Department of Energy
Washington, D.C. 20545
Docket No. 50-537
HQ:S:82:119

NOV 0 2 1982

Mr. Paul S. Check, Director
CRBR Program Office
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Check:

ELECTRICAL POWER WORKING MEETING, OCTOBER 19, 1982 - ADDITIONAL INFORMATION

Reference: Longenecker to Check, Subject: Meeting Summary for the Electrical Power Working Meeting, October 19, 1982, dated October 19, 1982

Enclosed is the additional information requested during the subject meeting for which response dates of November 2, 1982, were projected. Marked up Preliminary Safety Analysis Report (PSAR) pages will be incorporated into a future PSAR revision. Additional information regarding item 8.3.3.3.g will be provided December 1, 1982.

Any questions regarding the information provided or further activities can be addressed to Messers. J. Krass (FTS 626-6163), D. Hicks (FTS 626-6150) or A. Meller (FTS 626-6355) of the Project Office Oak Ridge staff.

Sincerely,

John R. Longenecker

John R. Longenecker
Acting Director, Office of the
Clinch River Breeder Reactor
Plant Project
Office of Nuclear Energy

Enclosure

X003

cc: Service List
Standard Distribution
Licensing Distribution

RESPONSES TO ITEMS FROM THE OCTOBER 19, 1982 ELECTRICAL POWER WORKING MEETING

1 - 8.2.2.1 - Physical/Independence of offsite circuits

2 - 8.2.2 - Availability of offsite power within sufficient time

3 - 8.2.2.3 - Load Sequencing

4 - 8.2.2.4 - Fault Sensing Relays/Availability of offsite Power Source

5 - 8.2.2.5 - Surveillance of Offsite Power Supplies

6 - 8.2.3.1 - Testing of Transfer Capability

7 - 8.3.1.1 - Division 1 and 2 Interconnection versus GDC 17

8 - 8.3 .2 - Suitable Electrical Interconnection

9 - 8.3.1.3 - Redundancy of Three Independent Load Groups

10 - 8.3.1.4 - Non-Class 1E Loads Powered from Class 1E Systems

a) Failure modes of Class 1E breaker

b) Non-Class 1E load failures

11 - 8.3.3.1.1 - Environmental Qualification of Cables and Terminations

12 - 8.3.3.3 - Independence-(Compliance with GDC 17)

a) Physical/Independence

c) Pipe Break

e) Associated Circuit (Additional information will be provided by December 1, 1982)

g) Physical separation of Class 1E equipment

h) Conduits as Fire Barriers

i) Protection of Class 1E Cables from Rotating or Dropped Equipment

13 - 8.3.3.5.1 - Testing of Circuit Breaker

14 - 8.3.3.4 - TMI Action Plan Requirements

NRC COMMENT

Physical Independence of Offsite Circuits

The Clinch River PSAR does not adequately describe or analyze physical independence of offsite circuits. The applicant by Letter dated June 1, 1982 has stated that the two offsite circuits that pass through the reserve switchyard provide the two physically independent offsite power sources. The PSAR, in contradiction, implies that the offsite circuits that pass through the generating switchyard are immediate access circuits and, thus, the preferred offsite circuit as defined by IEEE Standard 308-1974. It is the staff position, in accordance with the requirements of GDC 17, that electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. The description and analysis required to demonstrate compliance with the above position will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

RESPONSE:

The CRBRP will be connected to the TVA 161KV grid using four separate connections between the switchyards and the TVA grid as described in Section 8.1 of the PSAR. All four transmission lines are kept continuously energized. The CRBRP design includes two physically separate and electrically independent switchyards, generating switchyard and reserve switchyard. Each of these two switchyards is connected to the TVA grid by two separate 161KV transmission lines. The two connections to the reserve switchyard from the Oak Ridge Gaseous Diffusion Plant (ORGDP) switchyard of DOE, designated as the K-31 line and the other to the Fort Loudoun Hydroelectric

Plant, designated as Fort Loudoun-2 line, are considered the two physically independent and immediate access circuits. These circuits are located so as to minimize the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. The physical separation of the four (4) transmission line connections from the TVA 161KV grid to the CRBRP switchyards is shown in Figure 8.2-12. The K-31 transmission line connection crosses over the two connections (Roane and Fort Loudoun 1) to the Generating switchyard. As such, failure of any of the two 161KV line connections to the Generating switchyard will not result in failure of the K-31 or Fort Loudoun-2 lines.

Further, between the CRBRP and the destination substations (K-31 and Fort Loudoun-2):

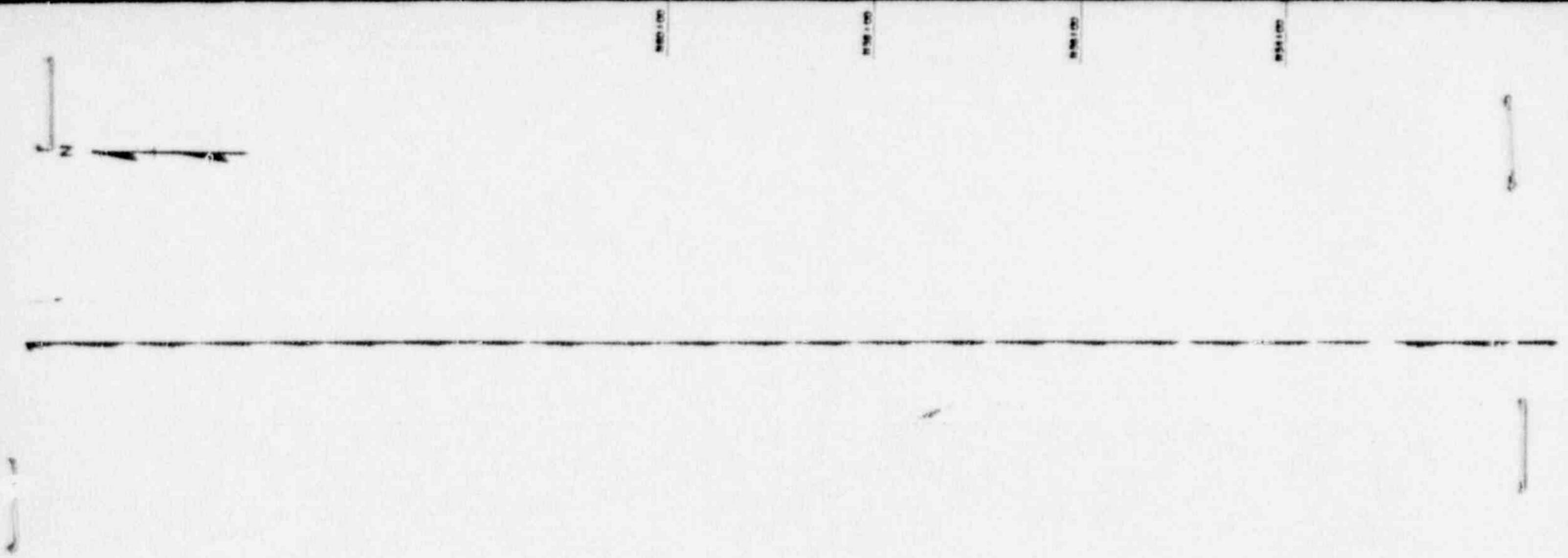
1. at any one location no transmission line crosses over the two transmission lines to the Reserve Switchyard simultaneously;
2. transmission lines are spaced sufficiently apart such that failure of one line does not affect the other line.

