PSEG Public Service Electric and Gas Company

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Robert L. Mittl General Manager
Nuclear Assurance and Regulation

September 27, 1984

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20814

Attention: Mr. Albert Schwencer, Chief
Licensing Branch 2
Division of Licensing

Gentlemen:

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
REVISED DSER OPEN ITEM/QUESTION RESPONSES/FSAR TEXT

Pursuant to discussions with the Power System Branch (PSB) and Instrumentation and Controls System Branch (ICSB), the responses to the DSER open items and FSAR Questions listed in Attachment 1 have been revised and are enclosed for your review and approval (See Attachment 2).

Pursuant to discussions with the Containment Systems Branch, enclosed for your review (see Attachment 3) is a copy of revised FSAR Section 6.2.5.2.1.

The revised FSAR question responses and text are scheduled to be incorporated into Amendment 8 of the HCGS FSAR.

Should you have any questions or require any additional information on these responses, please contact us.

Very truly yours,

R L Mittl / R P Douglas

B001 1/1

Attachments

C D. H. Wagner
USNRC Licensing Project Manager

W. H. Bateman
USNRC Senior Resident Inspector

MA 19 01/02-C

<u>Attachment 1</u>

DSER Open Items:	244	Rev. 2A
	245	Rev. 2B
	253	Rev. 3A

Question Responses:	421.10
	430.75
	430.81

Attachment 2

Rev. 2A #25/#27

DSER Open Item No. 244 (DSER Section 8.3.3.3.1)

ANALYSIS AND TEST TO DEMONSTRATE ADEQUACY OF LESS THAN SPECIFIED SEPARATION

The applicant, by Amendment 4 to the FSAR, provided a description of physical separation between redundant enclosed raceways (covered trays and open top raceways, and between non-Class 1E trays and Class 1E conduit, as follows:

1. In the cable spreading rooms, the main control room, relay room, and control equipment room, the separation is twelve inches (12") horizontal, and eighteen inches (18") vertical.

2. In all other plant areas, the separation is three feet horizontal and five feet vertical.

The applicant further stated that where the separation distances specified above can not be maintained, cable trays shall either be covered with metal tray covers or an analysis, based on test results, will be performed.

The staff concludes that the above separation meets the guidelines of Regulatory Guide 1.75 and is acceptable except for the following:

(1) The use of 18 versus 36 inches of separation between raceways is evaluated in Section 8.3.3.3.2 of this report, and

(2) The use of an analysis to justify less than specified separation will be pursued with the applicant.

RESPONSE

The response to Question 430.52 has been revised to provide the requested analysis. One copy of each of the following reports were attached for your use: on August 30, 1984

1) Wyle Laboraties, Test Report No. 56719, Dated November 20, 1980, prepared for Susquehanna Steam Electric Station for electrical wire and cable isolation barrier ~~test~~ materials test.

2) Franklin Institute Research Laboratories, Dated March 30, 1977, prepared for Toledo Edison Company for Conduit Separation test Program.

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QUESTION 430.52 (SECTION 8.3.1 and 8.3.2)

Provide a description of separation between redundant enclosed raceways or conduit and open top raceways and between Non Class 1E trays and Class 1E conduit.

RESPONSE

Refer to Section 8.1.4.14 and revised Section 1.8.1.75 for a description of HCGS separation provisions and a discussion of HCGS compliance to Regulatory Guide 1.75.

1.8.1.74 Conformance to Regulatory Guide 1.74, Revision 0, February 1974: Quality Assurance Terms and Definitions

HCGS complies with ANSI N45.2.10-1973, as interpreted in Regulatory Guide 1.74.

See Section 17.2 for further discussion of quality assurance and Section 1.8.2 for the NSSS assessment of this Regulatory Guide.

1.8.1.75 Conformance to Regulatory Guide 1.75, Revision 2, September 1978: Physical Independence of Electric Systems

HCGS complies with IEEE 384-1974, as modified and endorsed by Regulatory Guide 1.75, with the clarifications and exceptions outlined below.

Position C.1 separation is accomplished in general by supplying non-Class 1E loads connected to a Class 1E bus through a single breaker with a shunt trip device tripped by a LOCA signal. All non-Class 1E loads will be tripped automatically by LOCA signal. Provisions for restoring certain of these loads from the main control room are provided.

Insert A →

Position C.12 states that redundant cable spreading areas should be provided. HCGS has only a single cable spreading area.

Position C.12 endorses IEEE 384-1974, Paragraph 5.1.3, which indicates that in cable spreading areas the minimum separation distance between redundant Class 1E cable trays should be 1 foot between trays separated horizontally and 3 feet between trays separated vertically. The separation criteria used on HCGS for cable spreading areas is a minimum of 1-foot horizontal distance and 18-inch vertical distance between redundant Class 1E cable trays. The configurations, for which the redundant cable trays can not be separated by distances specified above, will either be analyzed or tested to demonstrate the compliance with the intent of Regulatory Guide 1.75.

Position C.15 specifies that redundant Class 1E batteries be located in separate safety class structures and be served by independent ventilation systems. The 250-V Class 1E batteries for electrical divisions A and B, located on elevation 163 feet of the auxiliary building, are served by a common ventilation

(Question 430.52/Item 25)

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Position C.6 states that all analyses to justify lesser separation distances shall be identified. The following are the HCGS exceptions to the IEEE 384 separation distances.

There are only three generic cases where analysis is used to justify lesser separation distances. These are identified and analyzed as follows:

- Conduit-to-conduit less than one (1) inch apart.

  Because of space limitations in some areas of the plant, the minimum separation distance of one inch between rigid steel conduits can not be maintained. The use of the conduits is limited to instrumentation to instrumentation control to control, and instrumentation to power feeder with maximum 120 Vac or 125 Vdc cables only. Wyle Test Report No. 56719, prepared for Susquehanna Steam Electric Station, showed that rigid steel conduits in contact with each other are acceptable barriers. The testing demonstrated that shorting of conductors in one conduit until failure did not affect the performance of the conductors in the other conduit or damage the conduit. In addition, Franklin Institute Research Laboratories (FIRL) performed similar testing for the Toledo Edison Company in 1977 with successful results. The test configuration and cables used conservatively bound the HCGS conditions; therefore, the limited cases where the HCGS separation has not been met in the installation are justified. The two reports referenced have been submitted under separate cover, by letter from R. L. Mittl, PSE&G, to A. Schwencer, NRC, dated August 30, 1984.

  Based on the results of this test and analysis program, separation criteria for Class 1E conduit has been established which assures that (1) any failure or occurrence in a Class 1E conduit will not degrade a redundant essential Class 1E circuit in adjacent Class 1E conduits, (2) a failure or occurrence in a non-Class 1E conduit will not degrade redundant essential Class 1E circuits in adjacent Class 1E conduits.

  The criteria established are as follows:

  1. Circuits carrying control, instrumentation, or power

Insert A (Cont'd)

cable (where the power cable is limited to 480 volt or lower and No. 12 AWG or smaller) are allowed to touch each other.

2. Conduit carrying essential Class 1E 4.16 kV power cables or 480 volt load center power cables will have a one inch minimum separation from conduits carrying Class 1E circuits of a redundant channel.

3. Conduit carrying non-essential 13.8 kV, 4.16 kV, or 480 volt load center cables that bridge conduits carrying essential Class 1E circuits of redundant channels will be separated from conduit carrying circuits of the redundant channel to give a minimum separation of one inch.

4. Conduit carrying essential Class 1E power cable of 480 volt or lower voltage with conductor size larger than number 12 AWG, and not covered by 2. above, will meet the following criteria:

   a. Will have a minimum of 1/8-inch separation from the surface of any conduit crossing above which contains an essential Class 1E circuit of the redundant channel.

   b. Are allowed to touch conduits containing an essential Class 1E circuit of the redundant channel when installed in a horizontal, side-by-side configuration.

   c. Will have a minimum separation of one inch from conduits containing an essential Class 1E circuit of the redundant channel mounted directly above and running parallel.

5. Conduit carrying non-essential power cable of 480 volt or lower voltage with conductor size larger than number 12 AWG, and not covered by 3. above, that bridge conduits carrying essential Class 1E circuits of redundant channels will be treated as in 4.a, b, and c for proper separation from the redundant channel.

- Non-Class 1E conduit separation from Class 1E tray.

In safety-related areas of the plant there are non-Class 1E rigid steel conduits within one inch of Class 1E tray. The non-Class 1E conduit contains only control, instrumentation or 120 Vac/125 Vdc power cables. The testing performed

Insert A (Cont'd)

for the above projects demonstrated that the rigid steel conduit is an effective barrier for protection of any cabling. Therefore, the HCGS cases where the non-Class 1E conduit is not installed as required is justified by the previous testing.

- Metal-clad cable separation from Class 1E raceways.

  Metal-clad cables, type MC, are used in non-Class 1E circuits only. The minimum separation between the metal-clad cable and Class 1E raceways (open top trays or conduits) is one (1) inch. The type MC cable is a factory assembly of one or more conductors, each individually insulated, covered with an overall insulating jacket and all enclosed in a metallic sheath of interlocking galvanized steel. The cable has passed the vertical flame test of IEEE 383-1974.

The above analysis identified the cases on a generic level. The installation and inspection of raceways are ongoing and the specific cases where the analysis appoes are documented on nonconformance reports that are part of the QA/QC program.

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DSER Open Item No. 245 (DSER Section 8.3.3.3.2)

THE USE OF 18 VERSUS 36 INCHES OF SEPARATION BETWEEN RACEWAYS

In Sections 1.8.1.75 and 8.1.4.14.3.1 of the FSAR it is stated that separation between redundant cable trays in the cable spreading area, control equipment room,, relay room, and main control room are separated by 18 inches vertically as opposed to the recommended 36 inches of separation required by IEEE Standard 384-1974.

The applicant, by Amendment 4 to the FSAR, indicated that this 18 inches of separation was approved by the staff during the preliminary design review of the Hope Creek plant. The staff's preliminary safety evaluation report for this item states that:

> "The applicant claims these separation distances are adequate because a high grade type cabling will be specified and results of extensive testing show that no cable degradation or flame propagation occurs when the lower tray, separated by 12 inches from the upper tray, is exposed to a gas flame for 15 minutes."

The results of these tests, that demonstrate no degradation to cables located in the trays 12 inches above the tray exposed to the gas flame, will be pursued with the applicant.

RESPONSE

Section 8.1.4.14.3.1 and the response to Question 430.51 have been revised to provide additional justification for the separation distance.

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HCGS FSAR

QUESTION 430.51 (SECTION 8.3.1 and 8.3.2)

In Sections 1.8.1.75 and 8.1.4.14.3.1 of the FSAR you state that separation between redundant cable trays in the cable spreading area, control equipment room, relay room, and main control room are separated by 18 inches of separation required by IEEE Standard 384-1974. Provide analysis substantiated by test that demonstrates the adequacy of 18 inches of separation.

RESPONSE

The HCGS PSAR was approved with 18 inch vertical separation between redundant cable trays.

A copy of the test report that substantiated the use of this vertical separation has been submitted under separate cover (letter from R. L. Mitt, PSE&G, to A. Schwencer, NRC, dated August 15, 1984).

Revised section 8.1.4.14.3.1 provides the analysis based on this test to demonstrate the adequacy of 18 inches separation.

In addition to the above test, an additional cable tray test will be performed that tests electrical shorting of electrical cabling utilizing the 18 inch vertical separation. This test plan is being submitted under separate cover.

If the test is unsuccessful, then cable tray covers will be added to the trays in accordance with IEEE Std 384-1974.

8.1.4.14.3.1 Cable Spreading Area, Control Equipment Room and ~~Relay Room~~, and Main Control Room Mezzanine

The cable spreading area, control equipment room and mezzanine ~~relay room~~, and main control room do not contain high energy equipment such as switchgear, transformer, rotating equipment, or potential sources of missiles or pipe whip, and are not used for storing flammable materials. Power supply circuits are limited to those serving these areas and their instrument systems. These 208/120-V power cables are installed in conduits. Conduits containing redundant cables are separated by a minimum of 1 inch. Conduit couplings, clamps, locknuts, bushings, etc, shall not be considered in determining the required separation distances. For conduits carrying redundant neutron monitoring cables, boxes also shall not be considered in determining the required separation. Redundant cable trays are separated by at least 18 inches vertically and 12 inches horizontally. The configurations, for which the redundant ~~cable trays~~ raceways can not be separated by distances specified above, will either be analyzed or tested to demonstrate the compliance with the intent of Regulatory Guide 1.75. Separation distance requirements between Class 1E and non-Class 1E raceways are the same as for the separation among redundant channels.

> INSERT A

Strict administrative control of operations and maintenance activities is developed to control and limit the introduction of potential hazards into these areas.

