

COLD SHUTDOWN/POWER BUS FAILURE  
ANALYSIS REPORT

AUGUST 1984

PUBLIC SERVICE ELECTRIC AND GAS  
HOPE CREEK GENERATING STATION

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## 1.0 ANALYSIS OBJECTIVE

The loss of a Class 1E or a non-Class 1E power bus may result in the loss of instrumentation providing information on plant parameters to the operator. A concern has been raised as to whether the operator would have enough information available to take proper actions if the loss of a bus were to occur concurrently with a plant event requiring the operator to bring the plant to a cold shutdown condition. In response to IE Bulletin 79-27 and Hope Creek Generating Station (HCGS) Final Safety Analysis Report (FSAR) Question 421.42, an analysis was conducted to determine whether loss of power to identified busses would impede the ability of the operator to bring the plant to a cold shutdown condition.

The actions performed in conducting the analysis are detailed below:

- 1) Review HCGS Emergency Operating Procedures to identify Class 1E and non-Class 1E power buses supplying power to safety- and nonsafety-related instrumentation that could affect the ability to achieve a cold shutdown condition.
- 2) Identify the instrument loads connected to the bus and evaluate the effects of loss of power to these loads in achieving a cold shutdown condition.
- 3) Identify and review the alarms and/or indications provided in the control room to alert the operator of the loss of power to the bus.
- 4) Identify alternate indications and/or instruments that may be powered from other non-Class 1E or Class 1E buses.
- 5) Identify methods for restoring power to the buses.
- 6) Describe any proposed design modifications or administrative controls to be implemented resulting from this analysis and the proposed schedule for implementing the changes.

A comprehensive approach was developed to analyze the consequences of a bus failure during cold shutdown procedures. Details of this approach are

identified in the analysis methodology section. Follow-up recommendations are discussed in Sections 2.6 and 2.7, and conclusions are discussed in Section 3.0.

## 2.0 ANALYSIS METHODOLOGY

The methodology required to analyze the effect of a bus failure on the ability to achieve a cold shutdown condition was conducted as follows:

### ACTIVITY

- 2.1 Identify Required Systems
- 2.2 Identify Required Devices
- 2.3 Identify Required Buses
- 2.4 Analyze Bus Loss During Shutdown
- 2.5 Determine Bus Loss Annunciation
- 2.6 Review Plant Procedures to Verify Appropriate Steps
- 2.7 Modify/Augment Plant Procedures if Necessary

### 2.1 IDENTIFY REQUIRED SYSTEMS

This step identified the systems required to bring the plant to a cold shutdown under emergency conditions. HCGS systems and subsystems were compiled and reviewed to determine only those systems necessary to achieve a cold shutdown condition.

### 2.2 IDENTIFY REQUIRED DEVICES

Only those devices that provide information to the operator to achieve a cold shutdown condition were identified. The HCGS Emergency Operating Procedures (see Table 3 of Appendix A), system drawings, and Table 7.5-1 of the HCGS FSAR were reviewed for the identification of the devices required. These devices are tabulated in the "Affected Device" column in Table 1 of Appendix A.

### 2.3 IDENTIFY REQUIRED BUSES

The devices discussed in Section 2.2 were reviewed to determine their power supply bus(es). The associations between the devices and their power buses are shown in Table 1 of Appendix A. This table is arranged by power supply buses that support the required devices determined to be necessary for cold shutdown.

### 2.4 ANALYZE BUS LOSS DURING SHUTDOWN

This step consisted of reviewing system drawings, HCGS FSAR, and HCGS Emergency Operating Procedures to determine the effect of a bus power loss and the ability to continue and achieve safe shutdown of the plant. Redundant systems or alternate information devices that are supplied by a different power bus than the associated affected device and that provide the required parameter information to the operator were identified. Information presented in Table 1 and 3 of Appendix A provides the facts necessary to analyze the consequences of a bus loss. Each instrument bus of a power bus was analyzed from the lowest level to the highest level to ensure the failure of the power to a channel, at any level, would not affect the power supplies of the redundant systems or alternate information devices for the affected devices.

### 2.5 DETERMINE BUS LOSS INDICATION OR INFORMATION

System drawings were reviewed to identify what type of information (i.e., annunciators, recorders, or computer points) would be relayed to the operator to alert him of a bus loss. This information is identified in Tables 1 and 2 of Appendix A. It should be noted that the HCGS design conforms with the requirement of the May 1973 revision of Regulatory Guide 1.47 for adequate annunciation in the control room for indicating inoperable safety-related features for the protection system and the engineered safety systems (see the response to NRC Question 421.7). Additional safety-related bus loss indicators and system out-of-service indicators are displayed in the control room to provide additional information to the operator (see Section 7.5 of the HCGS FSAR).