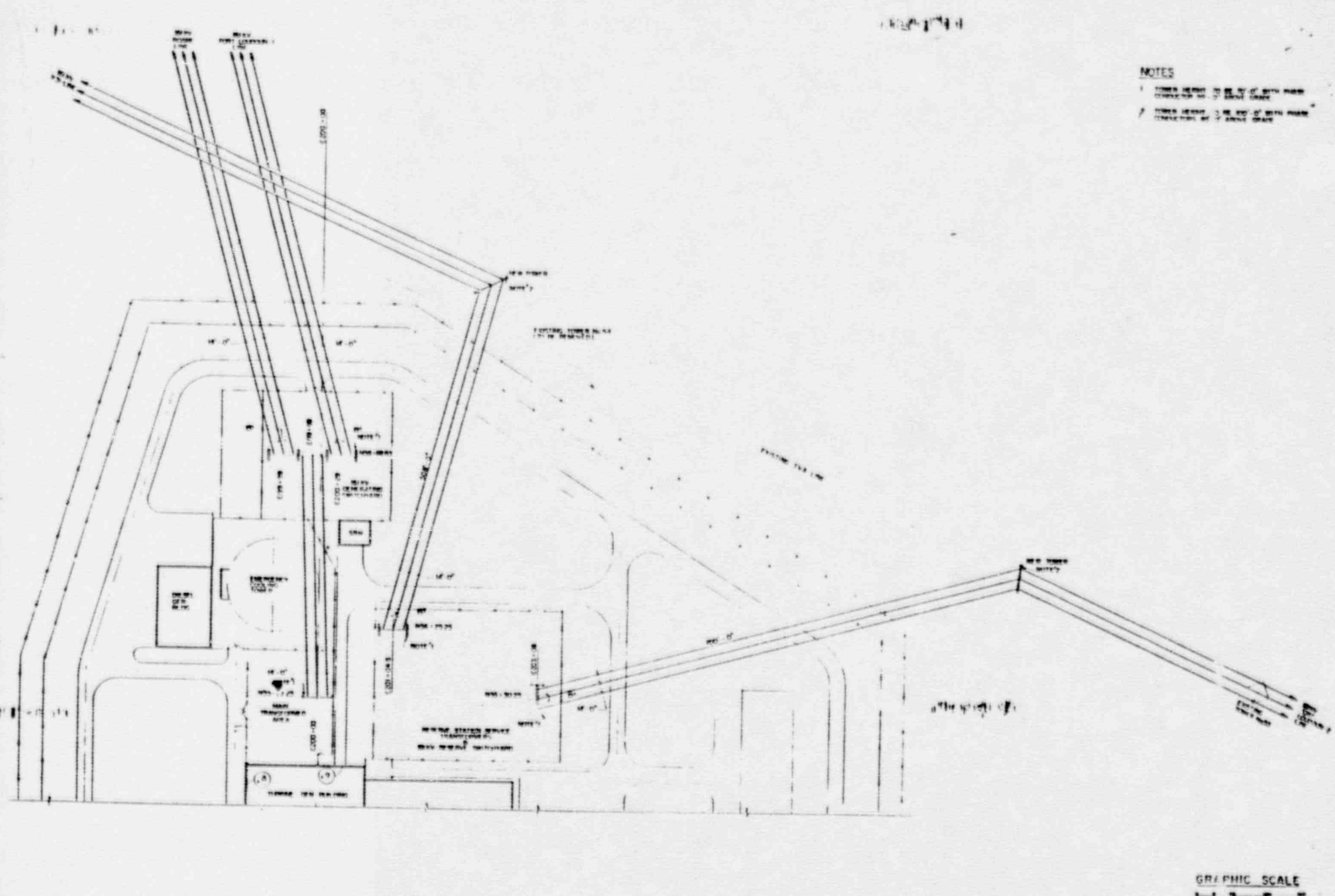
The 4.16KV medium voltage (MV) winding of the Reserve Station Service Transformer (RSST) 11AAX005A will be connected to the Medium Voltage switchgear of Class 1E, Division 1 through a non-segregated phase bus duct and to the Medium Voltage Switchgear of Class 1E, Division 3 through a non-segregated phase bus duct and MV cables. The 4.16KV MV winding of the RSST 11AAX005B will be connected to the Medium Voltage Switchgear of Class 1E Division 2 through non-segregated phase bus duct. Similarly, the 4.16KV windings of the Unit Station

Service Transformers (USSTs) 11AAX006A and B are also connected to the Class 1E, Division 1, 2 and 3 Medium Voltage Switchgear through non-segregated phase bus ducts.

Non-segregated bus ducts from the RSSTs 11AAX005A and B and USSTs 11AAX006A and B to the Medium Voltage Switchgear of Class 1E, Divisions 1, 2 and 3 will be physically separated such that failure of any one bus duct will minimize the likelihood of failure of the other bus ducts.

The response to question CS430.1 will be revised as attached to include the above description.





161KV TRANSMISSION LINES FROM TVA GRID TO CRBRP

~~page 1 W82-0298 (8,22) 42~~

Question CS430.1 (8.2)

Provide physical layout drawings and/or additional description in the PSAR of the physical independence to be provided between the offsite power circuits in proximity of the plant to the switchyards and from the switchyard to the Class 1E onsite power system. Also provide description of physical independence between Class 1E and the offsite circuits protective relaying.

Response

K-31 and Fort Loudoun-2 161kV transmission lines (both connected to the reserve switchyard of the CRBRP) provide the two physically independent offsite power sources to CRBRP; details of their routing and construction in the proximity of the plant have been described in Section 8.2.1.1 and 8.2.1.3 of the PSAR. ~~Further, in the proximity of the CRBRP:~~ SEE INSERT 1

1. at any one location no transmission line crosses over these two transmission lines simultaneously;

2. transmission lines are spaced sufficiently apart such that failure of one line does not affect the other line. (see Figures 8.2-11 and 8.2-12 attached).

This demonstrates the physical independence of the two offsite power sources.

The 4.16kV medium voltage (MV) winding of the Reserve Station Service Transformer (RSST) 11AAX005A will be conected to the Medium Voltage Switchgear of Class 1E Division 1 through a non-segregated phase bus duct and to the Medium Voltage Switchgear of Class 1E Division 3, through the non-segregated phase bus duct and MV cables. Similarly, the 4.16kV MV winding of the RSST 11AAX005B is connected to the Class 1E Division 2 switchgear through non-segregated phase bus duct.

Non-segregated phase bus duct runs from RSSTs 11AAX005A and 5B are physically separated.

Control and protection circuits for the Reserve Switchyard have been arranged to receive 125V DC power from two independent Divisions A and B DC power distribution systems (see Figure 8.2-13).

The DC equipment of the two divisions are physically separate and electrically independent of each other. The control cables of Divisions A and B are routed in separate trays and conduits.

INSERT 1

The CRBRP will be connected to the TVA 161KV grid using four separate connections between the switchyards and the TVA grid as described in Section 8.1 of the PSAR. All four transmission lines are kept continously energized. The CRBRP design includes two physically separate and electrically independent switchyards, generating switchyard and reserve switchyard. Each of these two switchyards is connected to the TVA grid by two separate 161KV transmission lines. The two connections to the reserve switchyard from the Oak Ridge Gaseous Diffusion Plant (ORGDP) switchyard of DOE, designated as the K-31 line and the other to the Fort Loudoun Hydroelectric Plant, designated as Fort Loudoun-2 line, are considered the two physically independent and immediate access circuits. These circuits are located so as to minimize the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. The physical separation of the four (4) transmission line connections from the TVA 161KV grid to the CRBRP switchyards is shown in Figure 8.2-12. The K-31 transmission line connection crosses over the two connections (Roane and Fort Loudoun 1) to the Generating switchyard. As such, failure of any of the two 161KV line connections to the Generating switchyard will not result in failure of the K-31 or Fort Loudoun-2 lines.

Further, between the CRBRP and the destination substations (K-31 and Fort Loudoun 2):

1. at any one location no transmission line crosses over the two transmission lines to the Reserve Switchyard simultaneously;

2. transmission lines are spaced sufficiently apart such that failure of one line does not affect the other line. (See Figures 8.2-11 and 8.2-12).

INSERT 1 (continued)

The 4.16KV medium voltage (MV) winding of the Reserve Station Service Transformer (RSST) 11AAX005A will be connected to the Medium Voltage switchgear of Class 1E, Division 1 through a non-segregated phase bus duct and to the Medium Voltage Switchgear of Class 1E, Divison 3 through a non-segregated phase bus duct and MV cables. The 4.16KV MV winding of the RSST 11AAX005B will be connected to the Medium Voltage Switchgear of Class 1E Division 2 through non-segregated phase bus duct. Similarly, the 4.16KV windings of the Unit Station Service Transformers (USSTs) 11AAX006A and B are also connected to the Class 1E, Division 1, 2 and 3 Medium Voltage Switchgear through non-segregated phase bus ducts.

Non-segregated phase bus ducts from the RSSTs 11AAX005A and B and USSTs 11AAX006A and B to the Medium Voltage Switchgear of Class 1E, Division 1, 2 and 3 will be physically separated such that failure of any one bus duct will minimize the likelihood of failure of the other bus ducts.

8.2.2 NRC COMMENT

Availability Of Offsite Power Circuits

GDC 17 requires, in part, that each of the offsite circuits be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and other offsite electric power circuits to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. Based on information in the PSAR, the staff is unable to conclude that the period of time that the station can remain in a safe condition assuming no immediate ac power is available is greater than the time required to reestablish ac power from the offsite grid to the onsite Class 1E distribution buses (reference: SRP Section 8.2, Part III, item 1d). This item will be pursued with the applicant and the results of the staff review will be reported in a supplement to this report.

