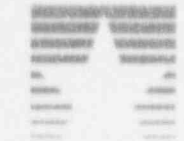


Log # TXX-91248
File # 10010
908.3
Ref. # 10CFR50.34(b)

July 29, 1991

William J. Cahill, Jr.
Executive Vice President

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
ADVANCED FSAR SUBMITTAL RELATED TO COPPER SHEATHED
AND ONE HOUR FIRE RATED CABLES

Gentlemen:

In a letter logged TXX-89412, dated July 31, 1989, TU Electric notified the NRC of its plans to use metal clad cable in certain non-safety applications at CPSES. This letter provides advance notice of a future FSAR amendment which will describe the use of copper sheathed (CS) cable as metal clad cable, and the use of one hour fire rated cable as a one hour fire rated material, in certain non-safety related applications for electrical separation.

The extent of metal clad cable use has been expanded to include, in addition to aluminum sheathed (ALS) cable, copper sheathed (CS) cable. The use of CS cable simplifies installation since manhour intensive cable pulling through conduit is eliminated. Furthermore, the reduction in the installation manhours reduces personnel radiation exposure and therefore enhances ALARA. Test and analyses support that CS cable is considered equivalent to conduit for electrical separation purposes. In addition, Wyle Laboratories Test Report #53575, "Test Report on Separation Verification Testing for Bechtel Energy Corporation for Houston Lighting and Power's South Texas Project," demonstrates that 1" electrical separation for CS cable provides adequate protection against cable faults. This test report has been previously docketed with the NRC.

The scope of one hour fire rated materials has been expanded to include one hour fire rated cables. The cable is safety-related and qualified per the provisions of IEEE 323-1974 and IEEE 383-1974 for flame retardancy. In addition, the cable meets the requirements of ASTM E-119-1971 for fire resistance, and therefore is considered equivalent to conventional cable enclosed within a one hour fire barrier (e.g. thermolag). The use of one hour fire rated materials (i.e. thermolag and one hour fire rated cable) are considered acceptable barriers for electrical separation and are considered equivalent to metal enclosed raceways with respect to protection from electrical failures. Applications of the one hour fire rated cables are restricted to power and control circuits for fire safe shutdown systems and outside containment where the total radiation dose is less than or equal to 50 MRADS gamma.

A029
1/1

To facilitate NRC Staff review of these changes, the enclosures are organized as follows:

1. Draft revised FSAR pages, with changed portions indicated by a bar in the margin as they are to appear in a future amendment (additional pages immediately preceding and/or following the revised pages are provided if needed to understand the change).

2. A description/justification of each item revised.

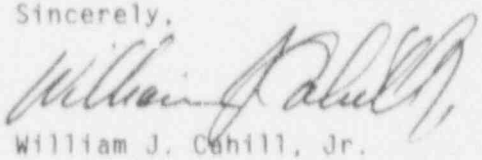
3. A copy of related SER/SSER sections.

4. The bold/overstrike version of the revised FSAR pages referenced by the description/justification for each item identified above. The bold/overstrike version facilitates review of the revisions by highlighting each addition of new text in bold type font and overstriking with a slash (/) the portion of the text that is deleted.

An 10CFR50.59 evaluation was performed for Unit 1 regarding the use of both CS and one hour fire rated cable. The evaluation revealed that no unreviewed safety question is created from the use of these cables. Copper sheathed cable and the one hour fire rated cable will both be applied to Units 1 and 2, where appropriate, as of the date of this letter.

If there are any questions regarding this submittal, contact Veronica Cornell at (214) 812-8886.

Sincerely,



William J. Cahill, Jr.

VPC/gj
Enclosures

c - Mr. R. D. Martin, Region IV
Resident Inspectors, CPSES (2)
Mr. T. A. Bergman, NRR
Mr. M. B. Fields, NRR

Advanced FSAR Change Related to Copper Sheathed Cable

Regulatory Position C.2 - For the purpose of electrical cable separation, acceptable barriers include rigid metal conduit, electrical metallic tubing (EMT), flexible metallic conduit, cable tray covers (both solid and ventilated types), cable bus enclosures, equipment and device enclosures, enclosed metal wireways inside equipment, a wrap of woven silicon dioxide and one hour fire rated materials (thermolag and one hour fire rated cable). DRAFT

A wrap of woven silicon dioxide, thermolag and one hour fire rated cable are equivalent to a metal enclosed raceway with respect to protection from electrical failures. DRAFT

Metal Clad (MC) cables include copper sheathed (CS) cable and aluminum sheathed (ALS) cable. MC cable conductor size is limited to #10 AWG and below with a maximum of four (4) conductors and will be used only in non-class IE, 120 Vac/125Vdc applications. MC cables are considered the same as cable inside conduit for separation purposes. DRAFT

CS cable is constructed of continuous corrugated 16 mil thick copper tube with no outer jacket and 600V XHHW, 90°C insulation. CS cable will be used only inside the containment and only in the lighting system. DRAFT

ALS cable is constructed of continuous corrugated 25 mil. thick seamless aluminum tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600V XHHW, 90° C insulation . ALS cable will only be used outside of the containment building in the lighting, fire protection, heat tracing and communication systems. DRAFT

The one hour fire rated cable provides a one hour fire rated barrier per ASTM standard E 119-1971. The cable is constructed of a continuously welded corrugated 12 mil thick stainless steel sheath with high temperature nickel-clad copper conductors, glass braid cable jacket and silicone rubber insulation. This cable will be used in power and control circuits for fire safe shutdown applications and outside containment where the total radiation dose in less than or equal to 50 MRAS gamma. Cable sizes will be 1/0 AWG and smaller. DRAFT

DRAFT

Metal Clad (MC) cables include copper sheathed (CS) cable and Aluminum sheathed (ALS) cable. MC cable conductor size is limited to #10 AWG and below with a mixiumum of four (4) conductors and will be used only in non-class IE, 120 Vac/125Vdc applications. MC cables are considered the same as cable inside conduit for separation purposes.

DRAFT

CS cable is constructed of continuous corrugated 16 mil thick copper tube with no outer jacket and 600V XHHW, 90°C insulation. CS cable will be used only inside the containment and only in the lighting system.

DRAFT

ALS cable is constructed of continuous corrugated 25 mil. thick seamless aluminum tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600V XHHW, 90° C insulation ALS cable will only be used outside of the containment building in the lighting, fire protection, heat tracing and communication systems.

65

Testing performed by other utilities has demonstrated the adequacy of the above materials to be used as enclosed raceway and barriers for Regulatory Guide 1.75 [15] separation purposes.

65

a. Flexible Conduit: Tests documented in Reference 43 for Niagara Mohawk Power Corporation's Nine Mile Point Nuclear Station Unit 2 demonstrated the adequacy of BOA stainless steel flexible conduit and Anaconda steel flexible conduit as an enclosed raceway. Anaconda, BOA and similar quality flexible conduit are used at CPSES. The power cable was manufactured by Okonite. The control cable was manufactured by Rockbestos. The cables are of the same manufacture and similar construction to those used at CPSES. Accordingly, the test results and conclusions are applicable to CPSES installations.

b. Ventilated Tray Covers and Cable Bus Enclosures: Tests documented in Reference 44 for Duquesne Light Company's Beaver Valley Power Station Unit 2 (Configuration No. 4) demonstrated the equivalency of a fluted, ventilated tray cover to a solid tray cover for the purpose of physical separation. The test results were also used to justify considering cable bus enclosures the same as enclosed raceway. Both the power cable tested and that used at CPSES are of the same manufacture and similar construction. Cable tray, tray covers and cable bus enclosures used at CPSES are of similar design and construction as those tested/analyzed for Beaver Valley 2 and accordingly, the test results and conclusions are applicable to CPSES installations. 65

c. Protective Wrap: Tests documented in Reference 44 for Duquesne Light Company's Beaver Valley Unit 2 (Configurations 1 and 2) concluded that cables covered with Siltemp protective wrap and 3M No. 69 glass tape combined with a 3/8 in. air space provides adequate protection regardless of whether the faulted cable is within the wrap or outside of the wrap. The results justify considering the protective wrap equivalent to a conduit with respect to protection from electrical failures. The power and control cables tested are of the same manufacture and similar construction to those used at CPSES. Accordingly, these test results and conclusions can be applied to the CPSES installation. 65 78 65

Ampacity tests included in the same report demonstrated that no additional derating, beyond design ampacities, was required when a cable was enclosed in protective wrap. Design ampacities for cables used at CPSES are similarly derated to those tested (from ICEA table values), and need not be additionally derated. 65

DRAFT

d. Metal Clad (MC) Cable: MC cable includes Aluminum sheathed (ALS) cable and Copper sheathed (CS) cables. Tests

77 documented in Reference 43 for Niagara Mohawk Power Corporation's Nine Mile Point Nuclear Station Unit 2 and Reference 41 for CPSES demonstrated the adequacy of BOA stainless steel flexible conduit and Anaconda steel flexible conduit as an enclosed raceway.

DRAFT

77 The ALS cable is enclosed in a 25 mil. thick corrugated seamless aluminum tube which provides mechanical integrity comparable to the 6 mil. thick BOA stainless steel flexible conduit tested in Reference 41. The seamless aluminum tube will contain any cable ignition within the

DRAFT tube. In addition, ALS cable has the annulus between the cable and the tube tightly packed with flame retardant filler materials, which will inhibit flame propagation due to the absence of free-air surrounding the cables. As ALS cable conductor size is limited to #10 AWG with a maximum number of 4 conductors, the cross sectional area of conductors used in the cable is much smaller than the 2/0 fault cable tested in the Anaconda steel flexible conduit in Reference 43. Therefore, the fault currents would be

77 lower than that tested.

