | 3505 | EGHV0127 | C | 5.2.10 | CCW HX Out to RCS Bypass Isolation |
| 14EGG18BD | 3505 | EGHV0127 | C | 5.2.10 | CCW HX Out to RCS Bypass Isolation |
| 14EGG18DC | 3505 | EGHV0133 | C | 5.2.10 | EGHV0061 Bypass Valve |
| 14EGG18DD | 3505 | EGHV0133 | C | 5.2.10 | EGHV0061 Bypass Valve |
| 14EGI13BA | 3505 | EGPT0078 | I | 5.2.10 | CCW Pumps B and D Discharge Press |
| 14EGK16BA | 3505 | EGTV0030 | C | 5.2.10 | CCW B HX Bypass Valve |

### 5.2.9 Reactor Coolant Pump (RCP) Seal Injection

PFSSD requires RCP seal injection to provide a boron injection path, provide makeup to the RCS to maintain hot standby inventory and prevent damage to the RCP seals. The Component Cooling Water (CCW) system is an alternative means of cooling the RCP seals.

Power and control cables associated with seal injection valves BBHV8351A, BBHV8351B, BBHV8351C and BBHV8351D, are run in this area. The seal injection valves are not high-low pressure interface valves so consideration of a 3-phase hot short is not required. In order to spuriously close any of these valves, a short between conductors 1 and 11 in cables 14BBG04AC, 14BBG04BC, 14BBG04CC and 14BBG04DC would have to occur. These cables are not run in area C-23 so this failure is not credible.

Cable 14BGG52BC is associated with Train B RCP seal injection flow throttling valve BGHV8357B. Damage to this cable could prevent the Train B centrifugal charging pump (CCP) from supplying water to the RCP seals. Train A seal injection flow throttling valve BGHV8357A is unaffected by a fire in this area.

Based on the above discussion, RCP seal injection is available if a fire occurs in fire area C-23 using the Train A CCP.

References: E-15000, XX-E-013, E-13BB04, E-13BG52, E-1F9102, E-1F9302, E-1F9303, M-12BB03

### 5.2.10 Component Cooling Water

The component cooling water system is required for PFSSD to provide cooling water to the CCP oil coolers, seal water heat exchanger, RHR heat exchanger, RHR pump seal cooler and RCP thermal barriers (to maintain RCP seal cooling in the event RCP seal injection is lost).

Cables associated with components on the Train B CCW system run through area C-23. Damage to these cables due to a fire could prevent operation of the associated equipment and prevent operation of Train B CCW. Cables associated with redundant Train A CCW are run in a different fire area and are unaffected by the fire.

Cables associated with Train B CCW pump room cooler SGL11B run in area C-23. Damage to these cables could prevent operation of the unit. Cables associated with redundant Train A CCW and room cooler SGL11A are run in a different fire area and are unaffected by the fire.

As discussed in Section 5.2.9, RCP seal injection is unaffected by a fire in this area. Therefore, the CCW to thermal barrier cooling coil flow path is not required to ensure adequate seal cooling.

Cables associated with valves EGHV0062, EGHV0127 and EGHV0133 run through area C-23. If the fire affects cables associated with EGHV0062 the valve may spuriously close. If this occurs, operators can open bypass valve EGHV0132 from the control room if thermal barrier cooling is desired. This is not a time critical action since RCP seal injection is unaffected.

Based on the above discussion, Train A CCW is available to provide cooling to essential PFSSD components.

References: E-15000, XX-E-013, E-13EG01C, E-13EG01D, ~~E-13EG05A, E-13EG05D,~~ E-13EG07A, E-13EG10, E-13EG13, E-13EG16, E-13EG18, E-13EG18A, E-13GL06, E-1F9303, E-1F9401A, E-1F9401B, E-1F9444, M-12EG01, M-12EG02, M-12EG03, M-12GL02