8.1.4.14.3.2 Limited Hazard Areas

Limited hazard areas are the general plant areas from which potential nonelectrical hazards such as missiles, pipe whip, and exposure fires are excluded. The hazards in this area are limited to failures or faults internal to the electrical equipment or cables. These areas include elevations 77, 102, 124, 130, and 137 feet in the auxiliary building wing areas and elevation 87 feet in the radwaste area. Minimum separation in these ~~nonhazardous~~ areas is as follows:

a. Conduits containing redundant cables are separated by a minimum of 1 inch, unless consideration of hazards indicates greater separation is required. Conduit couplings, clamps, locknuts, bushings, etc, shall not be considered in determining the required separation distances. For conduits carrying redundant neutron

INSERT A TO 8.1.4.14.3.1

IEEE 384-1974 requires a minimum vertical separation of 3 feet between trays. The HCGS minimum vertical separation distance is 18 inches. The following analysis provides the justification for he lesser separation distance:

A. All cables are flame retardant and meet or exceed the flame test specified in IEEE 383-1974 as demonstrated by tests. Cable test reports are on file and available for audit.

B. As indicated in the above paragraph, high energy equipment and potential sources of missiles or pipe whip are excluded from the areas. Power circuits in the areas are installed in conduits that qualify as barriers; the maximum potential of the power circuits is limited to 208/120 volts ac or 125 volts dc. There are no power cables of higher potential serving equipment in the areas.

C. The cable tray test report performed for Salem showed that a fire in a cable tray located 12" directly below another tray did not propagate to the upper cable tray nor degrade the cables in the upper cable tray. The test configuration and cables were representative of the HCGS design and installation except that the test configuration used a 12 inch vertical separation. Because the Salem test demonstrated that the 12 inch vertical separation was adequate, the HCGS separation distance is justified. The Salem test report, ~~entitled~~ "Basis For Cable System Design Power Generating Stations", dated July 16, 1971, has been submitted under separate cover (letter from R.L. Mittl, PSE&G, to A. Schwencer, NRC, dated August 15, 1984).

ABSTRACT-PHYSICAL SEPARATION TEST PLAN

1.0 SCOPE

This document is a test plan for the purpose of testing physical separation between redundant Class 1E cables and Class 1E and non-Class 1E cables with respect to electrical faults in configurations representative of HCGS.

1.1 OBJECTIVE

The purpose of this procedure is to present the requirements, procedures, and sequence for testing the design adequacy of the Hope Creek cable tray-to-cable tray separation. Figure 1 identifies the tray-to-tray separation test configuration.

1.2 APPLICABLE DOCUMENTS

- IEEE Std 384-1981
- IPCEA S19-81
- HCGS FSAR Section 8.1

1.3 EQUIPMENT DESCRIPTION

This test procedure encompasses testing of control cable and instrumentation cable as described below:

Item No.	Description
1.0	Okonite 600VAC, two conductor, size # 14 AWG (HCGS No. C02)
2.0	Okonite 600VAC, two conductor, size # 12 AWG (HCGS No. P12)
3.0	Eaton 600VAC, two conductor, size # 16 AWG (HCGS No. I02)

2.0 TEST REQUIREMENTS

2.1 Acceptance Criteria

2.1.1 Insulation Resistance Test

Measured insulation resistance on all "target" cables and any other cable, in the target raceway, that might sustain significant damage to its insulation system shall be greater than 1.6×10^6 ohms with an applied potential of 500 VDC for sixty seconds.

2.1.2 High Potential Test

There shall be no evidence of insulation breakdown or flashover with an applied potential of 2200 VAC for sixty seconds on all "target" cables and any other cable, in the target raceway, that might sustain significant damage to its insulation system.

2.1.3 Cable Continuity Test

Energized non-fault specimens in the "target" raceway shall conduct 100% rated current at 120 VAC throughout the overcurrent test.

2.1.4 Cable Temperature

The cabling in the upper cable tray shall be monitored for cable jacket temperature and it shall not exceed the qualified parameter in the environmental qualification of the cable.

3.0 TEST PROGRAM

3.1 Test Configuration

These tests shall consist of a series of tests with two vertically separated horizontal cable trays (see Figure 1). The test setup shall be identical for each test with the exception of the location of the faulted cable.

3.1.1 Purpose

The purpose of the tests is to demonstrate the adequacy of design where two horizontal cable trays are physically separated by eighteen inches vertically when an electrical fault occurs in the lower cable tray.

3.1.2 Test Specimen Preparation

The test specimens shall be placed in the cable tray assembly as shown in Figure 1. This apparatus shall be assembled to the indicated dimensions. The following guidelines shall be observed with regard to the materials and construction of the cable tray assembly:

1. The cable trays shall be ladder rung trays 72" by 24" by 4" (horizontal tray) from PSE&G stock.

2. The cable trays shall be supported with unistrut hangers and shall be mounted such that the bottom of the upper horizontal cable tray is eighteen inches above the top of the upper horizontal cable tray.

3. The upper and lower cable trays shall be filled to a 50% fill level (by area) using an assortment of six ft unpowered control and instrumentation cables from PSE&G stock.

4. One energized 2/C Size 16 AWG cable and one energized 3/C Size 14 AWG cable shall be placed inside the cable trays that do not have the faulted cable. The energized "target" cables shall be located in the worst case locations (directly above, underneath or next to the faulted cable) as shown in Figure 1. (NOTE: Figure 1 shows the fault and "target" cable locations for the two tests).

3.1.3 Instrumentation Setup

3.1.3.1 Thermocouple Locations

For the test, five thermocouples are to be mounted to the upper and lower cable tray on the edge closest to the faulted cable in the horizontal cable tray.

These thermocouples shall be monitored by a Fluke Datalogger feeding a high-speed printer. The datalogger shall be operated at its maximum rate throughout the overcurrent test.

3.1.3.2 Electrical Monitoring -- All voltages and phase currents of the energized cables and the fault cable current shall be fed to oscillograph recorders. The oscillographs shall be operated at the 0.1 inch per minute rate throughout the overcurrent test. The oscillograph channels shall be as specified below:

Oscillograph #1 Channels

Channel No.	Test No.	Signal	Location
1	1	Current	16 AWG Upper Cable Tray
1	2	Current	14 AWG Lower Cable Tray
2	1	Current	12 AWG Upper Cable Tray
2	2	Current	16 AWG Lower Cable Tray
3	1	Current	16 AWG Upper Cable Tray
3	2	Current	14 AWG Lower Cable Tray
4	1	Voltage	16 AWG Upper Cable Tray
4	2	Voltage	12 AWG Lower Cable Tray
5	1	Voltage	12 AWG Upper Cable Tray
5	2	Voltage	16 AWG Lower Cable Tray
6	1	Voltage	16 AWG Upper Cable Tray
6	2	Voltage	14 AWG Lower Cable Tray

Oscillograph #2 Channels

Channel No.	Test No.	Signal	Location
1	1,2	Current	Faulted Cable

A digital multimeter shall be utilized to measure all phase-to-phase voltages and all phase currents prior to, during, and after the overcurrent test. These data shall be recorded to provide accurate evidence of the energized specimens' ability to conduct rated current and 120 VAC throughout the overcurrent test.

3.1.4 Baseline Functional Tests for Cabling in Upper Tray

The baseline functional tests shall consist of insulation resistance and high potential tests on the "target" cables.

3.1.4.1 Insulation Resistance Test

1. Using a megohmmeter, apply a potential of 500 VDC and record the minimum insulation resistance indicated over a period of 60 seconds on the "target" cables.

2. Perform a high potential test on the "target" cable.

3.1.5 Overcurrent Test

1. Connect the worst case cable (WCC) size to the copper bus bars per Figure 3.

2. Energize the two 3/C Size 14 AWG cables with 120 VAC and 15 amperes.

3. Energize the two 3/C Size 12 AWG cables with 120 VAC and 90 amperes.

4. Energize the worst case cable size with rated current (90 amps).

5. Record "target" cable voltages and currents and the fault cable current.

6. Allow the worst case cable size to conduct rated current for 15 minutes.

7. Increase the Multi-Amp Test Set output to 660 amperes in increments of 50 amperes. Hold at each level until cable failure occurs or until thermocouple readings stabilize.

8. Record "target" cable voltages and currents and the fault cable current and temperatures.

9. De-energize the Multi-Amp Test Set output.

10. Record Multi-Amp Test Set time to failure of the faulted cable.

11. Record "target" cable voltages and currents.

12. De-energize the "target" cables.

13. Photograph the post-test damage.

14. Remove the faulted cable and any other cables that were significantly damaged.

15. Repeat the applicable portions of Paragraphs 3.1.2 (Test Specimen Preparation), 3.1.3 (Instrumentation Setup) and 3.1.4 (Baseline Functional Tests).

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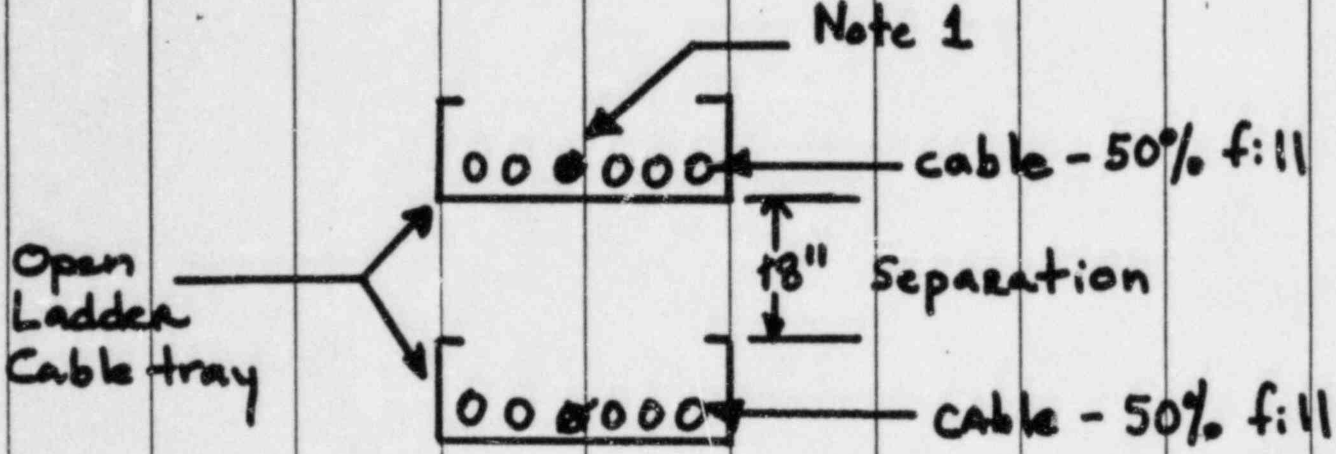
(Item 26)