RESPONSE:

The CRBRP will be connected to the TVA 161KV grid using four separate connections between the switchyards and the TVA grid as described in Section 8.1 of the PSAR. All of these four transmission lines are kept continuously energized. During normal operation, the electrical power to the plant auxiliary loads is provided from the main generator through the generator circuit breaker and the unit station service transformers. When the plant is not producing power, the auxiliary loads can be fed from the generating switchyard through the main power transformer and the unit station service transformers or from the reserve switchyard through the reserve station service transformers. Should a fault occur resulting in the loss of offsite power from the generating switchyard, while the plant auxiliary loads are connected to the unit station service transformers, the power connections to the medium voltage switchgears including the 4.16KV

switchgears of the Class 1E system, will be automatically transferred to the reserve station service transformers. This transfer of power will be accomplished within 6 cycles. The connected loads, in general, will not experience any loss of power. Based on the above, it is evident that offsite power will be restored to the class 1E distribution buses in a very short time without affecting the safe condition of the plant.

8.2.2.3 NRC COMMENT

Sequencing of Loads on the Offsite Power System

The offsite power system should have sufficient capacity to supply all required loads without sequencing of loads on the offsite power system. By letter dated June 1, 1982 the applicant addressed capacity of offsite circuits. Based on this letter the capacity of offsite circuits to block load all connected loads without reliance on the load sequencer is not clear. Clarification of this item will be pursued with the applicant and the results of the staff review will be reported in a supplement to this report.

RESPONSE:

The CRBRP system design has no provision of using a load sequencer to switch the loads on to offsite ac power supply. Each one of the offsite ac power supplies is capable of feeding all the required plant auxiliary loads without the need of a load sequencer.

However, a load sequencer has been provided to connect various Class 1E load blocks (in a pre-selected sequence) to the onsite ac power supply.

NRC COMMENT - 8.2.2.4

The applicant has documented in Section 3.1 of the PSAR that automatic transfer from the normal power source to the reserve power source is initiated by fault sensing relays in the normal power supply. Given loss or failure of the normal power supply, it is not clear how fault sensing relays will assure the availability of the reserve offsite power source.

It is the staff position in accordance with GCD17 that provisions be included to minimize the probability of losing electric power from reserve offsite power source as a result of or coincident with loss of power from the normal offsite power source. This item will be pursued with the applicant and the results of the staff review will be reported in a supplement to this report.

RESPONSE

Primary and backup fault sensing relays have been provided in the normal power supply (Generator, generating switchyard, main step-up transformer and the Unit Station Service Transformers) and the reserve switchyard to perform the required protection of the electrical distribution system.

Each fault sensing relay provided in the normal power supply will actuate its respective lockout relay on sensing a fault in the normal power supply. The lockout relay will trip the normal (generating switchyard or CRBRP generator) power supply incoming circuit breakers on the medium voltage switchgear including the 4.16 KV Class 1E switchgear. The tripping of these circuit breakers will automatically initiate closing of the reserve offsite power supply

(preferred power) incoming circuit breakers on the medium voltage switchgear using the early "b" contact of the normal power supply incoming circuit breakers.

The medium voltage switchgear buses are also provided with undervoltage sensors, which will also initiate tripping of the normal power supply circuit breaker and close the reserve power supply circuit breakers on sensing an undervoltage condition on the bus. In the case of Class 1E, 4.16KV medium voltage switchgear buses, the detection of an undervoltage condition will also result in an automatic start signal to the emergency diesel generator. However, if the automatic bus transfer to the reserve power supply restores the voltage to the medium voltage Class 1E switchgear buses, the circuit breaker connecting the diesel generator to the MV switchgear bus will remain open and the safety related loads will be powered from the reserve power supply.

A back-up breaker failure protection scheme is also provided in the event of the failure of the above protection scheme. On failure of the fault sensing relay(s), the fault sensing relay(s) in the generating switchyard relaying scheme will actuate another lockout relay which will trip the 161KV circuit breakers in the generating switchyard, thereby isolating the medium voltage switchgear from the normal power supply and will initiate the closing of reserve offsite power supply incoming circuit breakers as described above. Additionally, in the event that a fast bus transfer is unsuccessful, a time delayed automatic bus transfer will be accomplished.

If this automatic closure of the reserve offsite power supply incoming circuit breaker(s) is not accomplished, the operator can manually close the reserve offsite power supply incoming circuit breaker(s).

PSAR Section 8.3.1.1.4 will be revised as attached to include the above description.

AC Power Supply will remain connected and provide uninterrupted power to the Plant AC Distribution System through the main power transformer and the unit station service transformers. An electrical fault downstream of the generator circuit breaker will cause tripping of the 161KV circuit breakers in the generating switchyard. This will result in the loss of the power supply from the unit station service transformers. Similarly, an event which trips the turbine or reactor concurrent with the loss of CRBRP Preferred Offsite Power from the generating switchyard will also result in the loss of the power supply from the unit station service transformers.

Fault sensing relays provided in the normal power supply and ~~Upon loss of the power supply from the unit station service transformers~~, undervoltage sensors at each 13.8KV and 4.16KV switchgear bus will ~~detect the loss of power and~~ initiate the following upon detecting a fault or loss of bus voltage:

A. Trip the supply circuit breakers from the unit station service transformers.

B. Close the Reserve AC Power Supply circuit breakers from the two 50 percent capacity reserve station service transformers by means of a fast dead bus transfer scheme.

INSERT 2.

Provision is included in the design for testing the transfer of power between the unit station service transformers and the reserve station service transformers. These tests are performed during prolonged plant shutdown periods by simulating loss of the AC power suply from the unit station service transformers as described in Section 8.3.1.1.2.

8.3.1.1.5 <u>120/208 Volt Vital (Uninterruptible) AC Power System</u>

The 120/208 volt Vital (Uninterruptible) AC Power System is a Class 1E system which is required to supply AC power to the Plant Protection System (PPS) controls, alarm and indication and other Class 1E loads for safe shutdown of the plant. The Plant Protection System (PPS), described in Chapter 7., generates signals to actuate reactor trip, and performs other supporting functions in the event of an emergency condition.

The system is divided into three separate and independent load groups (Divisions 1, 2 and 3), each receiving AC power from a separate inverter through a static transfer switch. Connections for the 120/208 volt Vital AC Power System are shown in Figure 8.3-2.

The normal source of power for the Vital AC Power Distribution buses are the inverters which are supplied from their associated division DC power supplies described in Section 8.3.2.

Each 120/208 volt Vital AC Power System Distribution bus can also receive power from a Class 1E 480 volt motor control center which serves as a backup power source. Each of the distribution buses is connected to this motor control center through a static transfer switch and 480-120/208V AC regulating transformer. Failure of an inverter or its DC power source is sensed and the associated distribution bus is transferred automatically by the static transfer switch to the backup transformer supplied by the Class 1E 480 volt motor control center. The transfer is accomplished at high speed and does not degrade the performance of control and instrumentation loads.

INSERT 2

Primary and backup fault sensing relays have been provided in the normal power supply (Generator, generating switchyard, main step-u transformer and the Unit Station Service Transformers) and the reserve switchyard to perform the required protection of the electrical distribution system.

Each fault sensing relay provided in the normal power supply will actuate its respective lockout relay on sensing a fault in the normal power supply. The lockout relay will trip the normal generating switchyard or CRBRP generator) power supply incoming circuit breakers on the medium voltage switchgear including the 4.16KV Class 1E switchgear. The tripping of these circuit breakers will automatically initiate closing of the reserve offsite power supply (preferred power) incoming circuit breakers on the medium voltage switchgear using the early "b" contact of the normal power supply incoming circuit breakers.

The medium voltage switchgear busses are also provided with undervoltage sensors, which will also initiate tripping of the normal power supply circuit breaker and close the reserve power supply circuit breakers on sensing an undervoltage condition on the bus. In the case of Class 1E, 4.16KV medium voltage switchgear busses, the detection of an undervoltage condition will also result in an automatic start signal to the emergency diesel generator. However, if the automatic bus transfer to the reserve power supply restores the voltage to the medium voltage Class 1E switchgear busses, the circuit breaker connecting the diesel generator to the MV switchgear bus will remain open and the safety related loads will be powered from the reserve power supply.

INSERT 2 (continued)

A back-up breaker failure protection scheme is also provided in the event of the failure of the above protection scheme. On failure of the fault sensing relay(s), the fault sensing relay in the generating switchyard relaying scheme will actuate another lockout relay which will trip the 161KV circuit breakers in the generating switchyard, thereby isolating the medium voltage switchgear from the normal power supply and will initiate the closing of reserve offsite power supply incoming circuit breakers as described above. Additionally, in the event that a fast bus transfer is unsuccessful, a time delayed automatic bus transfer will be accomplished.

If this automatic closure of the reserve offsite power supply incoming circuit breaker(s) is not accomplished, the operator can manually close the reserve offsite power supply incoming circuit breaker(s).

The CRBRP design includes capability to test the transfer of power supplies among the plant power supply, the normal AC supply through the generating switchyard, the reserve AC supply through the reserve switchyard and the onsite standby diesel generator power supplies.

The sensors that detect the loss of power will be tested during plant operation or plant shutdown.

