Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

June 17, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
Fire Protection
NRC Docket Nos. 50-454, 50-455, 50-456, and 50-457

Reference (a): April 11, 1983, letter from B. J. Youngblood to D. L. Farrar.

Dear Mr. Denton:

This is to provide additional information regarding instrumentation which would be used to assure a safe shutdown in the event of a fire at Byron or Braidwood stations. This information was requested by the NRC in reference (a). It will be incorporated into the FSAR and the Fire Protection Report in future amendments.

The two remaining NRC concerns involve source range neutron monitoring after a fire in the control room and safe shutdown instrumentation operability after a fire in the auxiliary electric room. The new panel will display steam generator pressures and levels, reactor coolant loop hot and cold temperature, and source range neutron flux. Appropriate changes to FSAR question 10.57 and Section 2.4 of the Fire Protection Report are included in Attachment A to this letter. Other minor changes are incuded to address minor issues discussed previously with NRC fire protection reviewers.

With the present equipment procurement and construction completion schedules it appears that the new panel will be operational pror to initial fuel load for all units except Byron 1. The Byron 1 panel will be installed as soon as practical but no later than the end of the first refueling outage. We consider interim operation of Byron 1 without this panel to be acceptable based upon: 1) the relatively low likelihood of a damaging fire in either the control room or the auxiliary electric equipment room during the first fuel cycle, 2) the circuits involved serve monitoring functions, not control functions, and 3) satisfactory maintenance of safe shutdown can be achieved through manual local monitoring of important parameters during the relatively short time it would take to restore remote indication of process variables.

B001
1/1

Please address further questions regarding this matter to this office.

One signed original and fifteen copies of this letter and the attachment are provided for NRC review.

Very truly yours,

T. R. Tramm
Nuclear Licensing Administrator

lm

Attachments

6789N

ATTACHMENT A

List of Revised Pages

FSAR: Question 010.57

Fire Protection Report:

2.4-6
2.4-7
2.4-10
2.4-10a
2.4-12
2.4-16
2.4-16a
2.4-25 thru -27
2.4-34a thru -34i
2.4-38
2.4-54
2.4-228 thru -250

6789N

QUESTION 010.57

"Table 2.4-4a of the safe shutdown analysis identifies safe shutdown instrumentation. However, the analysis indicates that following a fire in a number of separate plant fire zones, redundant channels of certain of these instruments which must be available during hot shutdown will be lost. This is unacceptable. It is our position that at least once channel of instrumentation essential for safe shutdown be protected from fire damage in accordance with Section III.G.2 of Appendix R or an alternate be provided which meets the requirements of Section III.L of Appendix R. The backup instrumentation justification discussion of these fire zones in the safe shutdown analysis does not comply with Section III.L. Instrumentation affected includes source range neutron flux monitoring, steam generator wide range level indication, reactor coolant hot and cold leg indication and auxiliary feedwater flow indication in the following areas:

a. Control room

b. Lower cable spreading room

c. Auxiliary electrical equipment room

d. Auxiliary building general Area, elevation 383'-0"

e. Radwaste and remote shutdown control room; and

f. Radwaste drumming station and tunnel."

RESPONSE

A discussion of each of the areas listed in the question follows. Note that the lower cable spreading rooms are divided into five fire zones. A discussion is provided for each zone. Table Q10.57-1 lists the number of channels of instrumentation affected in each fire zone for each of the instrumentation types listed in the question. The list in this table does not include new indication for some of these parameters added in response to staff positions. These are described in the applicable portions of Section 2.4 of the Fire Protection Report. Reference to specific subsections which may be applicable are provided under the discussions for each fire zone which follows.

a. Control Room (Fire Zone 2.1-0)

Both channels of source range neutron monitoring instrumentation would be affected by a fire in this zone. This is due to the fact that the neutron monitoring

system panel 1PM07J is located in the control room. It is the Applicant's position, however, that the source range neutron monitoring instruments are not required to achieve or maintain the plant in the hot standby or hot shutdown conditions. In the event of a fire in this zone, the operators would have sufficient time to scram the reactor prior to evacuating the room. Once the control rods are inserted into the core, sufficient negative reactivity has been inserted to ensure subcriticality while hot standby or hot shutdown conditions are maintained. Should it be necessary to determine or verify the available shutdown margin, a primary coolant system sample can be drawn and analyzed for boron concentration. This operation can be performed onsite by station personnel.

Thus, no reliance is placed on the neutron monitoring system instrumentation until actions are begun to take the plant to cold shutdown.

The Applicant believes this position meets Appendix R requirements. In particular, Section III.L.1.a, which states that alternative shutdown capability shall be capable of achieving and maintaining subcriticality, is met by manually scramming the reactor, since subcriticality is assured by inserting the control rods into the core and maintaining hot standby conditions, Section III.L.2.d, which states that direct indication of process variables necessary to perform and control the reactivity control function shall be provided, is met because once the control rods have been inserted into the core, direct indication of neutron flux is not required to control reactivity while hot standby is maintained. Credit is taken for repairing fire damage to neutron monitoring system cables prior to initiating cold shutdown actions, as per Appendix R.

In summary, the Applicant's position meets Appendix R and protection of neutron monitoring system cables from fire damage is not warranted.

Nevertheless, in response to a staff position, the Applicant has agreed to provide indication of source range neutron flux independent of this zone. Refer to Subsection 2.4.2.4 of the Fire Protection Report for a detailed description of the modifications provided.

b. Lower Cable Spreading Rooms:

1) Fire Zone 3.2A-1 - This zone does not contain any of the instrumentation cable listed for this question.

2) Fire Zone 3.2B-1 - This zone contains cables from both trains of the neutron monitoring system. Refer to part a of this response for the Applicant's position on this system. Cables for not more than one train out of two of instrumentation for other parameters listed in this question are routed through this zone. Thus, additional fire protection features are not required for this zone.

3) Fire Zone 3.2C-1 - This zone contains cables from both trains of the neutron monitoring system. Refer to part a of this response for the Applicant's position on this system. Cables for not more than one train out of two of instrumentation for other parameters listed in this question are routed through this zone.

4) Fire Zone 3.2D-1 - Cables for not more than one train out of two of instrumentation for parameters listed in this question are routed through this zone. Thus, additional fire protection features are not required for this zone.

5) Fire Zone 3.2E-1 - Cables for not more than one train out of two of instrumentation for parameters listed in this question are routed through this zone. Thus, additional fire protection features are not required for this zone.

c. Auxiliary Electric Equipment Room (Fire Zone 5.5-1)

Modifications to provide essential instrumentation independent of this zone are described in Subsection 2.4.2.21 of the Fire Protection Report.

d. Auxiliary Building General Area - Elevation 383 feet 0 inch (Fire Zone 11.4-0)

Only one out of two channels of the neutron monitoring system are present in this zone. Four-out-of-four channels of steam generator wide range level and reactor coolant hot and cold leg temperature instrumentation are present, however. Refer to part c of this question for a description of the resolution for these instruments.

All eight channels of auxiliary feedwater flow are present. A fire in this zone could render all auxiliary feedwater flow indication here inoperable. The auxiliary feedwater flow transmitters (located in Fire Zone 11.3-0) are indicating transmitters, however. Thus, if indication is lost in this zone, an operator could be sent to read

the local indication at the transmitters. The operator would maintain communication with the control room by portable radio or other plant communications equipment. Thus, the loss of the auxiliary feedwater flow indication due to a fire in this zone is acceptable.

e. Radwaste and Remote Shutdown Control Rooms (Fire Zone 11.4C-0)

The discussion under Part d of this question for Fire Zone 11.4-0 is also applicable for this fire zone.

f. Radwaste Drumming Station and Tunnel (Fire Zone 14.1-0)

The fire zone boundary of this zone is redefined in the revised Fire Protection Report. The original boundary was arbitrary and did not conform to plant structural features. The new boundary follows a structural concrete wall. As a result of this change, the area on elevation 383 feet 0 inch roughly between column-rows 21 and 25 and P to Q was deleted from Fire Zone 14.1-0 and added to Fire Zone 11.4-0. This area included the cables from the safe shutdown instrumentation listed in this question. Fire Zone 14.1-0 now contains no safe shutdown cables. Refer to part d of this question for a resolution of this question for Fire Zone 11.4-0.

