COMMON POWER/CONTROL SYSTEMS FAILURES EVALUATION REPORT

AUGUST 1984

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK GENERATING STATION

CONTENTS

ILLUSTRATIONS

COMMON POWER/CONTROL SYSTEMS FAILURES EVALUATION REPORT FOR THE HOPE CREEK GENERATING STATION

1.0 OBJECTIVES

The objectives of this evaluation report are as follows:

- Perform an analysis in response to the NRC concern stated in FSAR question 421.51 that the failures of power sources, which provide power or electrical signals to multiple control systems, could result in consequences outside the bounds of the Hope Creek Generating Station Final Safety Analysis Report (FSAR) Chapter 15 analyses and would require actions or responses beyond the capability of operators or safety systems.

- Provide a positive demonstration that adequate review and analysis has been performed to ensure that despite such failures the consequences of the FSAR Chapter 15 analyses are bounding, and no consequences beyond the capability of operators or safety systems would result.

- Provide additional analyses necessary to ensure the effects of the worst-case limiting event are bounded by those of the events analyzed in FSAR Chapter 15 with the assumption that there is a single active failure in a safety system required to mitigate the effects of the event.

2.0 CONCLUSIONS

The information contained herein, supplemented by the existing FSAR Chapter 15 transient analyses, documents an evaluation of the Hope Creek Generating Station for control systems interaction by electrical means. The conclusion of this evaluation is that the limits of minimum critical power ratio (MCPR), peak vessel and main steamline pressures, and peak fuel cladding temperature for the expected operational occurrence category of events would not be exceeded as a result of common power source failures. Although transient category events have been postulated as a result of this study, the net effects have been positively determined to be less severe than and bounded by the events in Chapter 15. It should be noted that this study used the event-consequence logic of the Chapter 15 analysis, but it started the logic chain from a specific source (e.g., a single bus failure) rather than a system condition (e.g., feedwater runout). By approaching the study in this manner, a great deal of confidence can be placed in the study conclusions. The soundness of the total plant design is demonstrated by its being tolerant of these effects.

3.0 ANALYSIS METHODOLOGY

To achieve the objectives discussed in Section 1, a comprehensive methodology was developed for the analysis of the control systems capable of affecting reactor water level, pressure or power in the Hope Creek Generating Station (HCGS).

The electrical control systems failure analysis was conducted in the following manner:

ACTIVITY

- Define Control Systems
- Identify Loads
- Define Bus Structures
- Determine Critical Loads
- Summarize Critical Loads
- Analyze Combined Effects
- Compare Results to Chapter 15
- Additional Single Failure in a Mitigating Safety System
- Analyze Exceptions
- Modify/Augment Chapter 15

3.1 DEFINE CONTROL SYSTEMS

The scope of control systems to be analyzed was established by first compiling a complete list of the Hope Creek Generating Station (HCGS) systems and subsystems. Next, the list was reviewed to confine the analysis to only those systems with the potential to affect reactor pressure vessel (RPV) pressure, water level, or power.

In order to ensure that all necessary systems were considered, certain elimination criteria, which documented the justification for not analyzing that system further (see Appendix B), were established. If there were any uncertainty as to whether or not a system met the criteria, it was retained for further analysis. Those systems that met the criteria for elimination were removed from the complete system list, leaving the following list of control systems for analysis.

System Designation MPL/M-System #	System
(B21)	Nuclear Boiler Process Instrumentation
(B21)	Jet Pump Instrumentation
(B21)	Steam Leak Detection System
(B31)	Reactor Recirculation System
(C11)	Control Rod Drive Hydraulic/Reactor Manual Control Systems
(C32)	Feedwater Control System
(C51)	Neutron Monitoring System
(D11)	Process Radiation Monitoring System
(G33)	Reactor Water Cleanup System
(M1)	Main Steam System (Turbine-Generator System)
(M2)	Extraction Steam System
(M3/M4)	Vents, Drains and Heaters System
(M5)	Condensate System
(M6)	Feedwater System
(M7)	Condenser Air Removal System
(M9)	Circulating Water System
(M10)	Service Water System
(M11/M12)	Safety Auxiliaries Cooling System
(M13)	Reactor Auxiliaries Cooling System
(M14)	Turbine Auxiliaries Cooling System
(M15)	Compressed Air System
(M16)	Condensate Demineralizer System
(M19)	Lube Oil System
(M25)	Plant Leak Detection System
(M26)	Radiological Monitoring System
(M28)	Generator Gas Control System
(M29)	Turbine Sealing Steam System
(M31)	Reactor Feed Pump Turbine Steam System
(M57)	Containment Atmosphere Control System
(M59)	Primary Containment Instrument Gas System
(M69/M70)	Gaseous Radwaste System (Offgas System)
(M71)	Liquid N_2 for Purge and Containment Inerting System
(M82)	Turbine Building Supply and Exhaust Vent System
(M83/M84)	Reactor Building Supply and Exhaust Vent System
(M86)	Drywell Vent Control System
(M87)	Chilled Water System
(M89)	Auxiliary Building Control Area Vent Control
(M90)	Auxiliary Building Control Area Chilled Water System

3.2 IDENTIFY LOADS

A set of system bus-load tables were assembled, each providing information on the loads. These tables identified all electrical loads of the control systems defined by the methodology described in Paragraph 3.0. Each load was listed with its power bus source, circuit description, and failure mode on power loss with primary and secondary effects. Samples of load tables are included in Appendix A.

3.3 DEFINE BUS STRUCTURE

Potential sources for control system interaction by electrical means were established by formulating the bus structure as follows: Bus trees (see Figures 1, 2 and 3) were constructed using one-line diagram information to show power distribution from the highest level not previously analyzed (the highest level previously analyzed is the loss of offsite power) down to the lowest level of plant distribution (motor control centers, instrument busses, etc.).

3.4 DETERMINE CRITICAL LOADS

The loads with the potential for initiating events affecting RPV pressure, water level, and power were identified. The elimination criteria established earlier for the system list, as defined in Appendix B, were used in the component review to determine which individual loads required further consideration or could be deleted from the analysis. If there was any uncertainty as to whether or not a load met the elimination criteria, it was retained for further analysis. The numerical code associated with an elimination criterion was assigned to each eliminated load in the load tables discussed in Paragraph 3.2.

3.5 SUMMARIZE CRITICAL LOADS

Noncritical loads were deleted from the load tables, and the remaining loads were grouped together by their common power busses. These tables are shown in Appendix C.

The primary effect column in Appendix C lists the component failure effect and resulting component failures that would lead to the secondary effect.

The secondary effect is the final macro failure that could effect RPV pressure, water level or power. In some cases there is no effect. Because this analysis reviews all interactions that potentially could result in a previously unanalyzed transient, no-effect failures indicate the soundness of plant design.

3.6 ANALYZE COMBINED EFFECTS

This portion of the analysis provided the basis for determining the worst case combinations of load and system failures that are credible events considering their interconnection by power distribution. Using the combined effects of a failure at the lowest level bus as a starting point, the next higher bus was postulated to fail, and the total effects at that level were analyzed. This process was continued up to the highest bus level. The combined effects at the lowest bus level are included in the Appendix C tables. Worst case effects at the higher levels are summarized in Section 4. The combined effects at intermediate bus levels less severe than their associated higher bus combined effects were analyzed but not included in Section 4. The more severe intermediate level combined effects analyses are formally represented along with their associated higher bus analysis.

3.7 COMPARE RESULTS TO FSAR CHAPTER 15

The consequences of all postulated control system interaction events initiated by electrical means, were then compared to the consequences of the events analyses described in Chapter 15 of the FSAR. A review of the information in the Appendix C tables was conducted in the course of developing the bus summaries of Section 4. At each bus level of the combined effects analysis, the review evaluated the effects as to whether they would be bounded by the consequences of a specific Chapter 15 event analysis. Section 4 includes these evaluations and considers the worst case effects.

3.8 ADDITIONAL SINGLE FAILURE IN A MITIGATING SAFETY SYSTEM

The consequences of the postulated common bus loss events, detailed in Section 4, are all bounded by the consequences of Chapter 15 transients. For each bounded bus-loss event, the mitigating safety systems were identified according to the FSAR Chapter 15 event description. One additional worst case single failure in a mitigating safety system was then postulated for each event, taking into consideration the bus loss effects. No bus loss was identified wherein an additional single failure in a mitigating safety system would cause the failure of that system to perform its intended safety function.

An an example of this process, consider AC Bus 10A101 from Section 4.0. The Chapter 15 bounding event is the Loss of Feedwater Flow, described in HCGS FSAR 15.2.7. The event scenario includes a vessel low water level (L3) scram trip from the Reactor Protection System (RPS), which performs a mitigating function. The loss of AC Bus 10A101 together with an additional single failure in the RPS was postulated. The RPS would not be prohibited from inserting the control rods, a function required for mitigating the effects of the transient. This process was followed for each mitigating safety system identified for the Loss of Feedwater Flow event. Each mitigating safety system in the Loss of Feedwater Flow event scenario was able to perform its intended safety function considering the bus loss and an additional single failure.

The above process was repeated for each identified bounding FSAR Chapter 15 event.

3.9 ANALYZE EXCEPTIONS

No failure scenarios were identified with consequences that were not directly bounded by those of the events analyses described in FSAR Chapter 15.

3.10 MODIFY CHAPTER 15 IF NECESSARY

As a result of this analysis, no modification of FSAR Chapter 15 was found to be necessary.

4.0 BUS LOSS SUMMARY RESULTS AND CHAPTER 15 COMPARISONS

AC BUS 10A101

Loss of this bus would result in the following effects:

1) Secondary condensate pumps A, B and C recirculation valves will open.

2) The compressed air compressors are inoperative.

3) Secondary condensate pump B stops.

The opening of secondary condensate pumps recirculation valves A, B and C and the stopping of the secondary condensate pump would result in a trip of reactor feedwater turbines A, B and C on low suction pressure. This would cause a reactor scram on low water level and the consequences of this event are bounded by the Loss of Feedwater Flow (FSAR 15.2.7) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.7.

Loss of an intermediate bus would result in a loss of compressed air. The consequences of this event are bounded by the Loss of Compressed Air event (FSAR 15.9.6, event 8). This event is much slower than the loss of feedwater flow.

Loss of any other intermediate busses ancillary to AC bus 10A101 have combined effects events with no consequences more severe than those discussed for higher bus 10A101.

AC BUS 10A102

Loss of this bus would result in the following effects:

1) Secondary condensate pump A recirculation valve will open.

2) Secondary condensate pumps A and C and primary condensate pump C stop.

3. Feedwater heater train A is isolated, and the extraction steam is dumped to condenser A.

The effects of this bus loss are bounded by the Loss of Feedwater Flow (FSAR 15.2.7) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.7.

Loss of intermediate bus will isolate feedwater heater train A and cause less than a 100°F reduction in feedwater temperature. The consequences of this event are bounded by the Loss of Feedwater Heating (FSAR 15.1.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.7.