## 2.6 REVIEW PLANT PROCEDURES TO VERIFY APPROPRIATE STEPS

Existing HCGS Emergency Operating Procedures, (tabulated in Table 3 of Appendix A), were used throughout the analysis methodology. A review will be made of the results of this report against the final Emergency Operating Procedures. The review will also verify that procedures to restore power to the affected power bus(es) are adequate.

## 2.7 MODIFY/AUGMENT PLANT PROCEDURES

If modification of the plant procedures is indicated by the review described in Paragraph 2.6, the necessary changes will be made. If the data in the effects column in Table 1 of Appendix A indicates that an alternative shutdown path may be required, then the final plant operating procedures will be reviewed and modified as necessary.

## 3.0 CONCLUSIONS

### 3.1 ALTERNATIVE SHUTDOWN PATHS

Analysis of the report information shows no situation where a single bus power failure would prevent plant personnel from achieving a safe shutdown condition. This conclusion is based primarily on the analysis results shown in Appendix A. The results establish that no single bus supplies power to all existing shutdown paths. The assignment of the instrument loads identified in this analysis is such that the loss of one bus would not prevent the minimum safety function from being performed.

### 3.2 BUS FAILURE ANNUNCIATION

The failure of the buses identified in Table 2 of Appendix A are annunciated and are displayed by the computer in the control room, thereby giving the operator the knowledge of which power bus is lost. The review and analysis presented in Tables 1 and 2 of Appendix A, shows conclusively that control room personnel will have knowledge of individual bus and/or circuit failures, and that the operator has alternate instruments and shutdown paths available to achieve a cold shutdown condition.

### 3.3 MODIFICATIONS

As a result of this analysis, no changes to present plant design and procedures are indicated.

## COLD SHUTDOWN POWER BUS ANALYSIS

POWER BUS			BUS LOADS			
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
10C410 (C71-P001)	NON-ESS (RPS)	U	NEUTRON FLUX - LPRM XI-R604A,C,E,G,J,L,N,R	207 100, 101	LPRM DOWNSCALE ANN 10C800C3	NONE, USE REDUNDANT XI ON BUS 10C411
		W	REACTOR PRESSURE - POST ACCIDENT PR-R623A	099, 101, 102, 201, 202, 203, 204, 205, 206	RPV ANN 10C800C5 AND COMP PT (D2113)	NONE, USE REDUNDANT PR ON BUS 10C411
		Y	REACTOR LEVEL LI-R604	099, 100, 101, 201-207	RPV LEVEL 3 ANN 10C800A7	LOSS OF LI, USE LI-R606C ON BUS 1CD318
10C411	NON-ESS (NMS)	R	NEUTRON FLUX - LPRM XI-R604B,D,F,H,K,M,P,S	207 100, 101	LPRM DOWNSCALE ANN 10C800C3	NONE, USE REDUNDANT XI ON BUS 10C410
		X	REACTOR PRESSURE - PGST ACCIDENT PR-R623B	099, 101, 102, 201, 202, 203, 204, 205, 206	RPV HI PRESS ANN 10C800C5 AND COMP PT (D2114)	NONE, USE REDUNDANT PR ON BUS 10C410
1AD307	NON-ESS (NMS)	R,T	NEUTRON FLUX - SRM XR-R602A	099, 100, 207	SRM DOWNSCALE ANN 10C300C3	NONE, USE REDUNDANT XR ON BUS 1BD307
			NEUTRON FLUX - IRM/APRM XR-R603A,C	100, 207	IRM DOWNSCALE ANN 10C800C3	NONE, USE REDUNDANT XR ON BUS 1BD307