DRAFT

ALS cable has thermosetting insulation which is similar to the Anaconda steel flexible conduit tested in Reference

DRAFT 43. The jacketing materials used in ALS cable are also flame retardant.

DRAFT

The conductor material, insulation and filler materials used in CS cable are the same as those used in ALS cable. The CS cable construction will exhibit the same flame retardancy characteristics as discussed above for ALS cable. In addition, CS cable is enclosed in a 16 mil thick corrugated copper tube which provides mechanical integrity comparable to ALS cable. Based on Wyle Laboratories Test

#53575 [47], CS cable may be considered as cable in enclosed raceway and one inch separation provides adequate protection to prevent degradation of redundant circuits. DRAFT

Only MC cable meeting the flame test requirements of IEEE-383 [30] will be used. 77

Based on the above testing and analysis, MC cable is equivalent to cable inside conduit for electrical separation. 77

e. One hour fire rated cable: DRAFT

The cable is constructed of a continuously welded corrugated 12 mil thick stainless steel sheath with high temperature nickel-clad copper conductors, glass braid cable jacket and silicone rubber insulation. The one hour fire rated cable meets the requirements of ASTM E-119-1971 for a fire resistance rating of one hour. This cable is therefore considered equivalent to cable in conduit for the purposes of electrical separation. DRAFT

Gaps of 3/8 in. or less at cable tray side rail joints, unfilled square holes 7/16 in. or less on tray side rails and 1/4 in. diameter Ty-rap holes on tray bottom are not considered significant enough to degrade the tray surface as a barrier. These gaps are comparable to openings on ventilated tray covers which have been tested and found acceptable as effective barriers to meet separation requirements per Regulatory Guide 1.75 [15]. 66

6. Cable Spreading Area and Control Room

The cable spreading area is the space below the Control Room where instrumentation and control cables converge prior to entering the control, termination, or instrument panels. This area does not contain high-energy equipment such as switchgear, transformers, rotating equipment, or potential sources of

41 missiles or pipe whip. Flammable material is not stored or installed in this area. Cable constructions are qualified in accordance with IEEE 383 [30]. The circuits in this area are limited to control and instrument functions and those power supply circuits serving the Control Room. Power circuits are not routed in this area, except power cables serving instrument and Control Room distribution panels. These power cables are encased in concrete or run in rigid steel conduits from the point where they enter this area.

62 In this area, a minimum separation of one ft horizontal and three ft vertical is preferred between redundant trays. Where raceway arrangements preclude maintaining the minimum separation distance, the redundant circuits are run in enclosed raceways or barriers are provided between redundant circuits.

62 Where it is impractical to meet the above requirements, for cables and raceways which are limited to instrumentation and control, the minimum separation distances are as listed in paragraph 8.3.1.4, Item 5.

7. Electric Penetration Area

41 Except for six penetrations, all individual penetrations are classified according to function and are restricted to exclusive use for power, control, or instrumentation. These six penetrations are exclusively used for six different motor operated valves for both power and control. In addition, penetrations used for the NIS cables are not used for any other purpose.

There are three electric penetration areas, one on each floor elevation. Class 1E penetrations are located on two different floor elevations, one train on each floor. The third (middle) floor area contains the four channels of the NIS and two channels of the RPS system. The remaining two channels of the Reactor Protection System (RPS) are located on the floor where train B

39. NEMA VE 1-1971, Cable Tray Systems, National Electrical Manufacturers Association.

40. IEEE 80-1961 (Reaff. 1971), Guide for Safety in AC Substation Grounding.

62 | 41. Wyle Laboratories Test Report No. 48037-02, Electrical Raceway Separation Verification Testing for the Texas Utilities Generating Company for use in the Comanche Peak Steam Electric Station Units 1 and 2, February 6, 1986.

62 | 42. Wyle Laboratories Test Report No. 48422-1, Cable Separation Test Program for the Texas Utilities Generating Company Comanche Peak Steam Electric Station Units 1 and 2, August 14, 1986.

65 | 43. Wyle Laboratories Test Report No. 47906-02, Test Report on Electrical Separation Verification Testing for the Stone & Webster Engineering Corporation for Use In Niagra Mohawk Power Corporation Nine Mile Point Nuclear Station - Unit 2, November 22, 1985, Configuration No.5.

7? | 44. Wyle Laboratories Test Report No. 17666-02, Test Report on Electrical Separation Verification Testing for the Stone & Webster Engineering Corporation for Use In Duquesne Light Company's Beaver Valley Power Station - Unit 2, April 19, 1985, Configurations 1, 2, 3, 4 and 6.

66 | 45. ASME Boiler and Pressure Vessel Code, Sections II, III, V, and IX.

?0 | 46. Brown Boveri Electric, Inc., Test Report K-82089-K1, Test Date May 27, 1982.

DRAFT | 47. Wyle Laboratories Test Report No. 53575, Test Report on Separation Verification Testing for Bechtel Energy Corporation for Houston Lighting and Power's South Texas Project, Configuration #1, Test #2.

CPSES FSAR AMENDMENT 82
DETAILED DESCRIPTION

FSAR Page (as amended)	Group	Description
1A(B)-51	2	Use of metal clad cable for electrical separation Addition: Expanded the scope of metal clad cable applications to include copper sheathed cable, in additon to aluminum sheathed cable. FSAR Change Request Number: 91-001.1 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 section 8.4.4 does not include copper sheathed cable within the scope of metal clad cable applications for CPSES.
1A(B)-51	2	Use of metal clad cable for electrical separation Addition: Expanded the scope of metal clad cable applications to include copper sheathed cable, in additon to aluminum sheathed cable. FSAR Change Request Number: 91-001.1 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 section 8.4.4 does not include copper sheathed cable within the scope of metal clad cable applications for CPSES.
1A(B)-51	2	Use of metal clad cable for electrical separation Addition: FSAR revised to allow the use of copper sheathed (CS) cable inside containment for lighting circuits. The CS cable is considered to be equivalent to cable in conduit for electrical separation purposes. UL crush test data demonstrates that the mechanical integrity of CS cable is better than that of aluminum sheathed (Al) cable, which has been previously accepted by the NRC at CPSES for electrical separation. For inside containment applications, the copper does not react with the accident environment, therefore hydrogen generation is not a concern. In addition, since the copper jacket provides comparable protection from fire as rigid conduit, CS cable is not considered an intervening combustible material and is excluded from the CPSES fire hazards combustible loadings. Wyle test report #53575 demonstrates that 1" separation is adequate to protect Class 1E cables due to a fault (325 amps) in 3/C #8 AWG CS cable. CPSES applications of CS cable, at a maximum, is 4/C #10 AWG. The CPSES cable faults are expected to be less severe than of those tested, thus, the test results can be applied to CPSES where 1" minimum separa-

CPSES FSAR AMENDMENT 82
DETAILED DESCRIPTION

FSAR Page (as amended)	Group	Description
		tion is maintained. The Wyle test has been reviewed and approved by the NRC for South Texas Project separation criteria. Based on the above conclusions, in containment applications of CS cable in lighting circuits will be implemented at CPSES. FSAR Change Request Number: 91-001.2 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 section 8.4.4 does not include CS cable as as one of CPSES metal clad cable applications.
1A(B)-51	3	Use of metal clad cable for electrical separation Clarification: Revised the text to specifically describe the characteristics and CPSES applications of aluminum sheathed cable. FSAR Change Request Number: 91-001.3 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: No
8.3-76	2	Use of metal clad cable for electrical separation Addition: Expanded the scope of metal clad cable applications to include copper sheathed cable, in additon to aluminum sheathed cable. FSAR Change Request Number: 91-001.4 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 does not include copper sheathed cable within the scope of metal clad cable applications for CPSES.
8.3-76	2	Use of metal clad cable for electrical separation Addition: FSAR revised to allow the use of copper sheathed (CS) cable inside containment for lighting circuits. The CS cable is considered to be equivalent to cable in conduit for electrical separation purposes. UL crush test data demonstrates that the mechanical integrity of CS cable is better than that of aluminum sheathed (Al) cable, which has been previously accepted by the NRC at CPSES for electrical separation. For inside containment applications, the copper does not react with the accident environment, therefore hydrogen generation is not a concern. In addition, since the copper jacket provides comparable protection from fire as rigid conduit, CS cable is not considered an intervening combustible material and is excluded from the CPSES fire hazards combustible loadings. Wyle test report #53575 demon-

CPSES FSAR AMENDMENT 82
DETAILED DESCRIPTION

FSAR Page (as amended)	Group	Description
		strates that 1" separation is adequate to protect Class 1E cables due to a fault (325 amps) in 3/C #6 AWG CS cable. CPSES applications of CS cable, at a maximum, is 4/C #10 AWG. The CPSES cable faults are expected to be less severe than of those tested, thus, the test results can be applied to CPSES where 1" minimum separation is maintained. The Wyle test has been reviewed and approved by the NRC for South Texas Project separation criteria. Based on the above conclusions, in containment applications of CS cable in lighting circuits will be implemented at CPSES. FSAR Change Request Number: 91-001.5 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 section 8.4.4 does not include CS cable as as one of CPSES metal clad cable applications.
8.3-76	3	Use of metal clad cable for electrical separation Clarification: Revised the text to specifically describe the characteristics and CPSES applications of aluminum sheathed cable. FSAR Change Request Number: 91-001.6 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: No
8.3-78	2	Use of metal clad cable for electrical separation Addition: Expanded the scope of metal clad cable applications to include copper sheathed cable, in additon to aluminum sheathed cable. FSAR Change Request Number: 91-001.7 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 does not include copper sheathed cable within the scope of metal clad cable applications for CPSES.
8.3-78	3	Use of metal clad cable for electrical separation Update: Revised the text to specifically describe the characteristics and CPSES applications of aluminum sheathed cable. Also, reduced the maximum number of conductors from 6 to 4 for aluminum sheathed cable applications. FSAR Change Request Number: 91-001.8 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 section 8.4.4 indicates that the maximum number of conductors used for metal clad cable is six.