Loss of an intermediate bus would result in runback of recirculation pump B due to secondary condensate pump C stopping, but recirculation pump A would be locked at last speed. The consequences of this event are less

severe than the One Recirculation Pump Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

Failure of any other intermediate busses ancillary to AC bus 10A102 would have combined effects events with no consequences more severe than those discussed for higher bus 10A102.

AC BUS 10A103

Loss of this bus would result in a main turbine trip. The consequences of this event are bounded by the Turbine Trip - Bypass On (FSAR 15.2.3) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.3.

AC BUS 10A104

Loss of this bus would result in recirculation runback when secondary condensate pump C stops. The consequences of this event are less severe than the One Recirculation Pump Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

AC BUS 10A501

Loss of this bus would result in recirculation runback due to the circulating water pumps 1BP501 and 1DP501 stopping. The consequences of this event are less severe than the One Recirculation Pump Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

AC BUS 10A502

Loss of this bus would result in recirculation runback due to the circulating water pumps A and C stopping. The consequences of this event are less severe than the One Recirculation Pump Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

AC BUS 10A110

Loss of this bus would result in a recirculation pump A trip with runback of recirculation pump B. The consequences of this event are bounded by the Two Recirculation Pumps Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

AC BUS 10A120

Loss of this bus would result in recirculation pump B trip with runback of recirculation pump A. The consequences of this event are bounded by the Two Recirculation Pumps Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

AC BUS 10A401

Loss of this bus would result in the following effects:

1) A main turbine trip.

2) The opening of the turbine bypass valves.

3) Trips of the primary condensate pumps A, B and C on condenser hotwell low-low level.

4) A trip of feedwater turbine A with the recirculation runback circuits disabled.

The consequences of the loss of this bus are bounded by the Turbine Trip - Bypass On (FSAR 15.2.3) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.3.

The loss of an intermediate bus would result in a trip of feedwater turbines A, B and C, causing reactor scram on low water level. The consequences of this event are bounded by the Loss of All Feedwater Flow (FSAR 15.2.7) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.7.

Loss of any other intermediate busses ancillary to AC bus 10A401 would have combined effects events with no consequences more severe than those discussed for AC bus 10A401.

AC BUS 10A402

Loss of this bus would result in the following effects:

1) A main turbine trip.

2) A trip of feedwater turbine B with the other feedwater turbines locked at their last speed.

The consequences of the loss of this bus are bounded by the Turbine Trip - Bypass On (FSAR 15.2.3) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.3.

Loss of an intermediate bus would result in a recirculation runback. The consequences of this event are bounded by the One Recirculation Pump Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

Loss of any other intermediate busses ancillary to AC bus 10A402 would have combined effects events with no consequences more severe than those discussed for AC bus 10A402.

AC BUS 10A403

Loss of this bus would result in the following effects:

1) A main turbine trip.

2) Trip reactor feedwater turbine C.

The consequences of the loss of this bus are bounded by the Turbine Trip - Bypass On (FSAR 15.2.3) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.3.

Loss of an intermediate bus would result in a recirculation runback. The consequences of this event are bounded by the One Recirculation Pumps Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

Loss of any other intermediate busses ancillary to AC bus 10A403 would have combined effects with no consequences more severe than those discussed for AC bus 10A403.

AC BUS 10A404

Due to disabling of the turbine trip solenoid, loss of this bus would result in a failure to trip the main turbine on receipt of the actual trip signal. There are no consequences due to loss of this bus.

Failure of ancillary intermediate busses would result in and could have no more severe effects than those of a main turbine trip. The consequences of a main turbine trip are bounded by the Turbine Trip - Bypass On (FSAR 15.2.3) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.3.

DC BUS 10D470

Loss of this bus would result in the following effects:

1) A trip of reactor feedwater turbine C.

2) Increased flow of the reactor feedwater turbines A and B.

3) Obviation of the main turbine trip by the disabling of the turbine trip solenoid.

The feedwater turbine C trip and increased flow demand to feedwater pump turbine A and B would result in a reactor scram on low water level. The consequences of this event are bounded by the Loss of Feedwater Flow (FSAR 15.2.7) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.2.7.

Loss of an intermediate bus would result in main turbine trip and reactor scram on high water level (bypass valves open). The consequences of this event are bounded by the Feedwater Controller Failure - Maximum Demand

(FSAR 15.1.2) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.1.2.

Loss of any other intermediate busses ancillary to DC bus 10D470 would have combined effects that have no consequences more severe than those discussed for DC bus 10D470.

DC BUS 10D480

Loss of this bus would result in a trip of the reactor feedwater turbine. The consequences of this event are bounded by the Two Recirculation Pumps Trip (FSAR 15.3.1) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.3.1.

Loss of an intermediate bus would result in a main turbine trip on high water level. The consequences of this event are bounded by the Feedwater Controller Failure - Maximum Demand (FSAR 15.1.2) event. An additional single failure in a mitigating safety system also would result in a bounded event, as discussed in FSAR 15.1.2.

Loss of any other intermediate busses ancillary to DC bus 10D480 would have combined effects that have no consequences more severe than those discussed for DC bus 10D470.