TABLE Q10.57-1

INSTRUMENTATION CHANNELS ROUTED THROUGH FIRE ZONES

	AREA	FIRE ZONE	INSTRUMENTATION: NEUTRON MONITORING	SG WIDE RANGE LEVEL	RC HOT & COLD LEG TEMPERATURE	AUXILIARY FEEDWATER FLOW
a.	Control Room	2.1-0	SR: 2/2	---	---	---
b.	Lower Cable Spreading Rooms	3.2A-1	---	---	---	---
		3.2B-1	SR: 2/2	2/4	Cold Leg: 4/4	4/8 (One Train)
		3.2C-1	SR: 2/2	---	Cold Leg: 4/4	4/8 (One Train)
		3.2D-1	---	2/4	Cold Leg: 4/4	4/8 (One Train)
		3.2E-1	SR: 1/2	2/4	Hot Leg: 4/4	4/8 (One Train)
c.	AEER	5.5-1	SR: 2/2 (Power Sources)	4/4	Hot Leg: 4/4 Cold Leg: 4/4	---
d.	Aux. Bldg. El. 383 ft 0 in.	11.4-0	SR: 1/2	4/4	Hot Leg: 4/4 Cold Leg: 4/4	8/8
e.	RSP	11.4C-0	SR: 1/2	4/4	Hot Leg: 4/4 Cold Leg: 4/4	8/8
f.	Radwaste	14.1-0	(1/2)*	(4/4)*	---	(8/8)*

* Due to redefinition of fire zone boundaries, Fire Zone 14.1-0 now has no safe shutdown cables routed through it.

c. In the case of associated cables sharing a common enclosure, the cables used on Byron/Braidwood meet the flame test of IEEE 383-1974 which demonstrates that the cable does not propagate fire even if its outer covering and insulation have been destroyed in the area of flame inpingement. In addition to the above, Byron/Braidwood cables are sparated in eight separate divisions as follows:

1. ESF Division 11.
2. ESF Division 12.
3. Non-Safety-Related Division 11.
4. Non-Safety-Related Division 12.
5. RPS Reactor Protection/Nuclear Instrumentation Channel 1.
6. RPS Reactor Protection/Nuclear Instrumentation Channel 2.
7. RPS Reactor Protection/Nuclear Instrumentation Channel 3.
8. RPS Reactor Protection/Nuclear Instrumentation Channel 4.

Therefore, associated cables of different divisions do not share a common cable tray, conduit or raceway.

2.4.1.6 Repairs

For many of the fire zones, credit is taken for making repairs to equipment in order to perform one or more of the safe shutdown functions. In all cases, such credit is taken only to accomplish a function required for cold shutdown. The ability to achieve and maintain hot shutdown independent of each fire zone, without taking credit for repairs, is demonstrated in Subsection 2.4.2.

Table 2.4-4B lists each fire zone for which credit for affecting repairs within 72 hours was taken in the Safe Shutdown Analysis. Also listed in the table are the affected equipment, a description of the repair for which credit is taken, and a list of major materials required. As can be seen from this table, most repairs identified consist of installing temporary cable to replace cables assumed to be damaged by a fire. The only exceptions are in fire zone 2.1-0, where control switches must be replaced, and in fire zone 11.5-0, where credit is taken for installing a pump. In this case, the pump involved is a small pump with a small electric motor.

For each of the fire zones listed in Table 2.4-4b, where credit is taken for making repairs, a procedure will be written and be available to cover the repair needed. The procedures will, however, be general for each type of repair. For example, one procedure will be written for "Install temporary cable," and this one procedure will be applicable for all zones where this repair is referenced. The repair procedure will be referenced in the Pre-Fire Plan for each fire zone where it is required.

The nature and scope of these repairs are such that they would be performed by the plant's normal maintenance staff, who possess adequate training to complete these tasks. Neither additional nor specially trained personnel would be required.

Cable separation for the PORV and block valve power and control cables were checked throughout the remainder of this zone. Except for the immediate area around the pressurizer coffin, the separation between the Division 11 PORV and block valve cables and the Division 12 PORV and block valve cables exceeds 20 ft. As previously stated, the present arrangement in the area of the pressurizer coffin is considered acceptable due to the low combustible loading in this zone and the fact that the cables of concern are routed in conduit.

Additional channels are available for all instruments lost except pressurizer temperature. This parameter is not essential however, since it can be inferred from pressurizer pressure, two channels of which remain available.

Thus, a credible fire in this zone will not affect the ability to achieve and maintain the plant in a safe shutdown condition.

2.4.2.4 Control Room (Fire Zone 2.1-0)

Safe shutdown equipment located in this zone and safe shutdown power and control cables routed through this zone are listed in Table 2.4-14. Safe shutdown instrumentation cables routed through this zone are listed in Table 2.4-15.

In the event of a fire in this zone, the reactor would be tripped and control rod insertion would be verified prior to control room evacuation, thus placing the plant in hot standby.

Both normal channels of source range neutron monitoring instrumentation could be affected by a fire in this zone. This is due to the fact that the neutron monitoring system panel 1PM07J is located in the control room. In response to a staff position on this subject, the applicant agreed to provide indication of source range neutron flux independent of this zone. The general scheme to be implemented involves taking a signal from an existing detector and using it with a new indicator on a new "Fire Hazards Panel" to be provided (refer to Subsection 2.4.2.21 for more details on the new panel). Should this prove to be impractical, a new detector will be provided in a spare well, making this new source range flux instrument completely independent of the existing system.

Also present in this zone are the controls for the pressurizer PORV's and block valves. Refer to Subsection 2.4.3.2.2 for a discussion of the effects of fire on this system. Following evacuation of the control room, overpressure protection for the primary system would be provided by the pressurizer safety

valves. The plant would be maintained in hot standby until repairs could be implemented to the PORV and block valves control switches and cables, thus allowing depressurization of the primary system. This would certainly be accomplished within 72 hours.

Under these circumstances, the plant can be maintained in both hot standby and cold shutdown from the Remote Shutdown Panel, (1PL04J, 1PL05J and 1PL06J), and other local instrumentation and controls.

Thus, a fire in this zone will not affect the ability to achieve and maintain the plant in a safe shutdown condition.

2.4.2.5 Record Storage Room (Fire Zone 2.1-1)

No safe shutdown equipment is located in this zone. No safe shutdown power or control cables are routed through this zone. Safe shutdown instrumentation cables routed through this zone are listed in Table 2.4-16.

This fire zone is a controlled access area. It is provided with an automatic fire detection and suppression system.

Thus, a fire in this zone will not now impare the capability to safely shutdown the plant.

2.4.2.8 Lower Cable Spreading Area (Fire Zone 3.2B-1)

No safe shutdown equipment is located in this zone. Safe shutdown power and control cables routed through this zone are listed in Table 2.4-21. Safe shutdown instrumentation cables routed through this zone are listed in Table 2.4-22.

Power, control and non-nuclear instrumentation cables from only one electrical division are located in this zone. A fire in this zone could result in the loss of both channels of intermediate and source range neutron detectors. A new indicator of source range neutron flux is provided independent of this zone. Refer to Subsection 2.4.2.4 for details. Thus, a fire in this zone would not affect the ability to safely shutdown the plant.

2.4.2.9 Lower Cable Spreading Area (Fire Zone 3.2C-1)

No safe shutdown equipment is located in this zone. Safe shutdown power and control cables routed through this zone are listed in Table 2.4-23. Safe shutdown instrumentation cables routed through this zone are listed in Table 2.4-24.

Power, control, and non-nuclear instrumentation cables from only one electrical division are located in this zone. A fire in this zone could result in the loss of both channels of intermediate and source range neutron detectors. A new indicator of source range neutron flux is provided independent of this zone. Refer to Subsection 2.4.2.4 for details. Thus, a fire in this zone would not affect the ability to safely shutdown the plant.

2.4.2.10 Lower Cable Spreading Area (Fire Zone 3.2D-1)

No safe shutdown equipment is located in this zone. Safe shutdown power and control cables routed through this zone are listed in Table 2.4-25. Safe shutdown instrumentation cables routed through this zone are listed in Table 2.4-26.

Cables from only one electrical division are located in this zone, therefore, a fire in this zone would not affect the ability to safely shut down the plant.

2.4.2.11 Division 11 Cable Riser (Fire Zone 3.2E-1)

No safe shutdown equipment is located in this zone. Safe shutdown power and control cables routed through this zone

The only "combustible" material in this zone is the cable insulation/jacketing materials as listed in Table 2.2-2. The Byron/Braidwood cables have passed the IEEE 383-1974 flame test and thus can be considered to be self-extinguishing and non-flame propagating. Although they may burn in the presence of a fire of non-related origin, no other combustible materials have been identified as being present in the zone. Transient combustibles are thus the only possible source of fire which could affect the cables. While transient combustibles may be present at times, a large enough quantity to affect more than a small part of this room would not ever be introduced.

In the event a credible fire were to start in this room, the arrangement of cabinets and separation of cables are such that the rapid spread of the fire would be severely hampered. The metal enclosures of the cabinets would act effectively to contain the fire within a single cabinet, or perhaps several adjacent cabinets. The spread of a fire from one row of cabinets to the next row is extremely unlikely due to the shielding effect of the cabinet enclosures to the cables inside from radiant energy. Divisional separation helps to limit the effects of any credible fire also. All division 12 cables enter the cabinets through the floor. These cables are not exposed to the general room environment. Division 11 cables leave the cabinets at their top, and then penetrate the ceiling to the cable spreading area above. Thus a general exposure fire that affected Division 11 cable trays near the ceiling would not affect redundant Division 12 cables.