8.2.2.5 NRC COMMENT

Surveillance of Offsite Circuits

Section 5.2.3(5) of IEEE Standard 308-1974 requires that offsite power supplies be monitored to the extent that is is shown to be ready to perform its intended functi... Description of the monitoring that is to be provided for Clinch River offsite power circuits has not been described in the PSAR. This item will be pursued with the applicant with the results reported in a supplement to this report.

RESPONSE

The availability of offsite power supplies to class 1E buses is monitored on the Electrical Control Panel in the control room. In the event the incoming offsite power source has undervoltage condition or any one of the protective relays is not reset, the condition will be alarmed on the Electrical Control Panel located in the Main Control Room to alert the operator.

In addition, an amber light on the Electrical Control Panel in the control room indicates that the offsite power supply line and its breaker are available for transfer of power from the other source if required.

PSAR Section 8.2.2.1 will be revised per Attachment 1.

ATTACHMENT I

The CRBRP Preferred AC Power Supply consists of two 161KV transmission lines in the generating switchyard connected to the main power transformer. In the event of a turbine trip when no electrical fault is present, the generator circuit breaker will open automatically and disconnect the Plant Power Supply. The Plant AC power distribution system will then be provided with power by the CRBRP Preferred AC Power Supply through the main power transformer without interruption. .

In the event of non-availability of both the Plant and the CRBRP Preferred AC Power Supplies, the Plant AC distribution system will be transferred to the Reserve AC Power Supply. This transfer is performed within a period of 6 cycles by a fast dead bus transfer scheme as described in Section 8.3.1.1. Both reserve station service transformers are kept energized at all times during plant operation and are available to the Plant AC distribution system within a few cycles. This assures that the specified acceptable design limits are maintained.

Regulatory Guide 1.93, Rev. 0 (12/74)

The available off-site AC power sources consist of the CRBRP Preferred AC Power Supply and the Reserve AC Power Supply. Each of these two supplies provides two connections to the TVA 161KV grid. The two 161KV grid connections to the reserve station service transformers constitute the required independent off-site power sources. In addition, two 161KV grid connections to the generating switchyard provide an added reliability to off-site power, available through the main power and the unit station service transformers.

On-site AC power sources and on-site DC power sources comply with the requirements of CRBRP GDC15 for the availability of electric power sources.

Should an LCO ~~be violated~~ CONDITION BE PRESENT on these power sources, the plant's continued operation will be restricted in accordance with the Regulatory Guide 1.93 recommendations.

IEEE Standard 308-1974

The Reserve AC Power Supply provides the two independent circuits of the IEEE Std. 308-1974 "preferred power supply". It connects the TVA 161KV grid to each of the two 4.16KV Class 1E switchgear buses through the reserve station service transformers. Hence, the safety-related AC distribution system has two physically separate and electrically independent sources available from the TVA grid.

The CRBRP Preferred and the Reserve AC Power Supplies, each has sufficient capacity to operate the loads applied during a design basis accident. Both the CRBRP Preferred and the Reserve AC Power Supplies are available during normal operation (see Section 16.3.9).

INSERT 'A'

~~Amend. 60~~
~~Dec. 1981~~

INSERT 'A'

The availability of offsite power supplies to Class 1E buses is monitored on the Electrical Control Panel in the control room. In the event the incoming offsite power source has undervoltage condition or any one of the protective relays is not reset, the condition will be alarmed on the Electrical Control Panel to alert the operator.

In addition, an amber light on the Electrical Control Panel in the control room will indicate that the offsite power supply line and its breaker are available for transfer of power from the other source if required.

8.2.3.1

NRC COMMENT

The Clinch River design includes provisions for transferring power between the plant power supply, the normal ac power supply through the generating switchyard, the reserve ac power supply from the reserve switchyard, and the onsite standby diesel generator power supply. By letter dated June 1, 1982, the applicant has implied that the design capability to test the transfer among the above listed power supplies during power operation has not been provided in accordance with GDC 18. It appears that the sensors that detect loss of the plant and normal power supplies, the transfer between the plant and normal supplies, and the transfer between the plant and onsite power supplies cannot be tested during normal plant operation. The justification for this apparent noncompliance to GDC 18 will be pursued with the applicant and the results will be reported in a supplement to this report.

RESPONSE

The CRBRP design includes capability to test the transfer of power supplies among the plant power supply, the normal AC supply through the generating switchyard, the reserve AC supply through the reserve switchyard and the onsite standby diesel generator power supplies.

The sensors that detect the loss of power will be tested during plant operation or plant shutdown.

PSAR Section 8.3.1.1.4 will be revised as attached with response to NRC comment 8.2.2.4.

8.3.1.1 NRC COMMENT

Interconnection Between Redundant Divisions

In Section 8.3.1.2.1 of the PSAR, the applicant has stated that "the standby onsite power supply network has provisions to manually cross-connect the 4.16 kv buses of the division 1 and 2 power supplies in case of extreme emergency." By letter dated June 1, 1982, the applicant defined extreme emergency conditions to be loss of offsite power, loss of one diesel generator, and failure of a critical system load on the remaining operative diesel generator. It appears that the failed load, since it has been characterized as critical, is needed to mitigate the consequences of some design bases event.

Thus, it appears that the interconnection between division A and B will be used to meet the redundancy requirement of GDC 17 at the expense of the independence requirement of GDC 17. The subject interconnection does not meet GDC 17. Resolution of this item will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

RESPONSE

The Class 1E electrical distribution system consists of three functionally redundant divisions regarding shutdown capability as described in Section 8.3.1 of the PSAR. Any of these three divisions has the capability to safely shut down the plant. The Class 1E Divisions 1 and 2 have a provision for manual cross-connection as an added conservatism in the system design as described in Section 8.3.1.2.1 of the PSAR. This manual cross-connection will only be used under an extreme emergency condition per the criteria for independence as described in response to Question CS430.5 (see letter of June 1, 1982).

8.3.1.1 (continued)

The postulated emergency also considers multiple equipment failures which is beyond the single failure criteria and also considers loss of all four offsite power sources and as such should be considered to have a very low probability to occur. It should be noted that the failed load is not needed to mitigate the consequences of any design basis event. The system design meets all redundancy requirements of GDC17 without the need of a manual cross-connection. It should also be noted that the design of the manual cross-connection between Class 1E Divisions 1 and 2 fully meets the criteria for independence of Regulatory Guide 1.6.

Response to question CS 430.5 will be revised as attached:

3) Mechanical and electrical interlocks have been provided to prevent an operator error that would result in paralleling of standby power sources;

4) The circuit breakers used for the cross-connection will normally be stored in separate locked dummy compartments. ~~Opening of the doors of these compartments shall be alarmed in the Control Room.~~

Therefore, there is no non-compliance with the Regulatory Requirements. PSAR Section 3.1 will be revised to include the following paragraph:

Provision has been made in the safety-related AC distribution system design, for manual cross-connection between the 4.16kV switchgear buses of Class 1E Divisions 1 and 2. Manual cross-connection details are as described in Section 8.2.1.2.1 of the PSAR.

5) The opening of the normal circuit breaker compartment doors will be annunciated to the Control Room Operator when these circuit breakers are inserted in the normal compartments

8.3.1.2 NRC COMMENT

Suitable Electric Interconnections

The terminology "suitable electric interconnections" contained in criterion 26 of Section 3.1 of the PSAR is inconsistent with terminology contained in GDC 17 (applicant's design criterion 15). GDC 17 requires that the onsite electric distribution system have sufficient independence and redundancy to perform its safety function assuming a single failure. The applicant's criterion 26 terminology "suitable electric interconnection" allows electric interconnection between redundant distribution systems in violation of the independence requirement of GDC 17.

It is the staff position that the terminology "suitable electric interconnection" be deleted from criterion 26 of the PSAR. This item will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

RESPONSE:

The terminology "suitable electric interconnections" as included in criterion 26 of PSAR Section 3.1 has been used to describe the electrical connections between the electric power distribution system equipment and the loads of the heat transport system. The terminology has not been used to describe any connections between redundant Class 1E divisions of the electric power distribution system. However, in order to avoid any inconsistencies with terminology contained in GDC 17, the criterion 26 will be revised to ~~delete~~ "suitable ~~electric~~ interconnections" as per the attachment.

Criterion 26 - HEAT TRANSPORT SYSTEM DESIGN

The heat transport system shall be designed to reliably remove heat from the reactor and transport the heat to the turbine-generator or ultimate heat sinks under all plant conditions including normal operation, anticipated operational occurrences and postulated accidents. Consideration shall be given to provision of independence and diversity to provide adequate protection against common mode failures. The system safety functions shall be to:

(1) Provide sufficient cooling to prevent exceeding specified acceptable fuel design limits during normal operation and following anticipated operational occurrences, and

(2) Provide sufficient cooling to prevent exceeding specified acceptable fuel damage limits and to maintain integrity of the reactor coolant boundary following postulated accidents.