CPSES FSAR AMENDMENT 82
DETAILED DESCRIPTION

FSAR Page (as amended)	Group	Description
8.3-78;79	2	Use of metal clad cable for electrical separation Addition: FSAR revised to allow the use of copper sheathed (CS) cable inside containment for lighting circuits. The CS cable is considered to be equivalent to cable in conduit for electrical separation purposes. UL crush test data demonstrates that the mechanical integrity of CS cable is better than that of aluminum sheathed (Al) cable, which has been previously accepted by the NRC at CPSES for electrical separation. For inside containment applications, the copper does not react with the accident environment, therefore hydrogen generation is not a concern. In addition, since the copper jacket provides comparable protection from fire as rigid conduit, CS cable is not considered an intervening combustible material and is excluded from the CPSES fire hazards combustible loadings. Wyle test report #53575 demonstrates that 1" separation is adequate to protect Class 1E cables due to a fault (325 amps) in 3/C #8 AWG CS cable. CPSES applications of CS cable, at a maximum, is 4/C #10 AWG. The CPSES cable faults are expected to be less severe than of those tested, thus, the test results can be applied to CPSES where 1" minimum separation is maintained. The Wyle test has been reviewed and approved by the NRC for South Texas Project separation criteria. Based on the above conclusions, in containment applications of CS cable in lighting circuits will be implemented at CPSES. FSAR Change Request Number: 91-001.9 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 section 8.4.4 does not include CS cable as as one of CPSES metal clad cable applications.
8.3-100	3	Use of metal clad cable for electrical separation Addition: Added Wyle test report #53575 as a Chapter 8 reference to support the use of copper sheathed cable for electrical separation. FSAR Change Request Number: 91-001.10 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: No

the staff position on this issue, the applicant has provided a keylock control board control power cutoff switch for each valve whose spurious movement could result in degraded emergency core cooling system performance. Keylock switch contacts are arranged in valve operator control circuits so that energizing the operator contactor coils from attendant control power sources can be precluded.

In order to meet the staff position that redundant valve status indication be provided in the control room, the MOVs are provided with red (open) and green (closed) position-indicating lights located at the control switch for each valve. These lights are powered by valve control power and actuated by valve motor operator limit switches. This indication circuitry is such that valve position indication is not lost when power is removed by the keylock control board control power cutoff switch. In addition, a monitor light is provided in an array of monitor lights that are all off when their respective valves are in proper position enabling safeguards operation. These lights are energized from a separate monitor light supply and actuated by valve motor-operated limit switches which are different from those used to actuate the red and green lights.

On the basis of its review and evaluation, the staff concludes that the electrical design provisions for the identified list of valves satisfy the staff position and are, therefore, acceptable.

8.4.4 Physical Identification and Independence of Redundant Safety-Related Electrical Systems

Physical Identification of Electrical Equipment

In the FSAR, the applicant has provided the criteria for physical identification of electrical equipment, including cables and raceways. Electrical equipment has its own tagging scheme developed by equipment type. All Class 1E system cables and the seismic Category I raceway system are marked by a nine-alphanumeric-character tag identifier. In addition to a tag number, each Class 1E raceway and cable in raceways are color coded to indicate its separation group. The identification scheme provides a means of readily distinguishing a cable or raceway associated with a particular separation group.

Exposed raceways containing Class 1E cables are marked by color codes in a distinct permanent manner at intervals not to exceed 15 feet and at points of entry to and exit from enclosed areas. In general, all Class 1E cables and associated cables are jacket color-coded throughout their entire length. Cable jackets that require field color coding before installation will be so worked at intervals not to exceed 5 feet. Cable jackets that require field color coding after installation due to reclassification of cables (e.g., from associated Class 1E to Class 1E or vice versa) will be color coded where the cables enter and exit equipment, in the raceway, and inside junction/pull boxes. Further, all exposed portions of these cables will be marked at intervals not to exceed 5 feet. In general, non-Class 1E equipment, raceways, and cables in raceways are not marked by color code, but are left in their natural color, generally black. However, non-Class 1E cables whose natural color is not black will be field color coded black at intervals not to exceed 5 feet.

Physical Independence of Electrical Equipment

The cable and raceway separation criteria are based on preservation of independence of redundant systems. Cables of redundant Class 1E systems are separated from each other as well as from cables of non-Class 1E systems. Cables of redundant Class 1E circuits are run in separate cable trays, conduits, ducts, and penetrations. The applicant has used lesser separation distances than those provided in guidance documents in several locations between Class 1E wiring and non-Class 1E area radiation monitoring detector wiring and public address system speaker wiring. The applicant has analyzed the effect of lesser separation between the non-Class 1E circuits and the Class 1E circuits. The applicant has treated these non-Class 1E circuits as low-energy circuits. An analysis has been performed that concludes for electric fault conditions in these non-Class 1E circuits, associated Class 1E circuits are not degraded below an acceptable level.

Fiber optic cables used in non-Class 1E monitoring circuits carry no electrical energy by themselves and therefore are not required to maintain physical separation from Class 1E circuits. In addition, radio antenna coaxial cables are used in the non-Class 1E radio communication system. The energy carried by such cables is not sufficient to cause an internally generated fire in these cables and therefore separation between these and Class 1E cables is not required.

In plant areas that are free from potential hazards such as missiles, external fires, and pipe whip, the minimum separation between redundant cable trays is 3 feet between trays separated horizontally and 5 feet between trays separated vertically. The minimum separation between safety-related conduit and redundant cable tray in these areas is 3 feet in both horizontal and vertical directions when the conduit elevation is above that of the tray side rails. The control room and cable spreading areas do not contain high-energy equipment such as switchgear, motor control centers, transformers, rotating equipment, or potential sources of missiles or pipe whip. In the cable spreading area and the control room, the minimum separation between redundant cable trays is 1 foot between trays separated horizontally and 3 feet between trays separated vertically. The minimum separation between safety-related conduit and redundant cable tray in this area is 1 foot horizontally and 2 feet vertically when the conduit elevation is above that of the tray side rails. Where cable spreading area and control room raceway arrangements preclude maintaining minimum separation distances, the redundant circuits are run in enclosed raceways, or barriers are provided between redundant circuits.

In all plant areas free of potential hazards, the minimum separation required in any direction between redundant tray and conduit is 1 inch when the conduit is not safety related or its elevation is not above the tray side rails. In SSER 17 (November 1988), the response on page 74 for Open Item E-28 indicates that for power cables, the 1-inch minimum separation is used in conjunction with two enclosures (conduit, Siltemp protective wrap, tray with cover top and bottom). This information was provided in the attachment to a letter from the applicant dated April 11, 1988. By letter dated June 5, 1989, the applicant provided clarifying information for this response. As noted in the clarifying information, as well as indicated above, CPSES uses lesser separation distances for power circuits, based on analysis, when conduit is located either above or tray, adjacent to open tray but not above the side rails, or below a ladder-type

tray. In addition, these separation criteria are also applied to power cables which are not located in raceway and are not inside equipment (as if the cables were in an open ladder-type tray). These CPSES criteria for lesser separation distances have been analyzed to show no adverse impact on Class 1E circuits.

Nuclear instrumentation system (NIS) cables are routed in conduit according to their channel assignment. A minimum separation of 6 feet is maintained between NIS conduits and raceways containing 6.9-kV circuits. In addition, a minimum separation of 2 feet is maintained from NIS conduits running parallel to raceways containing electrical noise sources such as low-voltage power and rod-control cables.

The minimum separation distance between redundant Class 1E and between Class 1E and non-Class 1E equipment and circuits internal to the control equipment is 6 inches. In this case, the wire and cables are flame retardant with self-extinguishing and nonpropagating characteristics. Other components, such as terminal blocks, wire troughs and cleats, cable ties, and glastic barriers, are manufactured from self-extinguishing material.

Where plant arrangements preclude maintaining the applicable minimum separation distances, as stated above, tray covers, solid bottoms, or other barriers are provided between the circuits requiring separation. The minimum distances between raceways requiring separation and between barriers and the raceways are in accordance with RG 1.75 and IEEE Standard 384-1974, "Trial-Use Standard Criteria for Separation of Class 1E Equipment and Circuits."

Inside equipment, for control and instrumentation cables or raceways, minimum separation is 1 inch. Cables No. 10 AWG (American wire gauge) and larger feeding power to control equipment from distribution panels and all power cables inside power equipment maintain a 6-inch separation or are enclosed or separated by a barrier.

For the purpose of electrical cable separation, enclosed raceway includes rigid metal conduit, electrical metallic tubing, and flexible metallic conduit. Ventilated tray covers are considered equivalent to solid nonventilated tray covers, and cable bus enclosures are considered the same as enclosed raceways. In addition, a wrap of woven silicon dioxide is equivalent to a conduit with respect to protection from electrical failures.

Metal-clad (MC) cable, constructed of a continuous corrugated 25-mil-thick seamless tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600-V, 90°C insulation, is considered the same as cable inside conduit for the purpose of electrical separation. MC cable conductor size is limited to No. 10 AWG and below, with a maximum of six conductors. MC cable will only be used in non-Class 1E applications outside the containment building for 120-V ac/125-V dc circuits in the following systems: lighting, fire protection, heat tracing, and communication.

Use of these separation criteria and materials has been demonstrated to be adequate by testing and/or analyses.