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POWER BUS			BUS LOADS			
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
1BD307	NON-ESS (NMS)	S,U	NEUTRON FLUX - SRM XR-R602B	099, 100, 101, 207	SRM DOWNSCALE ANN 10C800C3	NONE, REDUNDANT XR ON BUS 1AD307
			NEUTRON FLUX - IRM/APRM XR-R603B,D	100, 101, 207	IRM DOWNSCALE ANN 10C800C3	NONE, REDUNDANT CH A,C ON BUS 1AD307
1CD318	NON-ESS	N	REACTOR LEVEL LI-R606C	099, 100	LOSS OF COMP PT (A2576)	NONE, USE REDUNDANT INSTRUMENT LI-R606A,B ON 1BJ483 BUSES AND 1DD318
			FEEDWATER PUMP A FLOW FI-R611A	099, 100, 101, 207	LOSS OF COMP PT (A1728)	NONE, USE TOTAL FEEDWATER FLOW FR-607 ON C650
			FEEDWATER PUMP C FLOW FI-R611C	099, 100, 101, 207	LOSS OF COMP PT (A1712)	NONE, USE TOTAL FEEDWATER FLOW FR-607 ON C650
1DD318	NON-ESS	N	REACTOR LEVEL LR-R608, LI-R606B	099, 100, 201, 202, 206, 207	LOSS OF COMP PT (A2574) AND (A2575)	NONE, USE LI-R606C ON BUS 1CD318
			FEEDWATER PUMP B FLOW FI-R611B	099, 100, 101, 207	LOSS OF COMP PT (A1729)	NONE, USE TOTAL FEEDWATER FLOW FR-607 ON C650

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POWER BUS			BUS LOADS			
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
1AD417	ESS	A	CORE SPRAY CONTROL BOARD 10C617	100, 204, 205, 206	CORE SPRAY LOGIC A OUT OF SERVICE ANN 10C800B3 AND COMP PT (D3149)	NONE, USE BOARD 10C618 ON BUS 1BD417
			RHR CONTROL BOARD 10C617	099, 100, 101, 205, 206, 207	RHR LOGIC A OUT OF SERVICE ANN 10C800A6 AND COMPUTER PT (D5687)	NONE, USE RHR CONTROL BOARD 10C618
			HPCI CONTROL BOARD 10C620 (INCLUDES FIC-R600)	099, 100, 101, 201, 202, 207	HPCI OUT OF SERVICE ANN 10C800B1 AND COMPUTER PT (D3431)	NONE, LOSS OF HPCI AND FIC, USE ADS TO DEPRESSURIZE
			DC STARTERS FOR HPCI PUMPS AND VALVES ON MCC 10D251 (BECHTEL DWG E-0011-1, SH 1)	099, 100, 101, 201, 202, 207	HPCI OUT OF SERVICE ANN 10C800B1 AND COMPUTER PT (D3431)	NONE, LOSS OF HPCI AND FIC, USE ADS TO DEPRESSURIZE
			REACTOR LEVEL - POST ACCIDENT LR-R623A	099, 100, 101, 201, 202, 203, 204, 205, 206, 207	LOSS OF COMP PT (A2595)	NONE, LR AVAILABLE ON CH B
1BD417	ESS	B	CORE SPRAY CONTROL BOARD 10C618	100, 204, 205, 206	CORE SPRAY LOGIC B OUT OF SERVICE ANN 10C800B3 AND COMPUTER ID D3150	NONE, USE BOARD 10C617 ON BUS 10AD417

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POWER BUS			BUS LOADS			
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
1BD417 (Cont'd)	ESS	B	RHR CONTROL BOARD 10C618	099, 100, 101, 205, 206, 207	RHR LOGIC B OUT OF SERVICE ANN 10C800A7 AND COMPUTER PT (D5688)	NONE, USE BOARD 10C617 ON BUS 1AD417
			RCIC CONTROL BOARD 10C621 (INCLUDES FIC-R600)	099, 100, 101, 201, 202, 207	RCIC OUT OF SERVICE ANN 10C800B1 AND COMPUTER ID D5339	NONE, USE HPCI, AND/OR FEEDWATER TO MAKE UP RPV INVENTORY AND DEPRESSURIZE
			DC STARTERS FOR RCIC PUMPS ON MCC 10D261 (BECHTEL DWG E-0011-1, SH 2)	099, 100, 101, 201, 202, 207	RCIC OUT OF SERVICE ANN 10C800B1 AND COMPUTER ID D5339	NONE, USE HPCI, AND/OR FEEDWATER TO MAKE UP RPV INVENTORY AND DEPRESSURIZE
			ADS CONTROL BOARD 10C628 (INCLUDES VALVE POSITION LIGHTS)	099, 100, 102, 202, 203, 205, 206, 207	ADS CH B OUT OF SERVICE ANN 10C800C1 AND COMPUTER ID D5315	NONE, USE AVAILABLE CH D
			REACTOR LEVEL - POST- ACCIDENT LR-R623B	099, 100, 101, 201-207	LOSS OF COMP PT (A2804)	NONE, LR AVAILABLE ON CH A
1CD417	ESS	C	CORE SPRAY CONTROL BOARD 10C641	100, 204, 205, 206	CORE SPRAY LOGIC C OUT OF SERVICE ANN 10C800B3 AND COMPUTER PT (D3151)	NONE, USE AVAILABLE CH B