Following the loss of a flow path, the heat transport system shall include at least two independent flow paths, each capable of performing the safety functions following shutdown.[1]

SUITABLE INTERCONNECTIONS

The system shall include [redacted], leak detections, isolation and containment capability to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the safety function can be accomplished, assuming a single failure.

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[1] This requirement is not intended to preclude two-loop operation provided the system safety functions can be appropriately met.

Response:

The primary heat transport system (PHTS) is being designed to accommodate the thermal transients resulting from the normal, upset, emergency (anticipated operational occurrences), and faulted conditions (postulated accidents) described in Appendix B.

The system will be designed such that a normal or upset event does not adversely affect the useful life of any HTS components.

Following an emergency condition, resumption of operation will be possible following repair and re-inspection of the components, except that the primary coolant pumps (damaged or undamaged) will maintain

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8.3.1.3 NRC COMMENT

Redundancy of the Three Independent Load Groups

Section 8.3.1.1 of the PSAR indicates that three independent load groups are provided with Load group 1 redundant to load group 2. No description as to the redundancy of Load group 3 was provided in Chapter 8 of the PSAR. By Letter dated June 1, 1982, the applicant indicated that each of the three load groups has the capability to shut down the plant safely and that since not all the loads in Load group 3 are identical or similar to those in Load group ~ and 2, Load group 3 has not been identified as redundant to Load groups 1 and 2 in the PSAR.

Even though Load group 3 loads are not identical or similar to Load groups 1 and 2 it appears that the three Load groups should be functionally redundant since it has been stated that each has the capability to shut down the plant safety. Clarification of this item will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

In addition, Section 8.3.1.2.1 of the PSAR states that the Class 1E safety related loads are separated into three load groups such that loss of any one group will not prevent safe shut-down of the plant. This statement implies that as a minimum the remaining two load groups are needed to shut down the plant. This statement contradicts other statements in the PSAR that imply that only one load group is needed to shut down the plant. This contradiction will be pursued with the applicant in coordination with RSB and the results of the staff evaluation will be reported in a supplement to this report.

<u>8.3.1.3</u> (continued)

<u>RESPONSE</u>:

Each of the three load groups of Divisions 1, 2 and 3 has the capability to shut down the plant safely and as such is considered functionally redundant.

Only one load group is required to shut down the plant. As such the loss of any two load groups, including a single failure condition, will not prevent safe shutdown of the plant. The PSAR Section 8.3.1.2.1 will be revised (as attached), to state that only one load group is required to safely shut down the plant.

, INCLUDING A SINGE FAILURE CONDITION,

8.3.1.2.1 NRC Regulatory Guide 1.6, Rev. 0 (3/71)

TWO

The Class 1E safety-related loads are physically and electrically separated into ~~three~~ load groups (Divisions 1, 2 and 3) such that loss of ~~any one~~ group will not prevent safe shutdown of the plant.* ~~Class 1E divisions 1 and 2 provide the two redundant load groups while Division 3 provides power to Loop 3 decay heat removal system.~~

FUNCTIONALLY REDUNDANT SHUTDOWN

Each AC load group will have connections to the CRBRP Preferred Power Supply, Reserve Power Supply and a Standby On-site AC Power Source. The Standby On-site AC Power source will have no automatic connection to any other redundant load group.

When operating from the Standby On-site sources, redundant load groups and the redundant Standby On-site sources will be independent of each other as follows:

a. The Standby On-site source of one Class 1E load group will not be automatically paralleled with the Standby On-site source of another Class 1E load group under normal or emergency conditions.

b. No provisions exist for automatically connecting one Class 1E load group to another Class 1E load group.

c. No provisions exist for automatically transferring loads between redundant Class 1E power sources.

d. Manually connecting redundant load groups together will require at least one interlock to prevent an operator error that would parallel such Standby On-site power sources.

Each Diesel Generator unit consists of one diesel engine, one generator and required accessories.

The Standby On-site Power Supply network has a provision to manually cross-connect the 4.16KV buses of the Division 1 and 2 power supplies in case of an extreme emergency. This connection will be put into service through strict administrative controls and must satisfy the following prerequisites:

a) There shall be a total loss of off-site power.

b) One of the two redundant diesel generators failed to start and it is determined to be inoperable.

c) Critical safety-related loads associated with the operative diesel generator have failed and become unavailable.

If the above prerequisites are met, loads of either redundant Division 1 or 2 can be connected to the diesel generator of the other division for safe shutdown of the plant and to maintain the plant in a safe shutdown condition.

Key and electrical interlocks and administrative controls will be provided to ensure:

* ONLY ONE LOAD GROUP IS REQUIRED TO SHUTDOWN THE PLANT SAFELY.

NRC COMMENT

Non-Class 1E Loads Powered from Class 1E System

Section 8.3.1.2.14 of the PSAR indicates that Non-Class 1E loads will be connected to one division of the Class 1E system through an isolation device.

a) The proposed design, for the isolation device, primarily addressed protection of the Class 1E system due to worst case faults in the non-Class 1E system. By letter dated June 1, 1982 the applicant indicated that faults and failure modes other than the worst case fault (three phase) have also been addressed in the design of the isolation system. Protective devices have been provided in the design to clear any fault on the non-Class 1E system such as phase to ground, phase to phase, and three phase faults, within a reasonable time such that there will be no degradation to the Class 1E System. A phase to ground fault (which is the most likely mode of failure) on a non-Class 1E circuit will have no effect on the Class 1E system since the isolation system includes a 4.16kV/480V delta-wye connected transformer with the high resistance grounded neutral. The neutral is grounded through a 55.4 ohm resistor which will limit the phase to ground fault current to approximately 5 amperes. The Class 1E 480V and 4.16kV circuit breakers will be tripped to clear a ground fault in the case that the affected non-Class 1E breaker fails to trip.

Any phase to phase or three phase fault on the non-Class 1E circuits will be isolated by instantaneous operation of the affected branch feeder circuit breaker. Back-up protection is provided by fast operation of the 480V supply circuit breaker (0.2-0.3 sec clearing time) or by the 4.16kV unit substation transformer feeder circuit breaker (0.6-0.7 sec clearing time). In addition undervoltage sensors are provided at the input terminals of the 480V supply circuit breaker. These undervoltage sensors will initiate tripping of the 480V and 4.16kV circuit breakers within five (5) seconds upon sensing the undervoltage caused by loss of power or failure of the circuit breakers to clear a fault. Failure modes such as the Class 1E breakers failing to operate, high voltage being imposed on the output terminals of the transformer or isolation system and proposed testing have not been addressed. These items will be pursued with the applicant and the results of our evaluation will be included in a supplement to this report.

b) The isolation device is to be designed as indicated in the PSAR so that voltage on the Class 1E system buses will not drop below 70 or 80 percent of nominal given a worst case fault in the non-Class 1E system. With most Class 1E equipment designed to operate at not less than 90 percent of nominal, the staff is concerned that Class 1E may not operate at the lower voltage. By letter dated June 1, 1982 the applicant stated:

The isolation system is designed so that impedance of the system is high enough that the worst possible fault (three phase bolted fault) on the 480V non-Class 1E bus will not degrade the voltage at 4.16kV Class 1E bus below the following levels:

(1) When the 4.16kV Class 1E bus is being supplied from offsite power supply, the voltage at the bus will not drop below 80 percent of nominal.

(2) When the 4.16kV Class 1E bus is being supplied from onsite (standby) power supply the voltage at the bus will not drop below 75 percent.

The minimum voltage levels of 80 and 75 percent of nominal are chosen to be the same as the allowable minimum voltage levels during the sequential loading of the 4.16kV Class 1E bus or during starting of the largest motor after the bus has been fully loaded.

As discussed in a) above, any fault on 480V non-Class 1E system will be cleared within five (5) seconds. After the fault has been cleared the voltage at the 4.16kV bus will be restored to a minimum of 90 percent of nominal within two (2) seconds, which will allow all connected loads to operate continuously.

Voltage drop and its affect, when failure of non-Class 1E loads occur at the same time the diesel generator is sequencing loads, has not been addressed. This item will be pursued with the applicant and the results of the staff evaluation will be included in a supplement to this report.

RESPONSE

a) As described in Section 8.3.1.2.14 of the PSAR, the isolation system will consist of a 4.16kV circuit breaker, a 4.16kV/480V high impedance transformer and a 480V circuit breaker, as shown in Figure 8.3-3 of the PSAR. The transformer and both breakers will be qualified as Class 1E equipment.

Normally a fault in the non-Class 1E system will be cleared by the non-Class 1E feeder circuit breakers. However, if these breakers fail to operate, the back-up protection will be provided first by the 480V Class 1E circuit breaker and then by the 4.16kV Class 1E circuit breaker. The system design is such that a single failure will not prevent the isolation of the faulted non-Class 1E system from the Class 1E system. The failure of both Class 1E circuit breakers to trip (event beyond the single failure requirement) under a fault in the non-Class 1E system may result in the loss of Class 1E Division 3 power supply depending on the magnitude of the fault on the non-Class 1E system. However, either of the Class 1E Divisions 1 and 2 will adequately provide the capability to shut down the plant safely.