Separation of electrical equipment is achieved by physical distance, separate rooms, and/or barriers. Possible hostile effects of non-safety-related equipment failure on safety-related equipment are also considered in determining adequate separation of components.

Each diesel generator, including its associated auxiliaries, is located in a separate room. The electrical switchgear of train A is separated from that of train B by physical distance, separate rooms, and barriers.

A separated and independently ventilated room is provided for the 125-V dc Class 1E batteries of each train in each unit. Battery chargers, distribution switchboards, and static uninterruptible power supplies of one train are separated from those of other trains by locating them in separate rooms. Physical independence is maintained to ensure that a single failure in one train does not cause a failure in the redundant train. There is no sharing between such Class 1E trains of equipment as batteries, battery chargers, or distribution panels.

On the basis of its review of the applicant's design criteria regarding physical identification and independence of redundant safety-related electrical equipment and systems, the staff finds these criteria to be in accordance with Regulatory Guide 1.75 and, therefore, acceptable.

8.4.5 Nonsafety Loads on Emergency Sources

Regulatory practice for operating license applications permits the connection of nonsafety loads, in addition to the required safety loads, to Class 1E (emergency) power sources if it can be shown that the connection of nonsafety loads will not result in degradation of the Class 1E system. The CPSES design provides for the connection of both safety and selected nonsafety loads to the Class 1E emergency buses of the ac and dc onsite emergency power systems. With this arrangement, electrical isolation is provided to preclude interaction between Class 1E and non-Class 1E circuits.

Electrical isolation devices and/or methods are used as required in power, control, and instrumentation circuits to maintain the independence of redundant circuits and equipment so that protective functions required during and after any design-basis event are accomplished. Different types of isolation devices are used for power, control, and instrumentation circuits. The following types of devices and/or methods are used for electrically isolating power circuits:

(1) Circuit breaker tripped by a safety injection signal.

(2) Starter contactor opened by a safety injection signal.

(3) Two circuit breakers, two fuses, or a breaker and a fuse in series, both coordinated with an upstream circuit breaker, and the circuit breakers periodically tested.

For instrumentation and control circuits, the following devices and/or methods are used for electrical isolation:

Regulatory Position C.2 - For the purpose of electrical cable separation, acceptable barriers include rigid metal conduit, electrical metallic tubing (EMT), flexible metallic conduit, cable tray covers (both solid and ventilated types), cable bus enclosures, equipment and device enclosures, enclosed metal wireways inside equipment, and a wrap of woven silicon dioxide and one hour fire rated materials (i.e. thermolag and one hour fire rated cable). | 79

A wrap of woven silicon dioxide, thermolag and one hour fire rated cable are is equivalent to a metal enclosed raceway with respect to protection from electrical failures. | 65

Metal Clad (MC) cables include copper sheathed (CS) cable and aluminum sheathed (ALS) cable. MC cable conductor size is limited to #10 AWG and below with a maximum of four (4) conductors and will be used only in non-class 1E, 120 Vac/125Vdc applications. MC cables are considered the same as cable inside conduit for separation purposes.

CS cable is constructed of continuous corrugated 16 mil thick copper tube with no outer jacket and 600V XHHW, 90°C insulation. CS cable will be used only inside the containment and only in the lighting system.

ALSMetal Clad (MC) cable is constructed of continuous corrugated 25 mil. thick seamless aluminum tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600V XHHW, 90° C insulation is considered the same as cable inside conduit for the purpose of electrical separation. MC cable conductor size is limited to #10 AWG and below with a maximum of six (6) conductors. ALSMC cable will only be used in non-class 1E applications outside of the containment building for 120VAC/125VDC circuits in the following systems: lighting, fire protection, heat tracing and communication systems. | 77

The one hour fire rated cable provides a one hour fire rated barrier per ASTM standard E 119-1971. The cable is constructed of a continuously welded corrugated 12 mil thick stainless steel sheath with high temperature nickel-clad copper conductors, glass braid cable jacket and silicone rubber insulation. This cable will be used in

power and control circuits for fire safe shutdown applications and outside containment where the total radiation dose in less than or equal to 50 MRADS gamma. Cable sizes will be 1/0 AWG and smaller.

Metal Clad (MC) cables include copper sheathed (CS) cable and Aluminum sheathed (ALS) cable. MC cable conductor size is limited to #10 AWG and below with a miximum of four (4) conductors and will be used only in non-class 1E, 120 Vac/125Vdc applications. MC cables are considered the same as cable inside conduit for separation purposes.

CS cable is constructed of continuous corrugated 16 mil thick copper tube with no outer jacket and 600V XHHW, 90°C insulation. CS cable will be used only inside the containment and only in the lighting system.

77 ALS Metal Clad (MC) cable is constructed of continuous corrugated 25 mil. thick seamless aluminum tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600V XHHW, 90° C insulation is considered the same as cable inside conduit for the purpose of electrical separation. MC cable conductor size is limited to #10 AWG and below with a maximum of six conductors. ALSMC cable will only be used in non-class 1E applications outside of the containment building for 120VAC/125VDC circuits in the following systems: lighting, fire protection, heat tracing and communication systems.

65 Testing performed by other utilities has demonstrated the adequacy of the above materials to be used as enclosed raceway and barriers for Regulatory Guide 1.75 [15] separation purposes.

65 a. Flexible Conduit: Tests documented in Reference 43 for Niagara Mohawk Power Corporation's Nine Mile Point Nuclear Station Unit 2 demonstrated the adequacy of BOA stainless steel flexible conduit and Anaconda steel flexible conduit as an enclosed raceway. Anaconda, BOA and similar quality flexible conduit are used at CPSES. The power cable was manufactured by Okonite. The control cable was manufactured by Rockbestos. The cables are of the same manufacture and similar construction to those used at CPSES. Accordingly, the test results and conclusions are applicable to CPSES installations.

77 d. Metal Clad (MC) Cable: MC cable includes Aluminum sheathed (ALS) cable and Copper sheathed (CS) cables. Tests documented in Reference 43 for Niagara Mohawk Power Corporation's Nine Mile Point Nuclear Station Unit 2 and Reference 41 for CPSES demonstrated the adequacy of BOA stainless steel flexible conduit and Anaconda steel flexible conduit as an enclosed raceway.

77 The ALSMC cable is enclosed in a 25 mil. thick corrugated seamless aluminum tube which provides mechanical integrity comparable to the 6 mil. thick BOA stainless steel flexible conduit tested in Reference 41. The seamless aluminum tube will contain any cable ignition within the tube. In addition, ALSMC cable has the annulus between the cable and the tube tightly packed with flame retardant filler materials, which will inhibit flame propagation due to the absence of free-air surrounding the cables. As ALSMC cable conductor size is limited to #10 AWG with a maximum number of 40 conductors, the cross sectional area of conductors used in the cable is much smaller than the 2/0 fault cable tested in the Anaconda steel flexible conduit in Reference 43. Therefore, the fault currents would be lower than that tested.

77 ALSMC cable has thermosetting insulation which is similar to the Anaconda steel flexible conduit tested in Reference
77 43. The jacketing materials used in ALSMC cable are also flame retardant.

The conductor material, insulation and filler materials used in CS cable are the same as those used in ALS cable. The CS cable construction will exhibit the same flame retardancy characteristics as discussed above for ALS cable. In addition, CS cable is enclosed in a 16 mil thick corrugated copper tube which provides mechanical integrity comparable to ALS cable. Based on Wyle Laboratories Test

#53575 [47], CS cable may be considered as cable in enclosed raceway and one inch separation provides adequate protection to prevent degradation of redundant circuits.

Only MC cable meeting the flame test requirements of IEEE-383 [30] will be used. | 77

Based on the above testing and analysis, MC cable is equivalent to cable inside conduit for electrical separation. | 77

Gaps of 3/8 in. or less at cable tray side rail joints, unfilled square holes 7/16 in. or less on tray side rails and 1/4 in. diameter Ty-rap holes on tray bottom are not considered significant enough to degrade the tray surface as a barrier. These gaps are comparable to openings on ventilated tray covers which have been tested and found acceptable as effective barriers to meet separation requirements per Regulatory Guide 1.75 [15]. | 66

6. Cable Spreading Area and Control Room

The cable spreading area is the space below the Control Room where instrumentation and control cables converge prior to entering the control, termination, or instrument panels. This area does not contain high-energy equipment such as switchgear, transformers, rotating equipment, or potential sources of missiles or pipe whip. Flammable material is not stored or installed in this area. Cable constructions are qualified in accordance with IEEE 383 [30]. The circuits in this area are limited to control and instrument functions and those power supply circuits serving the Control Room. Power circuits are not routed in this area, except power cables serving instrument and Control Room distribution panels. These power cables are encased in concrete or run in rigid steel conduits from the point where they enter this area. | 41

39. NEMA VE 1-1971, Cable Tray Systems, National Electrical Manufacturers Association.

40. IEEE 80-1961 (Reaff. 1971), Guide for Safety in AC Substation Grounding.

62 | 41. Wyle Laboratories Test Report No. 48037-02, Electrical Raceway Separation Verification Testing for the Texas Utilities Generating Company for use in the Comanche Peak Steam Electric Station Units 1 and 2, February 6, 1986.

62 | 42. Wyle Laboratories Test Report No. 48422-1, Cable Separation Test Program for the Texas Utilities Generating Company Comanche Peak Steam Electric Station Units 1 and 2, August 14, 1986.

65 | 43. Wyle Laboratories Test Report No. 47906-02, Test Report on Electrical Separation Verification Testing for the Stone & Webster Engineering Corporation for Use In Niagra Mohawk Power Corporation Nine Mile Point Nuclear Station - Unit 2, November 22, 1985, Configuration No.5.