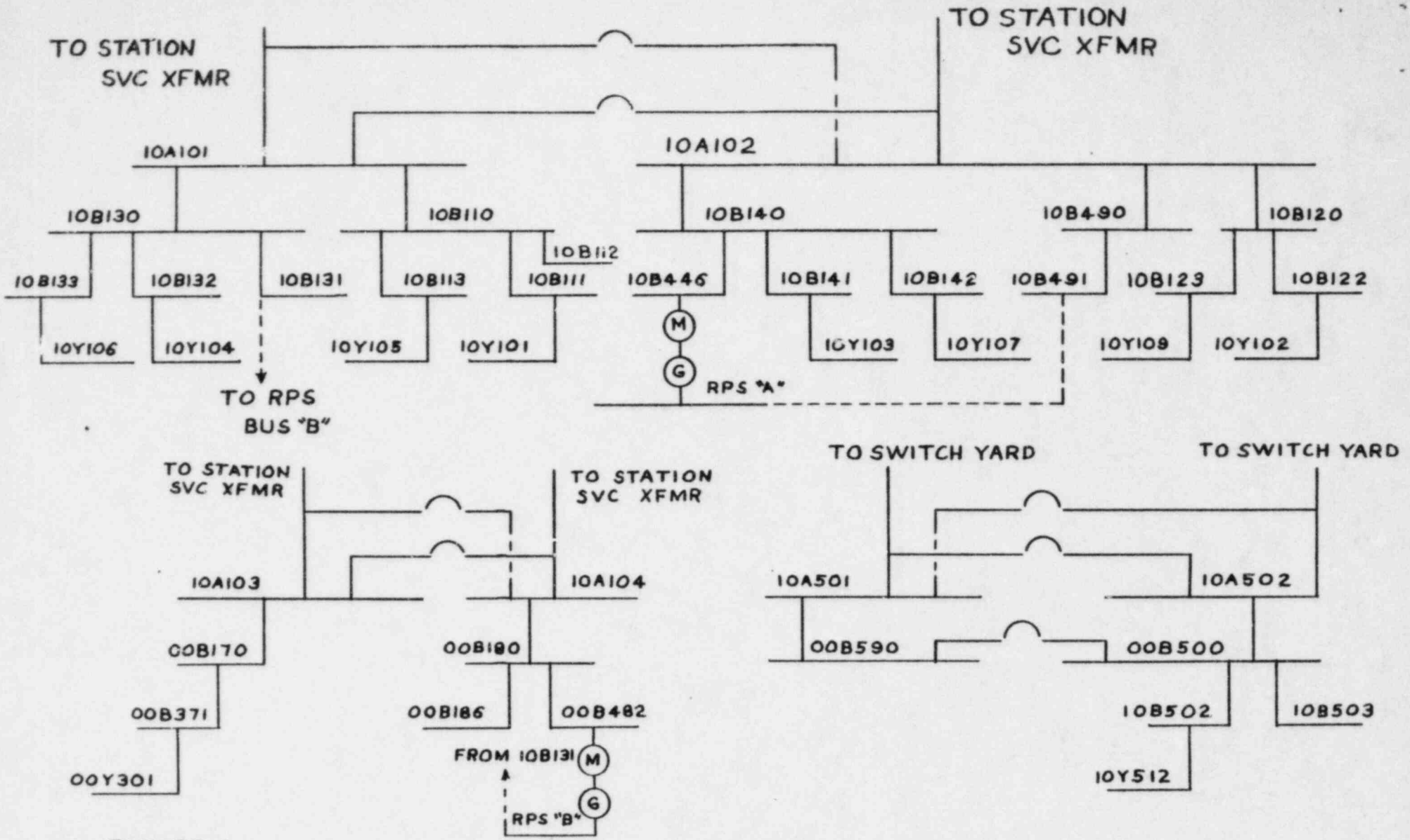


FIGURE 1
AC POWER BUSES

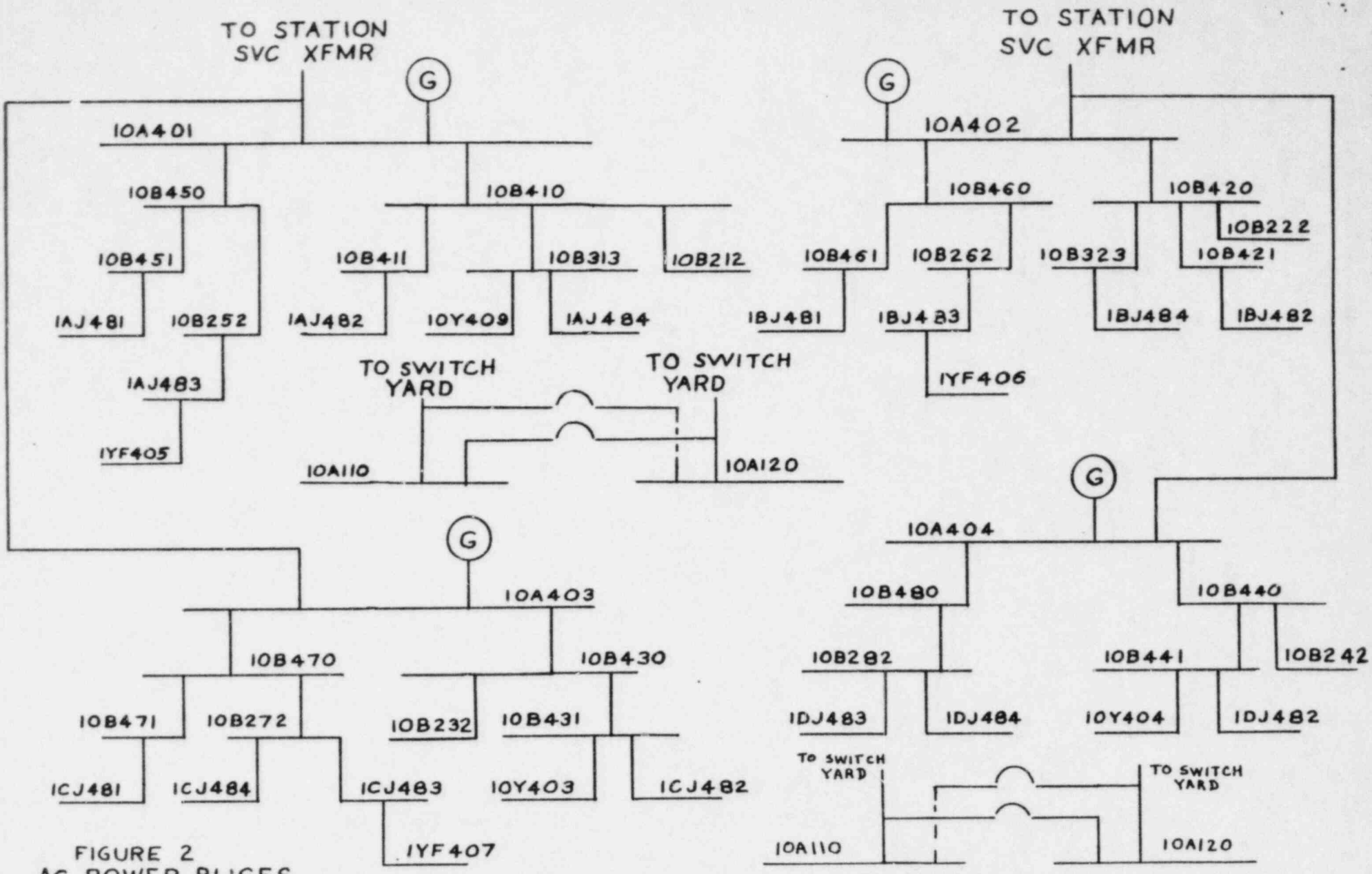


FIGURE 2
AC POWER BUSES

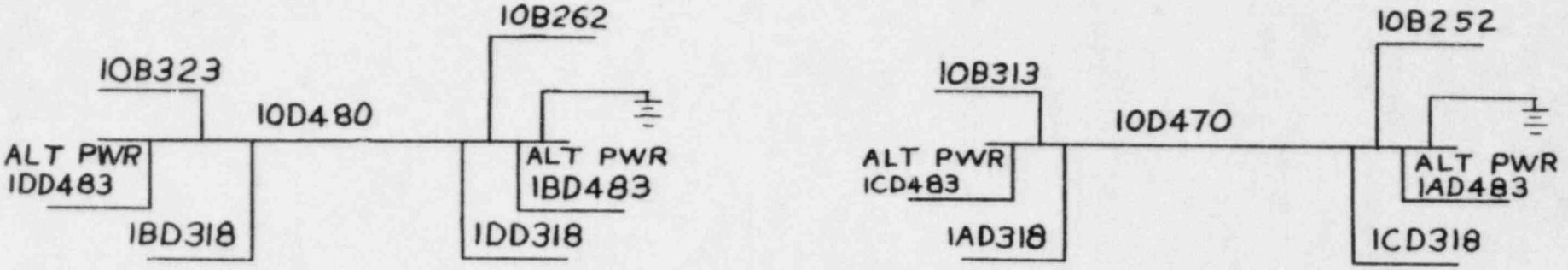


FIGURE 3
D.C. POWER BUSES

APPENDIX A
BUS TABLES

PROJECT HOPE CREEK
SYSTEM FEEDWATER CONTROL
XFMR
BUS 1OD480
MCC
PANEL 1OD318 (125Vdc)
CIRCUIT
DWG. NO. REV.
AE
SH
GE 729E629 10 IED
791E408AC 4 E/D
COMMENTS:

RESPONSIBLE ENGINEER:
ED SCHRULL
DATE:
4/12/84
REVIEWED BY:
R. YASPO

SYSTEM CONTROLS AND INSTRUMENTATION LOADS ON BUS (MPL # AND DESCRIPTION)	PRINCIPAL FUNCTION	EFFECTS WITHIN SYSTEM DUE TO BUS LOSS	EFFECTS ON OTHER SYSTEMS	CODE	EFFECT (WITHIN 30 MIN.) ON REACTOR WATER LEVEL, PRESSURE AND POWER	INPUTS RECEIVED FROM OTHER SYSTEMS AND EFFECT OF INPUT
REACTOR HIGH LEVEL TRIP "B" (C32-N004B)	TRIPS RFP TURBINE AND MAIN TURBINE ON RECEIPT OF 2/3 ("A", "B", "C") HIGH LEVEL SIGNALS	NONE - ONE MORE HIGH LEVEL SIGNAL REQUIRED	NONE	D	NONE	LEVEL SIGNAL FROM B21 - NO EFFECT RRCS SIGNAL - NO EFFECT
SRU-6 (C32-N011B)	POWERS DIFF PRESS XMTRS FOR FEED PUMP "B" DISCHARGE, FEEDWATER FLOW "B" INLET, AND REACTOR LEVEL "B"	PER TELECON 4/17/84 WITH C.W. MA: AN "INCREASE FLOW" SIGNAL WILL BE SENT TO THE FEED PUMPS CONTROL	NONE	A	FEEDWATER FLOW INCREASES WHICH INCREASES WATER LEVEL, COLLAPSES CORE VOIDS, INCREASES POWER AND STEAM FLOW	
(C32-N002B) (C32-N004B/K624B)		50% FLOW INDICATION RESULTS IN NO EFFECT ON RECIRC CAVITATION INTERLOCK	NONE	D	NONE	
		NONE - ONE MORE HIGH LEVEL SIGNAL REQUIRED	NONE	D	NONE	
(C32-N017)	INDICATES WIDE RANGE	NONE	NONE	D	NONE	NONE

CODE CLASSIFICATION FOR EFFECTS ON REACTOR PARAMETERS:
"A" - IMMEDIATE (<1 MIN.) AND DIRECT
"B" - IMMEDIATE BUT INDIRECT
"C" - EFFECT IS DELAYED
"D" - NO EFFECT ON REACTOR PARAMETERS (<30 MIN.)

PROJECT HOPE CREEK

SYSTEM AE-FEEDWATER
AD-CONDENSATE, AF-
HEATER VENT AND DRAIN

XFMR

BUS

MCC 10B141023
(next higher bus)

PANEL 10Y103

CIRCUIT

DWG. NO. REV.

AE E-1410-0 3

SH 142A

GE

COMMENTS:

RESPONSIBLE ENGINEER:
C. DOTSON

DATE:
5/7/84

REVIEWED BY:
S. CHEN

SYSTEM CONTROLS AND INSTRUMENTATION LOADS ON BUS (MPL # AND DESCRIPTION)	PRINCIPAL FUNCTION	EFFECTS WITHIN SYSTEM DUE TO BUS LOSS	EFFECTS ON OTHER SYSTEMS	CODE	EFFECT (WITHIN 30 MIN.) ON REACTOR WATER LEVEL, PRESSURE AND POWER	INPUTS RECEIVED FROM OTHER SYSTEMS AND EFFECT OF INPUT
AC-102 FEEDWATER CONDENSATE TRAIN "A" REMOTE CONTROL PANEL	FEEDWATER/CONDENSATE HEATER LEVEL CONTROL					
	FEEDWATER HEATER LEVEL NORMAL CONTROL LT/LIC/LV-1464A, LT/LIC/LV-1506A, LT/LIC/LV-1514A, LT/LIC/LV-1523A, LT/LIC/LV-1532A	VALVES FAIL CLOSED	CAUSES SLIGHT DECREASE IN FEEDWATER HEATING	C	SLIGHT LOSS IN FEED-WATER. HEATING CAUSES SLIGHT INCREASE IN NEUTRON FLUX/REACTOR POWER	
	FEEDWATER HEATER LEVEL HIGH LEVEL CONTROL LT/LIC/LV-1451A, LT/LIC/LV-1501A, LT/LIC/LV-1513A, LT/LIC/LV-1521A, LT/LIC/LV-1531A	VALVES FAIL OPEN	NONE	D		

CODE CLASSIFICATION FOR EFFECTS ON REACTOR PARAMETERS:
"A" - IMMEDIATE (<1 MIN.) AND DIRECT
"B" - IMMEDIATE BUT INDIRECT
"C" - EFFECT IS DELAYED
"D" - NO EFFECT ON REACTOR PARAMETERS (<30 MIN.)

APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

Elimination Criterion*	Basis
N1	Nonelectrical components (i.e., mechanical and structural components); however, associated functions that are electrically controlled or controlling (including signal inputs to electrical systems) may be relevant to the analysis. N1 examples are piping, tanks, turbines, etc.
N2	Instrumentation with no direct or indirect controlling function or passive input (such as a permissive signal) into control logic. Instrumentation and other dedicated inputs to the process computer, as well as the computer itself, are excluded. Operator actions as a result of indications are not considered control functions for the control systems failure analysis.
N3	Control systems and controlled components (i.e., pumps, valves) that have no direct or indirect interaction with reactor operation/parameters. Examples are communications, most unit heaters and controls, lighting controls, ventilation control systems for exterior building, machine shop equipment, refueling or maintenance equipment controls, etc.
N4	Control systems and controlled components (i.e., pumps, valves) that do interact or interface with reactor operating systems but cannot affect the reactor parameters (water level, pressure or reactivity) either directly or indirectly.
N5	Systems or components that cannot affect reactor parameters within 30 minutes of the loss of any power bus or combination thereof.
N6	Systems that are not used during normal power operation. For example, start-up, shutdown or refueling systems not used during normal operation may be eliminated.
N7	Electrical components involved in distribution, tranformation or interruption of power; however, controls for these components may need to be considered if loss of such control power may lead to failure of other electrical busses.
N8	Safety systems, except for their response to conditions brought about by control systems failures. Example: A level 3 scram will be assumed for a loss-of-feedwater event.

* In some cases, more than one of these criteria may apply.

APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS
OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

RELATED P&ID	GE MPL NO.	ELIMINATION CRITERION	SYSTEM/SUBSYSTEMS
			I. REACTOR SYSTEMS
M42	B21	*	Nuclear Boiler Vessel Instrumentation
M25	B21	*	Steam Leak Detection System
M43	B31	*	Reactor Recirculation System
M26	D11	*	Process Radiation Monitoring System
M44/M45	G33	*	Reactor Water Cleanup System (RWCU)
M46/M47	C11	*	Control Rod Drive Hydraulics System
M48	C41	N8/N6	Standby Liquid Control System (SLC)
M49/M50	E51	N8/N6	Reactor Core Isolation Cooling (RCIC)
M51	E21	N8/N6	Residual Heat Removal System (RHR)
M52	E21	N8/N6	Core Spray System (CS)
M55/M56	E41	N8/N6	High Pressure Cooling INjection (HPCI)
	C71	N8	Reactor Protection System (RPS)
M41	B21	N8	Automatic Depressurization System (ADS)
M42	B21	*	Jet Pump Instrumentation System
M41	B21	N8	Nuclear Steam Supply Shutoff System
Various		N8	Primary Containment Isolation System
	C22	N8	Redundant Reactivity Control System
M72		N8/N6	Main Steam Isolation Valve Sealing System
M53/M54		N3	Fuel Pool Cooling & Torus Water Cleanup
M57			Containment Atmosphere Control
M58		N8/N6	Containment Hydrogen Recombination System
M57		N1	Primary Containment Vacuum Relief System
	C51	*	Neutron Monitoring System

* To be included in analysis.

APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS
OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

RELATED P&ID	GE MPL NO.	ELIMINATION CRITERION	SYSTEM/SUBSYSTEMS
M41		N3	Safety Relief Valve Position Indication
	C11	*	Reactor Manual Control System
M59		*	Primary Containment Instrument Gas System
Various		N6/N8	Remote Shutdown System
M38		N6	Post Accident Liquid & Gas Sampling

* To be included in analysis.

APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS
OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

RELATED P&ID	GE MPL NO.	ELIMINATION CRITERION	SYSTEM/SUBSYSTEMS
			II. TURBINE/GENERATOR SYSTEM
M1		*	Main Steam System
		*	Main Turbine System
		*	Turbine Control System
M2		*	Extraction Steam System
M3/M4		*	Heater Vent & Drain System
M5		*	Condensate System
M6		*	Feedwater System
	C32	*	Feedwater Control System
M7		*	Condenser Air Removal System
M8		N5	Condensate & Refueling Water Storage & Transfer
M16		*	Condensate Demineralizer
M19		*	Lube Oil System
M29		*	Turbine Sealing Steam
M31		*	Reactor Feed Pump Turbine Steam System
M9		*	Circulating Water System
		*	Generator System
		*	Generator Excitation System
M28		*	Generator Gas Control System

* To be included in analysis.

APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS
OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

RELATED P&ID	GE MPL NO.	ELIMINATION CRITERION	SYSTEM/SUBSYSTEMS
			III. AUXILIARY SYSTEMS
		N8/N6	Diesel Generator System
M30		N8/N6	Diesel Engine Auxiliary System
M20		N3/N6	Auxiliary Boiler Fuel Oil System
M21		N3/N6	Auxiliary Steam System
M10		*	Service Water System
M11		*	Safety Aux Cooling (SAC), Reactor Building
M12		*	Safety Aux Cooling, Aux Building
M13		*	Reactor Auxiliary Cooling (RAC)
M14		*	Turbine Auxiliary Cooling
M24		N5	Circulation & Service Water Hypochlorination & CW Acid Injection
M15		*	Compressed Air System
M18		N4	Demineralizer Water Makeup Storage & Transfer
M22		N3	Fire Protection
M23		N4	Process Sampling
M25	B21	*	Plant Leak Detection System
M26		*	Radiological Monitoring System
M33		N3	Low Volume & Oily Wastewater Treatment
M17		N3	Fresh Water Supply
M71		*	Liquid N_2 for Purge & Containment Inerting
M94/M97		N3	Building Drainage System
M99		N6	Primary Containment Leak Testing
		N3	Site Environs Radiation Monitoring
M98		N3	Domestic Water System

* To be included in analysis.

APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS
OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

RELATED P&ID	GE MPL NO.	ELIMINATION CRITERION	SYSTEM/SUBSYSTEMS
			IV. HEATING, VENTILATION, AIR CONDITION AND COOLING (HVAC) SYSTEMS
M36/M37		N3	Guard House HVAC System
M73/M74		N3	Admin. Building & Warehouse HVAC System
M82		*	Turbine Building Supply & Exhaust Vent System
M83/M84		*	Reactor Building Supply & Exhaust Vent System (FRVS)
M86		*	Drywell Vent Control System
M88		N3	Auxiliary Bldg-Diesel Area Vent Control System
M89		*	Auxiliary Bldg-Control Area Vent Control System
M92		N3	Auxiliary Bldg - RW Area Vent Control System
M93		N3	Aux Bldg-Service Area & TSC Vent Control System
M87		*	Chilled Water System
M90		*	Aux Bldg - Control Area Chilled Water System
M95		N3	Misc Structure & Yard Bldgs Vent Control Systems
M96		N3	Plant Heating System

* To be included in analysis.

APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS
OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

RELATED P&ID	GE MPL NO.	ELIMINATION CRITERION	SYSTEM/SUBSYSTEMS
			V. RADWASTE SYSTEM
M69/M70		*	Gaseous Radwaste System
M61/M62		N3	Liquid Radwaste System
M63/M64			
M65			
M66/M67		N3	Solid Radwaste System
M68			

* To be included in analysis.

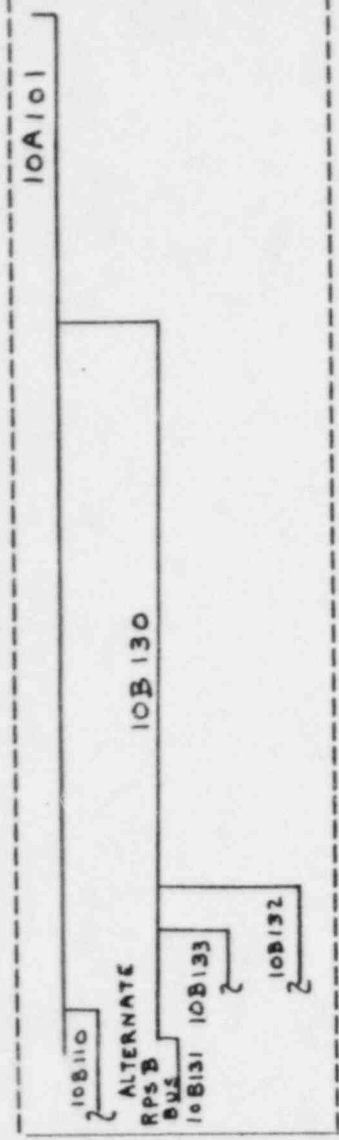
APPENDIX B
CRITERIA FOR ELIMINATION OF SYSTEMS AND COMPONENTS
OF SYSTEMS FROM THE CONTROL SYSTEMS FAILURE ANALYSIS

RELATED P&ID	GE MPL NO.	ELIMINATION CRITERION	SYSTEM/SUBSYSTEMS
			VI. ELECTRICAL SYSTEMS
		N3	Communication System
		N3	Lighting System
		*	Class IE AC System
		*	Non Class IE AC System
		*	Class IE DC System
		*	Non Class IE DC System

* To be included in analysis.

APPENDIX C

HOPE CREEK CONTROL COMMON POWER FAILURE ANALYSIS



SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
CHILLED WATER	1CK111 WATER CHILLER	AUTO START CHILLER STANDING BY (OTHER TWO RUNNING) IF STANDBY CHILLER NOT AVAILABLE INCREASE IN DRYWELL PRESSURE IF NO CHILLED WATER, REACTOR SCRAM AND HPCI INITIATION ON HIGH DRYWELL PRESSURE	NONE	FOR COMBINED EFFECTS, SEE SECTION 4
CHILLED WATER	1AP161 CHILLED WATER IF ANY ESSENTIAL BUS (10A410, 10A402, 10A403, 10A404) LOST AUTO SWITCH TO REACTOR AUXILIARY COOLING SYSTEM (RACS)	START PUMP STANDING BY (OTHER RUNNING)	NONE	NONE
RECIRCULATION SYSTEM	AC RECIRC LUBE OIL PUMPS A1 AND B1	PUMPS STOP AUTO TRANSFER TO LUBE OIL PUMPS A2,B2 (10B140)	NONE	
COMPRESSED AIR SYSTEM	1SV7889 SOLENOID ACTUATING 10K107 AUX MECH OIL PUMP	10K107 AUX OIL PUMP NOT AVAILABLE	NONE	
	0SV7885 SOLENOID ACTUATING 00K107 AUX MECH OIL PUMP	00K107 AUX OIL PUMP NOT AVAILABLE (00B186)	NONE	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10B133, 10B132, 10Y104	CONDENSATE SYSTEM	SECONDARY CONDENSATE PUMP B CONTROL CIRCUITS	SECONDARY CONDENSATE PUMP B STOPS TRIP REACTOR FEED PUMP B, FLOW DECREASE TO 85%	RECIRCULATION RUNBACK	REACTOR SCRAM ON LOW WATER LEVEL
		SECONDARY CONDENSATE PUMP B RECIRC VALVE	VALVE OPENS REDUCING FEEDWATER FLOW, TRIPPING FEEDWATER PUMPS A, B, AND C ON LOW SUCTION PRESSURE	REACTOR SCRAM ON LOW WATER LEVEL	
	FEEDWATER VENTS, DRAINS AND HEATERS SYSTEM	FEEDWATER HEATER TRAIN B LEVEL, DRAIN AND DUMP VALVES LV1464B, LV1506B, LV1514B, LV1523B, LV1532B	CLOSE NORMAL DRAINS TO HEATER TRAIN B	NONE	
		LV1451B VALVE LV1505B VALVE LV1513B VALVE LV1521B VALVE LV1531B VALVE	DUMP EXTRACTION STEAM TO MAIN CONDENSER B	NONE	
		HEATER TRAIN B HI HI LEVEL SWITCHES	LEVEL SWITCHES FAIL CLOSED CAUSING HV1620B AND HV1638B VALVES TO CLOSE	REDUCE FEEDWATER HEATING BY LESS THAN 100°F	REDUCE FEEDWATER HEATING BY LESS THAN 100°F
10B133, 10Y106	COMPRESSED AIR SYSTEM	SERVICE AIR COMPRESSORS 00K107 AND 10K107 CONTROL CIRCUITRY	BOTH COMPRESSORS DISABLED MANUAL STARTUP OF 10K100 AIR COMPRESSOR LOSS OF INSTRUMENT AIR IF NOT AVAILABLE (10Y409)	MAIN STEAM ISOLATION VALVES CLOSURE IN MINUTES	REACTOR SCRAM ON LOW WATER LEVEL
	CONDENSATE SYSTEM	SECONDARY CONDENSATE PUMP C RECIRC VALVE	VALVE OPENS REDUCING FEEDWATER FLOW, TRIPPING FEEDWATER PUMPS A, B, AND C ON LOW SUCTION PRESSURE	REACTOR SCRAM ON LOW WATER LEVEL	
	FEEDWATER VENTS, DRAINS AND HEATERS SYSTEM	HEATER TRAIN C HI HI LEVEL SWITCHES	LEVEL SWITCHES FAIL CLOSED CAUSING HV1620C AND HV1638C VALVES TO CLOSE	REDUCE FEEDWATER HEATING BY LESS THAN 100°F	