**Table C-30-3**
**PFSSD Cables Located in Fire Area C-30**

| Cable # | Location | Primary PFSSD Equipment | Cable Function (P) Power (C) Control (I) Instrumentation | Evaluation Section | Comments |
|---|---|---|---|---|---|
| ~~14EGG05BA~~ | ~~3617~~ | ~~EGHV0016~~ | ~~P~~ | ~~5.2.10~~ | ~~CCW B Common Header Return~~ |
| ~~14EGG05BB~~ | ~~3617~~ | ~~EGHV0016~~ | ~~C~~ | ~~5.2.10~~ | ~~CCW B Common Header Return~~ |
| 14EGG05BC | 3617 | EGHV0016 | C | 5.2.10 | CCW B Common Header Return |
| ~~14EGG05DA~~ | ~~3617~~ | ~~EGHV0054~~ | ~~P~~ | ~~5.2.10~~ | ~~CCW B to Common Header~~ |
| ~~14EGG05DB~~ | ~~3617~~ | ~~EGHV0054~~ | ~~C~~ | ~~5.2.10~~ | ~~CCW B to Common Header~~ |
| 14EGG05DC | 3617 | EGHV0054 | C | 5.2.10 | CCW B to Common Header |
| 14EGG07BA | 3617 | EGHV0102 | P | 5.2.10 | CCW to RHR HX B Isolation |
| 14EGG07BB | 3617 | EGHV0102 | C | 5.2.10 | CCW to RHR HX B Isolation |
| 14EGG07BC | 3617 | EGHV0102 | C | 5.2.10 | CCW to RHR HX B Isolation |
| 14EGG09CC | 3617 | EGHV0071 | C | 5.2.10 | CCW HX Out to RCS Ctmt Isolation |
| 14EGG10AC | 3617 | EGHV0062 | C | 5.2.10 | CCW Return from RCP Thermal Barrier |
| 14EGG18BC | 3617 | EGHV0127 | C | 5.2.10 | CCW HX Out to RCS Bypass Isolation |
| 14EGG18BD | 3617 | EGHV0127 | C | 5.2.10 | CCW HX Out to RCS Bypass Isolation |
| 14EGG18DC | 3617 | EGHV0133 | C | 5.2.10 | EGHV0061 Bypass Valve |
| 14EGG18DD | 3617 | EGHV0133 | C | 5.2.10 | EGHV0061 Bypass Valve |
| 14EGI13BA | 3617 | EGPT0078 | I | 5.2.10 | CCW Pumps B and D Discharge Press |
| 14EGK16BA | 3617 | EGTV0030 | C | 5.2.10 | CCW B HX Bypass Valve |
| 14EGK16BC | 3617 | EGTV0030 | C | 5.2.10 | CCW B HX Bypass Valve |
| 14EJB01BB | 3617 | DPEJ01B | C | 5.2.11 | RHR Pump B Motor |
| 14EJG04BC | 3617 | EJHV8804B | C | 5.2.11 | RHR B Supply To SI Pump B Iso Valve |
| 14EJG06BC | 3617 | EJHV8811B | C | 5.2.20 | Containment Recirc Sump Iso Valve |
| 14EJG06BG | 3617 | EJHV8811B | C | 5.2.20 | Containment Recirc Sump Iso Valve |
| 14EJG08BC | 3617 | EJFCV0611 | C | 5.2.11 | RHR Pump B Miniflow Valve |

DPBG05A is unaffected by a fire in area C-30 and per Section 5.2.23 BIT inlet valve EMHV8803A and outlet valve EMHV8801A are unaffected.

Cable 14BGG52BC is associated with centrifugal charging pump (CCP) B to RCP seal injection valve BGHV8357B. Redundant Train A CCP to RCP seal injection valve BGHV8357A is unaffected. However, since the seal injection valves could close and alternate means of ensuring boration and seal cooling is available, these valves are not required to ensure PFSSD if a fire occurs in this area.

Based on the above discussion, RCP seal injection may be lost, but alternative means exist to ensure boration, inventory control and RCP seal integrity.

References: E-15000, XX-E-013, E-13BB04, E-13BG52, E-1F9102, E-1F9302, E-1F9303, M-12BB03, M-12BG03

### 5.2.10 Component Cooling Water

Cables associated with components on the Train B CCW system run through area C-30. Damage to these cables due to a fire could prevent operation of the associated equipment and prevent operation of Train B CCW. Cables associated with redundant Train A CCW are run in a different fire area and are unaffected by the fire.

Cables associated with Train B CCW pump room cooler SGL11B run in area C-30. Damage to these cables could prevent operation of the unit. Cables associated with redundant Train A CCW and room cooler SGL11A are run in a different fire area and are unaffected by the fire.

As discussed in Section 5.2.9, RCP seal injection may be lost if a fire occurs in this area. The CCW system is an alternate means of providing seal cooling. Therefore, the CCW to thermal barrier cooling coil flow path needs to be available if a fire occurs in area C-30 to ensure adequate seal cooling. To ensure an operable flow path, either valves EGHV0071 or EGHV0126 must be open and either EGHV0058 or EGHV0127 must be open. In addition, either valves EGHV0062 or EGHV0132 must be open and either EGHV0061 or EGHV0133 must be open. Also, valve EGHV0015 needs to be open when operating the Train A CCW system to ensure a return flow path to the suction side of the CCW pumps.

Cables associated with valves EGHV0062, EGHV0071, EGHV0127 and EGHV0133 run through area C-30. If the fire affects cables associated with EGHV0062 and EGHV0071, the valves may spuriously close. If seal injection is lost and valves EGHV0062 and EGHV0071 close, then a loss of all seal cooling has occurred. Operators should immediately open valves EGHV0132 and EGHV0126 using associated hand switches EGHIS0132 and EGHIS0126 on RL020.

Based on the above discussion, Train A CCW is available to provide cooling to essential PFSSD components as well as provide cooling to the RCP seals.

References: E-15000, XX-E-013, E-13EG01C, E-13EG01D, E-13EG05A, **E-13EG05D**, E-13EG07, E-13EG09, E-13EG10, E-13EG13, E-13EG16, E-13EG18, E-13EG18A, E-13GL06, E-1F9303, E-1F9401A, E-1F9401B, E-1F9444, M-12EG01, M-12EG02, M-12EG03, M-12GL02

### 5.2.11 Residual Heat Removal (RHR)

Hot shutdown requires isolation of the RCS to RHR flow path by maintaining either BBPV8702A or EJHV8701A closed and either BBPV8702B or EJHV8701B closed. Cold shutdown requires RHR taking suction from the RCS. RHR pump suction from the RCS is controlled by valves BBPV8702A and EJHV8701A (Train A) and BBPV8702B and EJHV8701B (Train B). The PFSSD methodology credits Train A RHR to achieve cold shutdown if a fire occurs in area C-30.

## LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by WCNOC in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding these commitments to Mr. Richard Flannigan at (620) 364-4117.

REGULATORY COMMITMENTS

| Regulatory commitment | Due |
|---|---|
| Implement License Amendment | Once approved, the amendment will be implemented within 180 days of receipt. |