Any fault with the Class 1E transformer of the isolation system, resulting in high voltage being imposed on the output terminals of the transformer or isolation system will be detected and cleared by the 4.16kV Class 1E circuit breaker.

The equipment will be tested at manufacturer's facility prior to delivery. Initial preoperational tests will be performed with the components installed and connected to demonstrate that the equipment operates within design limits and that the system meets its performance specifications. Periodic tests will be performed at regular intervals to verify the performance and condition of the protective equipment and system. For more details, refer to Section 8.3.1.1.2 of the PSAR. The design of the protective system will ensure that the prot ctive relays and devices are testable during normal power operation and during refueling periods.

The high impedance transformer will be subject to a short-circuit withstand test in the manufacturer's facility to verify the transformer current limiting capability, as described in response to question CS430.15.

b) During sequential loading of the Division 3 diesel generator, all the Class 1E loads, including both 4.16KV/480V transformers, will be sequenced first. The non-Class 1E loads will be connected by closing of the 480 volt Class IE breaker after all Class 1E loads have been connected. The 4.16KV bus voltage and frequency would have been restored and stabilized to the

nominal values prior to connecting of non-Class 1E loads. The isolation system will be designed so that any fault in the non-Class 1E system during or after the sequential loading will not degrade 4.16kV bus voltage and frequency below the levels described in response to question CS430.15.

8.3.3.1.1 NRC COMMENT

Environmental Qualification of Cables and Terminations

Section 8.3.1.4 of the PSAR states that environmental-type test will be performed on cables and terminations that are required to function in a hostile environment. This statement implies that cables or terminations that are not required to function in a hostile environment will not be environmentally qualified and may not be in compliance with IEEE Standard 323-1974. By letter dated June 1, 1982, the applicant provided the following corrected statement: environmental type test will be performed on all cables and terminations for their expected environment. Pending documentation of this corrected statement, we conclude that there is reasonable assurance that cables and terminations will be designated to be environmentally qualified and is, therefore, acceptable.

RESPONSE

Updated Section 8.3.1.4 as provided with the response to question CS 430.9 will be included in the revised PSAR.

8.3.3.3 NRC COMMENT

Independence - (Compliance With General Design Criterion (GDC) 17

a. Physical Independence of Cables

Section 8.3.1.2.14 of the PSAR indicates that physical separation of circuits and equipment comprising or associated with the Class 1E power system, Class 1E protection systems and Class 1E equipment, will be in accordance with criteria set forth in paragraph 8.3.1.4 of the PSAR. Separation criteria described in Sections 8.3.1.2.14 and 8.3.1.4 of the PSAR was not clear and did not meet the guidelines of IEEE Standard 384 and Regulatory Guide 1.75. For example, the PSAR indicated that non-Class 1E cables in panels will be separated from Class 1E cables so that they will not provide a combustion path between different divisions. Section 5.6.5 of IEEE Standard 384-1974 states that non-Class 1E cables shall be separated by six inches or a barrier. In general, no criteria has been described for separation of Class 1E and non-Class 1E cables. Other examples include: (1) no criteria for separation between cables trays and conduits of another division, (2) confusing criteria for the separation of the third division (the design indicates, there are three divisions but only two redundant divisions. Separation criteria refers to the two redundant divisions in many cases versus the three divisions), (3) confusing definition for associated cables, (4) no criteria for separation between associated cables and non-Class 1E cables, and (5) no criteria before and after an isolation device.

By letter dated June 1, 1982, the applicant stated that the separation design criteria for Clinch River is fully consistent with the guidelines set forth in IEEE Standard 384-1974 and Regulatory Guide 1.75 (Revision 2). In addition, the applicant provided a revised PSAR Section 8.3.1.4 (item F) to clarify each of the above described examples of noncompliance. Based on a review of the information contained in the revised PSAR, the following items remain as concerns: (1) Adequacy of metal conduit or steel wire ducts as barriers inside panels, (2) routing of non-Class 1E cables in the same raceway with Class 1E cables, (3) location of a referenced Attachment I, and (4) RG 1.75 requirement that associated non-Class 1E circuits meet all requirements of Class 1E circuits. These concerns will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

RESPONSE:

1. PSAR Section 8.3.1.4 (item F) currently includes the design that metal conduits, fire barriers or steel wire ducts may be used in addition to the Regulatory Guide 1.75 spacial separation requirement of six (6) inches. Where used, this design will be more conservative than the use of wires with only six (6) inches of spacial separation as required by Regulatory Guide 1.75.

2. Routing of non-Class 1E cables will not be in the same raceway with Class 1E cables. This is identified in Section 8.3.1.4, paragraph E

of the revised PSAR pages included in response to Question CS 430.10

3. Attachment I identified in the response to Question CS 430.10 consists of the revised PSAR pages for Section 8.3.1.4 of the PSAR.

4. The requirements on electrical cables are identified in Section 8.3.1.4, paragraphs B and C of the revised PSAR pages transmitted in response to Question CS 430.10. These requirements apply to all cables (Class 1E, associated and non-Class 1E) and are consistent with the guidelines of Reg. Guide 1.75.

h) Containment Isolation System (CIS Logic Train Actuation wiring is routed through two independent conduits. One conduit contains wiring from only one CIS Logic Train. No intermixing of CIS Logic trains within a conduit is permitted. CIS Logic Train 1 wiring is routed from CIS Logic Panel 1 to CIS Breaker 1 in the Intermediate Building. CIS Logic Train 2 is routed from CIS Logic Panel 2 to CIS Breaker 2 in the Intermediate Building .

i) The wiring from a PPS buffered output which is used for a non-PPS purpose may be included in a PPS rack. The PPS wiring is separated from the non-PPS wiring. The amount of separation is defined on an individual case basis; however, it is designed to meet the requirements of IEEE Std. 384-1974 and Regulatory Guide 1.75.

j) Containment Isolation Valve actuation wiring (for either manually or automatically initiated actuation) to the Inside Containment and the Outside Containment Isolation Valves are separated as Division 1 and Division 2 cabling, respectively.

k) Rigid, metallic, completely enclosed and unvented raceways are considered acceptable for any of the above applications as they are equivalent to rigid metal conduit, as defined in IEEE Std. 100 and NFPA 70.

l) The physical separation between PPS conduits, containment penetrations, or panels is in accordance with IEEE Std. 384-1974 and Regulatory Guide 1.75 to provide assurance that a credible single event cannot simultaneously degrade redundant protection channels or shutdown systems.

m) The Primary Steam Generator Auxiliary Heat Removal System (SGAHRS) channels and logic outputs are treated and separated as Primary PPS signals. The primary SGAHRS logic output is kept separated from the Secondary SGAHRS logic output channels. The Secondary SGAHRS channels and logic outputs are treated and separated as Secondary PPS signals. The Secondary SGAHRS logic output is kept separated from Primary PPS, CIS and non-PPS outputs. Redundant SGAHRS logic train outputs are separated from each other. The manual trip and reset inputs to each SGAHRS divisional latch logic are ~~is~~ routed and separated as redundant PPS signals separated from the automatic SGAHRS logic outputs and all other PPS and non-PPS channels.

F. Cables Within Control Board and Other Panels SEE INSERT 3

Within control boards and other panels, harnesses of different divisions are provided with a minimum of 6 inches free air separation. ~~Otherwise barriers are to be installed.~~ ~~Metal conduit, fire barriers, or steel wire ducts are acceptable barriers to maintain independence without additional special separation over that required by Regulatory Guide 1.75.~~ Non-Class IE wiring are ~~is~~ not harnessed together with Class IE cable~~, and is not permitted to provide a combustion path between harnesses of different divisions. Penetrations through barriers are permitted if fire stops are provided.~~ non Class IE ~~cable~~ wiring are separated from Class IE or associated wiring with a minimum of 6 inches free air or by a barrier

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INSERT 3

F. Cables Within Control Board and Other Panels

Within control boards and other panels, harnesses of different divisions are provided with a minimum of six (6) inches free air separation. The design of some control boards or panels also includes the use of metal conduits, fire barriers or steel wire ducts in addition to the six (6) inches air separation. Where used, this design will be more conservative than the use of wires with only six (6) inches of spacial separation as required by Regulatory Guide 1.75. Non-Class 1E wiring is not harnessed together with Class 1E cables. Non-Class 1E wiring is separated from Class 1E or associated Class 1E wiring in a similar manner as between different divisions as described above.