FIGURE 1 - TEST SETUP FOR TRAY-TO-TRAY SEPARATION



● Denotes Target Cable Location

⊗ Denotes Fault Cable Location

Note 1 - Target cable will be energized during the faulted test condition

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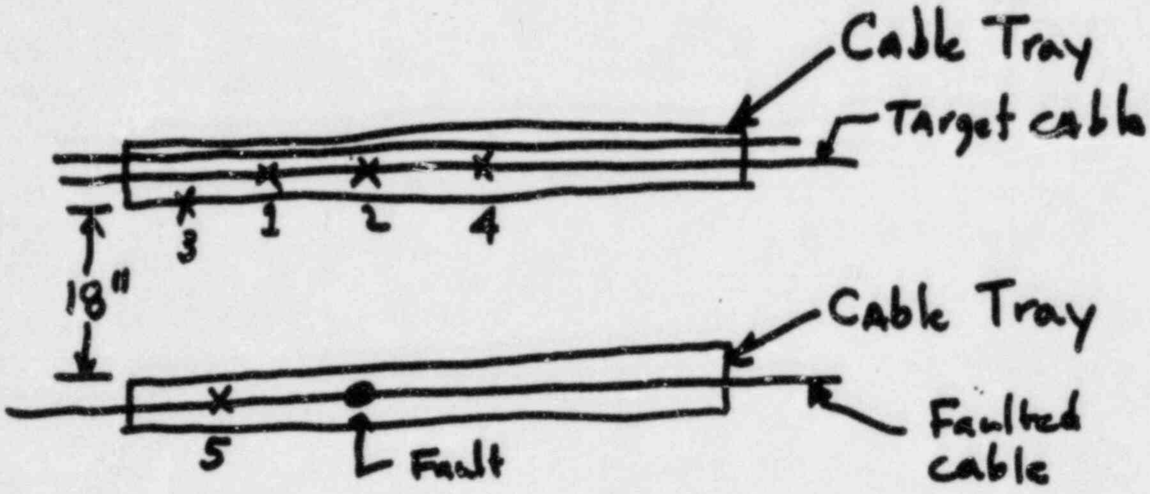
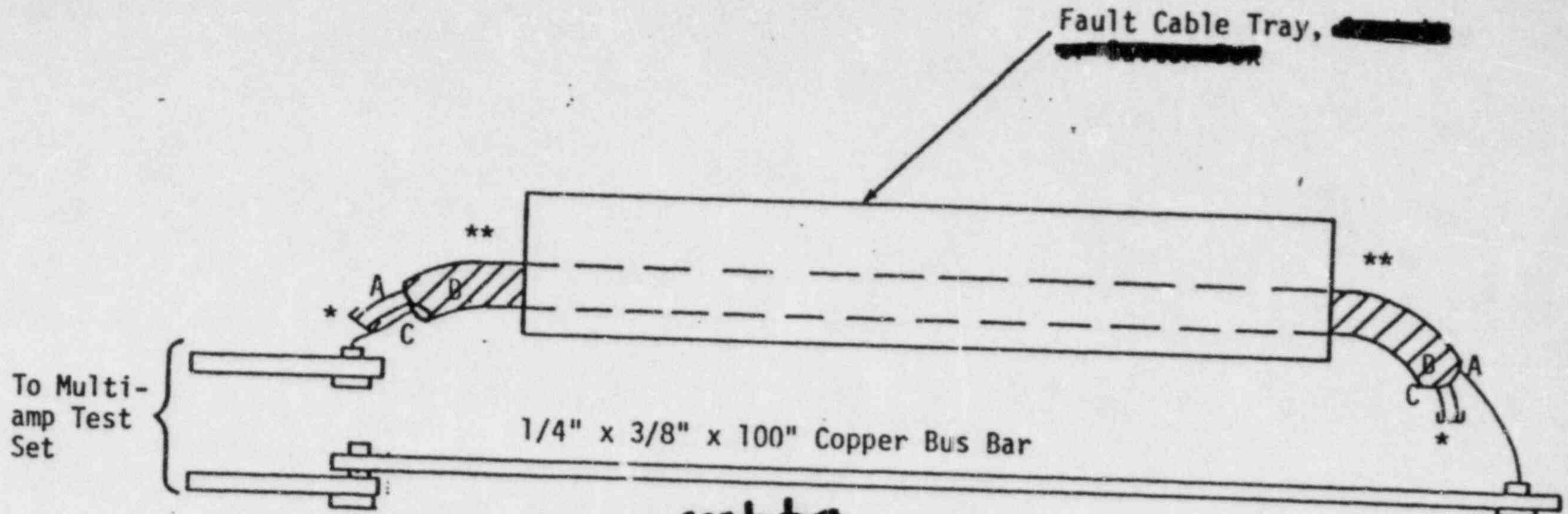
Figure 2 - Thermocouple Locations



X - Type "K" thermocouple mounted on the target cable jacket and cable adjacent to the target &cable and the cable rungs.



* The three conductors of the fault cable shall be connected in series.

** The fault cable shall be wrapped with a single layer of siltemp wide tape No. 65 from the edge of the test area to the bus bar.

FIGURE 3. TYPICAL FAULT CABLE CONNECTIONS

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DSER Open Item No. 253 (DSER Section 8.3.3.1.4)

COMMITMENT TO PROTECT ALL CLASS 1E EQUIPMENT FROM EXTERNAL HAZARDS VERSUS ONLY CLASS 1E EQUIPMENT IN ONE DIVISION

In Section 8.1.14.3.3 of the FSAR, it is stated that where neither compartmentalization nor the construction of barriers is possible (to protect Class 1E circuits or equipment from hazards such as pipe break, flooding, missiles, and fires) an analysis is performed to demonstrate that none of the hazards disables redundant equipment, conduits, or trays. Based on this statement, the staff concludes that at least one of the redundant Class 1E systems and components at Hope Creek need not be protected from external hazards. The design, thus, does not meet the protection requirement of Criteria 2 and 4, nor the single failure requirement of Criterion 17 of Appendix A to 10 CFR 50. Justification for non-compliance with Criteria 2, 4, and 17 will be pursued with the applicant.

RESPONSE

The response to Question 430.38, and Section 8.1.4.14.3.3, have been revised to provide a discussion of protection of Class 1E systems and components against external hazards.

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QUESTION 430.38 (SECTION 8.3.1 and 8.3.2)

In Sections 8.1.4.14.3.3 of the FSAR you state that where neither compartmentalization nor the construction of barriers is possible (to protect Class 1E circuits or equipment from hazards such as pipe break, flooding, missiles, and fires) an analysis is performed to demonstrate that none of the hazards disables redundant equipment, conduits, or trays. Based on this statement it appears that at least one of the redundant Class 1E systems and components at Hope Creek may not be protected from external hazards. The design, thus, does not meet the protection requirement of Criteria 2 and 4 nor the single failure requirement of Criterion 17 of Appendix A to 10CFR50. Justify non-compliance with Criteria 2, 4, and 17.

RESPONSE

Section 3.5 indicates that Class 1E equipment is protected from postulated missiles by use of plant arrangement or suitable physical barriers such that a single missile cannot simultaneously damage a critical system component and its backup system. This is accomplished by locating redundant systems in different areas of the plant or separation by missile-proof walls. There are no Class 1E electrical equipment and components that can be damaged by missiles generated externally to the plant.

Section 3.6.1.1 indicates that, as part of the design basis for protection against dynamic effects associated with the postulated rupture of piping, a single active component failure is assumed to occur in systems used to mitigate the consequences of the postulated piping rupture and to shut down the reactor. A thorough review of the plant using the design bases provided in Section 3.6.1.1 was conducted and no cases were found where the piping failure would prevent safe shutdown (Reference: Question/Response 410.23).

Section 8.1.4.14.3.3 has been revised to INCLUDE THE FOLLOWING STATEMENTS:

INSERT "A"

INSERT A (Question 430.38/Item 34)

A separation analysis has been performed which addresses protection of all Class 1E electrical equipment from external hazards generated by a non-safety system or component. It has been concluded that in certain areas, a break in a fire protection system could affect some Class 1E electrical equipment. HCGS has committed to protect all Class 1E equipment from this hazard. In addition, the flooding hazard in the main steam tunnel which results from a feedwater line break could cause the failure of some Class 1E motor operated valves and some Class 1E temperature elements (RTDs). These devices are protected from short circuit damage by Class 1E overcurrent protective devices located in hazard free areas. These primary overcurrent protective devices are backed up by additional Class 1E overcurrent protective devices also located in hazard free areas. HCGS will complete an analysis to verify that after the back-up isolation device clears the flooded devices, the plant can be safely shutdown with the worst case single failure in a redundant train. If this is not the case flood protection will be provided. Other external hazards were also analyzed and it is concluded that no other Class 1E electrical equipment can be damaged by external hazards originating from a non-safety system or component.

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monitoring cables, boxes also shall not be considered in determing the required separation.

b. In case of open ventilated trays, redundant trays are separated by 3 feet horizontally and 5 feet vertically, respectively. If the redundant trays cannot be separated by the distances specified above, solid covers for trays are provided as designated in Section 6.1.4 of IEEE 384-1981.

Separation requirements between Class 1E and non-Class 1E circuits are the same as those required between redundant circuits.

8.1.4.14.3.3 Hazardous Areas

These are areas where one or more of hazards such as pipe break, flooding, missile, and fire can be postulated.

Routing of redundant Class 1E circuits or the locating of redundant Class 1E equipment in hazardous areas is avoided. The preferred separation between redundant Class 1E circuits or equipment in these areas is by a wall, floor, or barrier that is structurally adequate to shield redundant raceways from potential hazards in the area.

Where neither compartmentalization nor the construction of barriers is possible, an analysis is performed to demonstrate that no missile, fire, jet stream impingement, or pipe whip hazard disables redundant equipment, conduits, or trays. In no case, regardless of the distance of physical separation, are redundant equipment cable trays located in the direct line of sight of the same potential missile source.

The plant design for fire protection separation of electrical cables and equipment is reviewed against 10 CFR 50, Appendix R, which is discussed in Section 9.5.1.

INSERT "A"

INSERT A INTO SECTION 8.1.4.14.3.3

A separation analysis has been performed which addresses protection of all Class 1E electrical equipment from external hazards generated by a non-safety system or component. It has been concluded that in certain areas, a break in a fire protection system could affect some Class 1E electrical equipment. HCGS has committed to protect all Class 1E equipment from this hazard. In addition, the flooding hazard in the main steam tunnel which results from a feedwater line break could cause the failure of some Class 1E motor operated valves and some Class 1E temperature elements (RTDs). These devices are protected from short circuit damage by Class 1E overcurrent protective devices located in hazard free areas. These primary overcurrent protective devices are backed up by additional Class 1E overcurrent protective devices also located in hazard free areas. HCGS will complete an analysis to verify that after the back-up isolation device clears the flooded devices, the plant can be safely shutdown with the worst case single failure in a redundant train. If this is not the case flood protection will be provided. Other external hazards were also analyzed and it is concluded that no other Class 1E electrical equipment can be damaged by external hazards originating from a non-safety system or component.

QUESTION 421.10 (SECTION 7.1 & 7.2)

The staff believes that the physical separation provided in the design of the RPS cabinets may not satisfy the requirements of Regulatory Guid 1.75 or the plant separation criteria and is, therefore, unacceptable. As an example, it has been noted on similar plants that the cabinet lighting and power circuits (which are not treated as associated circuits) becomes associated with Class 1E circuits inside the RPS cabinets. Section 8.1.4.14 includes a brief discussion on the physical separation provided within panels, instrument racks and control boards for the instrumentation and control circuits of different divisions. Review the design of all Class 1E cabinets for separation between non-Class 1E and Class 1E circuits. Provide the staff with a listing of the cabinets which were reviewed and describe in detail how physical separation is maintained within the panels, racks and boards for those cases where a 6 inch air space cannot be maintained. Provide a summary of the analysis and testing performed to support this lesser separation. Include in the discussion the separation provided for associated circuits, internal wiring identification and the use of common terminations.

RESPONSE

The HCGS RPS cabinets (10C609, 10C611, 10C622 and 10C623) meet the requirements of IEEE Standard 384 as modified and endorsed by Regulatory Guide 1.75, as stated in Section 1.8.1.75. Cabinet lighting and receptacle power circuits are physically separated from RPS circuits by being routed in metallic conduit or by structural steel barriers.

Physical separation between non-Class 1E and Class 1E instrumentation and control circuits is provided in panels, instrument racks and control boards in accordance with IEEE Standard 384, as modified and endorsed by Regulatory Guide 1.75 as stated in Section 1.8.1.75. The following is a listing of Class 1E panels, instrument racks and control boards reviewed for the separation requirements of IEEE Standard 384:

Panels

1AC200	H_2/O_2 Analyzer A Panel
1BC200	H_2/O_2 Analyzer B Panel
1CC200	H_2/O_2 Analyzer Heat Trace Panel
1DC200	H_2/O_2 Analyzer Heat Trace Panel
1AC201	SACS Control Panel A
1BC201	SACS Control Panel B
1CC201	SACS Control Panel C
1DC201	SACS Control Panel D
10C202	RACS Heat Exchanger and Pumps Control Panel

1AC213	Instrument Gas Compressor A Control Panel
1BC213	Instrument Gas Compressor B Control Panel
1AC215	H_2 Recombiner A Power Distribution Panel
1BC215	H_2 Recombiner B Power Distribution Panel
1AC281	Reactor Building Unit Cooler Control Panel
1BC281	Reactor Building Unit Cooler Control Panel
1CC281	Reactor Building Unit Cooler Control Panel
1DC281	Reactor Building Unit Cooler Control Panel
1AC285	Reactor Building FRVS Control Panel
1BC285	Reactor Building FRVS Control Panel
1CC285	Reactor Building FRVS Control Panel
1DC285	Reactor Building FRVS Control Panel
1OC286	Reactor Building Equipment Lock Ventilation
1OC399	Remote Shutdown Panel
1OC401	Diesel Generator Area Battery Room Panel
1OC402	Diesel Generator Area Battery Room Panel
1AC420	Diesel Generator A Exciter Panel
1BC420	Diesel Generator B Exciter Panel
1CC420	Diesel Generator C Exciter Panel
1DC420	Diesel Generator D Exciter Panel
1AC421	Diesel Generator A Local Engine Control Panel
1BC421	Diesel Generator B Local Engine Control Panel
1CC421	Diesel Generator C Local Engine Control Panel
1DC421	Diesel Generator D Local Engine Control Panel
1AC422	Diesel Generator A Remote Control Generator Panel
1BC422	Diesel Generator B Remote Control Generator Panel
1CC422	Diesel Generator C Remote Control Generator Panel
1DC422	Diesel Generator D Remote Control Generator Panel
1AC423	Diesel Generator A Remote Engine Control Panel
1BC423	Diesel Generator B Remote Engine Control Panel
1CC423	Diesel Generator C Remote Engine Control Panel
1DC423	Diesel Generator D Remote Engine Control Panel
1AC428	Diesel Generator A Load Sequencer Panel
1BC428	Diesel Generator B Load Sequencer Panel
1CC428	Diesel Generator C Load Sequencer Panel
1DC428	Diesel Generator D Load Sequencer Panel
1AC482	Electric Heater Control Panel 1AVH403
1BC482	Electric Heater Control Panel 1BVH403
1AC483	Diesel Area HVAC Control Panel
1BC483	Diesel Area HVAC Control Panel
1CC483	Diesel Area HVAC Control Panel
1DC483	Diesel Area HVAC Control Panel
1AC485	Control Area HVAC Control Panel
1BC485	Control Area HVAC Control Panel
1AC486	Diesel Area Panel Room Supply System
1BC486	Diesel Area Panel Room Supply System
1AC487	Water Chiller Panel
1BC487	Water Chiller Panel
1AC488	Chiller AK403 Power Panel
1BC488	Chiller BK403 Power Panel
1AC489	Electric Heater Control Panel 1AVH407
1BC489	Electric Heater Control Panel 1BVH407