This room is provided with ionization detectors which would quickly detect any fire. Since it is adjacent to the control room, which is continously manned, fire fighting personnel would quickly respond to any alarm, and would have easy and unobstructed access to the room to conduct fire fighting activities. Numerous extinguishers are located in this zone and in the adjacent control room, as shown on Figure 2.3-8 (sheet 1).

For the reasons outlined above, a credible fire in this zone would not seriously affect the ability to safely shutdown the unit.

Nevertheless, indication for several key safe shutdown parameters will be provided independent of this zone. These parameters will be displayed on a new "Fire Hazards Panel" which will be located in an area independent of this zone. Two areas under consideration for locating this new panel are the electrical cable penetration areas on elevations 414'-0" and 426'-0". A final location has not been chosen at this time, however.

Parameters to be displayed are the following: 1) two channels (one for each of two steam generators) of steam generator wide range level; 2) two channels (one for each of two steam generators) of steam generator pressure; 3) one channel of pressurizer level; 4) one channel of pressurizer pressure; 5) four channels each of reactor coolant hot and cold leg temperature, and 6) one channel of source range neutron monitoring. Note that the two channels of steam generator pressure and the two channels of steam generator wide range level will be provided for the same two steam generators.

The general scheme to be implemented for the new indication is as follows. The signal from one of the existing transmitters will be intercepted with a local transfer switch located between the containment penetration and the Auxiliary Electric Equipment Room. A new indicator will be provided. New equipment consists of the transfer switch, any required signal conditioning/processing circuitry, the indicator and associated cabling. In accordance with Section III.L.b of Appendix R, the new equipment and components will not be designed to meet seismic Category I criteria, the single failure criteria, or other design basis accident criteria. Only the interface needs to be designed so as not to degrade the performance or reliability of the existing equipment.

In addition to the parameters listed above, reactor coolant hot and cold leg temperature instrumentation is also present in this zone. The applicant has conducted a thorough review and found eleven fire zones where all four channels of hot leg temperature instrumentation could be lost due to a fire, and eight fire zones where all four channels of cold leg temperature could be lost. The following modification will be implemented to resolve this problem. All eight existing RTD's (four hot leg and four cold leg) will be replaced with qualified dual element RTD's. One element for each RTD will be connected to the existing cables, so that the existing system functions will not be changed in any way. The second element from each RTD will be wired to the new indicators at the new "Fire Hazards Panel." The new cable routing will be accomplished in such a way that no single fire could disable either all eight hot leg or all eight cold leg temperature indicators.

The new "Fire Hazards Panel" and the modifications to the reactor coolant temperature RTD's are presently being designed. Upon completion of the design process, further details will be reported.

Should use of this panel be required by a fire in this zone, an operator would be dispatched to the zone. He would maintain communication with the control room using a portable radio or other plant communications equipment.

2.4.2.43 Auxiliary Building General Area, Elevation 383 feet 0 inch (Fire Zone 11.4-0)

Safe shutdown equipment located in this zone and safe shutdown power and control cables routed through this zone are listed in Table 2.4-70. Safe shutdown instrumentation cables routed through this zone are listed in Table 2.4-71.

All of the equipment located in this zone and all of the power and control cables routed through this zone are from electrical Division 11 with only one exception. Cable 1CC020 is the Division 12 power cable to the shared component cooling pump. However, it is separated from 1CC001, the power cable to the Division 11 pump, by more than 20 feet.

At one point in this zone, cables for all of the auxiliary feedwater pump flow channels and all four steam generator wide range level channels are within 20 feet of each other. Cables for the reactor coolant hot and cold leg wide range temperature indication are also within 20 feet of each other. However, if these were lost, AFW flow would be read at the transmitters. As a result of modifications made in response to a staff position, indication for the other parameters would still be available at the Fire Hazards Panel (refer to Subsection 2.4.2.21 for a description of the Fire Hazards Panel and the modifications made in response to the staff position). Other instrumentation present is redundant, or is not needed for 72 hours, leaving time available to effect repairs.

This general area has a low combustible loading which consists mostly of cable jacket and insulation materials and automatic fire detection is provided. Since redundant or equivalent essential equipment and instrumentation is available independent of this zone, a fire in this zone will not prevent the safe shutdown of the plant.

2.4.2.44 Unit 1 Auxiliary Feedwater Pump Diesel Room (Fire Zone 11.4A-1)

Safe shutdown equipment located in this zone and safe shutdown power and control cables routed through this zone are listed on Table 2.4-72.

With the exception of valve 1AF006A (essential service water to auxiliary feedwater pump suction); all equipment and cables are associated with one electrical division. While a fire in this zone could affect the ability to supply essential service water to both auxiliary feedwater pumps, this source of water is not normally used. The normal source is the condensate storage tank, which is still available. Therefore, a fire in this zone would not affect the ability to safely shut down the plant.

2.4.2.45 Radwaste and Remote Shutdown Control Room (Fire Zone 11.4C-0)

Safe shutdown equipment located in this zone and safe shutdown power and control cables routed through this zone are listed in Table 2.4-73. Safe shutdown instrumentation cables routed through this zone are listed in Table 2.4-74.

A number of essential functions are monitored or controlled from the remote shutdown panels. The cables routed through this zone cannot be isolated from the control room. In other words, while this zone can be isolated so that a fire in the control room cannot affect the controls and instruments in this zone, the reverse is not true. A fire in this zone will render both these panels and the corresponding instruments and controls in the control room inoperable. This is an acceptable situation, however, since all of the instruments and controls have additional redundant channels or diverse equipment located in the control room or elsewhere that can perform the safe shutdown function independent of this zone. A detailed analysis follows.

Instrumentation provided on remote shutdown panels 1PL04J, 1PL05J and 1PL06J is listed on Tables 2.4-74a, b and c respectively.

Panel 1PL04J has auxiliary feedwater pump 1A flow to steam generators A through D (four channels), steam generator level (A through D, four channels), and essential service water temperature (two channels) as listed in Table 2.4-74a. The auxiliary feedwater flow can be read from local indicators at the transmitters, independent of this fire zone. Steam generator wide range level remains available at the Fire Hazards Panel (refer to Subsection 2.4.2.21). The essential service water temperature indication was not identified as required for safe shutdown, and thus its loss has no affect on the ability to safety shutdown the unit.

Panel 1PL05J has auxiliary feedwater pump 1B flow to steam generators A through D (4 channels), reactor coolant loop A through D hot and cold leg temperatures (4 channels each), and essential service water temperature (two channels). As stated above, the auxiliary feedwater flow indication is available elsewhere independent of this fire zone. Reactor coolant hot and cold leg temperature indication remains available at the "Fire Hazards Panel" (refer to Subsection 2.4.2.21 for a detailed discussion of this instrumentation). The essential service water temperatures are not required for safe shutdown of the unit.

Panel 1PL06J has steam generator A through D steam pressure (4 channels), pressurizer level (2 channels), pressurizer pressure (one channel), source range detector count rate (one channel), boron injection flow (one channel), volume control tank level (one channel), charging header pressure (one channel) and charging header flow (one channel) as listed in Table 2.4-74c. Two channels per steam generator of steam generator steam pressure indication remain available in the control room independent of this zone. One channel of pressurizer level and three channels of pressurizer pressure indication remain available in the control room independent of this zone. One channel of source range detector count rate remains available in the control room independent of this zone. Emergency boron injection flow is only required for cold shutdown, thus, time is available to repair the cable prior to its use. Volume control tank level and charging header pressure are not required for safe shutdown of the unit. Charging header flow is not redundant, but pressurizer level and pressurizer pressure indication are still available. Since the primary system conditions are those in which the operators are most interested, loss of the charging header flow indication will not prevent safe shutdown of the unit.

Controls provided on remote shutdown panels 1PL04J, 1PL05J and 1PL06J are listed on Table 2.4-74d, e, and f respectively.

Controls on panel 1PL05J are identical to those on panel 1PL04J, except they are for Division 12 equipment, while controls on 1PL04J are for Division 11 equipment. The following discussion of panel 1PL04J controls therefore applies equally to panel 1PL05J.

Among the safe shutdown equipment controlled from panel 1PL04J are the auxiliary feedwater regulating valves and steam generator isolation valves. The steam generator isolation valves are

2.4.3 Identification and Analysis of High-Low Pressure Interfaces

2.4.3.1 Identification of High-Low Pressure Interfaces

A thorough review of all interfaces of the RCS with other plant systems has identified four high-low pressure interfaces that utilize redundant electrically controlled devices for isolation of the primary coolant pressure boundary. Two of the interfaces consist of the two motor-operated valves in series in each of the RHR pump suction lines. These are discussed in detail in Subsection 2.4.3.2.1. The other two interfaces consist of the two power-operated relief valves (PORV's) and their associated motor-operated block valves. These are discussed in detail in Subsection 2.4.3.2.2.