8.3.3.3 c

NRC COMMENT

Pipe Break Protection

Separation of Class 1E raceways from high energy pipelines as defined in the PSAR is to be greater than 15 feet or less than 15 feet if the pipe is suitably restrained so as not to whip and strike the raceway. Current regulatory guidelines require that the Class 1E raceway be protected so that pipe whip missiles, jet impingement or environmental effects of the pipe break will not cause failure of the Class 1E raceway. Fifteen feet of space is not considered adequate protection.

By letter dated June 1, 1982, the applicant stated that any damage to cable trays caused by pipe whip, missiles, jet impingement, or environmental effect will be limited to the same safety division to which the pipe belongs. The two other divisions, each capable of shutting down the plant, will remain unaffected by the pipe break. Thus, the staff concludes that the final design will meet the guidelines of sections 4.1 and 4.2 of IEEE Standard 308-1974 and sections 4.1 and 4.4 of IEEE Standard 384-1974, the independence requirement of GDC 17, and is, therefore, acceptable with one exception. Section 8.3.1.4 states in contradiction to the above statement that "Under no circumstances do safety-related raceways run less than fifteen feet from high-energy pipelines of the opposite safety system." Our original concern, fifteen feet of space is not considered adequate protection, remains as a concern. This concern is addressed in Section 3.6.1 of this report.

RESPONSE:

The response to Question CS430.13 stated that; "Additional protection will be provided against any single Class 1E Division cable tray damage due to high energy pipe whip missiles by restraint of high energy pipe lines in the

8.3.3.3 c (continued)

vicinity of Class 1E raceways. The design of restraints and/or barriers will be determined by analysis to meet BTP APCSB 3-1, rather than the arbitrary 15 foot distance."

The PSAR, Section 8.3.1.4 will be revised as shown on the attached mark-up.

In Non-Hazard Zones, a minimum horizontal clear space as shown in Figure 8.3-6, of three feet is maintained between cable trays of different divisions. If a horizontal clearance of less than three feet is unavoidable, a fire barrier ~~and a cover (top and bottom) on the trays~~ is provided between the divisions as shown in Fig 8.3-6.

Vertical stacking of cable trays of different divisions is avoided wherever possible. Where cable trays of different divisions are stacked vertically, a minimum clear space of five feet is provided between the divisions as shown in Figure 1. If a vertical clearance of less than five feet is unavoidable, a fire barrier is provided between the divisions as shown in Figure 8.3-6.

Fire Hazard Zones

In fire hazard zones, Class 1E conduits, trays, wireways or raceways of only one safety division are routed. This division is suitably protected by fire barriers and fire protection systems to mitigate the effects of fire in this zone on the safety function of the other safety groups.

Equipment Hazard Zone (Pipe Break Hazard Zone)

To the extent practical, Class 1E cables are routed in areas remote from high energy piping or areas of potential sodium fires; if unavoidable, the following precautions are taken:

a) ~~Raceways (Trays and conduit) are not less than fifteen feet from a high-energy pipeline unless the pipeline is suitably restrained so as not to whip and strike the raceway. This spacing applies regardless of whether the high energy pipeline is a safety system or non-safety system pipeline. The exception to this consideration is the acceptability of the mechanical failure of one safety system damaging the cable that provides service to components/systems of the mechanical system that has failed.~~ SEE INSERT 5

~~Under no circumstances do safety-related raceways run less than fifteen feet from high-energy pipelines of the opposite safety system.~~

b) Redundant Class 1E circuits are routed or protected such that a postulated event in one system and division cannot preclude the operation of the other redundant system or division.

c) In all areas of the plant, the separation between redundant Class 1E cable raceways takes into consideration the presence of rotating equipment, monorails and equipment removal paths and the possibility that heavy equipment could be lifted and dropped and possibly cause failure of two raceway channels. Where this is the case, the minimum separation is such as to preclude this possibility.

d) In general, Class 1E electrical distribution equipment (e.g., switchgear, motor control centers, etc.) is not located in areas where high energy piping or other similar hazards are located.

~~Amend 63~~
~~Dec. 1981~~

INSERT 5

CRBRP has three (3) Class 1E Divisions with complete physical separation between divisions. Any damage to cable trays caused by pipe whip missiles, jet impingement, or environmental effect will be limited to the same safety division to which the pipe belongs, and the two other divisions capable of safely shutting down the plant will remain unaffected.

Additional protection will be provided against any single Class 1E Division cable tray damage due to high energy pipe whip missiles by restraint of high energy pipe lines in the vicinity of Class 1E raceways. The design of restraints and/or barriers will be determined by analysis to meet BTP APCSB 3-1

8.3.3.3 NRC COMMENT

e) Associated Circuit Compliance With All Requirements Placed On Class 1E Circuits

Section 8.3.1.2.14 of the PSAR states that associated circuits will be installed in accordance with the requirements placed on Class 1E circuits such as separation from non-Class 1E cables, cable derating, environmental qualification, flame retardance, splicing restrictions and raceway fill limitations. Based on this PSAR statement, it appears that associated circuits may meet only the requirements listed. Items not listed such as protection from design basis events, quality assurance, and seismic qualification of the associated circuit from and including its supply breaker to and including the actuated equipment, are of concern. In accordance with position C.4 of Regulator Guide 1.75, it is the staff position that associated circuits meet all requirements placed on Class 1E circuits. This item will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

RESPONSE:

The associated circuits will be installed in accordance with the requirements for physical and electrical separation of Class 1E cables as described in Section 8.3.1.4 of the PSAR and response to question CS430.10. The Section 8.3.1.2.14 (item f) of the PSAR will be revised as per the attachment.

e. The isolation system will be able to accept any single component failure concurrent with the worst fault on the Non-Class 1E 480V bus without unacceptable consequences. (This does not include short circuits on the 4.16KV portion of the isolation system since this is considered an extension of the Class 1E bus).

f. Undervoltage sensing will be provided on the 480V side of the transformer. Its function will be to isolate the Non-Class 1E loads if an undervoltage condition, caused by a fault on a Non-Class 1E load, exists on the 480V bus.

ALL

The system is designed to keep the number of associated circuits to a bare minimum. The associated circuits as defined in paragraph 4.5 of IEEE Std. 384-1974 are installed in accordance with the requirements placed on Class 1E circuits [illegible]. The analyses and testing of associated circuits will be performed in accordance with paragraphs 4.5(3), 4.6.2 and 5.1.1.2 of IEEE Std. 384-1974. The cable installation design prohibits the use of cable spicing inside the cable tray or conduit raceway system.

DELETE

The physical identification of Class 1E equipment, cables and raceway systems are described in Section 8.3.1.5.

The design provides two separate cable spreading rooms, one above the Control Room and one below it. The design does not permit location of any high energy equipment in the cable spreading rooms as required by IEEE Std. 384-1974. The criteria for routing of circuits in the cable spreading rooms is given in Section 8.3.1.4.

The Divisions 1, 2 and 3 Class 1E Standby Diesel Generator units are described in Section 8.3.1.1.1. The diesel generator units and associated auxiliaries and control equipment are located in separate Seismic Category I structures having independent ventilating systems. The physical separation of circuits related to redundant Standby Diesel Generators are routed in accordance with the criteria specified in Section 8.3.1.4.

The Non-Class 1E and Class 1E DC batteries and related uninterruptible power supply (UPS) equipment are described in Section 8.3.2. DC battery and associated UPS equipment of each safety division is separated from equipment of the other safety division by reinforced concrete walls. The Class 1E batteries and UPS equipment are located in Seismic Category I structures. The physical separation of circuits related to each separate division of batteries and UPS system is in accordance with the criteria described in Section 8.3.1.4.

~~Amend 05~~
~~Dec. 1981~~

8.3.3.3-9

8.3.3.3 g NRC COMMENT

Physical Separation of Class 1E Equipment

It is the staff position that Class 1E equipment that supply power to different load groups should be located in separate rooms of a seismic Category I building. Based on information in the PSAR, the staff can conclude that each diesel generator will be located in a separate room and that two of the three 4.16kv Class 1E switchgear busses will be located in separate rooms. The separation of the remaining Class 1E equipment is not clear. This item will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

RESPONSE-

All Class 1E equipment including the diesel generators, 4.16 kv switchgear, unit substations, motor control centers, control room panels, etc. are located inside seismic Category I buildings. Each division of Class 1E equipment of Divisions 1, 2, and 3 are located in separate rooms which are separated by a minimum of 3 hours rated fire barriers. For the purposes of equipment location and raceway system, all three Class 1E divisions are considered redundant and meet the physical and electrical separation design criteria set forth in IEEE Standard 384-1974 and Regulatory Guide 1.75 and as desribed in Section 8.3.1.4 of the PSAR.

8.3.1.2.4 NRC Regulatory Guide 1.29, Rev. 3 (9/78)

The Class 1E Electric Systems, including the auxiliary systems for the Onsite Electric Power Supplies, that provide the Class 1E electric power needed for functioning of nuclear safety related equipment are designated as Seismic Category I.