1AC490	Water Chiller A Control Panel
1BC490	Water Chiller B Control Panel
1AC491	Water Chiller A Power Panel
1BC491	Water Chiller B Power Panel
1AC492	Electric Heater Control Panel
1BC492	Electric Heater Control Panel
1AC493	Control Panel - Auxiliary Building Diesel
1AC494	Control Panel - Auxiliary Building Diesel
1AC495	Control Panel - Auxiliary Building Diesel
1BC495	Control Panel - Auxiliary Building Diesel
1CC495	Control Panel - Auxiliary Building Diesel
1DC495	Control Panel - Auxiliary Building Diesel
1AC515	Traveling Screen Control Panel
1BC515	Traveling Screen Control Panel
1CC515	Traveling Screen Control Panel
1DC515	Traveling Screen Control Panel
1AC516	Service Water Pump Panel
1BC516	Service Water Pump Panel
1CC516	Service Water Pump Panel
1DC516	Service Water Pump Panel
1AC581	Intake Structure HVAC Control Panel
1BC581	Intake Structure HVAC Control Panel
1CC581	Intake Structure HVAC Control Panel
1DC581	Intake Structure HVAC Control Panel
1OC601	RRCS Division 1 Panel
1OC602	RRCS Division 2 Panel
1OC604	Class 1E Radiation Monitoring Instrumentation Cabinet
1OC617	Division 1 RHR and Core Spray Relay Vertical Board
1OC618	Division 2 RHR and Core Spray Relay Vertical Board
1OC620	HPCI Relay Vertical Board
1OC621	RCIC Relay Vertical Board
1OC622	Inboard Isolation Valve Relay Vertical Board
1OC623	Outboard Isolation Valve Relay Vertical Board
1OC628	ADS Division 2 Relay Vertical Board
1OC631	ADS Division 4 Relay Vertical Board
1AC633	Post LOCA H_2 Recombiner A Control Cabinet
1BC633	Post LOCA H_2 Recombiner B Control Cabinet
1OC640	Division 4 RHR and Core Spray Relay Vertical Board
1OC641	Division 3 RHR and Core Spray Relay Vertical Board
1OC650	Main Control Room Vertical Board
1OC651	Unit Operators Console
1AC652	1E Solid State Logic Cabinet Channel A
1BC652	1E Solid State Logic Cabinet Channel B
1CC652	1E Solid State Logic Cabinet Channel C
1DC652	1E Solid State Logic Cabinet Channel D
1AC655	1E Analog Logic Cabinet Channel A
1BC655	1E Analog Logic Cabinet Channel B
1CC655	1E Analog Logic Cabinet Channel C
1DC655	1E Analog Logic Cabinet Channel D
1AC657	1E Digital Termination Cabinet Channel A
1BC657	1E Digital Termination Cabinet Channel B
1CC657	1E Digital Termination Cabinet Channel C

1DC637	1E Digital Termination Cabinet Channel D
1AC680	1E Electrical Auxiliary Cabinet Channel A
1BC680	1E Electrical Auxiliary Cabinet Channel B
1CC680	1E Electrical Auxiliary Cabinet Channel C
1DC680	1E Electrical Auxiliary Cabinet Channel D

Instrument Racks

10C002	Reactor Water Clean-up Rack
10C004	Reactor Vessel Level and Pressure A Rack
10C005	Reactor Vessel Level and Pressure C Rack
10C009	Jet Pump Rack A
10C014	HPCI A/HPCI Leak Detection A Rack
10C015	Main Steam C/D and Recirc A Flow Rack
10C018	RHR A and ADS Rack
10C021	RHR B and ADS Rack
10C025	Main Steam C/D and Recirc A Flow Rack
10C026	Reactor Vessel Level and Pressure D Rack
10C027	Reactor Vessel Level and Pressure B Rack
10C037	RCIC D/RCIC Leak Detection D Rack
10C041	Main Steam A/B and Recirc B Flow Rack
10C042	Main Steam A/B and Recirc B Flow Rack
10C069	RHR D and ADS Rack
10C208A	RCIC/Reactor Cooling
10C211	RCIC Pump
10C212	RCIC Pump

Instrument racks are separated into channels. No two redundant piped or tubed safety-related instruments are located on the same rack.

Where a 6-inch air space cannot be maintained between instrumentation and control circuits of different channels (both Class 1E to Class 1E and Class 1E to non-Class 1E), barriers are provided in accordance with IEEE Standard 384. These barriers are metallic conduit, structural steel barriers, or non-metallic wrap (Havey Industries Siltemp Sleeving Type S or Siltemp Woven Tape Type WT65). The metallic conduit and structural steel barriers are noncombustible materials. The nonmetallic wrap (Siltemp) was successfully tested for use as an isolation barrier (reference Wyle Laboratories Test Report Number 56669).

For certain types of isolation devices, barriers of the type noted above are not feasible. For these cases, requirements of Section 7.2.2.1 of IEEE Standard 384 are met, as follows:

> "The separation of the wiring at the input and output terminals of the isolation device may be less than 6 inches (0.15 m) as required in 6.6.2 provided that it is not less than the distance between input and output terminals.

Add Insert A

— INSERT A —

At HCGS, three isolation devices are used which do not satisfy the 6 inch air space requirement and, by design, barriers of the type identified above are not feasible. The 6 inch air space requirement is maintained for wiring associated with these devices except at the device itself where the separation is maintained not less than the physical distance between the input and output terminals of the isolation device. These devices are:

a) TEC analog isolator, model 156 – provides class 1E to non-class 1E isolation for low level analog inputs to the plant compute

b) Struthers Dunn type 219 relay – provides class 1E to non-class 1E isolation for inputs to the plant annunciator (125 vdc contact interrogation voltage is used by the plant annunciator),

c) Allen Bradley model 700-200A12P relay – provides class 1E to non-class 1E isolation for inputs to the plant annunciator.

These devices are fully qualified for their applicati as described in part (d) of the response to question 421.12

Minimum separation requirements do not apply for wiring and components within the isolation device; however, separation shall be provided wherever practicable."

Testing, in accordance with IEEE Standard 472 (Surge Withstand Capability) will be performed to ensure that the Class 1E inputs to the isolation devices are not affected by short-circuit failures, ground faults or voltage surges on the output side of the isolation devices.

~~The only~~ Single Failure analysis ~~that will be~~ were performed to support air spaces less than 6 inches, ~~since the requirements of IEEE Standard 384 are satisfied, is~~ for the Neutron Monitoring System Panel (10C608) and the Process Radiation Monitoring System Panels (10C635 and 10C636). This report was submitted under separate cover (R.L Mitti to A Schwencer dated September 7, 1984.) No associated circuits have been identified in the non-NSSS panels, instrument racks, or control boards. Internal wiring identification is done using color coded insulation or insulation marked with color coded tape. For panel sections of one channel only, internal wiring identification may not be done. Where common terminations are used, the requirements of IEEE Standard 384 are satisfied as stated above.

Electrical equipment and wiring for the reactor protection system (RPS), the nuclear steam supply shutoff systems (NSSSS) and the engineered safeguards subsystems (ESS) are segregated into separate divisions designated I and II, etc., such that no single credible event is capable of disabling sufficient equipment to prevent reactor shutdown, removal of decay heat from the core, or closure of the NSSSS valves in the event of a design basis accident.

No single control panel section (or local panel section or instrument rack) includes wiring essential to the protective function of two systems that are backups for each other (Division I and Division II) except as allowed below:

a. If two panels containing circuits of different separation divisions are less than 3 feet apart, there shall be a steel barrier between the two panels. Panel ends closed by steel end plates are considered to be acceptable barriers provided that terminal boards and wireways are spaced a minimum of one inch from the end plate.

b. Floor-to-panel fire proof barriers must be provided between adjacent panels having closed ends.

c. Penetration of separation barriers within a subdivided panel is permitted, provided that such penetrations are sealed or otherwise treated so that an electrical fire could not reasonably propagate from one section to the other and destroy the protective function.

d. Where, for operational reasons, locating manual control switches on separate panels is considered to be prohibitively (or unduly) restrictive to normal functioning of equipment, then the switches may be located on the same panel provided no single event in the panel can defeat the automatic operation of the equipment.

With the exception of panels 10C608, 10C635 and 10C636, internal wiring of the NSSS panels and racks has color-coded insulation. Associated circuits are treated within a panel or rack in the same manner as the essential circuits. Where common terminations are used, the requirements of IEEE Standard 384 are satisfied.

Electrical protection assemblies have been added between the power range NMS panel (10C608) and its two 120V ac UPS power feeders as described in revised Section 7.6.1.4.2.

CHAPTER 7

FIGURES (Cont)

coaxial cable. The amplifier is a linear current amplifier whose voltage output is proportional to the current input and therefore proportional to the magnitude of the neutron flux. Low level output signals are provided that are suitable as an input to the computer, recorders, etc. The output of each LPRM amplifier is isolated to prevent interference of the signal by inadvertent grounding or application of stray voltage at the signal terminal point.

Power for the LPRM is supplied ~~by~~ from two non-Class 1E uninterruptible power sources (See Figure 8.3-11, Sht. 3). Approximately half of the LPRMs are supplied from each bus. Each LPRM amplifier has a separate power supply in the main control room, which furnishes the detector polarizing potential. The LPRM amplifier cards are mounted into pages in the NMS cabinet, and each page is supplied operating voltages from a separate low voltage power supply.

– INSERT A –

The trip circuits for the LPRM provide signals to actuate lights and annunciators. Table 7.6-3 lists the LPRM trips.

Each LPRM may be individually bypassed via a switch on the LPRM amplifier card. Placing an LPRM in "bypass" sends a signal to the assigned APRM, electronically causing it to adjust its averaging amplifier's gain to allow for one less LPRM input. In this way, each APRM can continue to produce an accurate signal representing average core power even if some of the assigned LPRMs fail during operation. If the number of functional assigned LPRMs drops to 50% of the normal number, the APRM automatically goes inoperative and a half scram (one trip logic channel deenergized), rod block, and appropriate annunciation are generated. Administrative controls ensure that a minimum number of LPRMs at each level (A, B, C, and D) in the core are maintained or the APRM is declared inoperative and manually placed in the tripped state.

In addition to the signals supplied to the APRMs, the LPRMs also send flux signals to the rod block monitor (RBM). When a central control rod is selected for movement, the output signals from the amplifiers associated with the nearest 16 LPRM detectors are displayed on the main control room vertical board meters and sent to the RBM. The four LPRM detector signals from each of the four detector assemblies are displayed on 16 separate meters. The operator can readily obtain readings from all the LPRM detectors by selecting the control rods in order. These signals from the

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INSERT A

8.3-14 and

Electrical protection assemblies (EPAs) identical to those used in the reactor protection system (RPS) (described in Section 8.3.1.5.4) are installed between the power range NMS and the two 120V AC feeders from the UPS power sources (see Figures 7.6-11). The EPAs ensure that the power range NMS never operates under degraded bus voltage or frequency conditions (undervoltage, overvoltage, underfrequency). The power range NMS panel (10C608) was analyzed with this power supply configuration to ensure that no single failure of the power range NMS could inhibit the proper operation of the reactor protection system or any other safety system required for the safe operation of the plant. The interfaces between the power range NMS and the RPS have adequate provisions for separation. The RPS cabling external to the NMS panel conforms to the separation guidelines of Regulatory Guide 1.75, which the RPS must satisfy. Within the panel, Where the cable and wiring runs to the different RPS divisions do not conform to the Regulatory Guide 1.75 separation criteria, fire-resistant "Sil-Temp" tape is wrapped around the cables and wires. This eliminates the possibility of fault propagation between the RPS divisions. In accordance with paragraph 5.6.2 of IEEE Standard 384, this tape has been demonstrated to be acceptable.