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POWER BUS			BUS LOADS		EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)	
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)		INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)
1CD417 (Cont'd)	ESS	C	RHR CONTROL BOARD 10C641	099, 100, 101, 205, 206, 207	RHR LOGIC C OUT OF SERVICE ANN 10C800A6 AND COMPUTER PT (D5689)	NONE, USE AVAILABLE CH B
1DD417	ESS	D	CORE SPRAY CONTROL BOARD 10C640	100, 204, 205, 206	CORE SPRAY LOGIC D OUT OF SERVICE ANN 10C800B3 AND COMPUTER PT (D3152)	NONE, USE AVAILABLE LOOP B
			RHR CONTROL BOARD 10C640	099, 100, 101, 205, 206, 207	RHR LOGIC D OUT OF SERVICE ANN 10C800A7 AND COMPUTER PT (D5690)	NONE, USE AVAILABLE LOOP B
			ADS CONTROL BOARD 10C631 (INCLUDES VALVE POSITION LIGHTS)	099, 100, 102, 202, 203, 205, 206, 207	ADS CH D OUT OF SERVICE ANN 10C800C1 AND COMPUTER PT (D5317)	NONE, USE AVAILABLE LOOP B
1AJ481	ESS	A	RHR HX A TO RCIC PRESS PIC-R609	099, 100, 101, 201, 202, 207	RCIC OUT OF SERVICE ANN 10C800B1 AND COMPUTER PT (D5339)	NONE, USE AVAILABLE HPCI ON CH B

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POWER BUS			BUS LOADS			
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
1AJ481 (Cont'd)	ESS	A	HPCI TO RHR HX A PRESS PIC-R606A	099, 100, 101, 201, 202, 207	VALVE E11-F051A FAILS CLOSED	NONE, USE AVAILABLE PIC-R606B ON CH B
			CORE SPRAY LOOP A FLOW FI-R601A	100, 204, 205, 206	LOSS OF COMP PT (A2224)	NONE, USE AVAILABLE LOOP B
			CORE SPRAY LOOP A DISCH PRESS PI-R600A	100, 204, 205, 206	CORE SPRAY LOOP A TRBL ANN 10C800B3 AND COMP PT (D3157)	NONE, USE AVAILABLE LOOP B
			RHR PUMP A FLOW FI-R603A	099, 100, 101, 205, 206, 207	NONE	NONE, USE RHR B FLOW AND FI-R603B ON CH B
			RHR PUMPS A AND C FLOW FR-R608A	099, 100, 101, 205, 206, 207	NONE	NONE, RHR FR FOR RECORDING ONLY, OTHER RHR LOOPS CAN BE USED
			RHR R/PV HEAD SPRAY FI-R607	100, 102, 201, 204, 205, 206	NONE	NONE, USE FI-4462B ON CH B

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POWER BUS			BUS LOADS			
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
1AJ481 (Cont'd)	ESS	A	STANDBY LIQUID CONTROL PUMP DISCHARGE PI-R600A	101, 206, 207	LOSS OF COMP PT (A7053)	NONE, USE PI-R600B ON CH B
			REACTOR LEVEL LR-R615	099, 201, 203, 204, 207	LOSS OF COMP PT (A2807)	NONE, USE R610 ON CH B
			CONTAINMENT H <sub>2</sub> AND O <sub>2</sub> AR-5039A1, AR-5039A2 SUBPANEL IN MCR	102	LOSS OF COMP PT (A2815) AND (A2816)	NONE, REDUNDANT SYSTEM CH B IN OPERATION
1BJ481	ESS	B	HPCI TO RHR HX B PRESS PIC-R606B	099, 100	VALVE E11-F057B FAILS CLOSED	NONE, USE PIC-R606A ON CH A
			CORE SPRAY LOOP B FLOW FI-R601B	100, 204, 205, 206	LOSS OF COMP PT (A2227)	NONE, USE AVAILABLE LOGIC A ON CH A
			CORE SPRAY LOOP B DISCHARGE PRESSURE PI-R600B	100, 204, 204, 206	CORE SPRAY LOOP B OUT OF SERVICE ANN 10C800B3 AND COMP PT (D3159)	NONE, USE AVAILABLE LOGIC A ON CH A
			RHR PUMP B FLOW FI-R603B	099, 100, 101, 205, 206, 207	NONE	NONE, USE FI-R603A ON CH A