2.4.3.2 Evaluation of High-Low Pressure Interfaces

2.4.3.2.1 RHR Pump Suction Lines

2.4.3.2.1.1 Interface Description

The two RHR pump suction lines are as follows:

1. MOV RH8701A-1 and RH8701B-2 in RHR suction line from RC loop A.

2. MOV RH8702A-1 and RH8702B-2 in RHR suction line from RC loop C.

These valves are interlocked by diverse pressure instruments as described in FSAR Subsection 7.6.4 and are shown in FSAR Figure 6.3-2 (P&ID M-62).

Power and control cables for valves 1RH8701A, 1RH8701B, 1RH8702A, and 1RH8702B are listed in Table 2.4-101.

Table 2.4-102 gives the control cable by fire zone for 1RH8701A and 1RH8701B and their function. The cables that are associated with the control logic of 1RH8701B are in parenthesis. Table 2.4-103 gives this information for 1RH8702 A and B. The cables associated with 1RH8702B are in parenthesis.

2.4.3.2.1.2 Failure Modes

Failure of a power cable either by ground open or hot short would not affect the valve actuation logic. Therefore, no further analysis will be performed for power cable since the valve will fail in the as is condition if these cables are disabled.

For these normally closed valves to open, five conditions must be met:

1. Control switch on main control room panel in open position
2. Reactor pressure less than 382 psig
3. Valve CV8804A/SI8804B closed - Limit Switch
4. Valve SI8811A/B closed - Limit Switch
5. Valve SI8812A/B closed - Limit Switch

Failure Modes

The following modes are postulated:

i. If cable from limit switches on valves CV8804A/SI8804B, SI8811A/B, and SI8812A/B short, the permissives for opening the valves 1RH8701A and 1RH8701B (1RH8702A and 1RH8702B) are satisfied. The valves could open if the other two conditions are met.

ii. An open in the cable from the limit switches above will open the permissive contact and prevent the valves from opening. This is a fail safe position.

iii. A short or open in the instrument, cable or logic associated with the reactor pressure permissive will deenergize the pressure interlock relay and permit the valve to open, if the other four conditions are met.

iv. A ground in all control cable will blow a fuse in the MCC. The valve will remain in the as is condition.

v. A short in the cable from the control switch will open the valve if all other permissives are met.

vi. An open in the cable from the control switch will cause the valve to remain in the as is condition.

Acceptance Criteria

The failure being considered is the spurious opening of both valves in series in the high-low pressure interfaces while the reactor pressure is above the pressure permissive set point. As indicated above,

five conditions must be met for the valve to open. Adequate protection is assured if within a specific fire zone, a postulated fire related failure cannot cause all five conditions to be met for both valves concurrently. If a control or interlock cable is present in a fire zone, it is assumed to fail in the most detrimental manner, (i.e., provide a signal to the valve logic that would permit the valve to open if all other signals were also present). Since valves CV8804A/SI8004B and SI8811A/B are normally closed (see FSAR Figure 6.3-1 (Sheets 1 and 4) and FSAR Figure 9.3-4 (Sheet 1)), the permissives associated with these valves are satisfied. Therefore, for the purpose of this analysis, the valve is considered capable of spuriously opening if cable serving the following three contacts in the logic circuitry are present in the fire zone:

i. control switch

ii. reactor pressure interlock

iii. interlock for SI8812A/B closed.

2.4.3.2.1.3 Evaluation and Results

Evaluation Results for 1RH8701A and 1RH8701B

Cable

In the following fire zones, the spurious opening of one valve 1RH8701A or 1RH8701B can be postulated due to fire related damage to cable. However, at least one of the permissives associated with other valves is independent of these fire zones assuring that the integrity of the high-low pressure interface is maintained (see Table 2.4-102 for listing of cable by fire zone).

FIRE ZONE FOR WHICH 1RH8701A COULD OPEN	FIRE ZONE FOR WHICH 1RH8701B COULD OPEN
11.5A-1	3.1-1
11.6-0	3.2A-1
	11.6-1

Cables associated with all the permissives for both 1RH8701A and 1RH8701B are routed through Fire Zone 11.5-0. However, using 20 feet as the minimum allowable cable separation, both valves cannot open spuriously as the result of a single fire.

Panels

Valve 1RH8701A is powered from MCC 131x2 which is located in Fire Zone 11.5A-1. Valve 1RH8701B is powered from MCC 132x2 which is located in Fire Zone 11.6-1. A single postulated fire could only cause the failure in one of these motor control centers.

A fire in the main control room (Fire Zone 2.1-0) affecting panel 1PM06J could not result in a failure by spurious opening of either valve at high reactor pressure because the reactor pressure interlock for each valve is independent of the control room.

The unit 1 auxiliary electrical equipment room (Fire Zone 5.5-1) contains panels 1PA01J, 1PA09J, 1PA27J, 1PA04J, 1PA10J, and 1PA28J through which the reactor pressure permissive signal is routed. A fire in this fire zone could result in the spurious opening of 1RH8701B because the cable associated with the control switch located in the main control room is also routed of this area. However, the control cable associated with the control switch for 1RH8701A is routed independent of this area.

Evaluation Results for 1RH8702A and 1RH8702B

Cable

In the following fire zones, the spurious opening of one valve 1RH8702A or 1RH8702B can be postulated due to fire related damage to cable. However, at least one of the permissives associated with the other valve is independent of these fire zones assuring that the integrity of the high-low pressure interface is maintained. See Table 2.4-103 for listing of cable by fire zone.

FIRE ZONES FOR WHICH 1RH8702A COULD OPEN	FIRE ZONES FOR WHICH 1RH8702B COULD OPEN
11.5-0	11.6-1
11.5A-1	
11.6-0	

In the following fire zones, the spurious opening of both 1RH8702A and 1RH8702B can be postulated:

None

Panels

Valve 1RH8702A is powered from MCC 131x2 which is located in Fire Zone 11.5A-1. Valve 1RH8702B is powered from MCC 131x2 which is located in Fire Zone 11.6-1. A single postulated fire could only cause the failure of one of these motor control centers.

A fire in the main control room (Fire Zone 2.1-0) affecting panel 1PM065 could result in the spurious opening of 1RH8702A. However, the reactor pressure interlock cable for 1RH8702B is routed independent of this fire zone.

The unit 1 auxiliary electrical equipment room (AEER) (Fire Zone 5.5-1) contains panels 1PA01J, 1PA09J, 1PA27J, 1PA04J, 1PA10J, and 1PA28J through which the reactor pressure permissive signal is routed. A fire in this fire zone could not result in a failure by spurious opening of either valve because the cable from the main control room control switch is independent of the AEER.

2.4.3.2.2 Pressurizer PORV's

2.4.3.2.2.1 Interface Description

The two PORV's and block valves are as follows:

1. PORV 1RY455A in series with block valve 1RY8000 A (Train A).

2. PORV 1RY456 in series with block valve 1RY8000B (Train B).

The PORV's are solenoid air-operated valves. FSAR Figure 7.2-1, sheet 11, shows the control logic for the PORV's. Each valve is controlled by a 4-position switch at the main control board (1PM05J). During at-power conditions, the switch is placed in the "auto" position. In this mode, PORV A will open upon closure of contacts PY455EX and PY458EX due to 2/4 high pressurizer pressure signals (channels 1 and 4). PORV B will open upon closure of contacts PY456EX and PY457EX due to 2/4 high pressurizer pressure signals (channels 2 and 3). The contacts are located in panels in the auxiliary electric equipment room.

The "arm" switch position is selected in order to activate the cold overpressure control system. This system protects the RPV from overpressurization during low temperature operational modes (RCS temperature at or below RNDT). (See FSAR Subsection 7.6.9 for a description of this system.)

Placing the switch in the "open" position directly energizes the operator and opens the valve.

The "close" position overrides all other switch positions.

The PORV block valves 1RY8000A and 1RY8000B are normally open motor-operated valves and are controlled by handswitches at 1PM05J.

Table 2.4-104 lists the power and control cables for the PORV's and block valves.

2.4.3.2.2.2 Failure Modes

Four fire-induced failure modes are postulated.

Failure Mode 1 - Spurious High Pressurizer Pressure Signals

A Train (1RY455A and 1RY8000A):

a. PORV handswitch in "auto" position.

b. Fire generates spurious high pressurizer pressure signal in pressure channels 1 and 4 (PORV opens).

c. Fire causes loss of control and power to block valve (valve fails open).

B Train (1RY456 and 1RY8000B):

a. PORV handswitch in "auto" position.

b. Fire generates spurious high pressurizer pressure signal in pressure channels 2 and 3 (PORV opens).

c. Fire causes loss of control and power to block valve (valve fails open).

Failure Mode 2 - Spurious Cold Overpressurization Signals

A Train:

a. PORV handswitch in "arm" position.

b. Fire generates a spurious cold overpressurization signal (opens PORV).

c. Fire causes loss of control and power to block valve (valve fails open.)

B Train:

a. PORV handswitch in "arm" position.

b. Fire generates a spurious cold overpressurization signal (opens PORV).

c. Fire causes loss of control and power to block valve (valve fails open).

Failure Mode 3 - PORV Handswitch Contact Closure

A Train:

a. Fire causes closure of PORV handswitch contacts in MCB 1PM05J (PORV opens.)

b. Fire causes loss of block valve control at MCB 1PM05J.

B Train:

a. Fire causes closure of PORV handswitch contacts in MCB 1PM05J (PORV opens).

b. Fire causes loss of block valve control at MCB 1PM05J.

Failure Mode 4 - Shorts in PORV Control Cables

A Train:

a. PORV handswitch in any position.

b. Fire causes shorts in either cable 1RY398 or 1RY246 which causes PORV solenoids to energize.

c. Fire causes loss of power and control to block valve.

B Train:

a. PORV handswitch in any position.

b. Fire causes shorts in either cable 1RY251 or 1RY252 which causes PORV solenoids to energize.

c. Fire causes loss of power and control to block valve.

2.4.3.2.2.3 Evaluation and Results

Analysis and Results of Failure Mode 1

Table 2.4-105 lists the power and control cables associated with the PORV's and block valves by fire zone. From the table, it is seen that failure mode 1 could occur in the following zone:

Fire Zone 1.2-1: PORV A opens

Block Valve A cannot be closed

PORV B opens

Block Valve B available

For the A train failure, placing the PORV A handswitch in the "close" position will override the "auto" mode and close the PORV. For the B train failure, both the block valve and the PORV can be closed.

Analysis and Results of Failure Mode 2

Occurrence of this type of failure during power operation would first require operator error; a failure to disarm the cold overpressurization system during power ascension would be a violation of station operating procedures. Therefore, this type of failure is only postulated for low temperature, low pressure operational modes.

A review of Table 2.4-105 reveals that both PORV's could open as a result of a fire in Fire Zone 5.5-1. The PORV's can be closed by placing both PORV handswitches in the "close" position. Both block valves could be closed since block valve cables are routed independent of this zone.

Analysis and Results of Failure Mode 3

This failure could only occur during a fire in the control room (Fire Zone 2.1-0), and would prevent immediate control of PORV's or block valves.

Should a PORV open inadvertently at this time due to a spurious signal, the operators would have no direct indication of this, since the instruments which the operators would use to detect this condition (PORV position indication, PORV discharge piping temperature, and pressurizer relief tank level, temperature and pressure) are all located in the control room. Because of this lack of direct indication of PORV status following

fire-induced control room evacuation, a procedure will be written to require closure of both of the PORV block valves (1RY8000A and B) following control room evacuation. Block valve 1RY8000A can be closed from motor control center 131X2, which is located on elevation 414 feet 0 inch at column-row 11/S (Fire Zone 11.5A-1). Closure is accomplished by jumpering the respective terminal points. Likewise, block valve 1RY8000B can be closed using jumpers at motor control center 132X2 located on elevation 426 feet 0 inch at column-row 12/S (Fire Zone 11.6-1).

This procedure will prevent the spurious operation of a PORV from having detrimental effects on plant safety.

Analysis and Results of Failure Mode 4

For this failure mode to occur, the following events must take place:

1. The fire must damage the control power cable to the PORV, the control cable to the block valve limit switch, and the power cable to the block valve. The PORV control power cable and the block valve control cable are assigned a control segregation while the block valve power cable is assigned a power segregation. The control and power cables are routed in separate cable tray/conduit systems.

2. The cable failure must be such that:

   a. The block valve control cable either shorts or opens and,

   b. The PORV control power cable has a sustained short to another cable such that the solenoid power conductor shorts to a positive DC source conductor and,

   c. The block valve power cable either shorts or opens.

Due to the number of events that must occur simultaneously, this failure is not considered credible.

TABLE 2.4-2 (Cont'd)

COMPONENT	EQUIPMENT NUMBER	FIRE AREA/ZONE	ELEVATION	COLUMN/ROW	COMMENTS
Reg. HX Line Containment Isolation Valve	MOV-1CV 8105-2	11.3-1	379'-0"	12-13/V-W	
Reg. HX Line Containment Isolation Valve	MOV-1CV 8106-1	11.3-1	379'-0"	12-13/V-W	
Cold Leg Injection Valve	MOV-1SI 8801A-1	11.3-1	383'-0"	12-13/V-W	
Cold Leg Injection Valve	MOV-1SI 8801B-2	11.3-1	383'-0"	12-13/V-W	
Volume Control Tank to Charging Pump Suction Valve	MOV-1CV LCV112B-1	11.6A-1	427'-1"	16-17/Q-S	
Volume Control Tank to Charging Pump Suction Valve	MOV-1CV LCV112C-2	11.6A-1	427'-1"	16-17/Q-S	
Atmospheric Relief Valves	1MS018A, D	18.3-1	404'-6"	6-7.7/Q-S	
Atmospheric Relief Valves	1MS018B, C	18.3-1	404'-6"	6-7.7/Y-AA	
PORV	1RY PCV455A	1.3-1	451'-0"	11-12/U-V	
PORV	1RY PCV456	1.3-1	451'-0"	11-12/U-V	

B/B

TABLE 2.4-4b

FIRE ZONE REPAIR DESCRIPTION

Zone No.	Affected Equipment	Repair Description	Required Material
1.1-1	RHR pump suction valves	either: a) provide temporary power cable for valve operator, or b) manually open valve when required	cable none
1.2-1	RHR pump suction valves	either: a) provide temporary power cable for valve operator, or b) manually open valve when required	cable none
2.1-0	PORV's and block valves	Install temporary cables and control switches	cable control switches
3.2E-1	Boric acid transfer pumps	Install temporary cables	cable
3.3C-1	Boric acid transfer pumps	Install temporary cables	cable
3.3D-1	Boric acid transfer pumps	Install temporary cables	cable
3.4A-1	Boric acid transfer pumps	Install temporary cables	cable
5.5-1	Boric acid transfer pumps	Install temporary cables	cable

B/B

AMENDMENT 2

TABLE 2.4-101

POWER AND CONTROL CABLE FOR RHR PUMP SUCTION VALVES

1. RC Loop A Isolation (1RH8701A/B)

Valve 1RH8701A

Power Cable

RH023	Power from MCC
RH024	131x2 to valve
AP144	
AP081	
AP414	
Ap415	
AP416	Auxiliary power to MCC 131x2
AP417	
AP418	
AP419	
AP428	
AP429	

Control or Interlock Cable

RH030	Interlock from PA28J-Reactor Pressure PT-0405
CV413	Interlock Valve CV8804A Closed
RH029	Interlock Valve SI8811A Closed
SI168	Interlock Valve SI8812A Closed
RH025	
RH026	
RH027	Limit Switch (LS) on 8701A
RH028	
RH031	Control Switch (CS) from MCR PM06J
SI-142	Interlock Valve
SI-143	CV8811A Closed
SI-166	Interlock Valve
SI-167	SI8812A Closed
CV-408	Interlock Valve
CV-410	CV8804A Closed

TABLE 2.4-101 (Cont'd)

Valve 8701B

Power

RH032	Power from MCC
RH033	132x2 to valve
AP252	
AP150	
AP117	
AP420	
AP421	Auxiliary Power to MCC 132x2
AP422	
AP423	
AP424	
AP425	
AP426	
AP427	

Control or Interlock Cable

RH043	Control Switch (CS) from PM06J
RH038	Interlock Valve SI8812A Closed
RH039	Interlock Valve CV8804A Closed
RH040	Interlock Valve SI8811A Closed
RH042	Interlock from PA28J - Reactor Pressure PT-0403
RH037	
RH034	Limit Switch (LS) on 8701B

2. RC Loop C Isolation (1RH8702A/B)

Valve 1RH8702A

Power Cable

RH044	Power from MCC
RH045	131x2 to valve
AP144	
AP081	
AP414	
AP415	
AP416	Auxiliary Power to MCC 131x2
AP417	
AP418	
AP419	
AP428	
AP429	

TABLE 2.4-101 (Cont'd)

Control or Interlock Cable	
RH049 RH046	Limit Switch (LS) on 8702A
RH051	Interlock SI8804B
RH052	Interlock SI8811B
RH050	Interlock S18812B
RH054	Interlock from PA27J Reactor Pressure PT-405
RH055	Control Switch (CS) from PM06J
Valve 1RH8702B	
Power Cable	
RH056	Power from MCC
RH057	131x2 to valve
AP252 AP150 AP227 AP420 AP421 AP422 AP423 AP424 AP425 AP426 AP427	Auxiliary Power to MCC 131x2
Control or Interlock Cable	
RH065	Control Switch (CS) from PM06J
RH060 RH061 RH058 RH059	Limit Switch (LS) on 8702B
RH064	Interlock from 1PA28J - Reactor Pressure PT-0403
SI061 RH063 SI062	Interlock SI8804B

TABLE 2.4-101 (Cont'd)

SI174 SI172 SI173	Interlock SI8812B
RH062 SI155 SI156	Interlock SI8811B

TABLE 2.4-102

CABLE LISTING BY FIRE ZONE FOR 1RH8701A (1RH8701B)

1.1-1
(RH037 LS)

1.2-1
RH027 LS
RH028 LS
(RH037 LS)

1.3-1
(RH037 LS)

2.1-0
RH031 CS

3.1-1 (8701B could open)
(RH043 CS)
(RH038 Interlock 8812A)
(RH042 Interlock PT-403)

3.2A-1 (8701B could open)
(RH043 CS)
(RH038 Interlock 8812A)
(RH042 Interlock PT-403)

3.2B-1
(RH043 CS)
(RH042 Interlock PT-403)

3.2C-1
(RH043 CS)
(RH042 Interlock PI-403)

3.2D-1
(RH043 CS)
(RH042 Interlock PT-403)

3.2E-1
RH30 Interlock PT-405

3.3B-1
RH30 Interlock PT-405
RH31 CS

3.3C-1
RH31

3.3D-1
RH30 Interlock PT-405

3.4A-1
RH30 Interlock PT-405

5.2-1
CV413 Interlock CV8804A
RH029 Interlock SI8811A
SI168 Interlock SI8812A
RH031 CS

5.4-1
RH031 CS

5.5-1
RH30 Interlock PT-405
(RH043 CS)
(RH042 Interlock PT-403)

5.6-1
RH031 CS

11.2-0
SI166 Interlock 8812A
SI167 Interlock 8812A
(RH038 Interlock 8812A)

11.2A-1
SI166 Interlock SI8812A
SI167 Interlock SI8812A

TABLE 2.4-102 (Cont'd)

11.2B-1
SI166 Interlock 8812A
SI167 Interlock 8812A
(RH038 Interlock 8812A)

11.2C-1
(RH038 Interlock 8812A)

11.3-0
CV413 Interlock CV8804A
RH029 Interlock SI8811A
SI168 Interlock SI8812A
(RH038 Interlock 8812A)

11.3-1
RH029 Interlock SI8811A
SI168 Interlock SI8812A
SI142 Interlock 8811A
SI143 Interlock 8811A
SI166 Interlock 8812A
SI167 Interlock 8812A
CV413 Interlock CV8804A
CV408 Interlock CV8804A
CV410 Interlock CV8804A
(RH039 Interlock CV8804A)
(RH040 Interlock SI8811A)

11.4-0
CV413 Interlock CV8804A
RH029 Interlock SI8811A
SI168 Interlock SI8812A
(RH038 Interlock 8812A)

11.5-0 (Both 8701A & 8701B could open)
RH30 Interlock PT-405
CV413 Interlock CV8804A
RH029 Interlock SI8811A
SI168 Interlock SI8812A
RH031 CS
(RH038 Interlock SI8812A)
(RH043 CS)
(RH042 Interlock PT403)

11.5-1
RH025 LS
RH026 LS
(RH039 Interlock CV08804A)
(RH040 Interlock SI8811A)

11.5A-1 (8701A could open)
RH30 Interlock PT-405
CV413 Interlock CV8804A
RH029 Interlock 8811A
SI168 Interlock 8812A
RH025 Interlock LS
RH026 Interlock LS
RH031 CS

11.6-0 (8701A could open)
RH030 Interlock PT-405
CV413 Interlock 8804A
RH029 Interlock 8811A
SI168 Interlock 8812A
RH031 CS
(RH043 CS)
(RH042 Interlock PT0403)

11.6-1 (8701B could open)
(RH038 Interlock 8812A)
(RH039 Interlock 8804A)
(RH040 Interlock 8811A)
(RH034 LS)
(RH043 CS)
(RH042 Interlock PT0403)

TABLE 2.4-103

CABLE LISTING BY FIRE ZONE FOR 1RH8702A (1RH8702B)

1.1-1
(RH060 LS)
(RH061 LS)

1.2-1
RH049 LS
(RH060 LS)
(RH061 LS)

1.3-1
(RH060 LS)
(RH061 LS)

2.1-0
RH054 Interlock PT-405
RH055 CS
(RH065 CS)

3.1-1
(RH065 CS)
(RH064 Interlock PT-403)

3.2A-1
RH054 Interlock PT-405
RH055 CS
(RH065 CS)
(RH064 Interlock PT-403)

3.2B-1
(RH064 Interlock PT-403)

3.2C-1
(RH065 CS)
(RH064 Interlock PT-403)

3.2D-1
(RH065 CS)
(RH064 Interlock PT-403)

3.3B-1
RH054 Interlock PT-405
RH055 CS

3.3C-1
RH054 Interlock PT-405
RH055 CS

5.2-1 (8702A could open)
RH051 Interlock SI8804B
RH050 Interlock SI8812B
RH054 Interlock PT-405
RH055 CS

5.4-1
RH054 Interlock PT-405
RH055 CS

5.5-1
(RH064 Interlock PT-403)

5.6-1
RH054 Interlock PT-405
RH055 CS

11.2D-1
RH050 Interlock SI8812B

11.3-1
RH051 Interlock SI8804B
RH052 Interlock SI8811B
RH050 Interlock SI8812B
(SI155 Interlock SI8811B)
(SI156 Interlock SI8811B)
(SI172 Interlock SI8812B)
(SI173 Interlock SI8812B)
(SI061 Interlock SI8804B)
(SI062 Interlock SI8804B)

11.3F-1
RH051 Interlock SI8804B

TABLE 2.4-103 (Cont'd)

11.5-1
RH046 LS
RH051 Interlock SI8804B
RH052 Interlock SI8811B
RH050 Interlock SI8812B
(SI155 Interlock SI8811B)
(SI156 Interlock SI8811B)
(SI172 Interlock SI8812B)
(SI173 Interlock SI8812B)
(SI061 Interlock SI8804B)
(SI062 Interlock SI8804B)

11.5-0 (8702A could open)
RH051 Interlock SI8804B
RH052 Interlock SI8811B
RH050 Interlock SI8812B
RH054 Interlock PT-405
RH055 CS
(RH065 CS)
(RH064 Interlock PT-403)

11.5A-1 (8702 could open)
RH046 LS
RH051 Interlock SI8804B
RH052 Interlock SI8811B
RH050 Interlock SI8812B
RH054 Interlock PT-405
RH055 CS

11.6-0 (8702A could open)
RH051 Interlock SI8804B
RH050 Interlock SI8812B
RH054 Interlock PT-405
RH055 CS
(RH065 CS)
(RH064 Interlock PT-403)

11.6-1 (8702B could open)
(RH065 CS)
(RH058 LS)
(RH059 LS)
(RH064 Interlock PT-403)
(RH062 Interlock SI8811B)
(RH063 Interlock SI8804B)
(SI174 Interlock SI8812B)
(SI155 Interlock SI8811B)
(SI156 Interlock SI8811B)
(SI172 Interlock SI8812B)
(SI173 Interlock SI8812B)
(SI061 Interlock SI8804B)
(SI062 Interlock SI8804B)

12.1-0
RH051 Interlock SI8804B
RH052 Interlock SI8811B
RH050 Interlock SI8812B

TABLE 2.4-104

POWER AND CONTROL CABLE FOR PRESSURIZER
PORV AND BLOCK VALVES

TRAIN A

PORV 1RY455A

Power Cables:

1DC005 1DC006 1DC193 1DC194	125-Vdc Distribution Center 111 to DC Battery Charger 111
1DC021	Battery Charger 111 to 480-V Switchgear Bus 131X
1AP081	4160-V ESF Bus 141 to Transformer 1AP11E
1AP414 1AP415 1AP416 1AP417 1AP419 1AP428 1AP429	Auxiliary Power From 1AP11E to ESF Switchgear 131X

Control Cables:

1DC095	125-Vdc Distribution Panel 111 to DC Fuse Panel 1DC10J
1DC100	DC Fuse Panel 1DC10J to MCB 1PM05J
1RY248	Valve limit switch open
1RY249	Valve limit switch close
1RY247	Solenoid to Junction Box
1RY388	Solenoid to Junction Box
1RY246	Junction Box to Penetration
1RY398	Penetration to MCB Handswitch

TABLE 2.4-104 (Cont'd)

Additional Cables Required for PORV A Operation on High Pressurizer Pressure:

1RY418	Relay Panel 1PA27J to MCB Handswitch
1RY417	Auxiliary Relay Cabinet 1PA24J to 1PA27J
1CC153	480-V MCC 132V2 to 1PA27J
1RY199	Pressurizer Pressure Transmitter 1PT-0455 to Penetration
1RY198	Penetration to I&C Rack 1PA01J
1RY211	Pressurizer Pressure Transmitter 1PT-0458 to Penetration
1RY210	Penetration to I&C Rack 1PA04J
1RY303	1PA01J to Rack 1PA06J
1RY310	1PA06J to Rack 1PA05J
1CV419	1PA05J to Auxiliary Relay Cabinet 1PA24J
1RC513	1PA04J to Rack 1PA08J
1RY320	1PA08J to Auxiliary Relay Cabinet 1PA24J

Additional Cables Required for PORV A Operation on RCS Cold Overpressure:

1RY418	Relay Panel 1PA27J to MCB Handswitch
1RY417	Auxiliary Relay Cabinet 1PA24J to 1PA27J
1CC153	480-V MCC 132V2 to 1PA27J
1RC351 1RC352	Loop 1A Hot Leg RTD to Penetration
1RC350	Penetration to I&C Rack 1PA01J
1RC356 1RC357	Loop 1B Hot Leg RTD to Penetration
1RC355	Penetration to 1PA01J

TABLE 2.4-104 (Cont'd)

1RC361 1RC362	Loop 1C Hot Leg RTD to Penetration
1RC360	Penetration to 1PA01J
1RC366 1RC367	Loop 1D Hot Leg RTD to Penetration
1RC365	Penetration to 1PA01J
Plug	1PA01J to 1PA05J
1RC373 1RC374	Loop 1A Cold Leg RTD to Penetration
1RC372	Penetration to 1PA02J
1RC372 1RC393	Loop 1B Cold Leg RTD to Penetration
1RC391	Penetration to 1PA02J
1RC397 1RC398	Loop 1C Cold Leg RTD to Penetration
1RC396	Penetration to 1PA02J
1RC402 1RC403	Loop 1D Cold Leg RTD to Penetration
1RC401	Penetration to 1PA02J
1RC500	1PA02J to 1PA083
1CV419	1PA05J to 1PA24J
1RY320	1PA08J to 1PA24J
1RC226	Loop 1B Hot Leg Pressure to Penetration
1RC225	Penetration to 1PA01J
1MS034	1PA01J to 1PA05J

TABLE 2.4-104 (Cont'd)

BLOCK VALVE 1RY8000 A

Power Cables:

1RY393	MCC 131X2 to Penetration
1RY002	Penetration to Motor
1AP144	MCC 131X2 to Switchgear 131X (1AP10E)
1AP081	4160-V ESF Bus 141 to Transformer 1AP11E
1AP414 1AP415 1AP416 1AP417 1AP418 1AP419 1AP428 1AP429	Auxiliary Power From 1AP11E to ESF Switchgear 131X

Control Cables:

1RY394	MCC 131X2 to MCB 1PM05J
1RY392	MCC 131X2 to Penetration
1RY004	Penetration to Valve Limit Switch

TABLE 2.4-104 (Cont'd)

TRAIN B

PORV 1RY456

Power Cables:

1DC012 1DC013 1DC195 1DC196	125-Vdc Distribution Center 112 to DC Battery Charger 112
1DC023	Battery Charger 112 to 480-V Switchgear Bus 132X
1AP117	4160-V ESF Bus 142 to Transformer 1AP13E
1AP420 1AP421 1AP422 1AP423 1AP424 1AP425 1AP426 1AP427	Auxiliary Power From 1AP13E to ESF Switchgear 132X

Control Cables:

1DC096	125-Vdc Distribution Panel 112 to DC Fuse Panel 1DC11J
1DC102	DC Fuse Panel 1DC10J to MCB 1PM05J
1RY254	Valve limit switch open
1RY255	Valve limit switch close
1RY253	Solenoid to Junction Box
1RY389	Solenoid to Junction Box
1RY252	Junction Box to Penetration
1RY251	Penetration to 1PM05J Handswitch

Additional Cables Required For PORV B Operation on Pressurizer High Pressure:

1RY420	Relay Panel 1PA28J to MCB Handswitch
1RY419	Auxiliary Relay Cabinet 1PA25J to 1PA28J
1CC154	480-V MCC 134V4 to 1PA28J

TABLE 2.4-104 (Cont'd)

1RY203	Pressurizer Pressure Transmitter 1PT-0456 to Penetration
1RY202	Penetration to I&C Rack 1PA02J
1RY207	Pressurizer Pressure Transmitter 1PT-0457 to Penetration
1RY206	Penetration to I&C Rack 1PA03J
1MS044	1PA02J to Rack 1PA06J
1MS067	1PA06J to Relay Cabinet 1PA25J
1RY304	1PA03J to Rack 1PA07J
1RY329	1PA07J to Relay Cabinet 1PA25J

Cables Required For PORV B Operation On RCS Cold Overpressure:

1RY420	Relay Panel 1PA28J to MCB Handswitch
1RY419	Auxiliary Relay Cabinet 1PA25J to 1PA28J
1CC154	480-V MCC 134V4 to 1PA28J
1RC373 1RC374	Loop 1A Cold Leg RTD to Penetration
1RC372	Penetration to I&C Rack 1PA02J
1RC392 1RC393	Loop 1B Cold Leg RTD to Penetration
1RC391	Penetration to 1PA02J
1RC397 1RC398	Loop 1C Cold Leg RTD to Penetration
1RC396	Penetration to 1PA02J
1RC402 1RC403	Loop 1D Cold Leg RTD to Penetration
1RC401	Penetration to 1PA02J
1RC500	1PA02J to 1PA08J

TABLE 2.4-104 (Cont'd)

1RC351 1RC352	Loop 1A Hot Leg RTD to Penetration
1RC350	Penetration to 1PA01J
1RC356 1RC357	Loop 1B Hot Leg to Penetration
1RC355	Penetration to 1PA01J
1RC361 1RC362	Loop 1C Hot Leg to Penetration
1RC360	Penetration to 1PA01J
1RC366 1RC367	Loop 1D Hot Leg to Penetration
1RC365	Penetration to 1PA01J
Plug	1PA01J to 1PA05J
1MS063	1PA05J to Auxiliary Relay Cabinet 1PA25J
1RY383	1PA08J to Auxiliary Relay Cabinet 1PA25J
1RC224	Loop 1A Hot Leg Pressure to Penetration
1RC223	Penetration to 1PA04J
1RC513	1PA04J to 1PA08J

BLOCK VALVE 1RY8000 B

Power Cables:

1RY396	MCC 132X2 to Penetration
1RY007	Penetration to Motor
1AP150 1AP252	MCC 132X2 to Switchgear 132X
1AP117	4160-V ESF Bus 142 to Transformer 1AP13E

TABLE 2.4-104 (Cont'd)

1AP420	Auxiliary Power From 1AP13E to ESF Switchgear 132X
1AP421	
1AP422	
1AP423	
1AP424	
1AP425	
1AP426	
1AP427	

Control Cables:

1RY397	MCC 132X2 to MCB 1PM05J
1RY395	MCC 132X2 to Penetration
1RY009	Penetration to Motor

TABLE 2.4-105

CABLE LISTING BY FIRE ZONE FOR PORV'S AND BLOCK VALVES

FIRE ZONE 1.1-1

1RC224	Loop 1A hot leg pressure - PORV B
1RC226	Loop 1B hot leg pressure - PORV A
1RC351 1RC352	Loop 1A hot leg RTD - PORV A and B
1RC356 1RC357	Loop 1B hot leg RTD - PORV A and B
1RC361 1RC362	Loop 1C hot leg RTD - PORV A and B
1RC366 1RC367	Loop 1D hot leg RTD - PORV A and B
1RC373 1RC374	Loop 1A cold leg RTD - PORV A and B
1RC392 1RC393	Loop 1B cold leg RTD - PORV A and B
1RC397 1RC398	Loop 1C cold leg RTD - PORV A and B
1RC402 1RC403	Loop 1D cold leg RTD - PORV A and B

1.2-1 (Failure mode 1 could occur; Train A)

1RY246	PORV A - control
1RY002	Block valve A - power
1RY004	Block valve A - control
1RC226	Loop 1B hot leg pressure - PORV A
1RC224	Loop 1A hot leg pressure - PORV B
1RC351	Loop 1A hot leg RTD - PORV A and B
1RC356	Loop 1B hot leg RTD - PORV A and B
1RC361	Loop 1C hot leg RTD - PORV A and B
1RC366	Loop 1D hot leg RTD - PORV A and B
1RC373	Loop 1A cold leg RTD - PORV A and B
1RC392	Loop 1B cold leg RTD - PORV A and B
1RC397	Loop 1C cold leg RTD - PORV A and B

TABLE 2.4-105 (Cont'd)

1RC402	Loop 1D cold leg RTD - PORV A and B
1RY199	Pressurizer pressure 1PT-0455 - PORV A
1RY203	Pressurizer pressure 1PT-0456 - PORV B
1RY207	Pressurizer pressure 1PT-0457 - PORV B
1RY211	Pressurizer pressure 1PT-0458 - PORV A

1.3-1

1RY002	Block valve A - power
1RY004	Block valve A - control
1RY007	Block valve B - power
1RY009	Block valve B - control
1RY246	PORV A - control
1RY247	PORV A - control
1RY248	PORV A - control
1RY249	PORV A - control
1RY252	PORV B - control
1RY253	PORV B - control
1RY254	PORV B - control
1RY255	PORV B - control
1RY388	PORV A - control
1RY389	PORV B - control
1RC224	Loop 1A hot leg pressure - PORV B
1RC373	Loop 1A cold leg RTD - PORV A and B
1RC392	Loop 1B cold leg RTD - PORV A and B
1RY203	Pressurizer pressure 1PT-0456 - PORV B
1RY211	Pressurizer pressure 1PT-0458 - PORV A

2.1-0 (Failure mode 3 could occur; Trains A and B)

1DC100	PORV A - control
1DC102	PORV B - control
1RY251	PORV B - control
1RY394	Block valve A - control
1RY397	Block valve B - control
1RY398	PORV A - control
1RY418	PORV A - control
1RY420	PORV B - control
Panel:	1PM05J - All PORV's and block valves

3.1-1

1RY251	PORV B - control
1RY397	Block valve B - control
1AP150 1AP252	Block valve B - power

TABLE 2.4-105 (Cont'd)

3.2A-1	
1DC021	PORV A - power
1DC023	PORV B - power
1DC102	PORV B - control
1RY251	PORV B - control
1RY394	Block valve A - control
1RY397	Block valve B - control
1AP150 1AP252	Block valve B - power
3.2B-1	
1DC102	PORV B - control
1RY251	PORV B - control
1RY397	Block valve B - control
1RC223	Loop 1A hot leg pressure - PORV B
1RC372	Loop 1A cold leg RTD - PORV A and B
1RC391	Loop 1B cold leg RTD - PORV A and B
1RC396	Loop 1C cold leg RTD - PORV A and B
1RC401	Loop 1D cold leg RTD - PORV A and B
1RY202	Pressurizer pressure 1PT-0456 - PORV B
1RY210	Pressurizer pressure 1PT-0458 - PORV A
3.2C-1	
1DC102	PORV B - control
1RY251	PORV B - control
1RY397	Block valve B - control
3.2E-1	
1RY398	PORV A - control
1RC350	Loop 1A hot leg RTD - PORV A and B
1RC355	Loop 1B hot leg RTD - PORV A and B
1RC360	Loop 1C hot leg RTD - PORV A and B
1RC365	Loop 1D hot leg RTD - PORV A and B
1RY198	Pressurizer pressure 1PT-0455 - PORV A
3.3A-1	
1DC100	PORV A - control

TABLE 2.4-105 (Cont'd)

3.3B-1	
1DC100	PORV A - control
1RY394	Block valve A - control
1RY206	Pressurizer pressure 1PT-0457 - PORV B
1RC350	Loop 1A hot leg RTD - PORV A and B
1RC355	Loop 1B hot leg RTD - PORV A and B
1RC360	Loop 1C hot leg RTD - PORV A and B
1RC365	Loop 1D hot leg RTD - PORV A and B
1RY198	Pressurizer pressure 1PT-0455-PORV A
3.3C-1	
1DC100	PORV A - control
1RY394	Block valve A - control
1RY398	PORV A - control
3.3D-1	
1RY398	PORV A - control
1RC350	Loop 1A hot leg RTD - PORV A and B
1RC355	Loop 1B hot leg RTD - PORV A and B
1RC360	Loop 1C hot leg RTD - PORV A and B
1RC365	Loop 1D hot leg RTD - PORV A and B
1RY198	Pressurizer pressure 1PT-0455-PORV A
3.4A-1	
1RY398	PORV A - control
5.1-1	
1DC023	PORV B - power
1RY251	PORV B - control
1RY397	Block valve B - control
1AP150 1AP252	Block valve B - power
1AP117 1AP420 1AP421 1AP422 1AP423 1AP424 1AP425 1AP426 1AP427	PORV B - power

TABLE 2.4-105 (Cont'd)

5.2-1

1DC021 PORV A - power
1RY394 Block valve A - control

1AP144
1AP081
1AP414
1AP415
1AP416 Block valve A - power
1AP417
1AP418
1AP419
1AP428
1AP429

5.4-1

1DC096 PORV B - control
1DC102 PORV B - control
Panel 1DC11J: PORV B - control

5.5-1

Cables

1RC223 Loop 1A hot leg pressure - PORV B
1RC225 Loop 1B hot leg pressure - PORV A
1RC350 Loop 1A hot leg RTD - PORV A and B
1RC355 Loop 1B hot leg RTD - PORV A and B
1RC360 Loop 1C hot leg RTD - PORV A and B
1RC365 Loop 1D hot leg RTD - PORV A and B
1RC372 Loop 1A cold leg RTD - PORV A and B
1RC391 Loop 1B cold leg RTD - PORV A and B
1RC396 Loop 1C cold leg RTD - PORV A and B
1RC401 Loop 1D cold leg RTD - PORV A and B
1RY198 Pressurizer pressure 1PT-0455 - PORV A
1RY202 Pressurizer pressure 1PT-0456 - PORV B
1RY206 Pressurizer pressure 1PT-0457 - PORV B
1RY210 Pressurizer pressure 1PT-0458 - PORV A
1RY418 1PA27J to 1PM05J - PORV A
1RY420 1PA28J to 1PM05J - PORV B

Panels

1PA01J	1PA05J	1PA24J
1PA02J	1PA06J	1PA25J
1PA03J	1PA07J	1PA27J
1PA04J	1PA08J	1PA28J

TABLE 2.4-105 (Cont'd)

Panel Interconnecting Cables

1MS034	1RY304	1RY419
1MS044	1RY305	1CV419
1MS063	1RY320	
1MS067	1RY329	
1RC500	1RY383	
1RC513	1RY310	
1RY303	1RY417	

5.6-1

1DC021	PORV A - power
1DC095	PORV A - control
1DC100	PORV A - control
1RY394	Block valve A - control

Panel 1DC10J: PORV A - control

11.5-0

1RY394	Block valve A - control
1RY398	PORV A - control
1RC350	Loop 1A hot leg RTD - PORV A and B
1RC355	Loop 1B hot leg RTD - PORV A and B
1RC360	Loop 1C hot leg RTD - PORV A and B
1RC365	Loop 1D hot leg RTD - PORV A and B
1AP144	Block valve A - power
1RY198	Pressurizer pressure 1PT-0455 - PORV A

11.5-1

1RY392	Block valve A - control
1RY393	Block valve A - power
1RY398	PORV A - control

11.5A-1

1RY392	Block valve A - control
1RY393	Block valve A - power
1RY394	Block valve A - control
1RY398	PORV A - control
1RC350	Loop 1A hot leg RTD - PORV A and B
1RC355	Loop 1B hot leg RTD - PORV A and B
1RC360	Loop 1C hot leg RTD - PORV A and B
1RC365	Loop 1D hot leg RTD - PORV A and B
1RY198	Pressurizer pressure 1PT-0455 - PORV A
1RY206	Pressurizer pressure 1PT-0457 - PORV B
1AP144	Block valve A - power

TABLE 2.4-105 (Cont'd)

11.6-0	
1RY398	PORV A - control
1RY394	Block valve A - control
1RC350	Loop 1A hot leg RTD - PORV A and B
1RC355	Loop 1B hot leg RTD - PORV A and B
1RC360	Loop 1C hot leg RTD - PORV A and B
1RC365	Loop 1D hot leg RTD - PORV A and B
1AP144	Block valve A - power
1RY198	Pressurizer pressure 1PT-0455 - PORV A
11.6-1	
1RY251	PORV B - control
1RY395	Block valve B - control
1RY396	PORV B - control
1RY397	Block valve B - control
1AP150	Block valve B - power
1RC372	Loop 1A cold leg RTD - PORV A and B
1RC391	Loop 1B cold leg RTD - PORV A and B
1RC396	Loop 1C cold leg RTD - PORV A and B
1RC401	Loop 1D cold leg RTD - PORV A and B
1RY202	Pressurizer pressure 1PT-0456 - PORV B
1RY210	Pressurizer pressure 1PT-0458 - PORV A
1RC223	Loop 1A hot leg pressure - PORV B