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four LPRM strings (16 detectors) surrounding the selected rod are used in the RBM to provide protection against local fuel overpower conditions.

7.6.1.4.3 Average Power Range Monitor Subsystem

The APRM subsystem monitors neutron flux from approximately 1% to above 100% power. There are six APRM channels, each receiving core flux level signals from 21 or 22 LPRM detectors. Each APRM channel averages the 21 or 22 separate neutron flux signals from the LPRMs assigned to it, and generates a signal representing core average power.

This signal is used to drive a local meter and a remote recorder located on the main control room vertical board. It is also applied to a trip unit to provide APRM downscale, inoperative and upscale alarms, and upscale reactor trip signals for use in the RPS or RMCS.

Refer to Section 7.2.1.1 for a description of the APRM inputs to the RPS, and Figure 7.6-5 for the RPS trip circuit input arrangement. APRM trips are summarized in Table 7.6-2.

The APRM scram units are set for a reactor scram at 15% core power in "refuel" and "startup" modes. When the mode switch is in "run," the APRM trip reference signal is provided by a signal that varies with recirculation flow. This provides a power following reactor scram setpoint. As power increases, the reactor scram setpoint also increases up to a fixed setpoint above 100%. Reactor power is always bounded with a reactor scram, yet the change in power required to generate the reactor scram does not vary greatly with the operating power level.

Provision is made for manually bypassing one APRM channel at a time. Calibration or maintenance can be performed without tripping the RPS. Removal of an APRM channel from service without bypassing it, by unplugging a card, by taking the APRM function switch out of "operate," or by having too few assigned LPRM signals to the APRM, will result in an APRM "inoperative" condition which causes a half scram, a rod block, and annunciation

6 The APRM channels receive power from [the same] non-Class 1E uninterruptible power sources [that supply the LPRMs (see Section 7.6.1.4.2)]. Power for each APRM trip unit is supplied from

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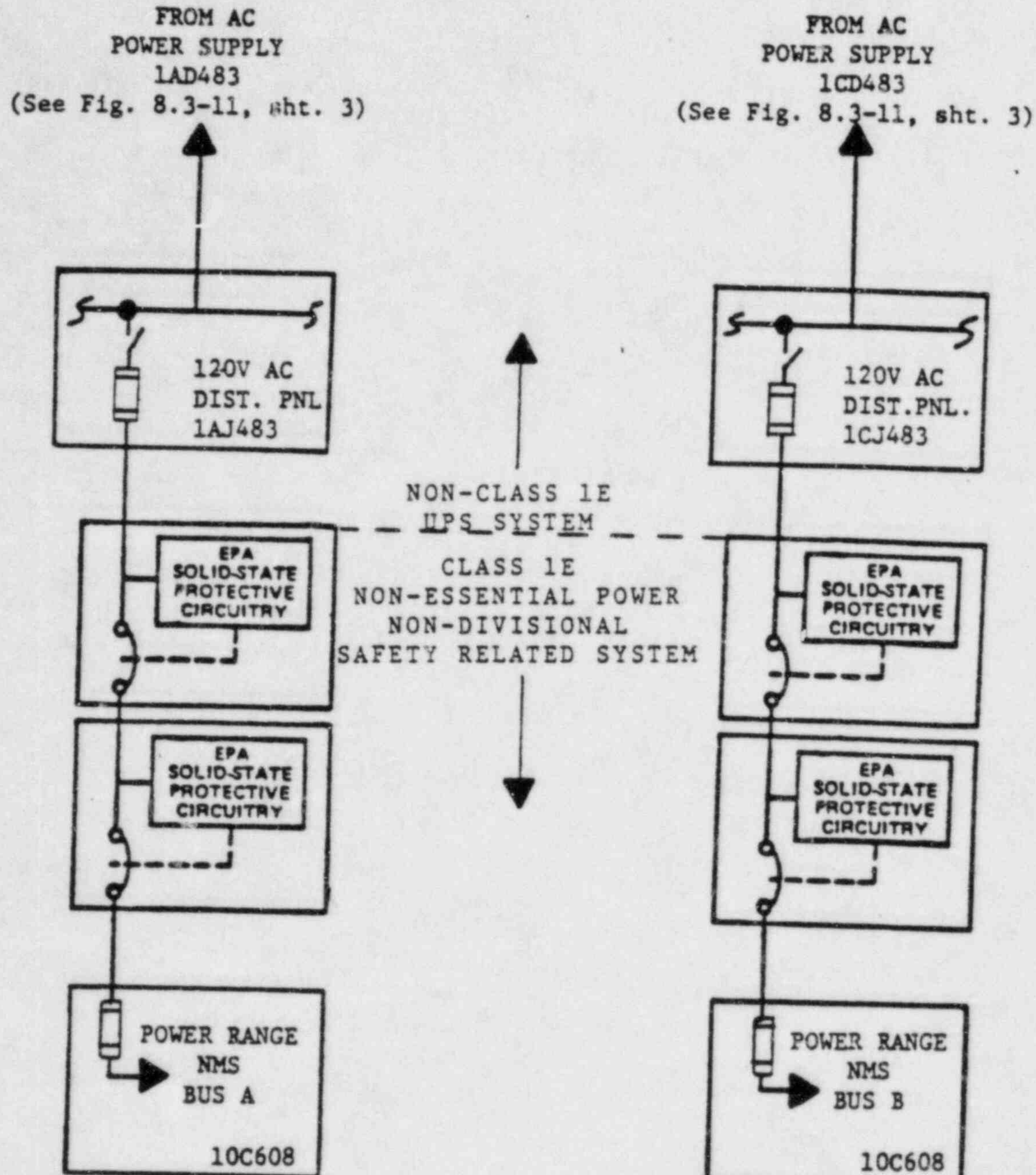

HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

ELECTRICAL PROTECTION ASSEMBLIES (EPAs) IN THE POWER RANGE NEUTRON MONITORING SYSTEM

FIGURE 7.6-11 Amendment

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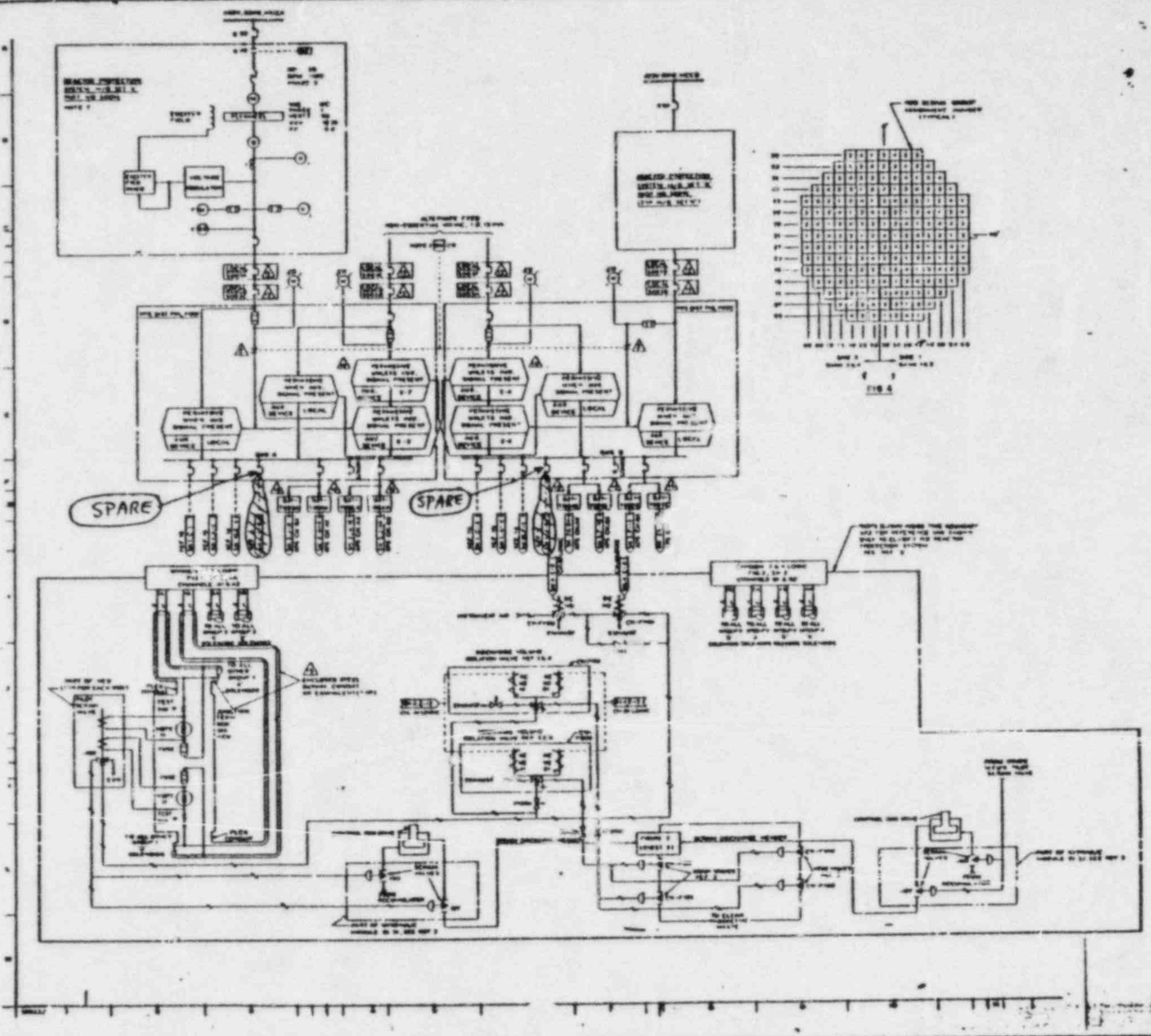

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REACTOR PROTECTION SYSTEM

SHEET 1
FIGURE
AMENDMENT

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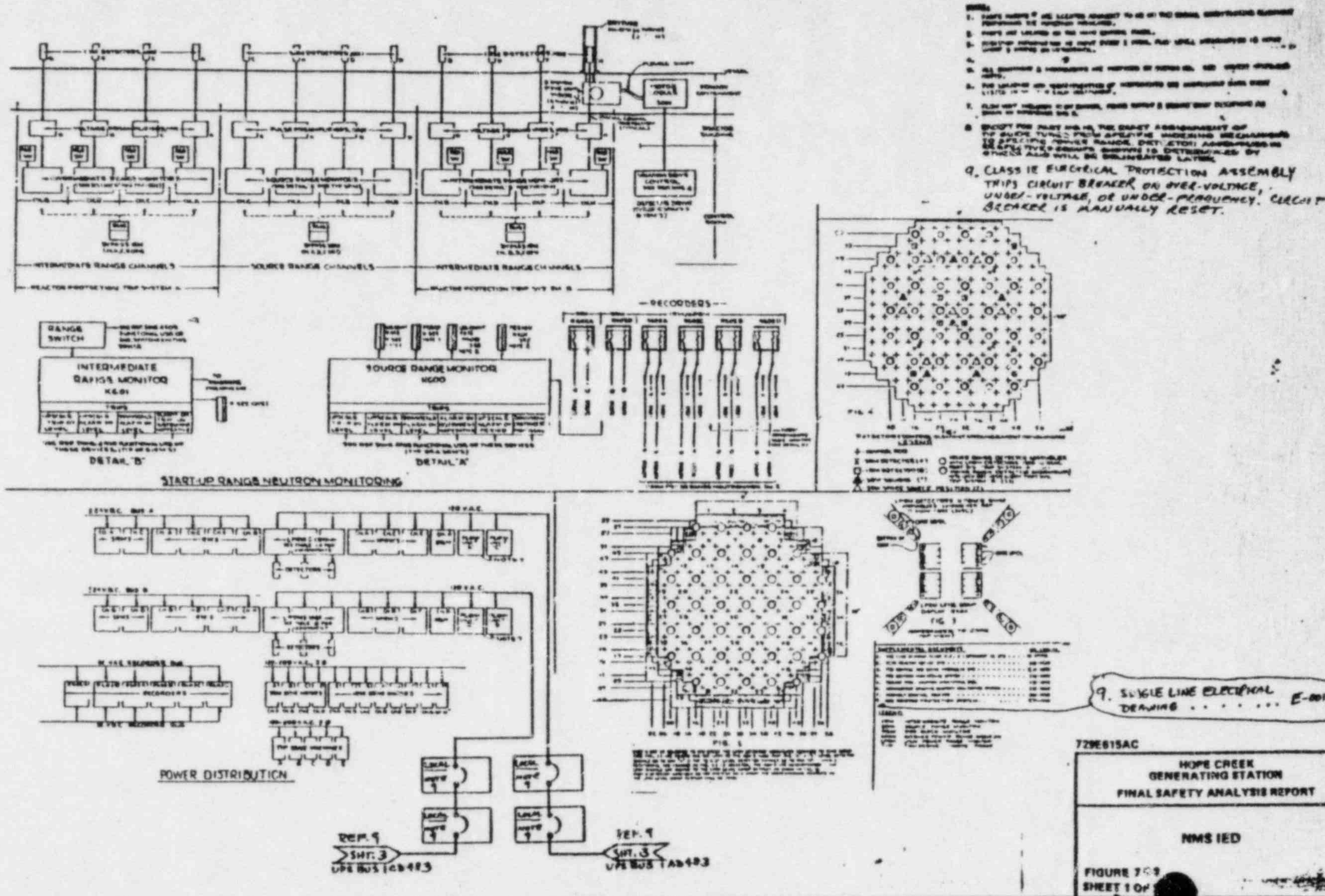