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POWER BUS			BUS LOADS			
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
1BJ481 (Cont'd)	ESS	B	RHR PUMPS B AND D FLOW FR-R608B	099, 100, 101, 205, 206, 207	NONE	NONE, RECORDING FLOW ONLY, NO CONTROLLING FUNCTION. OTHER RHR LOOP CAN BE USED.
			STANDBY LIQUID CONTROL PUMP DISCHARGE PI-R600B	101, 206, 207	LOSS OF COMP PT (A7054)	NONE, USE PI-R600A ON CH A
			REACTOR LEVEL LI-R610	099, 100, 101, 201-207	LOSS OF COMP PT (A2804)	NONE, USE LI-R615 ON CH A
			CONTAINMENT H <sub>2</sub> AND O <sub>2</sub> AR-5039B1, AR-5039B2 SUBPANEL IN MCR	102	LOSS OF COMPT PT (A2875) AND (A2817)	NONE, REDUNDANT SYSTEM IN OPERATION (CH A)
1CJ481	ESS	C	RHR PUMP C FLOW FI-R603C	099, 100, 101, 205, 206, 207	NONE	NONE, USE FI-R603A ON CH A
1DJ481	ESS	D	RHR PUMP D FLOW FI-R603D	099, 100, 101, 205, 206, 207	NONE	NONE, USE FI-R603B ON CH B

## COLD SHUTDOWN POWER BUS ANALYSIS

POWER BUS			BUS LOADS			EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	
1AJ482	ESS	A	RHR CONTAINMENT SPRAY FLOW FI-4462A	102	LOSS OF ERF COMPUTER PT (A3161)	NONE, LINE UP REDUNDANT SYSTEM LOOP B FOR CONTAINMENT SPRAY
			RHR SUPPRESSION POOL SPRAY FLOW FI-4461A	102	LOSS OF ERF COMPUTER PT (A3164)	NONE, LINE UP REDUNDANT SYSTEM LOOP B FOR SUP'R POOL SPRAY
			RHR HX A LEVEL LIC-R604A	099, 100, 101, 205, 206, 207	NONE	NONE, USE LIC-R604B ON CH B
			ECCS JOCKEY PUMP 1AP228 DISCHARGE PRESSURE PI-4891	206, 207	HPCI JOCKEY PUMP 1AP228 ANN 10C800B1, COMPUTER PT (D3347)	NONE, IF HPCI PUMP IS NOT RUNNING, PIR606 MAY BE USED FOR JOCKEY PUMP DISCHARGE PRESS. IF HPCI PUMP IS RUNNING, LOSS OF INDICATION FOR JOCKEY PUMP DISH PRESS HAS NO EFFECT.
			SUPPRESSION POOL WATER TR-3881A1	102	NONE	NONE, USE TR 3881B1
			SUPPRESSION POOL WATER LI-4805-1, LR-4805-1	102	SUPPRESSION POOL LEVEL HI/LO ANN 10C800B1, COMPUTER PT (D5471) AND LOSS OF ERF COMPT PT (A2368)	NONE, USE LI-4801 ON CH C
			SUPPRESSION CHAMBER PR-4960A1, TR-4967A1	102, 202, 206	LOSS OF ERF COMPUTER PTS (A2813) AND (A7082)	NONE, USE REDUNDANT SYSTEMS ON CH D