79 | 44. Wyle Laboratories Test Report No. 17666-02, Test Report on Electrical Separation Verification Testing for the Stone & Webster Engineering Corporation for Use In Duquesne Light Company's Beaver Valley Power Station - Unit 2, April 19, 1985, Configurations 1, 2, 3, 4 and 6.

66 | 45. ASME Boiler and Pressure Vessel Code, Sections II, III, V, and IX.

70 | 46. Brown Boveri Electric, Inc., Test Report K-82089-K1, Test Date May 27, 1982.

47. Wyle Laboratories Test Report No. 53575, Test Report on Separation Verification Testing for Bechtel Energy Corporation for Houston Lighting and Power's South Texas Project, Configuration #1, Test #2.

Advanced FSAR Change Related to One Hour Fire Rated Cable

Regulatory Position C.2 - For the purpose of electrical cable separation, acceptable barriers include rigid metal conduit, electrical metallic tubing (EMT), flexible metallic conduit, cable tray covers (both solid and ventilated types), cable bus enclosures, equipment and device enclosures, enclosed metal wireways inside equipment, a wrap of woven silicon dioxide and one hour fire rated materials (thermolag and one hour fire rated cable).

A wrap of woven silicon dioxide, thermolag and one hour fire rated cable are equivalent to a metal enclosed raceway with respect to protection from electrical failures.

Metal Clad (MC) cables include copper sheathed (CS) cable and aluminum sheathed (ALS) cable. MC cable conductor size is limited to #10 AWG and below with a maximum of four (4) conductors and will be used only in non-class IE, 120 Vac/125Vdc applications. MC cables are considered the same as cable inside conduit for separation purposes.

CS cable is constructed of continuous corrugated 16 mil thick copper tube with no outer jacket and 600V XHHW, 90°C insulation. CS cable will be used only inside the containment and only in the lighting system.

ALS cable is constructed of continuous corrugated 25 mil. thick seamless aluminum tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600V XHHW, 90° C insulation . ALS cable will only be used outside of the containment building in the lighting, fire protection, heat tracing and communication systems.

The one hour fire rated cable provides a one hour fire rated barrier per ASTM standard E 119-1971. The cable is constructed of a continuously welded corrugated 12 mil thick stainless steel sheath with high temperature nickel-clad copper conductors, glass braid cable jacket and silicone rubber insulation. This cable will be used in power and control circuits for fire safe shutdown applications and outside containment where the total radiation dose in less than or equal to 50 MRAS gamma. Cable sizes will be 1/0 AWG and smaller.

77 Regulatory Position C.4 - The multiconductor cable between the Safety System Inoperable Indication (SSII) logic panel located in the control room and the termination cabinet in the cable spreading room meet the requirements of this position except for Class 1E environmental qualification. The cable materials meet IEEE Standard 383-1974 for the attributes of flame and radiation resistance. The cable is installed in a mild environment. Based on analysis, a fault at the SSII logic panel will not impact the availability of adjacent Class 1E cables with which these associated cables are routed. This analysis is provided in Section 8.3.

64 Regulatory Position C.6 - Lesser separations are being used in several locations between Class 1E wiring and non-Class 1E Area Radiation Monitoring detector wiring and Public Address System speaker wiring based on analysis. This analysis is provided in Section 8.3.

76 Separation between associated circuits and non-Class 1E circuits in fire panels CPX-EIPRLV-29, CPX-EIPRLV-29A, and CPX-EIPRLV-30 is not required based on analysis. This analysis is provided in Section 8.3.

77 Separation between associated cables and non-Class 1E cables at the Safety System Inoperable Indication panels is not required based on analysis. This analysis is provided in Section 8.3.

75 Regulatory Position C.9 - Splice type connections have been used to terminate field routed cables in raceways. Such splices are utilized
68 in CPSES design at:

68 a. Electric penetration assemblies (EPAs) and Thermocouple Reference Junction Boxes

60 b. Solenoid valves, limit switches, level switches, etc. (local mounted devices - LMDs)

b. Raceways

Exposed raceways containing Class 1E cables are marked by the color codes described previously in a distinct permanent manner at intervals not to exceed 15 ft and at points of entry to and exit from enclosed areas. These raceways are marked prior to the installation of their cables.

c. Cables

In general, all Class 1E cables and associated cables are jacket color-coded throughout their entire length. Cable jackets that require field color coding prior to installation, will be so worked at intervals not to exceed five feet. One hour fire rated cable has an overall stainless steel sheath. The stainless steel sheath will be field color-coded similar to that of cable jackets. Cable jackets that require field color coding after installation (due to reclassification of cables from associated Class 1E to Class 1E, or vice versa, after their initial pull) will be field color coded as follows: | 45 | DRAFT | 45

i) Where entering and exiting equipment, raceway and inside junction/pull boxes. | 45

ii) All exposed portions of the cables will be worked at intervals not to exceed five feet. | 45

iii) Portions of installed cables in conduit or trays will not be field color coded. | 45

Separation within other equipment listed in Table 8.3-10 is not required since circuits are isolated from Class 1E buses by isolation devices. 75

79

Minimum separation for control and instrumentation cables or raceways inside equipment is 1". Conduit to conduit minimum separation is 0". Cables #10 AWG and larger feeding power to control equipment from distribution panels and all power cables inside power equipment maintain 6" separation or are enclosed or separated by a barrier. 79 76

79

Control and instrumentation cables entering control equipment through BISCO fire sealant maintain a minimum separation of 1" and cables #10 AWG and larger feeding power to control equipment from distribution panels maintain 6" separation. 76

76

The above separation criteria has been demonstrated by testing and analysis (refer to References 41 and 42) to meet or exceed Regulatory Guide 1.75 [15] and IEEE-384 [31]. 62

For the purpose of electrical cable separation, acceptable barriers include rigid metal conduit, electrical metallic tubing (EMT), flexible metallic conduit, cable tray covers (both solid and ventilated types), cable bus enclosures, equipment and device enclosures, enclosed metal wireways inside equipment, a wrap of woven silicon dioxide, and one hour fire rated materials (thermolag and one hour fire rated cable). DRAFT

A wrap of woven silicon dioxide, thermolag and one hour fire rated cable are equivalent to a conduit with respect to protection from electrical failures. DRAFT

#53575 [47], CS cable may be considered as cable in enclosed raceway and one inch separation provides adequate protection to prevent degradation of redundant circuits. DRAFT

Only MC cable meeting the flame test requirements of IEEE-383 [30] will be used. 77

Based on the above testing and analysis, MC cable is equivalent to cable inside conduit for electrical separation. 77

e. One hour fire rated cable: DRAFT

The cable is constructed of a continuously welded corrugated 12 mil thick stainless steel sheath with high temperature nickel-clad copper conductors, glass braid cable jacket and silicone rubber insulation. The one hour fire rated cable meets the requirements of ASTM E-119-1971 for a fire resistance rating of one hour. This cable is therefore considered equivalent to cable in conduit for the purposes of electrical separation. DRAFT

Gaps of 3/8 in. or less at cable tray side rail joints, unfilled square holes 7/16 in. or less on tray side rails and 1/4 in. diameter Ty-rap holes on tray bottom are not considered significant enough to degrade the tray surface as a barrier. These gaps are comparable to openings on ventilated tray covers which have been tested and found acceptable as effective barriers to meet separation requirements per Regulatory Guide 1.75 [15]. 66

6. Cable Spreading Area and Control Room

The cable spreading area is the space below the Control Room where instrumentation and control cables converge prior to entering the control, termination, or instrument panels. This area does not contain high-energy equipment such as switchgear, transformers, rotating equipment, or potential sources of

41 | missiles or pipe whip. Flammable material is not stored or installed in this area. Cable constructions are qualified in accordance with IEEE 383 [30]. The circuits in this area are limited to control and instrument functions and those power supply circuits serving the Control Room. Power circuits are not routed in this area, except power cables serving instrument and Control Room distribution panels. These power cables are encased in concrete or run in rigid steel conduits from the point where they enter this area.

62 | In this area, a minimum separation of one ft horizontal and three ft vertical is preferred between redundant trays. Where raceway arrangements preclude maintaining the minimum separation distance, the redundant circuits are run in enclosed raceways or barriers are provided between redundant circuits.

62 | Where it is impractical to meet the above requirements, for cables and raceways which are limited to instrumentation and control, the minimum separation distances are as listed in paragraph 8.3.1.4, Item 5.

7. Electric Penetration Area

41 | Except for six penetrations, all individual penetrations are classified according to function and are restricted to exclusive use for power, control, or instrumentation. These six penetrations are exclusively used for six different motor operated valves for both power and control. In addition, penetrations used for the NIS cables are not used for any other purpose.

There are three electric penetration areas, one on each floor elevation. Class 1E penetrations are located on two different floor elevations, one train on each floor. The third (middle) floor area contains the four channels of the NIS and two channels of the RPS system. The remaining two channels of the Reactor Protection System (RPS) are located on the floor where train B

13. Fire Hazards Analysis Evaluation | 71

A Fire Hazard Analysis Evaluation is an assessment of the impact of a single fire hazard on redundant components or systems used to provide fire safe shutdown functions for the plant. A Fire Hazards Analysis Evaluation is performed by a Fire Protection Engineer and, if required a Systems Engineer. The purpose of a Fire Hazards Analysis Evaluation is to demonstrate compliance with BTP APCSB 9.5-1 Appendix A based on the following considerations: | 71

- potential transient and in situ combustible hazards are considered. | 66

- protection provided is commensurate with the hazards. | 66

- the consequences of a fire on the plant's ability to safely shutdown are considered. | 66

- The Fire Hazards Analysis Evaluation is written, organized and maintained to facilitate review by a person who is not involved in the evaluation. | 71

- The conclusions of the FHA Evaluations are summarized in the applicable sections of the Fire Protection Report. | 71

9.5.1.2.2 Assumptions

The FHA Evaluation is based on the following assumptions: | 50

1. Generally, the minimum fire barrier rating is three hours except for the barriers enclosing the stairwells and elevator shafts, which are rated at two hours, the cable tray/conduit fire barriers which are rated at 1-hour, one hour fire rated cable, and other special cases where a rating of less than three hours is adequate. | DRAFT

8. Fixed automatic water suppression systems will generally be installed in safety related plant areas where any of the following conditions exist:

a. A high fire hazard exists

65 b. Redundant safe shutdown equipment or cabling outside the Containment Building is located in the same fire area and is not separated by a three hour fire barrier.

c. There is a congestion of cabling.