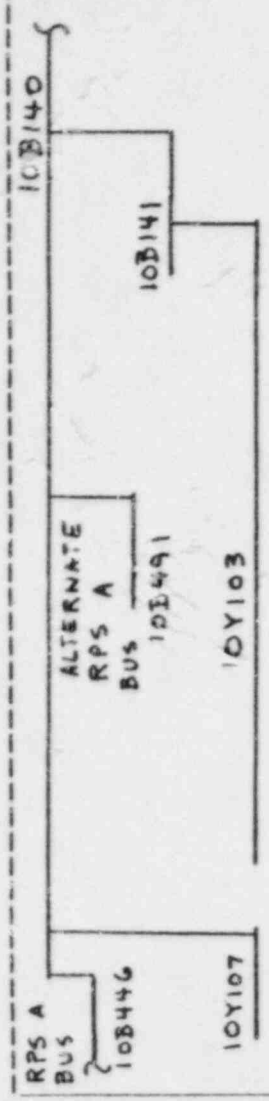
APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10B110	GENERATOR SYSTEM	GENERATOR STATOR COOLING WATER PUMP 1AP119	PUMP 1AP119 STOPS IF AVAILABLE, AUTO TRANSFER TO PUMP 1BP119 (10B120)	NONE	
10B110	CHILLED WATER	1CP161 CHILLED WATER PUMP IF ANY ESSENTIAL BUS (10A401, 10A402, 10A403, 10A404) LOST AUTO SWITCH TO REACTOR AUXILIARY COOLING SYSTEM (RACS)	START PUMP STANDING BY (OTHER RUNNING)	NONE	
10B112	TURBINE-GENERATOR SYSTEM	HYDRAULIC EHC PUMP 1AP116	PUMP STOPS TURBINE TRIP IF 1BP116 NOT AVAILABLE	NONE	NONE
10Y101	CONDENSATE SYSTEM	SV1650A,B,C SECONDARY CONDENSATE PUMP RECIRC VALVES	VALVES FAIL OPEN AND DISCHARGE TO MAIN CONDENSERS REACTOR FEED PUMP A, B AND C TRIP ON LOW SUCTION PRESSURE	REACTOR SCRAM ON LOW LEVEL	REACTOR SCRAM ON LOW LEVEL
10B113	COMPRESSED AIR SYSTEM	COMPRESSOR 10K107 LUBE OIL PUMP	OIL PUMP STOPS LOSE AIR COMPRESSOR IF AUXILIARY LUBE OIL PUMP NOT AVAILABLE (1SV7889 ON 10B130)	NONE	NONE
10B113	TURBINE-GENERATOR SYSTEM	TURBINE MOTOR SUCTION OIL PUMP 10P108	OIL PUMP NOT AVAILABLE, USED DURING STARTUP	NONE	
10Y105	GENERATOR SYSTEM	COOLING WATER PANEL CIRCUITS	DE-ENERGIZE LOSS OF STATOR COOLING WATER TRIP CIRCUIT	LOSE CAPABILITY TO TRIP TURBINE ON LOSS OF STATOR COOLING WATER (PUMPS AP119 AND BP119)	NONE

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
CONDENSATE SYSTEM	PRIMARY CONDENSATE PUMP 1CP102	PUMP 1CP102 STOPS	RECIRCULATION RUNBACK	FOR COMBINED EFFECTS, SEE SECTION 4
GENERATOR SYSTEM	GENERATOR STATOR COOLING WATER PUMP 1BP119	PUMP 1BP119 STOPS IF AVAILABLE, AUTO TRANSFER TO PUMP 1AP119 (10B110)	IF AVAILABLE, AUTO TRANSFER TO PUMP 1AP119 (10B110) REACTOR AT OPERATING POWER WITH RECIRCULATION PUMPS LOCKED AT LAST SPEED	
[illegible] WATER SYSTEM	1BP161 CHILLED WATER PUMP. IF ANY ESSENTIAL BUS (10A401, 10A402, 10A403, 10A404) LOST, AUTO SWITCH TO REACTOR AUXILIARY COOLING SYSTEM (RACS)	START PUMP STANDING BY (OTHER RUNNING)	NONE	
[illegible]E SYSTEM	SECONDARY CONDENSATE PUMP C CONTROL CIRCUITS	SECONDARY CONDENSATE PUMP C STOPS. TRIP REACTOR FEED PUMP C. FLOW DECREASES TO 85%.	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
FEEDWATER VENTS, DRAINS AND HEATERS SYSTEM	FEEDWATER HEATER TRAIN C LEVEL, DRAIN AND DUMP VALVES LV1414C, LV1506C, LV1514C, LV1523C, LV1532C	CLOSE NORMAL DRAINS TO HEATER TRAIN C	NONE	
	LV1451C VALVE LV1505C VALVE LV1513C VALVE LV1521C VALVE LV1531C VALVE	DUMP EXTRACTION STEAM TO MAIN CONDENSER C	NONE	
RECIRCULATION SYSTEM	SCOOP TUBE FOR PUMP A	SCOOP TUBE LOCKS IN POSITION PUMP REMAINS AT LAST SPEED	RECIRCULATION PUMP A REMAINS AT LAST SPEED	RECIRCULATION PUMP A REMAINS AT LAST SPEED

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS



SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
RECIRCULATION SYSTEM	AC RECIRC LUBE OIL PUMPS A2 AND B2	PUMPS STOP AUTO TRANSFER TO LUBE OIL PUMP A1 AND B1 (10B130)	NONE	REACTOR SCRAM ON LOW WATER LEVEL
TURBINE GENERATOR SYSTEM	HYDRAULIC EHC PUMP 1AP116	NONE, TURBINE TRIP IF PUMP 1AP116 NOT AVAILABLE (10B112)	NONE	
CONDENSATE SYSTEM	SECONDARY CONDENSATE PUMP A CONTROL CIRCUITS	SECONDARY CONDENSATE PUMP A TRIP REACTOR FEED PUMP A, FLOW DECREASES TO 85%	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
	SECONDARY CONDENSATE PUMP A RECIRC VALVE	VALVE OPENS REDUCING FEEDWATER FLOW, TRIPPING FEEDWATER PUMPS A, B, AND C ON LOW SUCTION PRESSURE	REACTOR SCRAM ON LOW WATER LEVEL	REACTOR SCRAM ON LOW WATER LEVEL
FEEDWATER VENTS, DRAINS AND HEATERS SYSTEM	FEEDWATER HEATER TRAIN A LEVEL, DRAIN AND DUMP VALVES LV1464A, LV1506A, LV1514A, LV1523A, LV1532A	CLOSE NORMAL DRAINS TO HEATER TRAIN A	NONE	
	LV1451A VALVE LV1505A VALVE LV1513A VALVE LV1521A VALVE LV1531A VALVE	DUMP EXTRACTION STEAM TO MAIN CONDENSER A	NONE	
	HEATER TRAIN A HI HI LEVEL SWITCHES	LEVEL SWITCHES FAIL CLOSED CAUSING HV1620A AND HV1638A TO FAIL CLOSED	FEEDWATER HEATING REDUCED BY LESS THAN 100°F	FEEDWATER HEATING REDUCED BY LESS THAN 100°F
RECIRCULATION SYSTEM	SCOOP TUBE CIRCUITS FOR PUMP B	SCOOP TUBE LOCKED IN POSITION PUMP REMAINS AT LAST SPEED	RECIRCULATION PUMP B REMAINS AT LAST SPEED	RECIRCULATION PUMP B REMAINS AT LAST SPEED

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

RPS A BUS 10B446

SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
PROCESS RADIATION MONITORING SYSTEM	HIGH RADIATION TRIP CIRCUITS	½ REACTOR SCRAM TRIP (CHANNELS A1 AND A2) REACTOR SCRAM IF CHANNELS A1 OR A2 TRIPPED	NONE	
		½ REACTOR MAIN STEAM ISOLATION TRIP (CHANNELS A1 AND A2) MAIN STEAM ISOLATION IF CHANNELS B1 OR B2 TRIPPED	NONE	
LEAK DETECTION SYSTEM	HIGH TEMPERATURE TRIP CIRCUITS	½ MAIN STEAM ISOLATION TRIP (CHANNELS A1 & A2)	NONE	
		ISOLATE REACTOR WATER CLEANUP	NONE	
		ISOLATE MAIN STEAM DRAIN VALVES RPS BUS "A" BACKED UP BY ALTERNATE BUS 10B491		
RECIRCULATION SYSTEM	CONTROL CIRCUITS FOR RECIRCULATION PUMP MOTORS A AND B SCOOP TUBES DEMAND SIGNAL	PUMP MOTORS LOCKED AT LAST SPEED	RECIRCULATION PUMPS A AND B REMAIN AT LAST SPEED	RECIRCULATION PUMPS A AND B REMAIN AT LAST SPEED

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10A103 00Y301	OFFGAS SYSTEM	UNIT 1 AND COMMON RECOMBINER ANALYZER PANELS	LOSE STEAM JET AIR EJECTOR	MAIN TURBINE TRIP IN 10 ± 1 MINUTES ON LOW CONDENSER VACUUM	MAIN TURBINE TRIP IN 10 ± 1 MINUTES ON LOW CONDENSER VACUUM
		A1S5724 HIGH HYDROGEN TRIP SOLENOID	DE-ENERGIZE A1S5724	MAIN TURBINE TRIP	MAIN TURBINE TRIP
		STEAM SUPPLY VALVES PV5641 AND SV5640 FAIL CLOSED	LOSE STEAM JET AIR EJECTOR	MAIN TURBINE TRIP IN 10 ± 1 MINUTES ON LOW CONDENSER VACUUM	

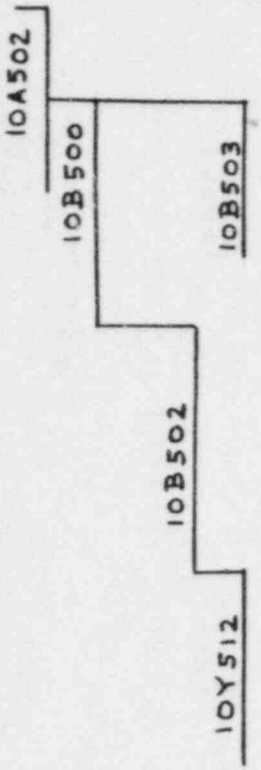
APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10A104 / 00B180 / 00B186	CONDENSATE SYSTEM	SECONDARY CONDENSATE PUMP 1CP137	PUMP 1CP137 STOPS	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
	COMPRESSED AIR SYSTEM	MAIN LUBE OIL PUMP OP178 TO COMPRESSOR 00K107	LUBE OIL PUMP STOPS START AUX (10B130) MECH LUBE OIL PUMP 00P179	NONE	
00B482	PROCESS RADIATION MONITORING SYSTEM	HIGH RADIATION TRIP CIRCUITS	½ REACTOR SCRAM TRIP (CHANNELS B1 AND B2) REACTOR SCRAM IF CHANNELS A1 OR A2 TRIPPED	NONE	
			½ REACTOR MAIN STEAM ISOLATION TRIP (CHANNELS B1 AND B2) MAIN STEAM ISOLATION IF CHANNELS A1 OR A2 TRIPPED	NONE	
	LEAK DETECTION SYSTEM	HIGH TEMPERATURE TRIP CIRCUITS	½ MAIN STEAH ISOLATION TRIP (CHANNELS B1 & B2) ISOLATE REACTOR WATER CLEANUP ISOLATE MAIN STEAM DRAIN VALVES RPS BUS "B" BACKED UP BY ALTERNATE BUS 10B131	NONE	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10A501	CIRCULATING WATER	CIRCULATING WATER PUMPS 1BP501 AND 1DP501	PUMPS 1BP501 AND 1DP501 STOP	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS



SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
CIRCULATING WATER SYSTEM	CIRCULATING WATER PUMPS 1AP501 AND 1CP501	PUMPS 1AP501 AND 1CP501 STOP	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
CIRCULATING WATER SYSTEM	HV2152C CONTROL CIRCUIT HV2152D CONTROL CIRCUIT	HV2152C AND HV2152D FAIL AS IS (IN POSITION)	NONE	
CIRCULATING WATER SYSTEM	HV2152A CONTROL CIRCUIT HV2152B CONTROL CIRCUIT	HV2152A AND HV2152B FAIL AS IS (IN POSITION)	NONE	
CIRCULATING WATER SYSTEM	HYDRAULIC FLUID PUMPS AS517, BS517 AND CS517	FLOW CONTROL VALVES HV2152A, HV2152B AND HV2152C REMAIN IN LAST POSITION LOSE CIRCULATING WATER IF HYDRAULIC LEAK EXISTS	NONE	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10A110	RECIRCULATION SYSTEM	PUMP MOTOR 1AP201	MOTOR STOPS	RECIRCULATION PUMP A TRIP	
	COMPRESSED AIR SYSTEM	AIR COMPRESSOR 10K107 MOTOR	MOTOR STOPS	NONE	RECIRCULATION RUNBACK ON SINGLE PUMP
			AUTOMATIC STARTUP OF AIR COMPRESSOR 00K107		
	CONDENSATE SYSTEM	PRIMARY CONDENSATE PUMP MOTOR 1AP102	MOTOR STOPS	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
		SECONDARY CONDENSATE PUMP MOTOR 1AP137	MOTOR STOPS		
	CHILLED WATER SYSTEM	1AK111 WATER CHILLER		NONE	
		1DK111 WATER CHILLER	AUTO START CHILLER STANDING BY (OTHER TWO RUNNING)		
			IF STANDBY CHILLER NOT AVAILABLE INCREASE IN DRYWELL PRESSURE		

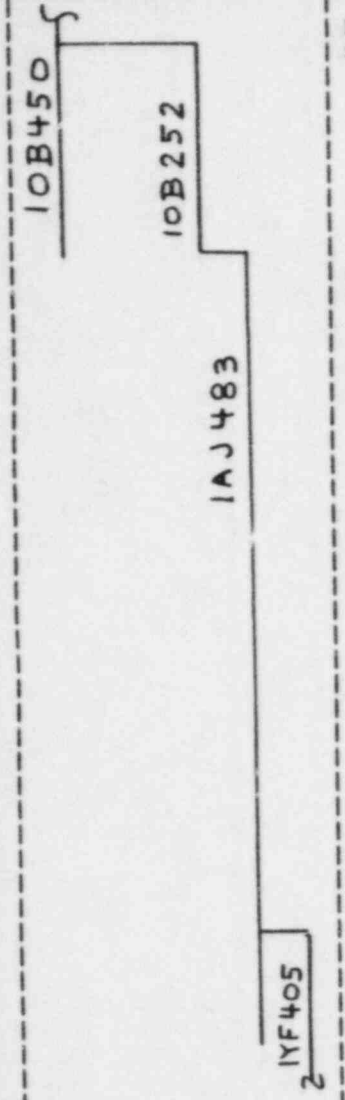
APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10A120	RECIRCULATION SYSTEM	PUMP MOTOR 1BP201	MOTOR STOPS	RECIRCULATION PUMP B TRIP	
	CONDENSATE SYSTEM	PRIMARY CONDENSATE PUMP MOTOR 1BP102	MOTOR STOPS	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK ON SINGLE PUMP
		SECONDARY CONDENSATE PUMP MOTOR 1BP137	MOTOR STOPS.		
	COMPRESSED AIR SYSTEM	AIR COMPRESSOR 00K107 MOTOR	MOTOR STOPS	NONE	
			AUTOMATIC STARTUP OF AIR COMPRESSOR 10K107		
	CHILLED WATER SYSTEM	1BK111 WATER CHILLER	AUTO START CHILLER STANDING BY (OTHER TWO RUNNING)	NONE	
			IF STANDBY CHILLER NOT AVAILABLE INCREASE IN DRYWELL PRESSURE		

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10A401	SAFETY AUXILIARY COOLING SYSTEM	COOLING WATER PUMP 1AP210 (LOOP A)	LOSE RHR HEAT EXCHANGERS COOLING AND TURBINE COOLING IF AUTO TRANSFER TO STANDBY LOOP NOT AVAILABLE (10A402) PUMP 1BP210 (10A404) PUMP 1DP210 LOSS OF BUS 10A401 TRANSFERS DRYWELL COOLERS TO REACTOR AUXILIARY COOLING SYSTEM	NONE	FOR COMBINED EFFECTS, SEE SECTION 4
1AJ481	SAFETY AUXILIARY COOLING SYSTEM	REMOTE CONTROL PANEL 1AC201 TACS LOOP SUPPLY VALVES HV2522A, E AND F ISOLATION ON LOW ACCUMULATOR PRESSURE CIRCUITRY PT2509, PT2546, PT2545, PT2543, PT2523, PT2587	INITIATE TACS ISOLATION SACS STANDBY LOOP STARTS AUTOMATICALLY	MAIN TURBINE TRIP	MAIN TURBINE TRIP
10B212	REACTOR AUXILIARY COOLING SYSTEM	REACTOR AUXILIARY COOLING PUMP 1AP209	PUMP STOPS, CAUSING LOSS OF OFFGAS RECOMBINER	MAIN TURBINE TRIP IN 10 ± 1 MINUTES ON LOW CONDENSER VACUUM	MAIN TURBINE TRIP IN 10 ± 1 MINUTES
10B450	SAFETY AUXILIARY COOLING SYSTEM	TACS LOOP DISH VALVE HV2496A	INITIATE TACS ISOLATION SACS STANDBY LOOP STARTS AUTOMATICALLY	TURBINE TRIP	MAIN TURBINE TRIP
10B410					

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS



SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
DRYWELL VENT CONTROL SYSTEM	DRYWELL COOLER A FANS	LOSS OF DRYWELL COOLER A AUTOMATIC STARTUP OF DRYWELL COOLER B (10B262)	NONE	MAIN TURBINE TRIP
REACTOR FEED PUMP TURBINE STEAM SYSTEM	REACTOR FEED PUMP TURBINE A CONTROL CIRCUITS	REACTOR FEED PUMP TURBINE A STOPS	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
POWER RANGE NEUTRON MONITORING SYSTEM	NEUTRON MONITORING CIRCUITRY	½ REACTOR SCRAM TRIP (CHANNELS A1 AND A2) REACTOR SCRAM IF CHANNEL B1 OR B2 TRIPPED	NONE	
TURBINE-GENERATOR SYSTEM	TURBINE MECHANICAL TRIP SOLENOID	LOSE CAPABILITY TO MECHANICALLY TRIP TURBINE	LOSE CAPABILITY TO MECHANICALLY TRIP MAIN TURBINE	LOSE CAPABILITY TO MECHANICALLY TRIP MAIN TURBINE
	TURBINE BYPASS VALVES CONTROL CIRCUIT	MAIN TURBINE BYPASS VALVES FAIL OPEN	MAIN TURBINE BYPASS VALVES FAIL OPEN	MAIN TURBINE BYPASS VALVES FAIL OPEN

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
1YF405 2	FEEDWATER SYSTEM	RFP REC1RC CONTROL VALVE FV1783A	FV1783A DUMPS TO MAIN CONDENSER A	NONE	
	FEEDWATER VENTS, DRAINS AND HEATERS SYSTEM	FEEDWATER HEATER TRAIN A LEVEL, DRAIN AND DUMP VALVES	REDUCE MAIN CONDENSER A VACUUM		
		LV1506A VALVE LV1514A VALVE LV1523A VALVE LV1532A VALVE	CLOSE NORMAL DRAINS TO HEATER TRAIN A	NONE	
	EXTRACTION STEAM SYSTEM	HV1373A VALVE HV1388A VALVE HV1355A VALVE HV1377A VALVE HV1387A VALVE HV1366A VALVE HV1359A VALVE HV1367A VALVE	EXTRACTION STEAM DUMPS TO MAIN CONDENSER A	NONE	
		MOISTURE SEPARATOR DRAIN CONTROL VALVES LV1363A, LV1364A	DRAIN VALVES FAIL CLOSED MAIN TURBINE TRIP IF A, B & C DRAIN VALVES CLOSED	NONE	
	SAFETY AUXILIARY COOLING SYSTEM	TACS LOOP SUPPLY VALVES HV2522 E AND F	INITIATE TACS ISOLATION	MAIN TURBINE TRIP	MAIN TURBINE TRIP