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NMS IED

FIGURE 7.6-3
SHEET 1 OF

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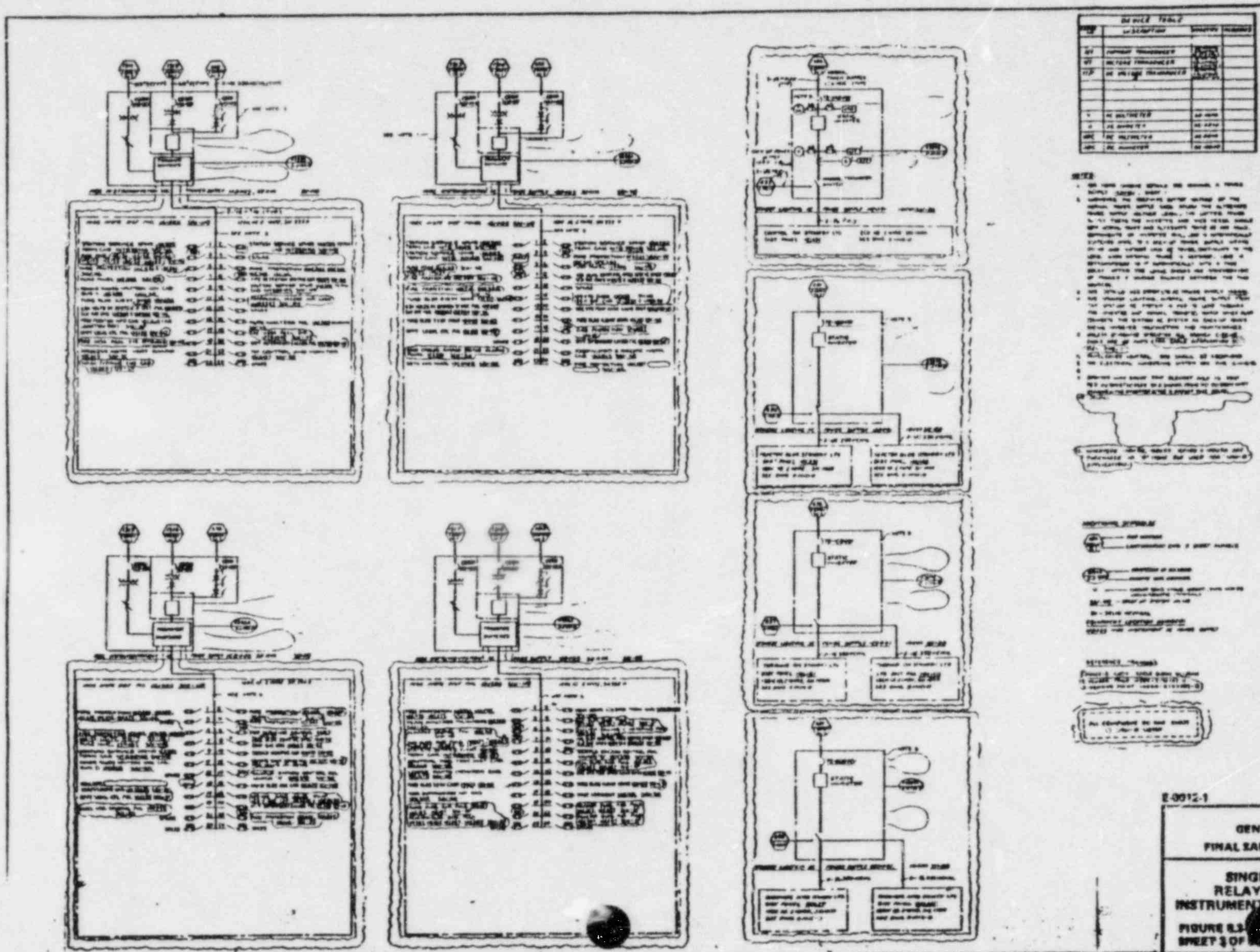
15/26



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SINGLE LINE METER &
RELAY DIAGRAM 120 V AC
INSTRUMENTATION & MISC. SYSTEMS

FIGURE 8.3
SHEET 3 OF
AMENDMENT

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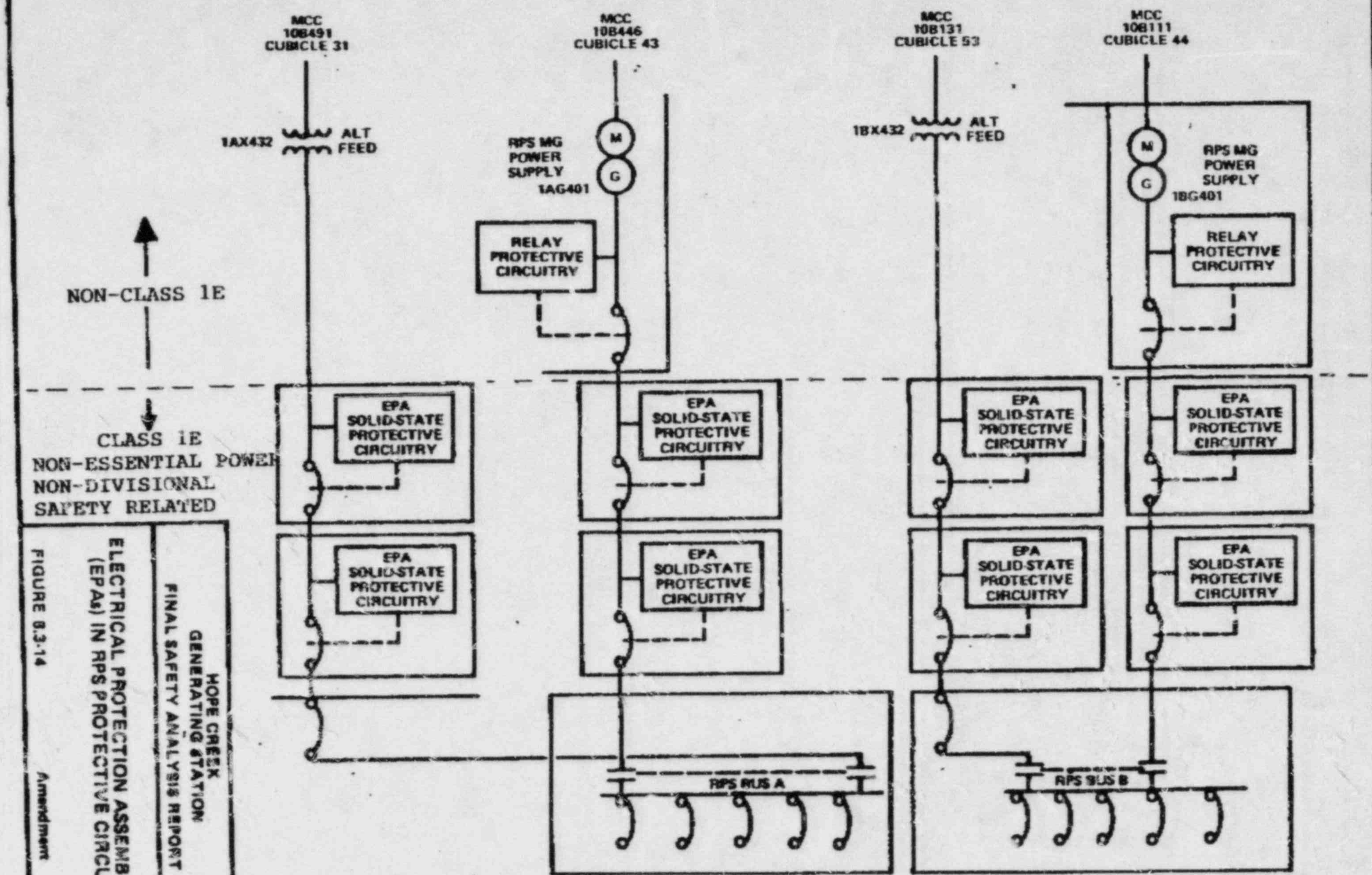

HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

ELECTRICAL PROTECTION ASSEMBLIES (EPAs) IN RPS PROTECTIVE CIRCUIT

FIGURE 8.3-14

Amendment

To: Bruce Preston
From: Dean James
Date: 9/4/84

REV. 1
12/26

SINGLE-FAILURE ANALYSIS FOR THE NEUTRON MONITORING AND PROCESS RADIATION MONITORING SYSTEMS

HOPE CREEK GENERATION STATION
PUBLIC SERVICE ELECTRIC AND GAS

AUGUST 1984

DBJ:rm/A08311*-1
8/31/84

REV. 18/24

SINGLE-FAILURE ANALYSIS FOR THE NEUTRON MONITORING AND PROCESS RADIATION MONITORING SYSTEMS

Some of the safety-related portions of the neutron monitoring system (NMS) and the process radiation monitoring system (PRMS) for the Hope Creek Generating Station (HCGS) are not designed and built to conform to the literal separation guidelines of Regulatory Guide 1.75. This analysis establishes the acceptability of these portions of the NMS and PRMS by demonstrating that they meet the single-failure criteria of IEEE Standard 279, which requires that the consequences of any single, design-basis failure event in a safety-related portion of the systems be tolerated without the loss of any safety function.

Portions of NMS and PRMS External to the NMS and PRMS Panels

See Figure 7.1-1 of the HCGS FSAR for the separations concept of the reactor protection system (RPS) and its relationship to the NMS.

Under the reactor vessel, cables from the individual, local power-range monitor (LPRM) detectors and from the individual intermediate-range monitor (IRM) detectors are grouped to correspond with the RPS trip channel designations. These cable groupings are run in conduit from the vessel pedestal area to the NMS and PRMS panels.

The radiation monitors on the main-steam lines are physically separated. The cabling from the individual sensors to the panels is run in separate metallic conduit.

Cabling from the NMS and PRMS panels to the RPS cabinets is also run in metallic conduit, providing electrical isolation and physical separation of the NMS and PRMS cabling associated with the RPS system.

It is concluded that the safety-related portions of the NMS and PRMS external to the NMS and PRMS panels adequately conform to the separation criteria of Regulatory Guide 1.75.

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Single Failure in the NMS and PRMS Panels

Figures 1 and 2 depict schematically the physical arrangement of the equipment in NMS and PRMS panels H11-P608, H11-P635, and H11-P636. The designs of these panels are similar to those of NMS and PRMS panels used in several BWR plants accepted by the NRC.

The layouts of the panels and the assignments of specific RPS trip logic circuitry provides the designs with the required tolerance to postulated single failures. The worst-case single failure would be the loss of any combination of trip signals within one bay of any panel. However, the loss of any bay and its associated wiring would not prevent a scram. A valid scram signal would be transmitted via the other bays because of the redundancy in the panel designs and the interconnections to the RPS (see Figure 7.1-1 of the HCGS FSAR).

The eight IRM channels and the six average power range monitor (APRM) channels are electrically isolated and physically separated. Within the IRM and APRM modules, analog outputs are derived for use with control room meters, recorders, and the process computer. Electrical isolation at the interfaces would prevent any single failure from influencing the trip unit output.

Physical Separation in the NMS and PRMS Panels

Adequate separation in the NMS and PRMS panels is achieved by using the bay design depicted in Figures 1 and 2, by using relay coil-to-contact as sufficient separation/isolation, and by separation between divisions/channels/wiring. Where conformation with Regulatory Guide 1.75 separation criteria cannot be achieved, the best-effort design is used.

Circuits that provide inputs to different divisions of the RPS are physically separated by airgaps or by the walls between the bays. Within the panels, where the cable and w[illegible]ing runs to the different RPS divisions do not conform to the Regulatory Gu[illegible] 1.75 separation criteria, fire-resistant "Sil-Temp" tape is wrapped around the cables and wires. This eliminates the possibility of fault propagation between the RPS divisions. In accordance with paragraph 5.6.2 of IEEE Standard 384, this tape has been demonstrated to be acceptable.

Separated ducts are provided in the panel for the incoming circuit wires from the sensors that belong to UPS Bus 1 or Bus 2.