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POWER BUS			BUS LOADS		EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)	
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)		INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)
1AJ482 (Cont'd)	ESS	A	DRYWELL PRESSURE PR-4960A2, PR-496A03	101, 102, 207	LOSS OF ERF COMPUTER PT (A2805)	NONE, USE REDUNDANT SYSTEMS ON CH D
			DRYWELL TEMPERATURE TR-4967A2	102, 202	LOSS OF ERF COMPUTER PT (A2811)	NONE, USE REDUNDANT SYSTEMS ON CH D
			REACTOR LEVEL - POST- ACCIDENT LR-3622A	099, 100, 101, 201-207	LOSS OF ERF COMPUTER PT (A2893)	NONE, USE LR-3622B ON CH B
			REACTOR LEVEL - POST- ACCIDENT LI-3682A, LI-3683A	099, 100, 101, 201-207	NONE	NONE, USE LR-3682B, LR-3683B ON CH B
			RHR HX OUTLET FLOW FI-2511A	099, 100, 101, 205, 206, 207	LOSS OF COMPUTER PT (A7080)	NONE, LINEUP REDUNDANT LOOP B OF RHR SYSTEM AND SEND SACS WATER TO BE205
			SACS PUMP DISCHARGE LOOP A FI-2549A1	099, 100, 101, 205, 206, 207	LOSS OF COMPUTER PT (A3128)	NONE, SACS PUMPS AP210 AND CP210 CAN CONTINUE TO OPERATE. THEY ARE BEING PROTECTED BY PDSL-2485A AND C AND ALARM FROM PDAL-2485A AND C IN MCR.
			REACTOR PRESSURE - POST- ACCIDENT PI-3684A	099, 100, 101, 102, 201-206	LOSS OF ERF COMPUTER PT (A2594)	NONE, USE REDUNDANT PRESSURE RECORDER FROM CH B PR-3684B

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NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	
1BJ482	ESS	B	RHR CONTAINMENT SPRAY FLOW FI-4462B	102	LOSS OF ERF COMPUTER PT (A3165)	NONE, USE REDUNDANT LOOP A
			RHR SUPPRESSION POOL SPRAY FLOW FI-4461B	102	LOSS OF ERF COMPUTER PT (A3251)	NONE, USE REDUNDANT LOOP A
			RHR HX B LEVEL LIC-R604B	099, 100, 101, 205, 206, 207	NONE	NONE, USE LIC-R604A ON CH A
			ECCS JOCKEY PUMP 1BP228 DISCHARGE PRESS PI-4303	206, 207	RCIC JOCKEY PUMP 1BP228 TROUBLE ANN 10C800B1 AND COMPUTER PT (D3549)	NONE, IF RCIC PUMP IS NOT RUNNING, PI-R604 MAY BE USED FOR JOCKEY PUMP DISCHARGE PRESSURE. IF RCIC PUMP IS RUNNING, LOSS OF INDICATION FOR JOCKEY PUMP DISCHARGE PRESSURE HAS NO EFFECT
			SUPPRESSION POOL WATER TR-3881B1	102	NONE	NONE, USE TR-3881A1
			REACTOR LEVEL - PGST- ACCIDENT LR-3622B	099, 100, 101 201-207	NONE	NONE, USE LR-3622A
			REACTOR LEVEL - POST- ACCIDENT LR-3682B, LR-3683B	099, 100, 101, 201-207	NONE	NONE, USE REDUNDANT INSTRUMENTS LI-3682A, LI-3683A

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POWER BUS			BUS LOADS			EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	
1BJ482 (Cont'd)	ESS	B	REACTOR PRESSURE - POST-ACCIDENT PR-3684B	099, 100, 101, 102, 201-206	LOSS OF ERF COMPUTER PT (A2802)	NONE, USE REDUNDANT CH A INDICATOR PI-3684A
			RHR HX B OUTLET FLOW FI-2511B	099, 100, 101, 205, 206, 207	LOSS OF COMPUTER PT (A7081)	NONE, SEE FI-2511A. SYSTEM WILL CONTINUE TO OPERATE.
			SACS PUMP DISCHARGE, LOOP B FI-2549B1	099, 100, 101, 205, 206, 207	LOSS OF COMPUTER PT (A3129)	NONE, SEE FI-2549A1. SYSTEM WILL CONTINUE TO OPERATE.
1CJ482	ESS	C	ECCS JOCKEY PUMP 1CP228 DISCHARGE PRESSURE PI-N053C	206	NONE	NONE, USE LOOP ON CH D
			SUPPRESSION POOL WATER LI-4801	102	LOSS OF COMPUTER PT (A2230)	NONE, USE CH A INDICATION LI-4805-1
1DJ482	ESS	D	ECCS JOCKEY PUMP 1DP228 PI-N053D	206	NONE	NONE, USE ALTERNATE LOOP ON CH C