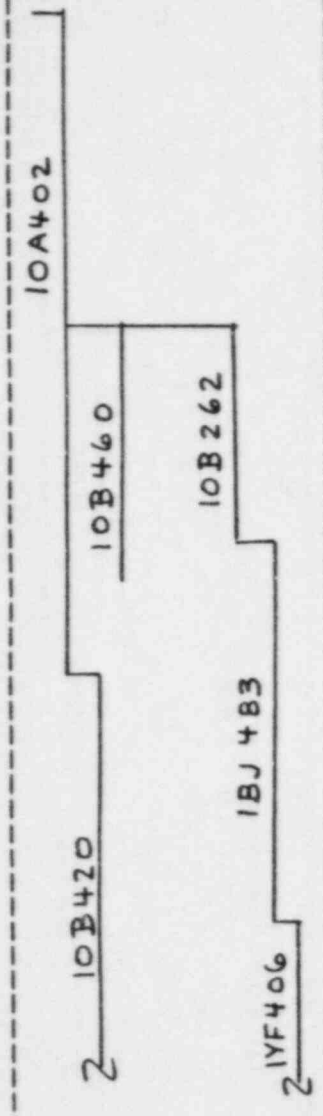
APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10B410 / 1AJ482	SAFETY AUXILIARY COOLING SYSTEM	BAILEY PANEL 1AC655 CONTROL CIRCUITRY TO SACS PUMP 1AP210	TRIP SACS PUMP 1AP210 SACS STANDBY LOOP STARTS AUTOMATICALLY	NONE	REACTOR SCRAM ON LOW WATER LEVEL
		BAILEY PANEL 1AC652 SACS LOOP SUPPLY VALVE HV2522A	INITIATE LOOP ISOLATION		
10B313 / 10Y409	COMPRESSED AIR SYSTEM	EMERGENCY INSTRUMENT AIR COMPRESSOR 10K100	COMPRESSOR NOT AVAILABLE COMPRESSORS 00K10 AND 10K107 EMERGENCY BACKUP NOT AVAILABLE	NONE	
1AJ484	FEEDWATER VENTS, DRAINS AND HEATERS	PANEL 1AC653 LV1506A VALVE LV1514A VALVE LV1523A VALVE LV1532A VALVE	CLOSE NORMAL DRAINS TO HEATER TRAIN A	NONE	
	EXTRACTION STEAM SYSTEM	PANEL 1AC653 HV1373A VALVE HV1388A VALVE HV1355A VALVE HV1377A VALVE HV1387A VALVE HV1366A VALVE HV1359A VALVE HV1367A VALVE	DUMP EXTRACTION STEAM TO MAIN CONDENSER A	NONE	
		PANEL 1AC653 MOISTURE SEPARATOR DRAIN CONTROL VALVES LV1363 AND LV1364	DRAIN VALVES FAIL CLOSED MAIN TURBINE TRIP IF A, B AND C DRAIN VALVES CLOSED	NONE	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
1AJ484 2	REACTOR FEED PUMP TURBINE STEAM SYSTEM	PANEL 1AC653 REACTOR FEED PUMP TURBINE A CONTROL CIRCUITS	REACTOR FEED PUMP TURBINES A, B AND C LOCKED AT LAST SPEED. CIRCUIT DE-ENERGIZED.	REACTOR FEED PUMP TURBINES A, B AND C LOCKED AT LAST SPEED	REACTOR LOW WATER LEVEL SCRAM
			REACTOR FEED PUMP TURBINE A STOPS, FLOW DECREASES TO 85%.	RECIRCULATION RUNBACK	
		PANEL 1AC654 FEEDWATER PUMP RECIRC VALVES A, B & C CONTROL CIRCUIT	FEEDWATER PUMP RECIRC VALVES A, B & C FAIL OPEN AND DUMP TO CONDENSERS. LOSE 1/3 FEEDWATER FLOW.	REACTOR SCRAM ON LOW WATER LEVEL	
			DECREASE CONDENSER VACUUM	NONE	
			FEEDWATER RUNBACK CIRCUITS A, B AND C DISABLED	FEEDWATER RUNBACK CIRCUITS A, B AND C DISABLED	
		PANEL 1AC653 PRIMARY CONDENSATE PUMPS A, B AND C CONDENSER HOTWELL LOW-LOW LEVEL TRIP CIRCUITRY	TRIP SECONDARY CONDENSATE PUMPS AND REACTOR FEED PUMPS	REACTOR LOW LEVEL SCRAM	
	COMPRESSED AIR SYSTEM	PANEL 1AC653 EMERGENCY AIR COMPRESSOR 10K100	AIR COMPRESSOR NOT AVAILABLE TO BACKUP COMPRESSORS 00K107 AND 10K107	NONE	
	OFFGAS SYSTEM	PANEL 1AC653 CONTROL CIRCUIT FOR VALVES HV5643A, HV5646, HV5666A	LOSE STEAM JET AIR EJECTOR A	MAIN TURBINE TRIP IN 10 ±1 MINUTE	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS



SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
SAFETY AUXILIARY COOLING SYSTEM	COOLING WATER PUMP 1BP210 (LOOP B)	LOSE RHR HEAT EXCHANGER COOLING AND TURBINE COOLING IF AUTO TRANSFER TO STANDBY LOOP NOT AVAILABLE (10A401) PUMP 1AP210 (10A402) PUMP 1CP210 LOSS OF BUS 10A402 TRANSFERS DRYWELL COOLERS TO REACTOR AUXILIARY COOLING SYSTEM	NONE	MAIN TURBINE TRIP
DRYWELL VENT CONTROL SYSTEM	DRYWELL COOLER B FANS	LOSS OF DRYWELL COOLER B AUTOMATIC STARTUP OF DRYWELL COOLER A (10B252)	NONE	RECIRCULATION RUNBACK
REACTOR FEED PUMP TURBINE STEAM SYSTEM	REACTOR FEED PUMP TURBINE B CONTROL CIRCUITS	REACTOR FEED PUMP TURBINE B STOPS, FLOW DECREASES TO 85%. LOSE FEEDWATER CONTROL SIGNALS A, B AND C LOCKING TURBINES AT LAST SPEED	RECIRCULATION RUNBACK FEED WATER TURBINES LOCKED AT LAST SPEED	
FEEDWATER CONTROL SYSTEM	FEEDWATER CONTROL CIRCUITS	FEEDWATER TURBINES LOCKED AT LAST SPEED	FEEDWATER TURBINES LOCKED AT LAST SPEED	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
2 of 4 of 1	FEEDWATER SYSTEM	RFP RECIRC CONTROL VALVE FV1783B	FV1783B DUMPS TO MAIN CONDENSER B	NONE	NONE
		FEEDWATER HEATER TRAIN B LEVEL, DRAIN AND DUMP VALVES	REDUCE MAIN CONDENSER B VACUUM		
		LV1506B VALVE LV1514B VALVE LV1523B VALVE LV1532B VALVE	CLOSE NORMAL DRAINS TO HEATER TRAIN B	NONE	
		HV1373B VALVE HV1388B VALVE HV1355B VALVE HV1377B VALVE HV1387B VALVE HV1366B VALVE HV1359B VALVE HV1367B VALVE	EXTRACTION STEAM DUMPS TO MAIN CONDENSER B	NONE	
		MOISTURE SEPARATOR DRAIN CONTROL VALVES LV1363B, LV1364B	DRAIN VALVES FAIL CLOSED	NONE	
			MAIN TURBINE TRIP IF A, B AND C DRAIN VALVES CLOSED		

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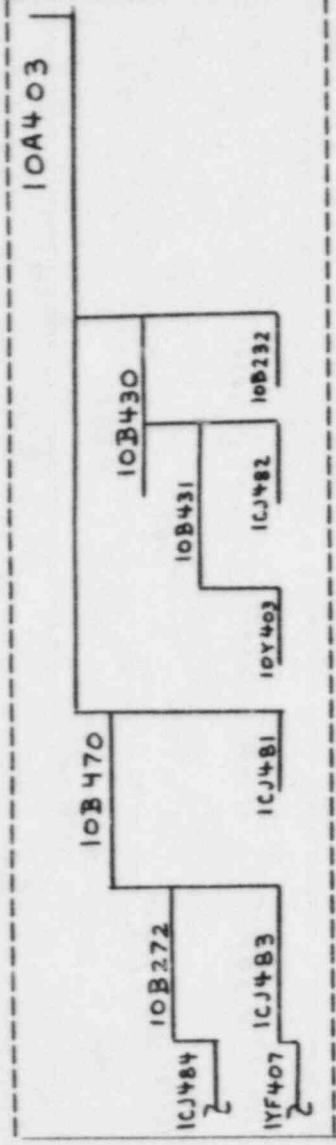
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10B420 2 10B222	REACTOR AUXILIARY COOLING SYSTEM	REACTOR AUXILIARY COOLING PUMP 1BP209	PUMP STOPS, CAUSING LOSS OF OFFGAS RECOMBINER	MAIN TURBINE TRIP IN 10 ± 1 MINUTES ON LOW CONDENSER VACUUM	MAIN TURBINE TRIP IN 10 ± 1 MINUTES ON LOW CONDENSER VACUUM
	SAFETY AUXILIARY COOLING SYSTEM	TACS LOOP DISH VALVE HV2496B	INITIATE TACS ISOLATION SACS STANDBY LOOP STARTS AUTOMATICALLY	MAIN TURBINE TRIP	MAIN TURBINE TRIP
1BJ482	SAFETY AUXILIARY COOLING SYSTEM	BAILEY PANEL 1BC655 AND BAILEY PANEL 1BC562	PUMP 1BP210 STOPS INITIATE LOOP ISOLATION		
		SACS LOOP SUPPLY VALVE HV2522B	SACS STANDBY LOOP STARTS AUTOMATICALLY		
10B323	TURBINE-GENERATOR SYSTEM	GENERATOR MAIN SEAL OIL PUMP 10P173	PUMP STOPS IF AVAILABLE EMERGENCY SEAL OIL PUMP 10P112 STARTS (10D480)	NONE	
		RECIRC SEAL OIL PUMP 10P172	PUMP STOPS	NONE	
		HI PRESS LIFT PUMPS	PUMPS INOPERATIVE; USED DURING STARTUP	NONE	
2 1BJ484		TURNING GEAR OIL PUMP 10P111	PUMP INOPERATIVE; USED DURING SHUTDOWN	NONE	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
1BJ484 2	EXTRACTION STEAM SYSTEM	PANEL 1BC653 HV1373A VALVE HV1388A VALVE HV1355A VALVE HV1377A VALVE HV1387A VALVE HV1366A VALVE HV1359A VALVE HV1367A VALVE	DUMP EXTRACTION STEAM TO MAIN CONDENSER A	NONE	RECIRCULATION RUNBACK
	FEEDWATER VENTS, DRAINS AND HEATERS SYSTEM	LV1506A VALVE LV1514A VALVE LV1523A VALVE LV1532A VALVE	CLOSE NORMAL DRAINS TO FEEDWATER HEATER TRAIN A	NONE	
	REACTOR FEED PUMP TURBINE STEAM SYSTEM	PANEL 1BC653. REACTOR FEED PUMP TURBINE CONTROL CIRCUITS	REACTOR FEED PUMP TURBINE B STOPS, FLOW DECREASES TO 85%.	RECIRCULATION RUNBACK	
	TURBINE-GENERATOR SYSTEM	PANEL 1BC653 HYDRAULIC FLUID PUMP 1AP116	PUMP STOPS IF AVAILABLE PUMP 1BP116 STARTS AUTOMATICALLY (1DJ484)	NONE	
	OFFGAS SYSTEM	PANEL 1BC653 CONTROL CIRCUITS CONTROL CIRCUIT FOR VALVES HV5643B, HV5649-1, HV5647, HV566B	LOSE STEAM JET AIR EJECTOR AUTOMATICALLY (1DJ484)	MAIN TURBINE TRIP IN 10 ±1 MINUTES	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS



SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
SAFETY AUXILIARY COOLING SYSTEM	COOLING WATER PUMP 1CP210 (LOOP A)	LOSE RHR HEAT EXCHANGERS COOLING AND TURBINE COOLING IF AUTO TRANSFER TO STANDBY LOOP NOT AVAILABLE (10A402) PUMP 1BP210 (10A404) PUMP 1DP210 LOSS OF BUS 10A403 TRANSFERS DRYWELL COOLERS TO REACTOR AUXILIARY COOLING SYSTEM	NONE	MAIN TURBINE TRIP
SAFETY AUXILIARY COOLING SYSTEM	TACS LOOP DISH VALVE HV2496C	INITIATE TACS ISOLATION SACS STANDBY LOOP STARTS AUTOMATICALLY	MAIN TURBINE TRIP	MAIN TURBINE TRIP
SAFETY AUXILIARY COOLING SYSTEM	BAILEY PANEL 1CC655 AND 1CC652	SACS PUMP 1CP210 STOPS	NONE	
	SACS LOOP A SUPPLY VALVE CONTROL CIRCUITRY HV2522C	INITIATE LOOP A ISOLATION		
PRIMARY CONTAINMENT INSTRUMENT GAS SYSTEM	COMPRESSOR A CONTROL CIRCUITS	COMPRESSOR A STOPS COMPRESSOR B STARTS AUTOMATICALLY	NONE	
SAFETY AUXILIARY COOLING SYSTEM	SACS LOOP A SUPPLY VALVE HV2522C	VALVE FAILS CLOSED, ISOLATING LOOP A IF AVAILABLE, STANDBY LOOP STARTS AUTOMATICALLY	NONE	
REACTOR FEED PUMP TURBINE STEAM SYSTEM	REACTOR FEED PUMP TURBINE C CONTROL CIRCUITS	REACTOR FEED PUMP TURBINE C STOPS, FLOW DECREASES TO 85%.	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
POWER RANGE NEUTRON MONITORING SYSTEM	NEUTRON MONITOR CIRCUITRY	½ REACTOR SCRAM TRIP (CHANNELS B1 AND B2) REACTOR SCRAM IF CHANNEL A1 OR A2 TRIPPED		

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
2 1A4407	FEEDWATER SYSTEM	RFP RECIRC CONTROL VALVE FV1783C	FV1783C DUMPS TO MAIN CONDENSER C	NONE	NONE
		FEEDWATER HEATER TRAIN C LEVEL, DRAIN AND DUMP VALVES	REDUCE MAIN CONDENSER C VACUUM		
		LV1506C VALVE LV1514C VALVE LV1523C VALVE LV1532C VALVE	CLOSE NORMAL DRAINS TO HEATER TRAIN C	NONE	
		HV1373C VALVE HV1388C VALVE HV1355C VALVE HV1377C VALVE HV1387C VALVE HV1366C VALVE HV1359C VALVE HV1367C VALVE	EXTRACTION STEAM DUMPS TO MAIN CONDENSER C	NONE	
		MOISTURE SEPARATOR DRAIN CONTROL VALVES LV1363C, LV1364C	DRAIN VALVES FAIL CLOSED MAIN TURBINE TRIP IF A, B AND C DRAIN VALVES CLOSED	NONE	
	NUCLEAR BOILER INSTRUMENTATION	DRAIN VALVES B21-F033, B21-F069, B21-F073	VALVES FAIL OPEN REDUCE CONDENSER VACUUM	NONE	

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COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
1CJ484	REACTOR FEED PUMP TURBINE STEAM SYSTEM	PANEL 1CC653 REACTOR FEED PUMP TURBINE C CONTROL CIRCUITS	REACTOR FEED PUMP TURBINE C STOPS	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
	CHILLED WATER SYSTEM	PANEL 1CC653 RECIRCULATION PUMP A MOTOR COOLING WATER VALVES HV9514A1 MAIN HV9514A2 MAIN HV9514B1 BACKUP HV9514B2 BACKUP	IF 120VAC PANEL LOST MAIN VALVES FAIL OPEN BACKUP VALVES FAIL CLOSED, OTHERWISE FAIL AS IS	NONE	
	FEEDWATER SYSTEM	PANEL 1CC653 LV1506C VALVE LV1514C VALVE LV1523C VALVE	CLOSE NORMAL DRAINS TO HEATER TRAIN C	NONE	
		LV1532C VALVE	DUMP EXTRACTION STEAM TO MAIN CONDENSER C	NONE	
		HV1373C VALVE HV1388C VALVE HV1355C VALVE HV1377C VALVE HV1387C VALVE HV1366C VALVE HV1359C VALVE HV1367C VALVE			

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10A404	SAFETY AUXILIARY COOLING SYSTEM	COOLING WATER PUMP 1DP210 (LOOP B)	LOSE RHR HEAT EXCHANGERS COOLING AND TURBINE COOLING IF AUTO TRANSFER TO STANDBY LOOP NOT AVAILABLE (10A410) PUMP 1AP210 (10A403) PUMP 1CP210 LOSS OF BUS 10A404 TRANSFERS DRYWELL COOLERS TO REACTOR AUXILIARY COOLING SYSTEM	NONE	FOR COMBINED EFFECTS, SEE SECTION 4
10B440 / 10B242	SAFETY AUXILIARY COOLING SYSTEM	TACS LOOP DISH VALVE HV2496D	INITIATE TACS ISOLATION SACS STANDBY LOOP STARTS AUTOMATICALLY	MAIN TURBINE TRIP	MAIN TURBINE TRIP
1DJ482	SAFETY AUXILIARY COOLING SYSTEM	BAILEY PANEL 1DC655 AND 1DC652	SACS PUMP 1DP210 STOPS		
		SACS LOOP B SUPPLY VALVE CONTROL CIRCUITRY HV2522D	INITIATE LOOP B ISOLATION	NONE	
10Y404	PRIMARY CONTAINMENT INSTRUMENT GAS SYSTEM	COMPRESSOR B CONTROL CIRCUITS	COMPRESSOR B STOPS COMPRESSOR A STARTS AUTOMATICALLY	NONE	
10B282 / 1DJ484 / 2 / 1DJ483	PROCESS RADIATION MONITORING SYSTEM	OFFGAS HIGH RADIATION MONITORING CIRCUITRY	CLOSE SHUTOFF VALVE OF THE OFFGAS LINE TO STACK. LOSE CAPABILITY TO TRIP ON HIGH TURBINE VIBRATION. LOSS OF INDICATORS	MAIN TURBINE TRIP IN 10 ± 1 MINUTE	MAIN TURBINE TRIP IN 10 ± 1 MINUTE
	TURBINE-GENERATOR SYSTEM	TURBINE VIBRATION SWITCH TSI			

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
1D1484	TURBINE-GENERATOR SYSTEM	PANEL 1DC653 HYDRAULIC FLUID PUMP 1BP116	PUMP STOPS IF AVAILABLE PUMP 1AP116 STARTS	NONE	
		PANEL 1DC653 TURBINE ELECTRICAL TRIP CIRCUIT	LOSE CAPABILITY TO TRIP TURBINE ON 1) LOW OIL PRESS (TURBINE) 2) LOW OIL PRESS (GENERATOR) 3) LOW HYD FLUID PRESS 4) MOISTURE SEPARATOR A LOW LEVEL 5) MOISTURE SEPARATOR B LOW LEVEL 6) SHAFT OIL PUMP DISH PRESS 7) HIGH EXHAUST HOOD A TEMP 8) HIGH EXHAUST HOOD B TEMP 9) HIGH EXHAUST HOOD C TEMP 10) SHAFT VOLTAGE TEST SOLENOID 11) LOSS OF STATOR COOLING 12) THRUST BEARING WEAR AND LOW OIL PRESS 13) CUSTOMER TRIPS 14) LOW MAIN CONDENSER VACUUM 15) MECHANICAL SOLENOID TRIP	DISABLE MAIN TURBINE TRIPS AS NOTED IN PRIMARY EFFECT	DISABLE MAIN TURBINE TRIPS AS NOTED IN PRIMARY EFFECT
	CONDENSATE SYSTEM	PANEL 1DC653 PRIMARY AND SECONDARY CONDENSATE PUMP TRIP CIRCUITRY	LOSE CAPABILITY TO TRIP REACTOR FEEDWATER PUMP TURBINE ON LOSS OF ASSOCIATED PRIMARY OR SECONDARY CONDENSATE PUMP		

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10D470 / 1AD318	REACTOR FEED PUMP TURBINE STEAM SYSTEM	REACTOR FEED PUMP TURBINE A CONTROL CIRCUITS - CONTROL PANEL 1AC132	REACTOR FEED PUMP A TURBINE STOPS, FLOW DECREASES TO 85%	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
10D470 / 1CD318	REACTOR FEED PUMP TURBINE STEAM SYSTEM	REACTOR FEED PUMP TURBINE C CONTROL CIRCUITS - PANEL 1CC132	REACTOR FEED PUMP TURBINE C STOPS, FLOW DECREASES TO 85%	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
	TURBINE-GENERATOR SYSTEM	TURBINE MECHANICAL TRIP SOLENOID	LOSE CAPABILITY TO MECHANICALLY TRIP TURBINE	DISABLE MAIN TURBINE TRIP	
		TURBINE TRIP CIRCUITRY	LOSE CAPABILITY TO ELECTRICALLY TRIP TURBINE		
	FEEDWATER CONTROL SYSTEM	TURBINE BYPASS VALVES TRIP CIRCUIT	TURBINE BYPASS VALVES FAIL OPEN	MAIN TURBINE BYPASS VALVES FAIL OPEN	
		HIGH LEVEL "C" TRIP CIRCUITRY	HIGH LEVEL "C" TRIP IF "A" OR "B" TRIPPED, THEN TRIP REACTOR FEEDWATER TURBINES AND MAIN TURBINE		
		REACTOR FEEDWATER PUMP CONTROL CIRCUITRY "C"	FEEDWATER FLOW INCREASES REACTOR FEED PUMP TURBINES A, B AND C AND MAIN TURBINE HIGH WATER LEVEL "B" ½ TRIP TRIP REACTOR FEED PUMP TURBINES A, B AND C AND MAIN TURBINE IF "A" AND "C" HIGH WATER LEVEL TRIP	MAIN TURBINE TRIP ON HIGH WATER LEVEL	

APPENDIX C
COMMON POWER/SYSTEMS CONTROL FAILURE ANALYSIS

	SYSTEM	COMPONENT DESCRIPTION	PRIMARY EFFECT	SECONDARY EFFECT	COMBINED EFFECTS
10D480	TURBINE-GENERATOR SYSTEM	TURBINE EMERGENCY OIL PUMP 10P112	NO BACKUP TO TURBINE MAIN SEAL OIL PUMP 10P173 (10B232)	NONE	MAIN TURBINE TRIP
1BD318	REACTOR FEED PUMP TURBINE STEAM SYSTEM	REACTOR FEED PUMP TURBINE B CONTROL CIRCUITS - CONTROL PANEL 1BC132	REACTOR FEED PUMP B TURBINE STOPS, FLOW DECREASES TO 85%	RECIRCULATION RUNBACK	RECIRCULATION RUNBACK
1DD318	FEEDWATER CONTROL SYSTEM	HIGH LEVEL "B" TRIP CIRCUITRY	HIGH LEVEL "B" TRIP IF "A" OR "C" TRIPPED, THEN TRIP REACTOR FEED PUMP TURBINES AND MAIN TURBINE	NONE	MAIN TURBINE TRIP
		REACTOR FEEDWATER PUMP CONTROL CIRCUITRY "B"	FEEDWATER FLOW INCREASES	MAIN TURBINE TRIP ON HIGH WATER LEVEL	