As shown in Figure 3, the isolation/separation precludes the propagation from outside the NMS cabinets of failures that could cause the loss of any safety function.

NMS/PRMS Interface to RPS

Although the LPRM sensors are not required to meet Class 1E requirements, the design bases of the APRMs specify that the LPRM signals used for the APRMs be so selected, powered, and routed that the APRMs do meet applicable safety criteria. The LPRM signal conditioners and associated power supplies are isolated and separated into groups.

The logic circuitry for the NMS and PRMS scram trip signals conforms to the single-failure criteria. The contact configurations and failure consequences associated with IRM A (see Figure 4) and APRM A (see Figure 5) are typical of the other trip channels and are described in what follows.

- With the reactor scram mode switch in the "Shutdown," "Refuel," or "Startup" positions, IRM A upscale or inoperating signals (unless bypassed) or APRM A upscale or inoperative signals (unless bypassed) would produce a channel trip of the output relay.

- With the reactor system mode switch in the "Run" position, IRM A upscale or inoperative signals (unless bypassed) and an APRM A downscale signal (unless bypassed) or APRM A upscale neutron trip or upscale thermal trip or inoperative signals (unless bypassed) would produce a channel trip of the output relay.

- A trip of the channel output relay for IRM A and APRM A or a trip of the channel output relay for IRM E and APRM E would produce an RPS A1 channel trip. In PRMS, the log radiation monitor A would produce an RPS A1 channel trip (see Figure 6).

For NMS, one tripped (unbypassed) channel on the RPS trip system would cause a half scram. If one APRM bay were to fail in an untripped condition, the remaining bays would be capable of sending RPS sufficient scram signals to produce a full scram, even if one of them were bypassed.

As shown in Figures 2 and 7, if one bay of panels H11-P635 or H11-P636 were to fail in an untripped condition, the remaining bays would be capable of sending sufficient RPS signals even if one of the IRM channels were bypassed. The IRM bypass switches can bypass one IRM channel at a time.

Similarly for PRMS, if one bay were to fail in an untripped condition, the remaining bays would be capable of sending sufficient RPS trip signals to produce a full scram.

Common Power Supply Justification

The NMS is supplied with 120-Vac, 60-Hz power from UPS busses 1 & 2. A design change has been authorized for the installation on each bus of redundant electrical protection assemblies (EPAs), which will monitor the incoming voltage and frequency.

Any fault in one NMS channel could not cause an unsafe failure in another channel sharing the same low voltage power supply because 10-amp fuses are installed for wire protection, and the power supplies are designed with over-voltage and over-current protection circuitry at their output.

The PRMS is supplied with 120-Vac, 60-Hz power from RPS busses A and B. EPAs are already installed on each bus to provide voltage and frequency protection.

Any fault in one PRMS channel could not cause an unsafe failure in another channel sharing the same power supply because 5-amp fuses are installed for wire protection, and the power supplies are designed with over-voltage and over-current protection circuitry at their output.

Because of the fail-safe NMS/PRMS logic configuration, a loss of one supply would result in a half scram signal to RPS. Loss of both supplies would resul. in a full scram.

Common Associated Circuit Interfaces

Nonessential (associated) circuits to common information equipment are current limited and protected such that their failure cannot jeopardize an adjacent circuit.

Figure 8 provides an example of an associated circuit interface on LPRM card Z11. At the zero-to-160-mV computer output, the card is protected with a 30-MA fuse. The zero-to-10-V output to the rod block monitor has an additional isolator protection for the card.

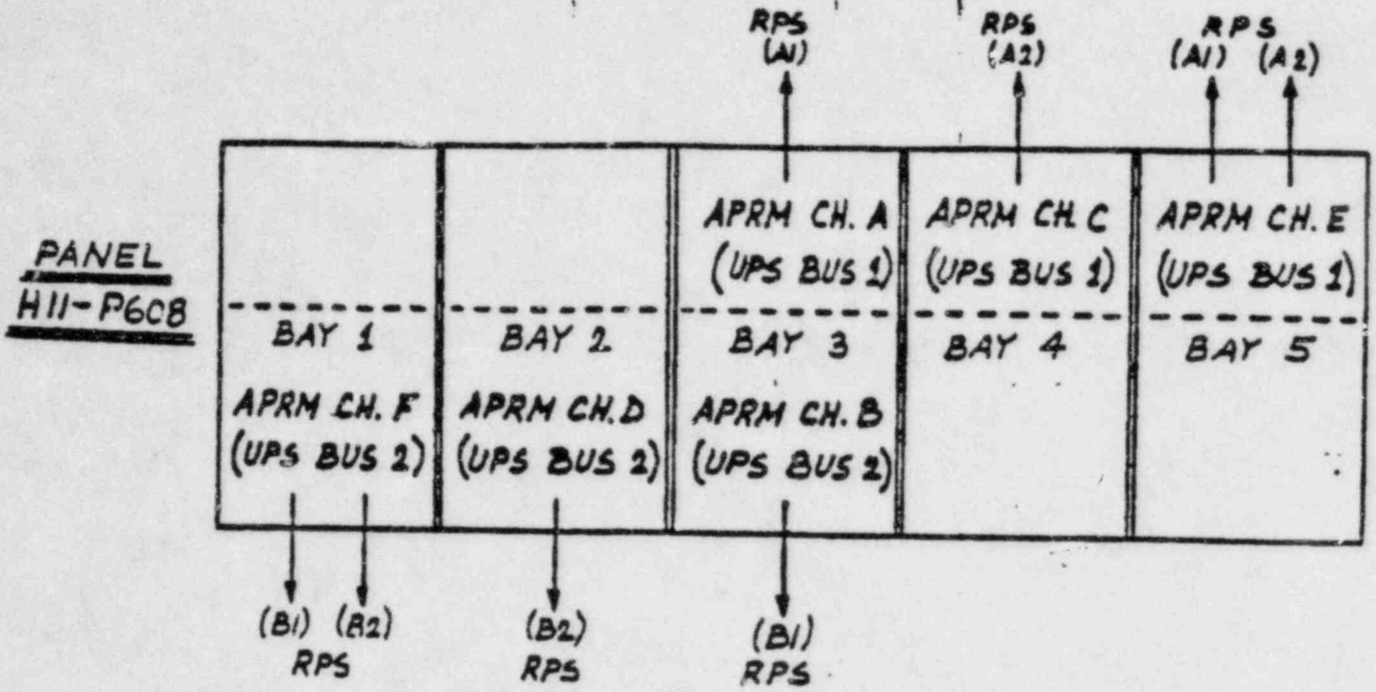

FIGURE 1 - APRM Panel Assignment

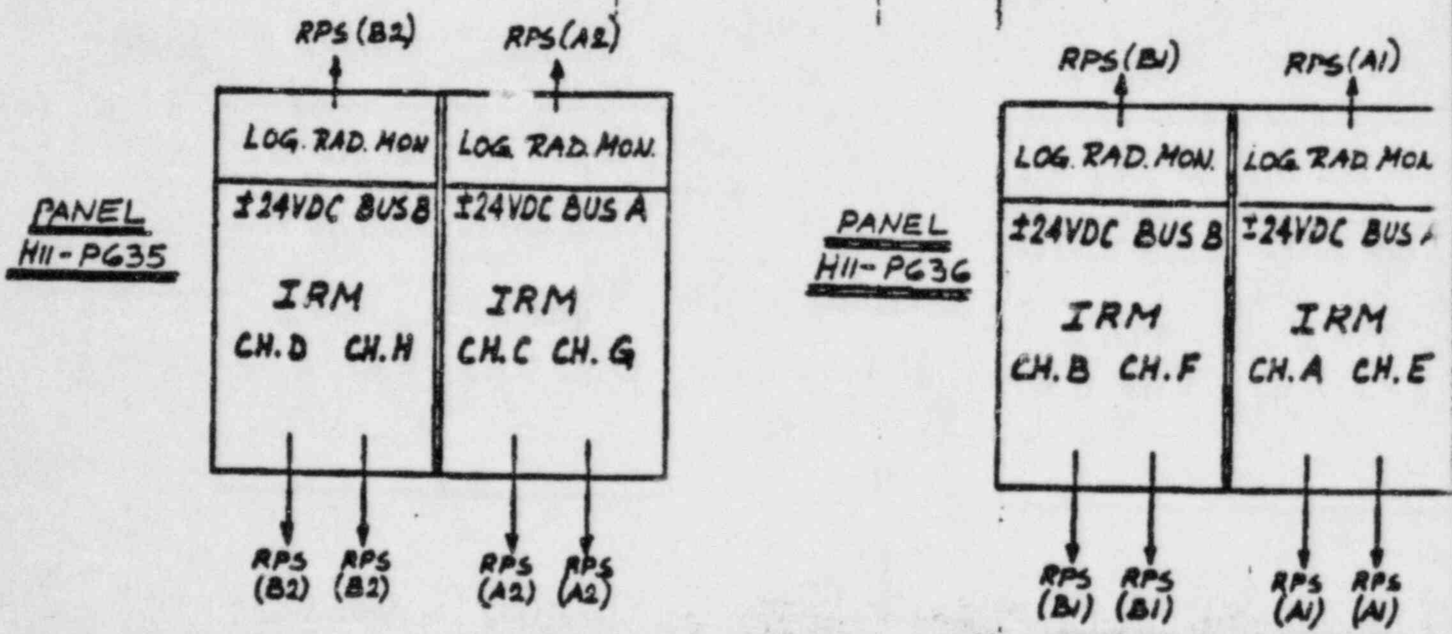

FIGURE 2 - Radiation Monitoring Panels

REV. 1
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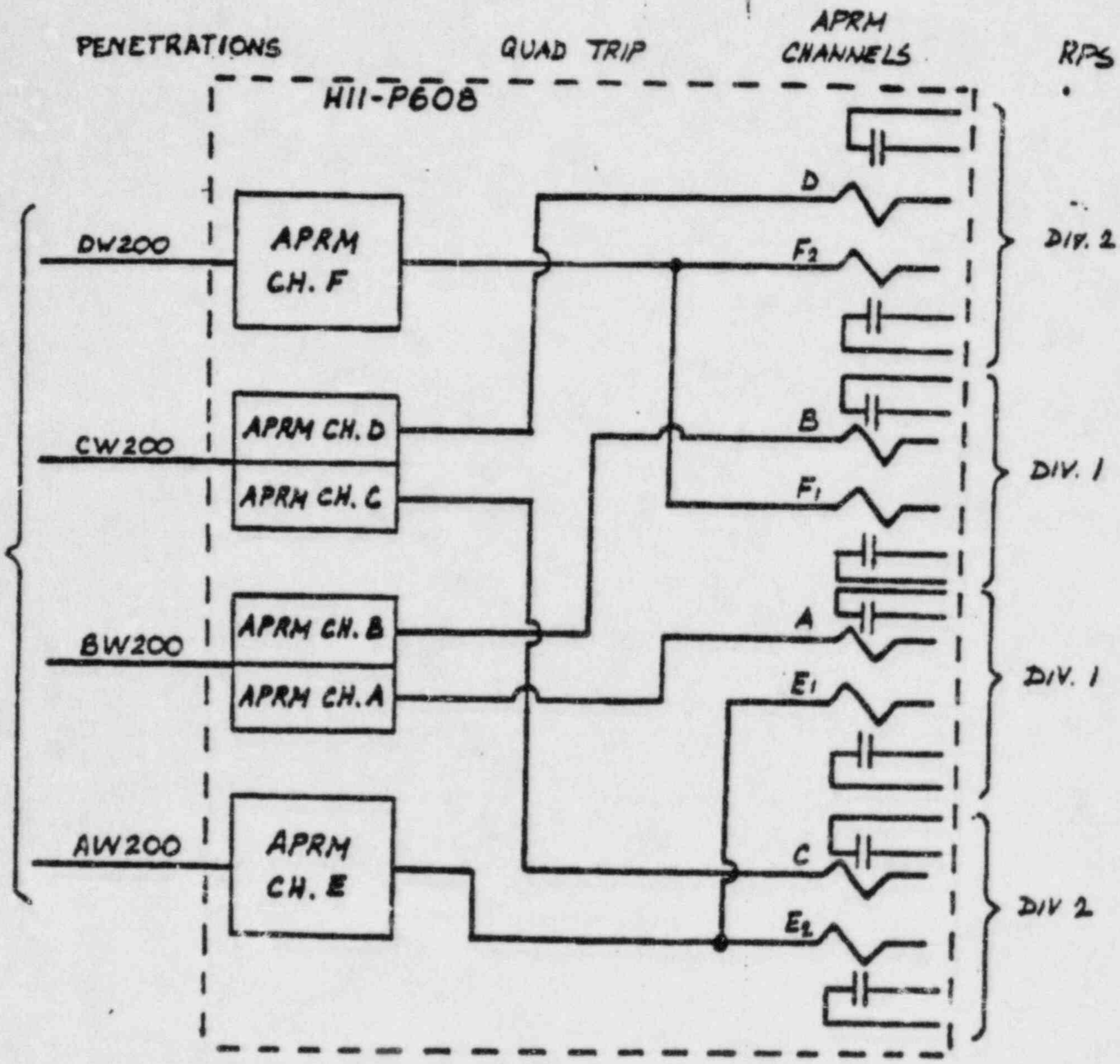
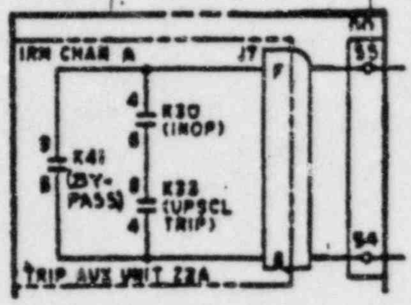
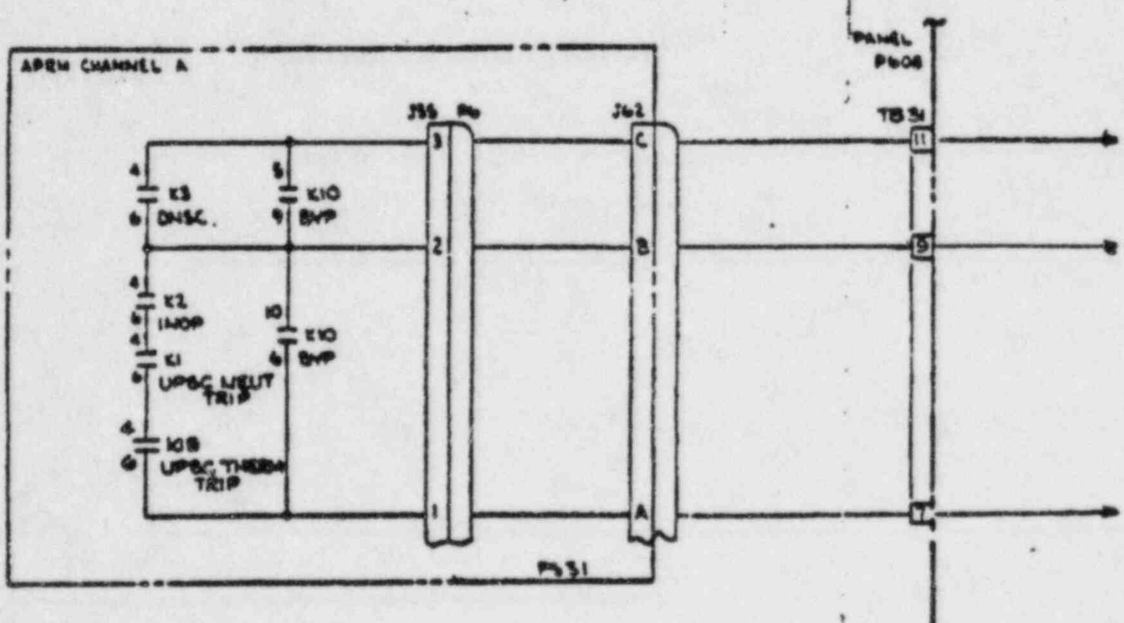