71 In areas where condition (a) and in areas where condition (b) described above exists, the type of protection that will be provided as a minimum will be a sprinkler system providing coverage adequate for the hazard in the area unless justification for deviations are provided per reference [19] and as described in 9.5.1.6.1. The water spray design density will
65 be based on Section 9.5.1.6.1-E.3.c.
65
66 Where the condition described in (c) exists, based on Section 9.5.1.D.3.c, sprinkler systems will be provided for cabling to augment other fire protection features in the area.

DRAFT 9. Where redundant fire safe shutdown equipment cabling is located in the same fire area and is not separated by a three hour fire barrier or a horizontal distance of 20 feet with negligible intervening combustibles or fire hazard, one train of this cabling, if not one hour fire rated cable, will be enclosed by a one-hour fire barrier (or radiant energy shield inside containment) unless an alternate shutdown path is utilized or justification for deviations are provided per reference [19] except as described in Section 9.5.1.6.1.

9.5.1.5.5 Electrical Cable and Cable Tray Design - Characteristics

50 Generally, electrical cables are flame-retardent, noncombustible, and nonpropagating in nature and conform to the criterion of IEEE 383-1974. They will not support combustion in the absence of a sustained ignition source. The cable construction will allow wetting down without structural damage or electrical faulting. All cable trays, conduits, and their supports are constructed of noncombustible materials.

DRAFT Outside the Containment buildings, where cable trays containing cabling related to both redundant trains of equipment required to bring the plant to a hot standby condition, and where both trains are located in the same fire area, and are not separated by a negligible combustible horizontal distance of greater than or equal to 20 feet, and are not comprised of one hour fire rated cable, one train of cabling will be protected by at least a one hour rated fire barrier.

71 Where this situation exists, automatic sprinklers are arranged to provide coverage adequate for the hazards in the area. Sprinklers

66 are also provided for cabling where there is a congestion of cable trays see Section 9.5.1.6.1d. Fire stops are provided within the cable trays whenever the cables penetrate walls or floors designated as fire barriers. Fire stops are not provided at intermediate points in vertical or horizontal cable runs, except in long vertical runs. In such instances, fire stops are located at intervals equivalent to

65 floor spacings. It is a general installation practice that vertical tray runs are provided with solid, sheet steel covers for a minimum distance of 4 feet above the floor where necessary for physical protection of the cable. Fire stops are not provided in cable trays inside the Containment Buildings. Conduit fire stops are provided when the conduit penetrates a designated fire barrier and is not run continuously through the fire area.

9.5.1.5.6 Transformers

All interior transformers are of the air-cooled dry type and do not

75 contain any insulating oil. The main, unit auxiliary, station service

65 For systems located outside the Containment Building the following is provided:

DRAFT 1) A one-hour fire barrier or one hour fire rated cable for one set of required fire safe shutdown cabling and, based on the fire hazards of the area, automatic fire suppression and fire detection are provided.

2) Alternate shutdown capability

71 3) Fire detection and suppression, adequate for the hazards of the area, accompanied by 20 feet of horizontal separation with negligible intervening combustibles or fire hazards, unless justified per Reference [19].

71 4) Separation of redundant required sets of fire safe shutdown systems and components by a fire barrier having a 3 hour rating, unless justified per Reference [19].

65 For systems located inside the Containment Building the following is provided:

71 1) Fire detection in combination with radiant energy shields protecting one set of required fire safe shutdown systems and components unless justified per Reference [19].

71 2) Fire detection accompanied by 20 feet of horizontal separation with negligible intervening combustibles or fire hazards, unless justified per Reference [19].

(b) Where a redundant system required to bring the plant to a cold shutdown condition is subject to damage from a single fire hazard, the following will be provided:

FSAR Page (as amended)	Group	Description
1A(B)-51	2	Use of one hour fire rated cable as electrical separation Addition: Added one hour fire rated materials (e.g. thermolag and one hour fire rated cable) as acceptable for electrical separation. The one hour fire rated cable is Rockbestos cable constructed of a continuously welded stainless steel sheath and 12 mils thick. The cable is constructed of organic and inorganic materials. The conductors are high temperature, nickel-clad copper sized for up to 1700 degrees F operation. The jacket material is a glass braid with a layered silicone rubber insulation. The cable is qualified per the ASTM E-119-1971 test criteria for a fire resistence rating of one hour. The ability of the cable to propagate a fire induced by an electrical fault is comparable to station cable in conduit due to the amount of combustible material in the cable. The layer of inorganic insulation in conjunction with the glass braid is similar to a wrap of woven silicone dioxide, which is considered equivalent to conduit for CPSES. Thermolag is also considered acceptable for electrical separation because of similar characteristics to the fire rated cable. FSAR Change Request Number: 91-053.1 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes The SSER does not include the Rockbestos one hour fire rated cable as acceptable for electrical separation.
1A(B)-51	2	Use of one hour fire rated cable as electrical separation Addition: Adds a general description regarding the construction and fire resistivity of the one hour fire rated cable. The cable will be limited to 1/0 AWG (maximum) power and control circuits where the maximum radiation dose is 50 MRADS or less. FSAR Change Request Number: 91-053.2 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes The SSER does not include the Rockbestos one hour fire rated cable as acceptable for electrical separation.
8.3-63	2	Use of one hour fire rated cable as electrical separation Addition: Adds a description to indicate the methodology for color-coding the Rockbestos cable. FSAR Change Request Number: 91-053.3 Related SSER Section: SSER22 8.4.4

FSAR Page (as amended)	Group	Description
		SER/SSER Impact: Yes SSER 22 Section 8.4.4 does not include in its description of color-coding methodology for Class 1E and associated cables a description for the Rockbestos one hour fire rated cable.
8.3-75	2	Use of one hour fire rated cable as electrical separation Addition: Added one hour fire rated materials (e.g. thermolag and one hour fire rated cable) as acceptable for electrical separation. The one hour fire rated cable is Rockbestos cable constructed of a continuously welded stainless steel sheath and 12 mils thick. The cable is constructed of organic and inorganic materials. The conductors are high temperature, nickel-clad copper sized for up to 1700 degrees F operation. The jacket material is a glass braid with a layered silicone rubber insulation. The cable is qualified per the ASTM E-119-1971 test criteria for a fire resistence rating of one hour. The ability of the cable to propagate a fire induced by an electrical fault is comparable to station cable in conduit due to the amount of combustible material in the cable. The layer of inorganic insulation in conjunction with the glass braid is similar to a wrap of woven silicone dioxide, which is considered equivalent to conduit for CPSES. Thermolag is also considered acceptable for electrical separation because of similar characteristics to the fire rated cable. FSAR Change Request Number: 91-053.5 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes The SSER does not include the Rockbestos one hour fire rated cable as acceptable for electrical separation.
8.3-79	2	Use of one hour fire rated cable as electrical separation Addition: Revised text to include the Rockbestos one hour fire rated cable as an acceptable for electrical separation. FSAR Change Request Number: 91-053.6 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes SSER 22 does not include the Rockbestos cable as an acceptable approach for electrical separation.

FSAR Page (as amended)	Group	Description
		FSAR Change Request Number: 91-053.7 Related SSER Section: SSER22 8.4.4 SER/SSER Impact: Yes The SSER does not include the Rockbestos one hour fire rated cable as acceptable for electrical separation.
9.5-5, 8	2	See Page No(s):30, 54 Use of one hour fire rated cable for electrical separation. Addition: Clarification that the one hour fire rated cable can be used in lieu of a one hour fire barrier for redundant fire safe shutdown equipment cabling. FSAR Change Request Number: 91-053.8 Related SSER Section: SSER21 9.5.1.8 SER/SSER Impact: No

the staff position on this issue, the applicant has provided a keylock control board control power cutoff switch for each valve whose spurious movement could result in degraded emergency core cooling system performance. Keylock switch contacts are arranged in valve operator control circuits so that energizing the operator contactor coils from attendant control power sources can be precluded.

In order to meet the staff position that redundant valve status indication be provided in the control room, the MOVs are provided with red (open) and green (closed) position-indicating lights located at the control switch for each valve. These lights are powered by valve control power and actuated by valve motor operator limit switches. This indication circuitry is such that valve position indication is not lost when power is removed by the keylock control board control power cutoff switch. In addition, a monitor light is provided in an array of monitor lights that are all off when their respective valves are in proper position enabling safeguards operation. These lights are energized from a separate monitor light supply and actuated by valve motor-operated limit switches which are different from those used to actuate the red and green lights.

On the basis of its review and evaluation, the staff concludes that the electrical design provisions for the identified list of valves satisfy the staff position and are, therefore, acceptable.

8.4.4 Physical Identification and Independence of Redundant Safety-Related Electrical Systems

Physical Identification of Electrical Equipment

In the FSAR, the applicant has provided the criteria for physical identification of electrical equipment, including cables and raceways. Electrical equipment has its own tagging scheme developed by equipment type. All Class 1E system cables and the seismic Category I raceway system are marked by a nine-alphanumeric-character tag identifier. In addition to a tag number, each Class 1E raceway and cable in raceways are color coded to indicate its separation group. The identification scheme provides a means of readily distinguishing a cable or raceway associated with a particular separation group.