All electric devices and circuitry involved in generating signals that initiate protective action are designed as Class 1E.

~~All electrical equipment in the Control Room is designed as Seismic Category I.~~ INSERT 4

Those portions of structures, systems or components whose continued function is not required but whose failure could reduce the functioning of any nuclear safety related equipment to an unacceptable safety level will be designed and constructed so that the SSE would not cause such a failure.

Seismic Category I design requirements will extend to the first seismic restraint beyond the defined boundaries. Those portions of structures, systems, or components which form interfaces between Seismic Category I and non-Seismic Category I features will be designed to Seismic Category I requirements.

For seismic design classifications, refer to Section 3.2.1.

8.3.1.2.5 NRC Regulatory Guide 1.30, Rev. 0 (8/72)

The Quality Assurance requirements for the installation, inspection and testing of instrumentation and electrical equipment during the plant construction, are those included in ANSI N45.2.4 supplemented by Regulatory Guide 1.30 as follows:

ANSI N45.2.4 will be used in conjunction with ANSI N45.2-1977.

ANSI N45.2.4 requirements will be considered applicable for the installation, inspection and testing of instrumentation and electric equipment during the plant operation.

8.3.1.2.6 NRC Regulatory Guide 1.32, Rev. 2 (2/77)

The electrical separation and independence of redundant (Divisons 1 and 2) and Division 3 Standby AC Power Supplies conform to IEEE Standard 308-1974 supplemented by Regulatory Guide 1.32 as follows:

Electrical independence between redundant Standby AC Power Supplies will be in accordance with Regulatory Guide 1.6 as described in Section 8.3.1.2.1.

Physical independence between redundant Standby AC Power Supplies will be in accordance with IEEE Standard 384-1974 supplemented by Regulatory Guide 1.75 as described in Section 8.3.1.2.14.

INSERT 4

All Class 1E equipment including the diesel generators, 4.16KV Switchgear, Unit Substation, Motor Control Centers, Control Room Panels, etc. are located inside Seismic Category I buildings and are designed as Seismic Category I.

All non-safety-related equipment located in Seismic Category I buildings are designed to maintain structural integrity under a Seismic event and will not become missiles.

C. Raceway Fill

Cable tray fill will be limited such that the summation of the crosssectional areas of cables in a tray section will in general be not more than 40% of the usable cross-sectional area of that tray section.

Conduits will be sized for a maximum percent fill of the inside area of the conduit in accordance with NFPA 70 "National Electrical Code" Art. 346.

D. Sealing Raceway Blockouts and Wall and Floor Penetrations

Fire stops will be installed for cable trays wherever the cables pass through fire walls and floors other than the Reactor Containment vessel. Cable and cable tray penetrations of fire barriers are sealed to provide protection at least equivalent to that required of the fire barrier. Penetrations are qualified to meet the requirements of ASTM E-119, and IEEE Std. 634-1978. The actual fire ratings of stops and penetrations is determined by the fire hazards analysis.

Fire stops, fire barriers, and air seals will be constructed of mastic type materials or elastomer modular construction materials qualified in accordance with IEEE Std. 634 and ASTM E-119. Fire stop/seal material will be compatible with insulation and conductor materials and will be shock, vibration, seismic, and radiation resistant in accordance with the area(s) penetrated.

E. Physical Separation Criteria for Cables of Class 1E Systems

The separation design description for raceways, Class 1E circuitry and associated cabling given below incorporates the requirements of IEEE Std. 384-1974, Regulatory Guide 1.6 and NRC Regulatory Guide 1.75.

Load groups, cables, and raceways of a safety-related system will be separated from load groups, cables, or raceways of other safety-related groups in accordance with the separation criteria described herein. This separation criteria will preclude a single failure within the safety-related system from preventing proper protective action at the system level when required. Raceways and cables will be classified by separation groups, namely Class 1E Division 1, Class 1E Division 2, Class 1E Division 3, and Plant Protection System.

Each division of Class 1E equipment of Divisions 1, 2 and 3 are located in separate rooms which are separated by a minimum of 3 hours rated fire barriers.

Cables designated in each division will be run in raceways separated from cables designated in other divisions and from Non-Class 1E cables. Associated cables will be separated as if they were Class 1E pursuant to the Class 1E division associated with these cables.

8.3.3.3 NRC COMMENT

h) Conduits as Fire Barriers

Section 8.3 1.1.2.1 of the PSAR states that "Cables of the division 3 power supply are separated from cables of the remaining Class 1E plant ac power supplies by routing them in conduits or cable trays in separate fire hazard areas". Based on this statement it appears that conduits will be used as a fire barrier for protecting division 3 cables. Clarification of this use of conduits will be pursued with the applicant and the results of our evaluation will be reported in a supplement to this report.

RESPONSE:

The conduits are not used as a fire barrier for protecting division 3 cables. The conduits and cable trays are used as raceways for routing of Class 1E division 3 cables. The cables and raceways of the Class 1E division 3 power supply are separated from other Class 1E divisions in accordance with the criteria described in the Section 8.3.1.4 of the PSAR and response to question CS430.10, forwarded by letter of June 1, 1982.

8.3.3.3 NRC COMMENT

i) Protection of Class 1E Cables from Rotating or Dropped Equipment

Separation between redundant raceways as defined in the PSAR takes into consideration the presence of rotating equipment, monorails, and equipment removal paths and the possibility that heavy equipment could be lifted and dropped and possibly cause failure of two raceway channels. The PSAR states that the minimum separation between two raceway channels at Clinch River will be such as to preclude failure of both channels. Current regulatory guidelines, however, requires protection of each raceway as well as separation so that the dropped equipment will not cause failure of either raceway. An alternative to protection may be a design that provides an additional two independent systems each capable of shutting down the reactor and separated such that neither will be affected by the "dropped equipment" or failure of rotating equipment.

By letter dated June 1, 1982, the applicant indicated that rou[illegible] of safety-related raceways will be such that any dropped eq[illegible] will not result in a failure of any safety-related raceway[illegible] staff concludes that safety related raceways will be protected from droppped equipment, meets review guidelines, and is acceptable.

Also, by letter dated June 1, 1982, the Applicant stated that the safety system design includes three divisions each capable of shutting down the reactor and each located such that failure of rotating equipment will not cause failure of more than one safety division. This statement is unclear as to the rotating equipment that has failed. Clarifications will be pursued with the applicant and in coordination with ASB the results will be reported in a supplement to this report.

RESPONSE:

The terminology "rotating equipment" contained in response to

question CS430.14 (See Letter dated June 1, 1982) includes motors, diesel generator & fans related to the same Class 1E division as the cables affected by the failure of rotating equipment. The failure of these rotating equipment may cause failure of only one Class 1E division. The remaining two Class 1E load groups which are individually capable to safety shutdown the plant will not be affected.

All non-safety related equipment located in Seismic Category I buildings are designed to maintain structural integrity under a Seismic event and will not become missiles.

8.3.3.5.1 NRC COMMENT

Testing of Circuit Breakers

Section 8.3.1.1.2 of the PSAR (under the subheading "Testing and Inspection") implies that when 4.16 kv and 480 V switchgear circuit breakers are being tested, their capability to respond to a bona fide signal during operation has not been maintained in accordance with guidelines of Section 5 of IEEE Standard 338-1977. By letter dated June 1, 1982, the applicant has further implied that the subject breakers are not designed in accordance with the guidelines of Section 5 of IEEE Standard 338-1977, to be functionally tested during operation of the nuclear power generating station. Justification for noncompliance will be pursued with the applicant and the results of the staff evaluation will be reported in a supplement to this report.

RESPONSE

The Class 1E electrical distribution system consists of three functionally redundant safety divisions, as described in Section 8.3.1 of the PSAR, any of which has the capability to safely shutdown the plant.

Circuit breakers of each of the three safety divisions are designed to be testable during plant operation as well as during plant shutdown.
The testing will demonstrate the

full functional capability of the equipment under test. The equipment being tested will not cause a loss of independence between redundant channels or load groups. As such, there is sufficient redundancy within the system to provide all necessary functions during testing, even when degraded by a single random failure.

8.3.3.4 NRC Comment

Compliance With the Guidelines of NUREG-0737, "Clarification of TMI Action Plan Requirements"

Two TMI items relating to GDC 17 are identified in NUREG-0737. These items are II.E.3.1, Emergency Power Supply for Pressurizer Heaters, and II.G.1, Emergency Power for Pressurizer Equipment. The background, the NUREG position, and clarification of the positions are included in the NUREG report.

This item will be pursued with the applicant and the results reported in a supplement to this report.

Response

The CRBRP's evaluation and resolution of TMI Action Plan Requirements are contained in Appendix H of the PSAR.

Specific information concerning items II.E.3.1 and II.G.1 are included in Appendix H.