## COLD SHUTDOWN POWER BUS ANALYSIS

POWER BUS			BUS LOADS			EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)	INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)	
1DJ482 (Cont'd)	ESS	D	SUPPRESSION CHAMBER PR-4960B1, PR-4960B3, TR-4967B1	102, 202, 206	LOSS OF COMPUTER PT (A2814) (A7085)	NONE, USE REDUNDANT INDICATION
			DRYWELL PRESSURE PR-4960B2	101, 102, 207	LOSS OF COMPUTER PT (A2806)	NONE, USE REDUNDANT INDICATION
			DRYWELL TEMPERATURE TR-4967B2	102, 202	LOSS OF COMPUTER PT (A2812)	NONE, USE REDUNDANT INDICATION
1AJ483	NON-ESS	N	STANDBY LIQUID CONTROL TANK LI-R601	101, 206, 207	NONE	NONE, USE RRCS DIV A OR B LEVEL DISPLAY
			CONTROL ROD POSITION INFORMATION CABINET 10C615	099, 100, 101	NONE	NONE, AUTO AND MANUAL SCRAM CAPABILITY STILL AVAILABLE
1BJ483	NON-ESS	N	REACTOR LEVEL INDICA- TION AND CONTROL LI-R606A, LIC-R602, LIC-R600	099, 100, 201-207	HIGH/LOW WATER LEVEL ALARM AND LOSS OF COMPUTER PT (A1727) AND LR-608	NONE, USE REDUNDANT LI-R606C ON BUS 1CD318 FOR INDICATION AND HPCI FOR WATER LEVEL CONTROL INSTEAD OF FWCS
			REACTOR PRESSURE PI-R605	099, 100, 101, 102, 201-206	NONE	NONE, USE B21 PR-632A ON BUS 10C410

## COLD SHUTDOWN POWER BUS ANALYSIS

POWER BUS			BUS LOADS		EFFECT ON CONTINUING IN EXISTING SHUTDOWN PROCEDURE (4)	
NUMBER	ESSENTIALITY CODE	CH (3)	AFFECTED DEVICES	PROCEDURE NUMBER (1)		INDICATION OR LOSS ASSOCIATED WITH LOSS OF AFFECTED DEVICE (2)
1AJ484	NON-ESS	N	CONDENSATE STORAGE TANK LR-2043	099, 100, 101, 201, 202, 207	LOSS OF COMPUTER PT (A2495)	NONE, LSSL-N661A&E WILL ANN ON MCR ON CST LOW LEVEL
			CRD WATER FLOW FIC-R600	201, 206, 207	LOSS OF COMPUTER PT (A1711). LOSS OF CONTROL TO CRD.	
10Y102, 10Y103, 10Y104	NON-ESS	N	CONDENSER VACUUM PR-1664	099, 100, 202, 207	NONE	NONE, LOSS OF POWER AFFECTS ONLY ONE INPUT TO RECORDER WHICH MONITORS THREE INPUTS SEPARATELY
10Y407	NON-ESS	N	REACTOR LEVEL - POST- ACCIDENT LI-R605	099, 100, 101, 201-207	NONE	NONE, USE LI-R608
			RHR HX TEMPERATURE TR-R605	099, 100, 101, 205, 206 207	NONE	

## NOTES:

1. THE "PROCEDURE NUMBER" COLUMN IDENTIFIES THE PROCEDURE NUMBERS OF THE HCGS EMERGENCY OPERATIONS PROCEDURES THAT REQUIRE THE AFFECTED DEVICE FOR ACHIEVING A COLD SHUTDOWN CONDITION. THESE PROCEDURES ARE TABULATED IN TABLE 3 OF APPENDIX A. ALL PROCEDURE NUMBERS ARE PRECEDED BY "OP-EO ZZ".
2. THIS COLUMN PROVIDES A TABULATION OF ADDITIONAL INDICATIONS, I.E., ANNUNCIATOR TRIP OR LOSS OF A COMPUTER POINT, WHICH MAY BE LOST ALONG WITH THE LOSS OF THE AFFECTED DEVICE.
3. ELECTRICAL DIVISIONAL SEPARATION SCHEME USED BY NSSS IS DESIGNATED AS DIVISION D1 ESF, D2 ESF, D3 ESF, AND D4 ESF FOR 1E BUS, AND N FOR NON-1E BUS. THE NON-NSSS DESIGNATION USES CHANNELS A, B, C, AND D FOR 1E BUS WITH N DESIGNATION FOR NON-1E BUS. FOR RPS POWER SUPPLY, NSSS USES D1 RPS, D2 RPS, D3 RPS, AND D4 RPS WHICH CORRESPONDS TO THE NON-NSSS CHANNELS W, X, Y, AND Z. FOR THE NEUTRON MONITORING SYSTEM SEPARATION NSSS USES NA, NB, NC, AND ND, AND NON-NSSS USES CHANNELS R, S, T, AND U.
4. OTHER ALTERNATE SYSTEMS AND/OR ALTERNATE INFORMATION INSTRUMENTS MAY BE AVAILABLE IN ADDITION TO THOSE LISTED IN THIS COLUMN.