Exposed raceways containing Class 1E cables are marked by color codes in a distinct permanent manner at intervals not to exceed 15 feet and at points of entry to and exit from enclosed areas. In general, all Class 1E cables and associated cables are jacket color-coded throughout their entire length. Cable jackets that require field color coding before installation will be so worked at intervals not to exceed 5 feet. Cable jackets that require field color coding after installation due to reclassification of cables (e.g., from associated Class 1E to Class 1E or vice versa) will be color coded where the cables enter and exit equipment, in the raceway, and inside junction/pull boxes. Further, all exposed portions of these cables will be marked at intervals not to exceed 5 feet. In general, non-Class 1E equipment, raceways, and cables in raceways are not marked by color code, but are left in their natural color, generally black. However, non-Class 1E cables whose natural color is not black will be field color coded black at intervals not to exceed 5 feet.

Physical Independence of Electrical Equipment

The cable and raceway separation criteria are based on preservation of independence of redundant systems. Cables of redundant Class 1E systems are separated from each other as well as from cables of non-Class 1E systems. Cables of redundant Class 1E circuits are run in separate cable trays, conduits, ducts, and penetrations. The applicant has used lesser separation distances than those provided in guidance documents in several locations between Class 1E wiring and non-Class 1E area radiation monitoring detector wiring and public address system speaker wiring. The applicant has analyzed the effect of lesser separation between the non-Class 1E circuits and the Class 1E circuits. The applicant has treated these non-Class 1E circuits as low-energy circuits. An analysis has been performed that concludes for electric fault conditions in these non-Class 1E circuits, associated Class 1E circuits are not degraded below an acceptable level.

Fiber optic cables used in non-Class 1E monitoring circuits carry no electrical energy by themselves and therefore are not required to maintain physical separation from Class 1E circuits. In addition, radio antenna coaxial cables are used in the non-Class 1E radio communication system. The energy carried by such cables is not sufficient to cause an internally generated fire in these cables and therefore separation between these and Class 1E cables is not required.

In plant areas that are free from potential hazards such as missiles, external fires, and pipe whip, the minimum separation between redundant cable trays is 3 feet between trays separated horizontally and 5 feet between trays separated vertically. The minimum separation between safety-related conduit and redundant cable tray in these areas is 3 feet in both horizontal and vertical directions when the conduit elevation is above that of the tray side rails. The control room and cable spreading areas do not contain high-energy equipment such as switchgear, motor control centers, transformers, rotating equipment, or potential sources of missiles or pipe whip. In the cable spreading area and the control room, the minimum separation between redundant cable trays is 1 foot between trays separated horizontally and 3 feet between trays separated vertically. The minimum separation between safety-related conduit and redundant cable tray in this area is 1 foot horizontally and 2 feet vertically when the conduit elevation is above that of the tray side rails. Where cable spreading area and control room raceway arrangements preclude maintaining minimum separation distances, the redundant circuits are run in enclosed raceways, or barriers are provided between redundant circuits.

In all plant areas free of potential hazards, the minimum separation required in any direction between redundant tray and conduit is 1 inch when the conduit is not safety related or its elevation is not above the tray side rails. In SSER 17 (November 1988), the response on page 74 for Open Item E-28 indicates that for power cables, the 1-inch minimum separation is used in conjunction with two enclosures (conduit, Siltemp protective wrap, tray with cover top and bottom). This information was provided in the attachment to a letter from the applicant dated April 11, 1988. By letter dated June 5, 1989, the applicant provided clarifying information for this response. As noted in the clarifying information, as well as indicated above, CPSES uses lesser separation distances for power circuits, based on analysis, when conduit is located either above op tray, adjacent to open tray but not above the side rails, or below a ladder-type

tray. In addition, these separation criteria are also applied to power cables which are not located in raceway and are not inside equipment (as if the cables were in an open ladder-type tray). These CPSES criteria for lesser separation distances have been analyzed to show no adverse impact on Class 1E circuits.

Nuclear instrumentation system (NIS) cables are routed in conduit according to their channel assignment. A minimum separation of 6 feet is maintained between NIS conduits and raceways containing 6.9-kV circuits. In addition, a minimum separation of 2 feet is maintained from NIS conduits running parallel to raceways containing electrical noise sources such as low-voltage power and rod-control cables.

The minimum separation distance between redundant Class 1E and between Class 1E and non-Class 1E equipment and circuits internal to the control equipment is 6 inches. In this case, the wire and cables are flame retardant with self-extinguishing and nonpropagating characteristics. Other components, such as terminal blocks, wire troughs and cleats, cable ties, and glastic barriers, are manufactured from self-extinguishing material.

Where plant arrangements preclude maintaining the applicable minimum separation distances, as stated above, tray covers, solid bottoms, or other barriers are provided between the circuits requiring separation. The minimum distances between raceways requiring separation and between barriers and the raceways are in accordance with RG 1.75 and IEEE Standard 384-1974, "Trial-Use Standard Criteria for Separation of Class 1E Equipment and Circuits."

Inside equipment, for control and instrumentation cables or raceways, minimum separation is 1 inch. Cables No. 10 AWG (American wire gauge) and larger feeding power to control equipment from distribution panels and all power cables inside power equipment maintain a 6-inch separation or are enclosed or separated by a barrier.

For the purpose of electrical cable separation, enclosed raceway includes rigid metal conduit, electrical metallic tubing, and flexible metallic conduit. Ventilated tray covers are considered equivalent to solid nonventilated tray covers, and cable bus enclosures are considered the same as enclosed raceways. In addition, a wrap of woven silicon dioxide is equivalent to a conduit with respect to protection from electrical failures.

Metal-clad (MC) cable, constructed of a continuous corrugated 25-mil-thick seamless tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600-V, 90°C insulation, is considered the same as cable inside conduit for the purpose of electrical separation. MC cable conductor size is limited to No. 10 AWG and below, with a maximum of six conductors. MC cable will only be used in non-Class 1E applications outside the containment building for 120-V ac/125-V dc circuits in the following systems: lighting, fire protection, heat tracing, and communication.

Use of these separation criteria and materials has been demonstrated to be adequate by testing and/or analyses.

Separation of electrical equipment is achieved by physical distance, separate rooms, and/or barriers. Possible hostile effects of non-safety-related equipment failure on safety-related equipment are also considered in determining adequate separation of components.

Each diesel generator, including its associated auxiliaries, is located in a separate room. The electrical switchgear of train A is separated from that of train B by physical distance, separate rooms, and barriers.

A separated and independently ventilated room is provided for the 125-V dc Class 1E batteries of each train in each unit. Battery chargers, distribution switchboards, and static uninterruptible power supplies of one train are separated from those of other trains by locating them in separate rooms. Physical independence is maintained to ensure that a single failure in one train does not cause a failure in the redundant train. There is no sharing between such Class 1E trains of equipment as batteries, battery chargers, or distribution panels.

On the basis of its review of the applicant's design criteria regarding physical identification and independence of redundant safety-related electrical equipment and systems, the staff finds these criteria to be in accordance with Regulatory Guide 1.75 and, therefore, acceptable.

8.4.5 Nonsafety Loads on Emergency Sources

Regulatory practice for operating license applications permits the connection of nonsafety loads, in addition to the required safety loads, to Class 1E (emergency) power sources if it can be shown that the connection of nonsafety loads will not result in degradation of the Class 1E system. The CPSES design provides for the connection of both safety and selected nonsafety loads to the Class 1E emergency buses of the ac and dc onsite emergency power systems. With this arrangement, electrical isolation is provided to preclude interaction between Class 1E and non-Class 1E circuits.

Electrical isolation devices and/or methods are used as required in power, control, and instrumentation circuits to maintain the independence of redundant circuits and equipment so that protective functions required during and after any design-basis event are accomplished. Different types of isolation devices are used for power, control, and instrumentation circuits. The following types of devices and/or methods are used for electrically isolating power circuits:

(1) Circuit breaker tripped by a safety injection signal.

(2) Starter contactor opened by a safety injection signal.

(3) Two circuit breakers, two fuses, or a breaker and a fuse in series, both coordinated with an upstream circuit breaker, and the circuit breakers periodically tested.

For instrumentation and control circuits, the following devices and/or methods are used for electrical isolation:

Regulatory Position C.2 - For the purpose of electrical cable separation, acceptable barriers include rigid metal conduit, electrical metallic tubing (EMT), flexible metallic conduit, cable tray covers (both solid and ventilated types), cable bus enclosures, equipment and device enclosures, enclosed metal wireways inside equipment, and a wrap of woven silicon dioxide and one hour fire rated materials (i.e. thermolag and one hour fire rated cable). | 79

A wrap of woven silicon dioxide, thermolag and one hour fire rated cable are is equivalent to a metal enclosed raceway with respect to protection from electrical failures. | 65

Metal Clad (MC) cables include copper sheathed (CS) cable and aluminum sheathed (ALS) cable. MC cable conductor size is limited to #10 AWG and below with a maximum of four (4) conductors and will be used only in non-class 1E, 120 Vac/125Vdc applications. MC cables are considered the same as cable inside conduit for separation purposes.

CS cable is constructed of continuous corrugated 16 mil thick copper tube with no outer jacket and 600V XHHW, 90°C insulation. CS cable will be used only inside the containment and only in the lighting system.