FIGURE 3 - APRM/RPS Signal Separation

REV. 1
25/26



<u>FIGURE 4</u> - IRM Channel A



<u>FIGURE 5</u> - APRM Channel A

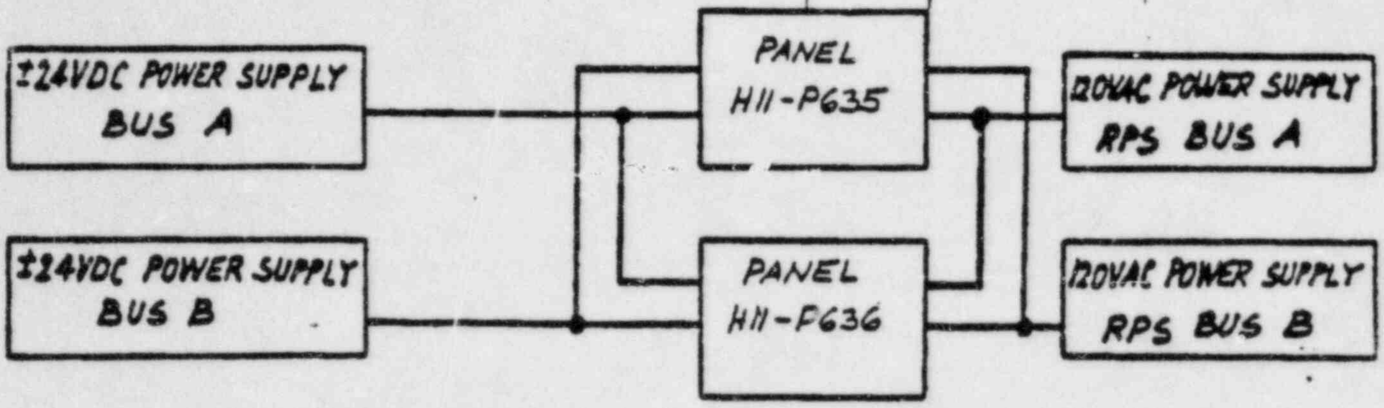


FIGURE 7 - Radiation Monitoring Panels Power Sources

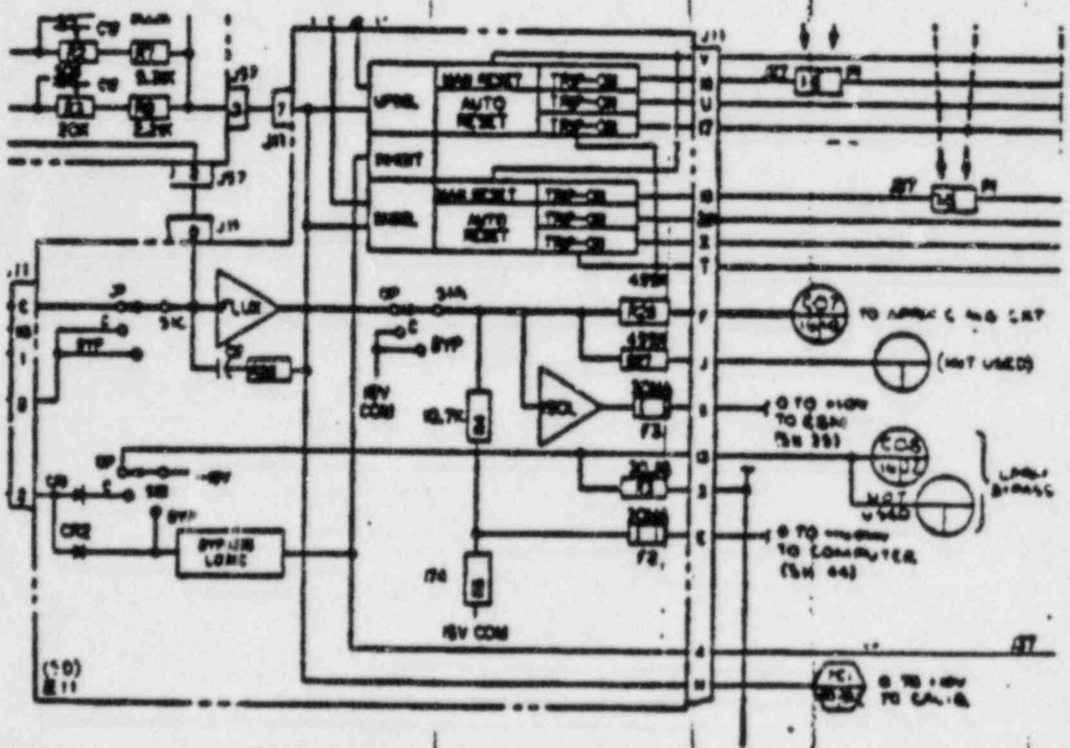


FIGURE 8 - LPRM Circuit Card

QUESTION 430.75 (SECTION 9.5.3)

In Section 9.5.2.4 of the FSAR you state that inservice inspection tests, preventative maintenance, and operability checks are performed periodically to prove the availability of the communication systems. However no description is provided for the inservice inspection tests, preventative maintenance and operability checks to prove the availability of the emergency lighting systems. Describe the tests and checks that will be performed on the emergency lighting systems and their frequency. (SRP 9.5.3, Parts I & II).

RESPONSE

The emergency lighting systems will be demonstrated operable by energizing the lighting systems. Visual inspections will be performed: (1) Semiannually for those areas of the plant that are accessible; and (2) Within 72 hours of achieving cold shutdown for those areas of the plant that are not accessible during plant operation, unless emergency lighting operability has been demonstrated in those areas within the past six months.

Testing of the Class 1E feed will be performed in conjunction with the standby diesel generator load testing.

Additionally the dc emergency battery pack lighting units, as well as stored onsite portable dc lighting packs, will be tested on an 18 month interval in accordanced with manufacturers recommendations to insure that rated illumination is available. As a minimum this will include the following:

a. Check of battery voltmeter.
b. Functional test of the unit by an installed push button to verify lamp operation, power transfer, and battery operability.

On a periodic basis the capability of the dc lighting packs to perform the design safety function shall be verified by testing a 5% sample in accordance with the manufacturer's recommendations and as specified in the maintenance procedures. In the event of a failure additional 5% samples will be tested until there are no failures in a sample.

QUESTION 430.81 (SECTION 9.5.4)

In Section 9.5.4.2.1 of the FSAR you state that "The interior and exterior surfaces of the [fuel oil storage] tank are corrosion protected by carboline carbo zinc 11 coatings. I&E circular 77-15 discusses the incompatibility between diesel fuel oil and zinc. The reaction results in a substance resembling soap which when heated becomes insoluble and this substance could render diesel generators inoperable due to blocked fuel lines, injectors, etc. This is not acceptable. It is our position that fuel oil storage tanks be provided with internal corrosion protection. Therefore provide the results of tests which show that over the lifetime of the plant that the carboline carbo zinc 11 coating used is compatible with the type of diesel fuel oil that will be used at your plant and that the condition described in the circular will not occur or replace the internal coating with a non-zinc base type that is compatible with diesel fuel oil. (SRP 9.5.4, Part II)

RESPONSE

Hope Creek will remove the existing inorganic zinc coating from the diesel generator fuel oil tanks. The tanks will be blasted to the white metal criteria of SSPC-SP5. Two coats of Amercoat No. 90 or equivalent will be applied to the tank interior to a height of one foot from the bottom.

Attachment 3

and performance data. All safety-related portions of the CACS are environmentally qualified to normal and accident environments according to Section 3.11 requirements.

The CACS is shown schematically on Figure 6.2-29. The system is located within the reactor building except for the nitrogen vaporizer, which is located in the auxiliary building; the HOAS hydrogen bottles, which are located on the reactor building roof; and the control cabinets, which are located in the auxiliary building.

6.2.5.2.1 Nitrogen Inerting

During normal power operation of the reactor, the oxygen content of the primary containment atmosphere is maintained at a concentration no greater than 4% by volume by the containment inerting and purge system (CIPS). This limit is established to preclude the attainment of a combustible gas mixture inside the containment if combustible gases are released into the containment atmosphere following a postulated accident. Oxygen monitoring during normal operation is done by analyzing grab samples taken by the plant leak detection system located in the reactor building and discussed in Section 11.5.2.

This low oxygen atmosphere is achieved by displacing air in the primary containment with nitrogen gas. Prior to reactor operation, the nitrogen is supplied from a liquid nitrogen facility, which consists of two liquid nitrogen storage tanks and one steam-heated water bath vaporizer.

Gaseous nitrogen from the discharge of the vaporizer is supplied to the drywell and/or the suppression chamber as selected by the operator. The flow rate of nitrogen is controlled to a value that is also selected by the operator. Displaced gases released from the primary containment during nitrogen inerting are processed through the HEPA filters of the RBVS exhaust system and monitored for radioactivity before release to the environment. The RBVS is discussed in Section 9.4.2.

During the inerting operation, nitrogen is supplied to the containment through the two RBVS supply purge penetrations, and gases are released from the containment through the two RBVS exhaust purge penetrations. Once the 4% by volume oxygen concentration in the primary containment has been achieved,

Insert A

Insert A to Section 6.2.5.2.1

Because the 24- and outboard 26-inch containment vent and purge butterfly valves are sealed closed and under administrative control during normal plant operating conditions (Operational Conditions 1,2, and 3), inerting is restricted to makeup operation under these conditions. During the makeup operation, nitrogen is supplied to the containment through the one inch nitrogen makeup line, and gases are released from the containment to the RBVS exhaust system by opening the inboard 26-inch purge and vent valve and the 2-inch bypass valve around the sealed closed 26-inch outboard purge and vent valve (Reference Figure 6.2-29).