LOSS OF POWER ALARM/INDICATION IN CONTROL ROOM

<u>BUS/PANEL</u>	<u>VOLTAGE</u>	<u>ANNUNCIATOR*</u>	<u>PANEL</u>	<u>COMPUTER PT</u>	<u>IE BUS</u>	<u>CH</u>
10C410	120 Vac	USS Fdr Brkr Trbl	10C800E3	D4620	No	U,W,Y
10C411	120 Vac	USS Fdr Brkr Trbl	10C800E3	D4625	No	R,X
1AD307	±24 Vdc	±24 Vdc Sys Trbl	10C800D3	D4656	No	R,T
1BD307	±24 Vdc	±24 Vdc Sys Trbl	10C800D3	D4660	No	S,U
1CD318	125 Vdc	125 Vdc Sys Trbl	10C800D3	D4646	No	N
1DD318	125 Vdc	125 Vdc Sys Trbl	10C800D3	D4651	No	N
1AD417	125 Vdc	125 Vdc Sys Trbl	10C800D3	D4630	Yes	A
1BD417	125 Vdc	125 Vdc Sys Trbl	10C800D3	D4634	Yes	B
1CD417	125 Vdc	125 Vdc Sys Trbl	10C800D3	D4638	Yes	C
1DD417	125 Vdc	125 Vdc Sys Trbl	10C800D3	D4642	Yes	D
1AJ481	120 Vac	120 Vac UPS Trbl	10C800D3	D4970	Yes	A
1BJ481	120 Vac	120 Vac UPS Trbl	10C800D3	D4971	Yes	B
1CJ481	120 Vac	120 Vac UPS Trbl	10C800D3	D4970	Yes	C
1DJ481	120 Vac	120 Vac UPS Trbl	10C800D3	D4971	Yes	D
1AJ482	120 Vac	120 Vac UPS Trbl	10C800D3	D4972	Yes	A
1BJ482	120 Vac	120 Vac UPS Trbl	10C800D3	D4973	Yes	B
1CJ482	120 Vac	120 Vac UPS Trbl	10C800D3	D4972	Yes	C
1DJ482	120 Vac	120 Vac UPS Trbl	10C800D3	D4973	Yes	D
1AJ483	120 Vac	120 Vac UPS Trbl	10C800D3	D4979	No	N
1BJ483	120 Vac	120 Vac UPS Trbl	10C800D3	D4980	No	N
1AJ484	120 Vac	120 Vac UPS Trbl	10C800D3	D4981	No	N
10Y102	120 Vac	USS Fdr Brkr Trbl	10C800E3	D4618	No	N
10Y103	120 Vac	USS Fdr Brkr Trbl	10C800E3	D4620	No	N
10Y104	120 Vac	USS Fdr Brkr Trbl	10C800E3	D4619	No	N
10Y407	120 Vac	USS Fdr Brkr Trbl	10C800E3	D4617	No	N

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\*USS = Unit Substation

UPS = Uninterruptable Power Supply

HCGS EMERGENCY OPERATING PROCEDURES

<u>PROCEDURE NO.</u>	<u>TITLE</u>	<u>REV DATE</u>
OP-EO ZZ099	Post Scram Restoration	6/83 Draft A
OP-EO ZZ100	Scram	6/83 Draft A
OP-EO ZZ101	Reactor Control	7/83 Draft A
OP-EO ZZ102	Containment Control and Drywell Pressure Control	6/83 Draft A
OP-EO ZZ103	Secondary Containment	12/83 Draft A
OP-EO ZZ104	Radioactivity Release	12/83 Draft A
OP-EO ZZ201	RPV Water Level Restoration	7/83 Draft A
OP-EO ZZ202	Emergency Depressurization	7/83 Draft A
OP-EO ZZ203	Blowdown Cooling	7/83 Draft A
OP-EO ZZ204	Spray Cooling	7/83 Draft A
OP-EO ZZ205	Alternate S/D Cooling	7/83 Draft A
OP-EO ZZ206	RPV Flooding	7/83 Draft A
OP-EO ZZ207	Level/Power Control	7/83 Draft A