ALS Metal Clad (MC) cable is constructed of continuous corrugated 25 mil. thick seamless aluminum tube with an outer thermosetting chlorosulphonated polyethylene jacket and 600V XHHW, 90° C insulation is considered the same as cable inside conduit for the purpose of electrical separation. MC cable conductor size is limited to #10 AWG and below with a maximum of six (6) conductors. ALSMC cable will only be used in non-class 1E applications outside of the containment building for 120VAC/125VDC circuits in the following systems: lighting, fire protection, heat tracing and communication systems. | 77

The one hour fire rated cable provides a one hour fire rated barrier per ASTM standard E 119-1971. The cable is constructed of a continuously welded corrugated 12 mil thick stainless steel sheath with high temperature nickel-clad copper conductors, glass braid cable jacket and silicone rubber insulation. This cable will be used in

power and control circuits for fire safe shutdown applications and outside containment where the total radiation dose in less than or equal to 50 MRADS gamma. Cable sizes will be 1/0 AWG and smaller.

b. Raceways

Exposed raceways containing Class 1E cables are marked by the color codes described previously in a distinct permanent manner at intervals not to exceed 15 ft and at points of entry to and exit from enclosed areas. These raceways are marked prior to the installation of their cables.

c. Cables

In general, all Class 1E cables and associated cables are jacket color-coded throughout their entire length. Cable jackets that require field color coding prior to installation, will be so worked at intervals not to exceed five feet. **One hour fire rated cable has an overall stainless steel sheath. The stainless steel sheath will be field color-coded similar to that of cable jackets.** Cable jackets that require field color coding after installation (due to reclassification of cables from associated Class 1E to Class 1E, or vice versa, after their initial pull) will be field color coded as follows: 45 45

i) Where entering and exiting equipment, raceway and inside junction/pull boxes. 45

ii) All exposed portions of the cables will be worked at intervals not to exceed five feet. 45

iii) Portions of installed cables in conduit or trays will not be field color coded. 45

Separation within other equipment listed in Table 8.3-10 is not required since circuits are isolated from Class 1E buses by isolation devices. 75

79

Minimum separation for control and instrumentation cables or raceways inside equipment is 1". Conduit to conduit minimum separation is 0". Cables #10 AWG and larger feeding power to control equipment from distribution panels and all power cables inside power equipment maintain 6" separation or are enclosed or separated by a barrier. 79 76

79

Control and instrumentation cables entering control equipment through BISCO fire sealant maintain a minimum separation of 1" and cables #10 AWG and larger feeding power to control equipment from distribution panels maintain 6" separation. 76

76

The above separation criteria has been demonstrated by testing and analysis (refer to References 41 and 42) to meet or exceed Regulatory Guide 1.75 [15] and IEEE-384 [31]. 62

For the purpose of electrical cable separation, acceptable barriers include rigid metal conduit, electrical metallic tubing (EMT), flexible metallic conduit, cable tray covers (both solid and ventilated types), cable bus enclosures, equipment and device enclosures, enclosed metal wireways inside equipment, ~~and~~ a wrap of woven silicon dioxide, **and one hour fire rated materials (thermolag and one hour fire rated cable)**. 79

A wrap of woven silicon dioxide, **thermolag and one hour fire rated cable are** ~~is~~ equivalent to a conduit with respect to protection from electrical failures. 78

#53575 [47], CS cable may be considered as cable in enclosed raceway and one inch separation provides adequate protection to prevent degradation of redundant circuits.

Only MC cable meeting the flame test requirements of IEEE-383 [30] will be used. | 77

Based on the above testing and analysis, MC cable is equivalent to cable inside conduit for electrical separation. | 77

e. **One hour fire rated cable:**

The cable is constructed of a continuously welded corrugated 12 mil thick stainless steel sheath with high temperature nickel-clad copper conductors, glass braid cable jacket and silicone rubber insulation. The one hour fire rated cable meets the requirements of ASTM E-119-1971 for a fire resistance rating of one hour. This cable is therefore considered equivalent to cable in conduit for the purposes of electrical separation.

Gaps of 3/8 in. or less at cable tray side rail joints, unfilled square holes 7/16 in. or less on tray side rails and 1/4 in. diameter Ty-rap holes on tray bottom are not considered significant enough to degrade the tray surface as a barrier. These gaps are comparable to openings on ventilated tray covers which have been tested and found acceptable as effective barriers to meet separation requirements per Regulatory Guide 1.75 [15]. | 66

6. Cable Spreading Area and Control Room

The cable spreading area is the space below the Control Room where instrumentation and control cables converge prior to entering the control, termination, or instrument panels. This area does not contain high-energy equipment such as switchgear, transformers, rotating equipment, or potential sources of missiles or pipe whip. Flammable material is not stored or installed in this area. Cable constructions are qualified in | 41

13. Fire Hazards Analysis Evaluation | 71

A Fire Hazard Analysis Evaluation is an assessment of the impact of a single fire hazard on redundant components or systems used to provide fire safe shutdown functions for the plant. A Fire Hazards Analysis Evaluation is performed by a Fire Protection Engineer and, if required a Systems Engineer. The purpose of a Fire Hazards Analysis Evaluation is to demonstrate compliance with BTP APCSB 9.5-1 Appendix A based on the following considerations: | 71

- potential transient and in situ combustible hazards are considered. | 66
- protection provided is commensurate with the hazards. | 66
- the consequences of a fire on the plant's ability to safely shutdown are considered. | 66
- The Fire Hazards Analysis Evaluation is written, organized and maintained to facilitate review by a person who is not involved in the evaluation. | 71
- The conclusions of the FHA Evaluations are summarized in the applicable sections of the Fire Protection Report. | 71

9.5.1.2.2 Assumptions

The FHA Evaluation is based on the following assumptions: | 50

1. Generally, the minimum fire barrier rating is three hours except for the barriers enclosing the stairwells and elevator shafts, which are rated at two hours, the cable tray/conduit fire barriers which are rated at 1-hour, **one hour fire rated cable,** and other special cases where a rating of less than three hours is adequate. | 65

8. Fixed automatic water suppression systems will generally be installed in safety related plant areas where any of the following conditions exist:

a. A high fire hazard exists

65 b. Redundant safe shutdown equipment or cabling outside the Containment Building is located in the same fire area and is not separated by a three hour fire barrier.

c. There is a congestion of cabling.

71 In areas where condition (a) and in areas where condition (b) described above exists, the type of protection that will be provided as a minimum will be a sprinkler system providing coverage adequate for the hazard in the area unless justification for deviations are provided per reference [19] and as described in 9.5.1.6.1. The water spray design density will
65 be based on Section 9.5.1.6.1-E.3.c.
65
66 Where the condition described in (c) exists, based on Section 9.5.1.D.3.c, sprinkler systems will be provided for cabling to augment other fire protection features in the area.

71 9. Where redundant fire safe shutdown equipment cabling is located in the same fire area and is not separated by a three hour fire barrier or a horizontal distance of 20 feet with negligible intervening combustibles or fire hazard, one train of this cabling, **if not one hour fire rated cable,** will be enclosed by a one-hour fire barrier (or radiant energy shield inside containment) unless an alternate shutdown path is utilized or justification for deviations are provided per reference [19] except as described in Section 9.5.1.6.1.

9.5.1.5.5 Electrical Cable and Cable Tray Design - Characteristics

50 Generally, electrical cables are flame-retardent, noncombustible, and nonpropagating in nature and conform to the criterion of IEEE 383-1974. They will not support combustion in the absence of a sustained ignition source. The cable construction will allow wetting down without structural damage or electrical faulting. All cable trays, conduits, and their supports are constructed of noncombustible materials.

71 Outside the Containment buildings, where cable trays containing cabling related to both redundant trains of equipment required to bring the plant to a hot standby condition, and where both trains are located in the same fire area, and are not separated by a negligible combustible horizontal distance of greater than or equal to 20 feet, **and are not comprised of one hour fire rated cable,** one train of cabling will be protected by at least a one hour rated fire barrier. Where this situation exists, automatic sprinklers are arranged to provide coverage adequate for the hazards in the area. Sprinklers
66 are also provided for cabling where there is a congestion of cable trays see Section 9.5.1.6.1d. Fire stops are provided within the cable trays whenever the cables penetrate walls or floors designated as fire barriers. Fire stops are not provided at intermediate points in vertical or horizontal cable runs, except in long vertical ru In such instances, fire stops are located at intervals equivalent to
65 floor spacings. It is a general installation practice that vertical tray runs are provided with solid, sheet steel covers for a minimum distance of 4 feet above the floor where necessary for physical protection of the cable. Fire stops are not provided in cable trays inside the Containment Buildings. Conduit fire stops are provided when the conduit penetrates a designated fire barrier and is not run continuously through the fire area.

9.5.1.5.6 Transformers

All interior transformers are of the air-cooled dry type and do not
75 contain any insulating oil. The main, unit auxiliary, station service

65 For systems located outside the Containment Building the following is provided:

71 1) A one-hour fire barrier **or one hour fire rated cable for ~~or~~** one set of required fire safe shutdown cabling and, based on the fire hazards of the area, automatic fire suppression and fire detection are provided.

2) Alternate shutdown capability

71 3) Fire detection and suppression, adequate for the hazards of the area, accompanied by 20 feet of horizontal separation with negligible intervening combustibles or fire hazards, unless justified per Reference [19].

71 4) Separation of redundant required sets of fire safe shutdown systems and components by a fire barrier having a 3 hour rating, unless justified per Reference [19].

65 For systems located inside the Containment Building the following is provided:

71 1) Fire detection in combination with radiant energy shields protecting one set of required fire safe shutdown systems and components unless justified per Reference [19].

71 2) Fire detection accompanied by 20 feet of horizontal separation with negligible intervening combustibles or fire hazards, unless justified per Reference [19].

(b) Where a redundant system required to bring the plant to a cold shutdown condition is subject to damage from a single fire hazard, the following will be provided: