PSEG

Public Service Electric and Gas Company P.O. Box 236 Hancocks Bridge, New Jersey 08038

Nuclear Department

January 27, 1984

U. S. Nuclear Regulatory Commission - Region 1
631 Park Avenue
King of Prussia, PA 19406

Attention: Mr. Thomas T. Martin, Director
Division Engineering and Technical Programs

Gentlemen:

FIRE PROTECTION INSPECTION
SALEM GENERATING STATION
UNIT NO. 1
DOCKET NO. 50-272

During the week of January 16-20, 1984 a team comprised of personnel from NRC Region 1 and 2, ONRR and Brookhaven National Laboratory conducted the subject inspection. This comprehensive inspection was performed to assess Salem's compliance to 10CFR50 Appendix R. As a result of the inspection, several concerns were identified with four specifically identified by the team as being apparent violations. As discussed during the January 20, 1984 exit meeting, PSE&G's response to the four apparent violations is attached. Attachment 1 defines our position on each concern and Attachment 2 provides the results of our in-containment analysis.

PSE&G believes that, not withstanding the concerns identified by the inspection team, the Salem Generating Station is well protected for any credible fire. This conclusion is based upon several factors. First, the criteria under which we developed the Salem Fire protection program were more comprehensive than Appendix R criteria; i.e., all trains of Auxiliary Feedwater, containment isolation capability and one train for achieving cold shutdown were protected. Secondly, during the licensing process for Unit 2, an NRC team conducted a thorough audit of Unit 2's fire protection program and concluded that the existing program was acceptable for Unit 2 operation. In that Unit 1 and Unit 2 have been treated identically for fire protection, the Unit 1 program is also considered equally acceptable for plant operation. Finally, we have reviewed all of the concerns identified during the recent inspection and believe that these concerns do not represent a significant degradation of our fire protection program. In fact, the majority of the concerns identified are of the type for which other utilities have requested, and have been granted, exemptions from Appendix R. Therefore, we believe that the concerns identified during the subject inspection, although requiring timely resolution, do not represent a public health or safety concern.

Sincerely,

E. A. Liden
Manager - Nuclear
Licensing and Regulation

TLP:jab

Attachment (2)

cc: Mr. Donald C. Fischer
Licensing Project Manager

Mr. James Linville
Senior Resident Inspector

bcc: Vice President - Nuclear
General Manager - Nuclear Services
General Manager - Nuclear Support
General Manager - Salem Operations
General Manager - Hope Creek Operations
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Manager - Nuclear Plant Engineering
Manager - Nuclear Engineering Control
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H24 1/2

ATTACHMENT 1

FIRE PROTECTION
SALEM GENERATING STATION - UNIT NO. 1

A. INTAKE STRUCTURE

NRC Concern:

(1) The doors and the motor control center wall penetrations in the Intake Structure did not have a 3-hr rating.

(2) The doors in the Intake Structure were open with no apparent supervision.

Response:

An exemption will be requested from the explicit requirements of 10CFR50, Appendix R Section III.G.2.a to the extent that the doors in the Motor Control Center (MCC) Bay and the penetrations between the MCC Bays do not constitute three hour barriers. A detailed technical justification for this exemption request will be submitted to ONRR by January 31, 1984.

The doors and penetrations serve as water tight barriers for the Intake Structure components and thus the explicit requrement of Appendix R is not met. However, these doors have been posted as fire barriers and will be administratively added to the list of doors to be checked by the roving fire watch in accordance with the Plant's Operating ProceduresOD-34 - Fire Protection Roving Watch and OD-52 - Penetration Fire Barrier Roving Watch. This ensures that sufficient barriers will exist for the limited fire loading in these areas.

B. CONTAINMENT

NRC Concern:

There was no containment analysis available,and Pressurizer heaters and instruments terminated in one panel.

Response:

(1) The Appendix R containment analysis has been performed, and illustrates that at least one train of safety-related equipment will be available in the "worst-case" fire in order to bring the plant to a safe and orderly shutdown. The detailed analysis is provided in ATTACHMENT 2.

(2) The In-Containment Analysis reveals that all four trains of Pressurizer Pressure and Pressurizer Level converge at Panel 335. We have reviewed this interaction and find it acceptable for the following reasons:

(a) The Panel is compartmentalized in that trains A, B, C and D are separated from each other by 10 gauge (0.141 in) plates which represent an adequate thermal shield as defined by 10CFR50 Appendix R, III.G.2.f.

(b) The panel design incorporates diversity in cable entry in that train A, B and D are top-entry cable while train C is a bottom-entry cable. It should be noted that train C has been designated as the "protected" in-containment channel.

(c) The panel interior has an insignificant amount of combustibles and therefore would not violate the 10 gauge barrier.

In light of the above we conclude that the present design of Panel 335 is sufficient to perform its intended function.

(3) We have evaluated the Loss of all Pressurizer Heaters and conclude that the plant could be brought to the Cold Shutdown condition without Pressurizer Heaters. The analysis demonstrates that we could maintain hot standby for a minimum of 8 hours prior to initiation of cold shutdown. The plant operating procedures for this event are presently in effect and available to the plant operators (Procedure EI-1-4.24 "Pressurizer Pressure Control Malfunction").

C. CHARGING PUMP SPRINKLER

NRC Concern:

The sprinkler system in the Charging Pump Cubicle did not meet a previous commitment in that it was not a pre-action dry pipe system.

Response:

We have evaluated the present sprinkler system installed in the Charging Pump Cubicle. This sprinkler system is a wet pipe design installed to minimize the spread of fire between charging pump cubicles. This system will be expanded to provide area wide coverage of this fire area. A wet pipe system provides better protection in that it provides quicker and more positive response (Only one operation is required; i.e., fusing of one sprinkler head for wet pipe rather than two heads for the pre-action dry pipe systems).

D. RESIDUAL HEAT REMOVAL

NRC Concern:

The RHR system did not incorporate appropriate repair procedures nor was an exemption request granted for area wide suppression or detection system.

Response:

An exemption will be requested from the explicit requirements of Section III.G.2.b to the extent that no area wide suppression or detection is provided in this area. The RHR system is required for cold shutdown functions only and thus manual action in this area is acceptable. Detailed technical justification will be submitted to ONRR by January 31, 1984.

ATTACHMENT 2

SALEM UNIT NO. 1
IN-CONTAINMENT FIRE ANALYSIS

The in-containment fire hazards analysis has been performed for the Salem 1 Generating Station. The methodology of the Analysis considers both hot shutdown and cold shutdown requirements. The instrumentation and number of channels necessary to bring the plant to cold shutdown were identified. Each system was also investigated to assure that a sufficient flowpath was available for plant cooldown functions.

The analysis examined the following required systems and instrumentation for any potential fire interaction in containment:

1) Component Cooling
2) Service Water
3) Auxiliary Feedwater
4) Chemical & Volume Control
5) Containment Ventilation
6) Diesel Generator/Electrical Power
7) Control Air
8) Residual Heat Removal
9) Primary System Instrumentation
    a) Pressurizer pressure and level
    b) Steam generator level
    c) T Hot and T Cold

The components of the systems/instrumentation required were determined, along with the operating mode in which these components are required. For those components required to achieve hot shutdown, the physical routing of the cabling was investigated to insure that at least one train of equipment is operable. The following is a summary of the findings for each system.

1. Component Cooling

Equipment which is part of the Component Cooling System located in containment which could cause degradation to the system due to fire consists of the CC 187 valve and the CC 190 valve. The CC 187 and CC 190 valves are in the Component Cooling water return lines from the Reactor Coolant Pump bearings and thermal barrier. These valves fail as-is in their normal operating position (open) and present no problem to system operation.

2. Service Water

The equipment associated with the service water system located inside containment consists of the 11-15 SW 65 valves. These valves are located in the lines which carry service water from the five containment fan coil units. The 11-15 SW 65 valves are designed to fail in the open position. Therefore, failure of these valves will not cause degradation of the system.

3. Auxiliary Feedwater

There are no components of the Auxiliary Feedwater system located inside containment which would degrade the system.

4. Chemical and Volume Control

The components of the Chemical Volume Control System located inside containment are the CV2, CV277, CV75, CV77, CV3, CV4, CV5, CV278, CV131, CV132, CV134, CV284, and CV104.

The CV2, CV277, CV278, CV131, CV3, CV4, CV5, CV132, and CV134 valves are associated with normal and excess letdown. The letdown function will not be used in cooldown. Valves in the letdown lines fail closed thereby preventing letdown. The CV75 valve controls auxiliary spray to the pressurizer. This line is not used without letdown but could be used if available. Should CV-75 fail, the pressurizer pressure will be controlled via the power operated relief valves, PR1 and PR2. The cabling is routed such that the worst case fire could destroy only two of the three trains available (see sections 5.0 and 7.5 of Appendix A). A fire at the pressurizer could render both valves inoperable, but no combustibles are located in this area, and a chance of fire is extremely remote.

The CV77 and CV79 valves deal with normal and alternate charging. Both valves fail in the open position assuring the charging function.

As demonstrated above, the chemical volume control system will not be degraded below the requirements for operability.

5. Containment Ventilation

The equipment of importance in regards to the containment ventilation system is the containment fan coil units (CFCU's). Due to the physical routing of the cabling, a single fire could render four of the CFCU's inoperable. However, one CFCU could adequately cool the containment atmosphere under cooldown conditions. With no CFCU's operating containment integrity would still be intact.

6. Diesel Generator/Electrical Power

All equipment associated with this system lie outside containment making this system not applicable to an in-containment analysis.

7. Control Air

The equipment of this system needed for shutdown lie outside containment making this system not applicable to an in-containment analysis.

8. Residual Heat Removal

The components associated with the RHR System located inside containment are the RH1, RH2, 11-14 SJ54, and RH26 valves. These valves are required to reach cold shutdown only. In the event that the cabling for the RH1 and/or RH2 valves is damaged, the valves would fail as-is in their normal operating position, closed. When initiating RHR, the valves can be aligned manually. The instructions are currently being revised to incorporate this action. If the cabling for the RH26 valve is damaged, the valve will fail as-is in its normal operating position, closed. No further action is required for the RH26 valve.

The 11-14 SJ54 valves are used to block accumulator discharge during depressurization of the reactor coolant system. If the cabling for the SJ54 valves is damaged, the vent valves on top of the accumulators can be opened to vent off the nitrogen blanket, or the SJ54 valves can be manually closed. The alternate equipment operating instructions for the accumulator vent valves and SJ54 valves are currently being written.

With these manual actions, the RHR system will not be degraded below its operational requirements.

9. Primary System Instrumentation

Pressurizer Pressure and Level

There are four channels, A, B, C, and D for pressurizer pressure and level indication. Channels A, C, and D are protected as they penetrate containment by radiant energy shields. Channels A, B, and D interact above elevation 100' while Channel C remains below a concrete barrier located at elevation 100'. Therefore, a single fire could not destroy all channels of pressurizer pressure and level indication. All channels do enter panel 335. Channels A, B, and D enter from the top of the cabinet, while Channel C enters from the bottom. The Panel is separated into 4 cubicles by 10 gauge steel plates. This will act as a radiant energy shield preventing the loss of all four channels with a fire in this area.

Steam Generator Level

Each steam generator (SG) has three channels of narrow range level indication. No.'s 11 and 14 SG's have channels B, C, and D, while No.'s 12 and 13 SG's have channels A, C, and D. Channels A, C, and D are protected at the penetration by radiant energy shields. Channels A, B, and D rise from the penetrations above elevation 100' and then travel to their respective SG. C Channels travel below the concrete barrier at elevation 100' to their respective SG. The cables run in such a way that cables for two SG's for a particular channel travel around containment in one dirction, while the cables for the other two SG's of the same channel travel around containment in the opposite direction. Therefore, the most damage due to fire would occur above elevation 100'. This ocurrence would still leave channel C for each of the SG's operable.

T Hot and T Cold

Each reactor loop is equiped with T Hot/T Cold indication, giving four channels of indication. Channels A, B, and D penetrate containment and travel above elevation 100'. Channels A, C, and D are protected below elevation 100' by Radiant Energy Shields. Again, the point of greatest interaction is at Elevation 100'. A fire here could destroy channels A and B. Here, Channel D is routed approximately 60 feet away from channels A and B, while channel C is routed below the concrete barrier at elevation 100'.

Summary

After the in-containment analysis, it was found that no system/instrumentation would be degraded below its operational requirements. The results of the worst case fire in regards to instrumentation and CFCU operation are tabulated in Table 1. The valves which will be required to operate to bring the plant to cold shutdown are listed in Table 2. Table 2 also shows the failure mode of each valve and the position to which the valve is required to be aligned to achieve either hor or cold shutdown.

Appendix A shows the cable routing analysis for the Primary System Instrumentation.

TABLE 1
FIRE PROTECTION IN CONTAINMENT
INSTRUMENTATION INTERACTION ANALYSIS

SYSTEM	FUNCTION	CHANNELS AVAILABLE	CHANNELS REQUIRED	FIRE LOCATION	CHANNELS AVAILABLE
Pressurizer	Pressure	A,B,C,D	1	El. 100'	C
Pressurizer	Level	A,B,C,D	1	El. 100'	C
11 STM GEN	Level	B,C,D		El. 100'	C
12 STM GEN	Level	A,C,D	1/4	El. 100'	A,C
13 STM GEN	Level	A,C,D		El. 100'	C
14 STM GEN	Level	B,C,D		El. 100'	C
RCS 11 Loop	TH/TC	A		El. 100'	-
RCS 12 Loop	TH/TC	B	1/4	El. 100'	-
RCS 13 Loop	TH/TC	C		El. 100'	C
RCS 14 Loop	TH/TC	D		El. 100'	D
11 CFCU	CNT ATM CLG	A1		El. 122'	-
12 CFCU	CNT ATM CLG	B1	1/5	El. 122'	-
14 CFCU	CNT ATM CLG	B2		El. 122'	-
13 CFCU	CNT ATM CLG	C1		El. 122'	-
15 CFCU	CNT ATM CLG	C2		El. 122'	C2

NOTE 1: All Channels for Pressurizer Indication Converge in Panel 335 and will be analyzed separately.

NOTE 2: If no CFCU's are available, Containment atmosphere temp. and press. will still be within Design Limits.

TABLE 2
FIRE PROTECTION IN-CONTAINMENT
COMPONENT INTERACTION ANALYSIS

VALVE	FUNCTION	OPERATOR	FAILURE MODE	REQUIRED HOT SHUTDOWN STATUS	REQUIRED COLD SHUTDOWN STATUS	REMARKS
1CC187	RCP BEARING WATER RETURN	MOTOR	AS-IS(OPEN)	OPEN	OPEN	
1CC190	RCP THERMAL BARRIER RETURN	MOTOR	AS-IS(OPEN)	OPEN	OPEN	
11-15 SW65	CFCU RETURN	AIR	OPEN	OPEN	OPEN	
1CV2	LETDOWN ISOLATION	AIR	CLOSED	NR	NR	
1CV3	LETDOWN ORIFICE ISOLATION	AIR	CLOSED	NR	NR	
1CV4	LETDOWN ORIFICE ISOLATION	AIR	CLOSED	NR	NR	
1CV5	LETDOWN ORIFICE ISOLATION	AIR	CLOSED	NR	NR	
1CV75	AUXILIARY PZR. SPRAY	AIR	CLOSED	NR	NR	
1CV77	ALTERNATE CHARGING	AIR	OPEN	OPEN	OPEN	
1CV79	NORMAL CHARGING	AIR	OPEN	OPEN	OPEN	
11-14 CV104	RCP SEAL WATER RETURN	AIR	OPEN	OPEN	OPEN	
1CV131	EXCESS LETDOWN ISOLATION	AIR	OPEN	NR	NR	
1CV132	EXCESS LETDOWN PRESSURE CONTROL	AIR	CLOSED	NR	NR	
1CV134	EXCESS LETDOWN DIVERT	AIR	OPEN TO VCT	NR	NR	

TABLE 2 (CONT'D)
FIRE PROTECTION IN-CONTAINMENT
COMPONENT INTERACTION ANALYSIS

VALVE	FUNCTION	OPERATOR	FAILURE MODE	REQUIRED HOT SHUTDOWN STATUS	REQUIRED COLD SHUTDOWN STATUS	REMARKS
1CV277	LETDOWN ISOLATION	AIR	CLOSED	NR	NR	
1CV278	EXCESS LETDOWN ISOLATION	AIR	CLOSED	NR	NR	
1CV284	EXCESS LETDOWN/RCP SEAL WATER RETURN	MOTOR	AS-IS (OPEN)	OPEN	OPEN	
SJ54 11-14	ACCUMULATOR DISCHARGE	MOTOR	AS-IS (OPEN)	CLOSED	CLOSED	Credit taken for manual operation
1RH1	HOT LEG SUCTION	MOTOR	AS-IS (CLOSED)	CLOSED	OPEN	Credit taken for manual operation
1RHR2	HOT LEG SUCTION	MOTOR	AS-IS (CLOSED)	CLOSED	OPEN	Credit taken for manual operation
1RH26	HOT LEG DISCHARGE	MOTOR	AS-IS (CLOSED)	NR	NR	
1PR1	PRESSURIZER PORV	AIR	CLOSED	OPEN	OPEN	See analysis summary for explanation
1PR2	PRESSURIZER PORV	AIR	CLOSED	OPEN	OPEN	See analysis summary for explanation
1PR6	PORV BLOCK VALVE	MOTOR	AS-IS (OPEN)	NR	NR	
1PR7	PORV BLOCK VALVE	MOTOR	AS-IS (OPEN)	NR	NR	

FQ

NR valve not required to operate from failed position.

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3.5 Fire Scenario

3.5.1 Elevation 78'

3.5.2 Elevation 100'

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4.3 No. 13 F.C.U. - "C" Channel

4.4 No. 14 F.C.U. - "B" Channel

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APPENDIX A

1.0 PRESSURIZER LEVEL AND PRESSURE CONTROL INSTRUMENTATION is contained in a setionalized four channel panel. The panel is identified as the 335 Panel and it is floor mounted on elevation 100', outside the polar crane wall (bio-shield) near col. A-4. This instrumentation complies with 10 CFR 50, Appendix R, III.G.2d and III.G.2.f. The four channels are routed as follows:

1.1 "A" Channel cables are 1PRZ67P-AQ (level) and 1PRZ68P-AQ (pressure). The cables leave penetration canister 1-65, which is covered by the Radiant Energy Shield (RES), below elevation 100' and rise up the cable shafts to a horizontal tray (1R121) above elevation 100'. The cables continue around the containment wall above elevation 100' in tray (1R321). Near column A8 the cables enter a 3-1/2" conduit which dumps into tray (1R329) also on the containment wall. Finally, the cables leave tray (1R329) in conduit and cross to the polar crane wall where they terminate into the top of Panel 335. Length of cable run is 235'.

1.2 "B" Channel cables are 1PRZ69P-BQ (level) and 1PRZ70P-BQ (pressure). The cables leave penetration canister 1-63, not covered by Radiant Energy Shield, below elevation 100' and rise up the cable shafts (1R058 and 1R358) which run from the containment wall to the polar crane wall. At the polar crane wall the cables enter tray (1R343) and continue around the crane wall to a conduit which enters the top of Panel 335. Length of cable run is 188'.

1.3 "C" Channel cables are 1PRZ72P-CQ (pressure) and 1PRZ73P-CQ (level). The cables leave penetration canister 1-59, covered by the Radiant Energy Shields, and directly enter a horizontal tray (1R001) on the containment wall below elevation 100'. The cables proceed around the containment, away from the previously described "A" and "B" channels, below elevation 100' until near column A4 where they enter a conduit and cross-over to the crane wall to enter Panel 335 from below. Length of cable run is 137'.

1.4 "D" Channel cables are 1PRZ74P-DQ (level) and 1PRZ75P-DQ. The cables leave penetration 1-7, covered by Radiant Energy Shield, in conduit and proceed below elevation 100' to the area of the "B" channel penetrations where the conduit then rises through elevation 100'. The conduit continues to horizontal tray (1R323) on the polar crane wall. The cables route in tray (1R323) for a short distance and then enter another conduit which routes toward the containment wall and then finally jumps into tray (1R323) again near colunm A4. Finally, the cables leave tray (1R323) above panel and enter a conduit which terminates in the top of Panel 335. Length of cable run is 234'.

Summary

1.5 Channels "A", "B", and "D" cross above elevation 100' at the containment wall near cable shaft (1R358), horizontal tray (1R321) and a 3-1/2" conduit. Channels "B" and "D" cross below elevation 100' at the containment wall near cable shaft (1R058) and a 3-1/2" conduit. Channels "C" and "D" cross behind the Radiant Energy Shield near cable shaft (1R052).

1.6 The scenario of a fire on elevation 78' in front of the penetrations would leave Channels "C" and "A" which are protected by the Radiant Energy Shields. While a fire on elevation 100' could destroy Channels "A", "B", and "D", leaving "C" below elevation 100' safe.

2.0 STEAM GENERATOR LEVEL CONTROL

The object is to maintain one channel of indication for two out of four Steam Generators. The cables for each Generator are routed in close proximity to each other from the point where they pass through the polar crane wall until they reach their respective panels on elevation 130', the operating floor. Thus, a fire at any one Steam Generator would disable only that Generator, leaving the other three intact. The following will detail the cable routes for each Steam Generator and analyze fire impact away from the Steam Generators. Thus, steam generator level control complies with 10 CFR 50 Appendix R, III.G.2.d and III.G.2.f.

2.1 No. 11 Steam Generator

2.1.1 1FW86P-BQ leaves penetration canister 1-63, not covered by Radiant Energy Shield (RES), and rises through elevation 100' in cable shaft (1R060 and 1R360) to a horizontal cross-over tray (1R3J8) to crane wall tray (1R343). The cable then passes through the crane wall and continues to the panel on elevation 135'.

2.1.2 1FW88P-CQ leaves penetration canister 1-59, covered by RES, and rises in cable shaft (1R052) to a horizontal tray (1R005) on the containment wall below elevation 100'. The cable enters a conduit below elevation 100' and rises through elevation 100' near the area where cable 1FW86P-BQ penetrates the crane wall. The circuit completes its run to the panel in conduit.

2.1.3 1FW90P-DQ leaves penetration 1-7, covered by RES, in conduit and is routed horizontally below elevation 100' to the area of the "B" channel penetrations, which is not protected by the RES, where the conduit rises through elevation 100' and dumps into a horizontal tray (1R323) on the crane wall. It then continues on to tray (1R123) and then through the crane wall. Tray (1R123) is adjacent to cables 1FW86P-BQ and 1FW88P-CQ.

2.2 No. 12 Steam Generator

2.2.1 1FW109P-AQ leaves penetration 1-65, protected by RES, and rises through elevation 100' in cable shafts (1R082 and 1R182) to horizontal tray (1R121) on the containment wall. Then exits tray (1R121) in conduit to go through the crane wall and to the panel in conduit.

2.2.2 1FW110P-CQ leaves penetration 1-59, protected by RES, via cable shaft (1R052) to horizontal tray (1R005) on the containment wall below elevation 100'. The cable leaves tray (1R005) and penetrates through elevation 100' along the containment wall. Above elevation 100' the conduit crosses to and through the crane wall and finally to the panel on elevation 130'.

2.2.3 1FW111P-DQ leaves penetration canister 1-7, protected by RES, in conduit below elevation 100' and routes along the containment wall to the area of the "B" channel penetrations, which is not protected by RES, where the conduit turns up through elevation 100' along the containment wall. The conduit then crosses to a horizontal tray (1R323) at the crane wall. The cable then routes from tray (1R323) to tray (1R123) and then into a conduit and through the crane wall to the panel.

2.3 No. 13 Steam Generator

2.3.1 1FW115P-AQ leaves penetration canister 1-65, protected by RES, and rises up through elevation 100' in cable shafts (1R080 and 1R180) to horizontal tray (1R121) on the containment wall. The cable then routes counter-clockwise above elevation 100' in tray (1R321), a 3-1/2" conduit and then tray (1R329). From tray (1R329) the cable enters cross-over tray (1R3B6) to the crane wall. At the crane wall the cable penetrates the wall and continues in tray (1R355) and conduit to panel.

2.3.2 1FW117P-CQ leaves penetration canister 1-59, protected by RES, and enters horizontal tray (1R001) at the containment wall below elevation 100'. It then is routed counter-clockwise around the containment below elevation 100' in tray (1R001) until column A-2 where it enters a conduit and rises through elevation 100' next to the containment wall. The conduit then crosses from the containment wall to penetrate the crane wall and continue on via tray (1R379) and conduit to the panel.

2.3.3 1FW118P-DQ leaves penetration canister 1-7, protected by RES, in 3" conduit below elevation 100' and proceeds to the area of the "B" channel penetration which is not protected by RES, and then turns up through elevation 100' at the containment wall and crosses over above elevation 100' to horizontal tray (1R323) on the crane wall. The cable is routed counter-clockwise around the crane wall and then enters a 3-1/2" conduit. The 3-1/2" conduit proceeds counter-clockwise to crane wall tray (1R323) near column A4. The cable continues in tray (1R323) to column A2 where it penetrates the crane wall and routes in conduit to the panel.

2.4 No. 14 Steam Generator

2.4.1 1FW124P-BQ leaves penetration canister 1-63, not protected by RES, and rises in cable shafts (1R060 and 1R360) through elevation 100' to dump into horizontal tray (1R337) at the containment wall above elevation 100'. The cable proceeds in a clockwise direction to vertical shaft (1R370) above elevation 100'. The cable leaves the shaft (1R370) still above elevation 100' to enter a 3-1/2" conduit and continues clockwise around the containment. The 3-1/2" conduit empties into a horizontal cross-over tray (1R3A2) at the containment wall. The cross-over tray (1R3A2) carries the cable to horizontal tray (1R343) on the crane wall above elevation 100'. The cable continues clockwise in crane wall tray (1R343) and passes column A17 where it then enters a conduit to pass through the crane wall and onto the panel.

2.4.2 1FW125P-CQ leaves penetration canister 1-59, protected by RES, and enters vertical cable shaft (1R052) to dump into horizontal tray (1R005) at the containment wall below elevation 100'. The cable then proceeds in a clockwise direction in tray (1R005) past the "B" and "A" channel penetrations. The cable continues clockwise below 100' elevation in tray (1R005) past column A18 where it enters a conduit at the containment wall to rise through elevation 100' and dumps into cross-over tray (1R3A4). Cross-over tray (1R3A4) carries the cable from the containment wall to the conduit penetration of the crane wall above elevation 100'. The cable then continues inside the crane wall in tray (1R389) and conduit to the panel.

2.4.3 1FW126P-DQ leaves penetration canister 1-7, protected by RES, in a conduit and runs below elevation 100' to the area of the "B" channel penetrations, not protected by RES, and rises through elevatin 100'. Above elevation 100', the conduit crosses from the containment wall to horizontal tray (1R323) on the crane wall. The cable proceeds clockwise around the crane wall in trays (1R323, 1R123 and 1R323) to column A14 where the cable enters a 3-1/2" conduit routed above elevation 100' on the crane wall. The cable continues clockwise to the conduit penetration of the crane wall after which it runs in tray (1R353) and conduit to the panel.

2.5 Fire Analysis - Steam Generator Level

2.5.1 Fire in the annulus, area between containment wall and crane wall, elevation 78' in front of the "B" channel penetrations, column A9. The Radiant Energy Shields would protect "A", "C" and "D" channel penetrations. Three "A" channel cables route directly up to next elevation and would not be in jeopardy. Three of the four "C" channel cables route away from the fire location and would not suffer damage. The two "B" channel and four "D" channel cables would all be in the fire area and, thus, lost.

2.5.2 Fire is in the annulus at elevation 100' near the intersection of vertical cable shaft (1R360), "B" channel, and horizontal trays (1R337), "B" channel, (1R321), "A" channel, 3" vertical conduit, "D" channel. This occurs all at the containment wall near column A9. One of the two "A" channel cables is greater than twenty feet from the fire and then routes clockwise to the number 12 Steam Generator. The other "A" channel cable for the number 13 Steam Generator routes through the fire and is lost. Additionally, all four "D" channel cables are lost as are both "B" channel cables. Finally, all four "C" channel cables will survive.

3.0 REACTOR COOLANT LOOP TEMPERATURE HOT (TH) AND COLD (TC) are wide range and are monitored by RTDs mounted on either side of the respective Reactor Coolant Pump (RCP). One channel out of four is necessary for accident monitoring. A fire at any one RCP would disable only that particular channel leaving the other three operational. Thus, we comply with 10 CFR 50, Appendix R, III.G.2.d and III.G.2.F. The following will detail the specific routing of each channel inside containment. A summary will highlight the impact of various fire locations on the four channels of the system.

3.1 The No. 11 Reactor Coolant Loop Temperature cables, 1RC18P-AQ (Tc) and 1RC19P-AQ (Th) follow the same routing to the area of the 11 RCP. The cables leave penetration canister 1-62, protected by RES, and go up through elevation 100' in vertical cable shafts (1R078 and 1R178) where the cables dump into a horizontal tray (1R121) on the containment wall. The cables are routed counter-clockwise to cross-over tray (1R3M8) which carries the cables to the penetration of the crane wall. Inside the crane wall the cables run in tray (1R355) and conduit to their respective RTDs.

3.2 The No. 12 Reactor Coolant Loop Temperature cables are, 1RC75P-BQ (Tc) and 1RC76P-BQ (Th) follow the same routing to the area of the 12 RCP. The cables leave penetration canister 1-61, not protected by RES, and rise in vertical shafts (1R068 and 1R368) through elevation 100' to horizontal tray (1R3P8). The cables exit the cross-over tray to a horizontal tray (1R341) on the crane wall. The cables continue clockwise to the conduit penetrations of the crane wall for the #12 Steam Generator. Inside the crane wall the cables run in tray (1R369) and conduit to their RTDs.

3.3 The No. 13 Reactor Coolant Loop Temperature cables, 1RC112P-CQ (Tc) and 1RC113P-CQ (Th) follow the same routing to the area of the 13 RCP. The cables leave penetration canister 1-60, protected by RES, and rise in shaft (1R052) to horizontal tray (1R001) on the containment wall below elevation 100'. The cables then route counter-clockwise below 100' elevation to a conduit on the containment wall near column A2. The conduit rises through elevation 100' and hits cross-over tray (1R3A6) at the containment wall. The cross-over tray carries the cables to the conduit penetration of the crane wall above elevation 100'. Inside the crane wall the cables route in tray (1R379) and conduit to the RTDs.

3.4 The No. 14 Reactor Coolant Loop Temperature cables, 1RC147P-DQ (Tc) and 1RC148P-DQ (Th) follow the same routing to the area of the 14 RCP. The cables leave penetration canister 1-69, protected by RES, and rise through elevation 100' in vertical shafts (1R042 and 1R342) where they enter cross-over tray (1R3B8) above elevation 100'. The cross-over tray terminates at horizontal tray (1R327) which the cables enter and proceed counter-clockwise in trays (1R327 and 1R323) on the crane wall above elevation. One hundred feet prior to column A2 the cables leave tray (1R323) in a 3-1/2" conduit which continues counter-clockwise to the conduit penetration of the crane wall. Inside the crane wall the cables route in tray (1R353) and conduit to their RTDs.

3.5 Summary for R.C. Temperature Hot, Cold

3.5.1 A fire in the annulus elevation 78' in front of the "B" channel, which is not protected by RES, would jeopardize only the "B" channel as the other channels are protected by the Radiant Energy Shields. Additionally, the "C" routes counter-clockwise away from the fire location while the "A" and "D" channels rise to the next elevation.

3.5.2 A fire in the annulus elevation 100' near column A10 would cause the loss of "A" and "B" channel, Loops 11 and 12, in the cross-over trays 1R3P8 and 1R3M8. Surviving, however, would be "D" channel on the same elevation but 60' in counter-clockwise direction away from the interaction around the containment and "C" channel which is routed on the lower elevation also in the counter-clockwise direction.

4.0 CONTAINMENT FAN COIL UNITS (F.C.U.) are supplied with 460 volt power for high speed and low speed circuits. The high speed and low speed circuits for each F.C.U. are routed parallel. All F.C.U. circuits are routed entirely in conduit. All the conduits leave their respective penetration canisters and rise directly through elevation 100' and then route around the containment below the H.V.A.C. ring duct. Thus, we comply with 10 CFR 50, Appendix R, III.G.2.F. The following will describe the direction of the conduit to the F.C.U.'s.

4.1 No. 11 F.C.U. is supplied by cables 1A2XP-A (low sp) and 1A4XP-A (high sp). The conduits leave penetration canister 1-64, protected by RES, and rise up near column A10 and rotate counter-clockwise to column A-7 where they go up through elevation 130' to the F.C.U.

4.2 No. 12 F.C.U. is supplied by cables 1B2XP-B (low sp) and 1B4XP-B (high sp). The conduits leave penetration canister 1-34, not protected by RES, and rise directly up through elevation 100' and 130' to the F.C.U.

4.3 No. 13 F.C.U. is supplied by cables 1C2XP-C (low sp) and 1C4XP-C (high sp). The conduits leave penetration canister 1-1, protected by RES, and rise up near column A7 and then rotate clockwise to column A-12 where they pass the 130' elevation to the F.C.U.

4.4 No. 14 F.C.U. is supplied by cables 1B6XP-B (low sp) and 1B8XP-B (high sp). The conduits leave penetration canister 1-12, not protected by RES, and rises near column A9 to rotate clockwise to column A14 where they rise through elevation 130' to the F.C.U.

4.5 No. 15 F.C.U. is supplied by cables 1C6XP-C (low sp) and 1C8XP-C (high sp). The conduits leave penetration canister 1-23 and rise up near column A7 to rotate counter-clockwise to column A3 where they rise to the F.C.U. on elevation 130'.

4.6 Fire Scenario

4.6.1 A fire on elevation 78' in front of the "B" channel penetrations, which are not protected by RES, would affect only the "B" channel. Thus, the "A" and "C" channels would survive. The "A" channel, protected by RES, supplies the No. 11 F.C.U. while the "C" channel, protected by another RES, supplies the Nos. 13 and 15 F.C.U.

4.6.2 A fire on elevation 100' near column A9 would jeopardize the feeder conduits for the Nos. 11, 12, 13 and 14 F.C.U.S. The feeder for the No. 15 F.C.U., "C" channel, routes away from the fire location and will survive.

5.0 PRESSURIZER PRESSURE RELIEF

5.1 No. 1 Power Operated Relief valve (PR-1)

Cable 1PRZ55P-AT leaves penetration Canister 1-14 and rises through elevation 100' in vertical shafts (1R076 and 1R176) where it dumps into horizontal tray (1R121) on the containment wall above elevation 100'. The cable then routes counter-clockwise around the containment wall in trays (1R121 and1R321) to column A8 where the cable enters a 3 1/2" conduit and continues counter-clockwise to tray (1R329) also on the containment wall above elevation 100'. The cable continues in tray (1R329) to cross-over tray (1R3B6) where it then crosses to the crane wall conduit penetration of the bio-shield (crane wall). Inside the crane wall the cable routes in tray (1R355) and then conduit to the terminal boxes.

5.2 No. 2 Power Operated Relief Valve (PR-2)

Cable 1PRZ56P-BT routes from penetration canister 1-8 up the vertical shafts (1R058 and 1R358) through elevation 100' where it hits cross-over tray (1R3J8) above elevation 100'. The cable exits the cross-over tray at the crane wall to enter tray (1R343), to route counter-clockwise to the conduit penetration of the crane wall. The cable penetrates the crane wall in conduit and routes on the crane wall in tray (1R383) and conduit to the terminal boxes.

5.3 Auxiliary Spray Valve - CV75

Cable 1CVC20P-BT routes from penetration canister 1-41 in vertical trays (1R070 and 1R370) through elevation 100'. The cable exits the vertical shaft in 3 1/2" conduit and routes clockwise to cross-over tray (1R3A2). The cable routes to horizontal tray (1R343) on the crane wall above elevation 100' and continues clockwise to column A17. Finally, at column A17, the cable enters a conduit and passes down through elevation 100' to enter the top of the 238 Panel, floor mounted on elevation 78'.

5.4 Fire Scenario

5.4.1 Fire at elevation 78' in front of the "B" penetration canister will cause the loss of cables 1PRZ56P-BT and 1CVC20P-BT leaving circuit 1PRZ55P-AT, which is protected by R.E.S., as it rises to the next elevation and routes clockwise.

5.4.2 Fire at elevation 100' between cable shafts (1R370 and 1R358), which are more than twenty feet (20') apart, would affect one "B" channel cable and the "A" channel cable. Consequently, one "B" channel cable, either 1PRZ56P-BT (PR2 valve) or 1CVC20P-BT (Aux Spray) would survive. The "A" channel cable 1PRZ55P-AT crosses horizontally through the fire area.

6.0 RADIANT ENERGY SHIELD

The location and design of the Radiant Energy Shields (R.E.S.) for the Reactor Containment penetrations is shown on Public Service drawing 250901-A-1814 Rev.0.

The design consists of two sections. The right section, facing the containment wall, protects the "A" channel penetrations and the associated cable shafts below the horizontal tray system. At the left end of the "A" channel shield there is another shield that goes to the containment wall, see Part Plan 2. The left shield section protects the "C" and "D" channel penetrations and associated vertical shafts. The "B" channel penetrations and shafts are not shielded, surmising that during a fire in that area, the other three channels would survive.

The shield system is fabricated of .125" thick stainless steel plates bolted to a Unistrut frame. The back side of the plates, toward the canisters, is covered with a "Thermolen" blanket, an asbestos type material.

The detail drawing (250901-A-1814 Rev.0) shows an elevation view looking at the shield pattern. The shield pattern is coordinated with the respective penetration numbers and channels across the top of the view. In addition, the canister and vertical shaft arrangements can be seen on Public Service drawing 205863-A-8776.

7.0 SUMMARY TABLE BY SYSTEMS

7.1 Pressurizer Pressure and Level

CABLE MARK	FUNCTION	FIRE LOCATION ELEV. 78'	FIRE LOCATION ELEV. 100'
1PRZ67P-AQ	PRZ LEVEL	S	L
1PRZ68P-AQ	PRZ PRESS	S	L
1PRZ69P-BQ	PRZ LEVEL	L	L
1PRZ70P-BQ	PRZ PRESS	L	L
1PRZ72P-CQ	PRZ LEVEL	S	S
1PRZ73P-CQ	PRZ PRESS	S	S
1PRZ74P-DQ	PRZ LEVEL	L	L
1PRZ75P-DQ	PRZ PRESS	L	L

7.2 Steam Generator Level

CABLE MARK	FUNCTION	FIRE LOCATION ELEV. 78'	FIRE LOCATION ELEV. 100'
1FW86P-BQ	11 STM GEN LVL	S	L
1FW88P-CQ	11 STM GEN LVL	L	S
1FW90P-DQ	11 STM GEN LVL	L	L
1FW109P-AQ	12 STM GEN LVL	S	S
1FW110P-CQ	12 STM GEN LVL	S	S
1FW111P-DQ	12 STM GEN LVL	L	L
1FW115P-AQ	13 STM GEN LVL	S	L
1FW117P-CQ	13 STM GEN LVL	S	S
1FW118P-DQ	13 STM GEN LVL	L	L
1FW124P-BQ	14 STM GEN LVL	L	L
1FW125P-CQ	14 STM GEN LVL	L	S
1FW126P-DQ	14 STM GEN LVL	L	L

NOTES: (1) S denotes channel survives
(2) L denotes channel lost

7.3 Reactor Coolant Temperatures

CABLE MARK	FUNCTION	FIRE LOCATION ELEV. 78'	FIRE LOCATION ELEV. 100'
1RC18P-AQ	11 RC Tc	S	L
1RC19P-AQ	11 RC Th	S	L
1RC75P-BQ	12 RC Tc	L	L
1RC76P-BQ	12 RC Th	L	L
1RC112P-CQ	13 RC Tc	S	S
1RC113P-CQ	13 RC Th	S	S
1RC147P-DQ	14 RC Tc	S	S
1RC148P-DQ	14 RC Th	S	S

7.4 Containment Fan Coil Units

CABLE MARK	FUNCTION	FIRE LOCATION ELEV. 78'	FIRE LOCATION ELEV. 100'
1A2XP-A	11 FCU (L.S.)	S	L
1A4XP-A	11 FCU (H.S.)	S	L
1B2XP-B	12 FCU (L.S.)	L	L
1B4XP-B	12 FCU (H.S.)	L	L
1C2XP-C	13 FCU (L.S.)	S	L
1C4XP-C	13 FCU (H.S.)	S	L
1B6XP-B	14 FCU (L.S.)	L	L
1B8XP-B	14 FCU (H.S.)	L	L
1C6XP-C	15 FCU (L.S.)	S	S
1C8XP-C	15 FCU (H.S.)	S	S

7.3 Pressurizer Pressure Relief

CABLE MARK	FUNCTION	FIRE LOCATION ELEV. 78'	ELEV. 100'
1PRZ55P-AT	1PR1 (POWER)	S	L
1PRZ56P-BT	1PR2 (POWER)	L	L/S
1CVC20P-BT	1CV75(POWER)	L	S/L

8.0 REFERENCE DATA

8.1 Cable Control Report circuit sheets are provided for each circuit energized. The sheet provides the "To" and "From" destinations, routing information, and actual length.

8.2 PSE&G Electrical arrangement drawings are colored coded by channel for the circuits analyzed. The plan view drawings are provided for orientation with most of the detailed routings marked on the elevation drawings. Please note the format of the plan view drawings in that the plan of elevation 78' is titled "Plan Below Elevation 100'. Likewise, the plan of 100' elevation is titled "Plan Below Elevation 122'". The list of drawings used is shown below.

DWG. NO.	TITLE
205850A8776-31	Arrangement Below El. 100' - East
205851A8776-25	Arrangement Below El. 100' - West
205852A8776-20	Arrangement Below El. 122' - East
205853A8776-25	Arrangement Below El. 122' - West
205854A8776-23	Arrangement El. 130' - East
205855A8776-27	Arrangement El. 130' - West
205859A8776-10	Arrangement Power Below El. 122' - West
205863A8776-24	Elevation - Containment Wall - East
205864A8776-23	Elevation - Containment Wall - West
205865A8776-18	Elevation - Crane Wall - East
205866A8776-19	Elevation - Crane Wall - West
209950A8830-22	Elevation Refueling Canal Wall - North & South
209953A8830-8	Arrangement Power Below El. 122' - East
233988A1420-5	Arrangement Misc. Conduit Below El. 122' - East
250901A1814-0	Radiant Energy Shields