ATTACHMENT 1

EXISTING TECHNICAL SPECIFICATIONS

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3.5 INSTRUMENTATION AND CONTROL

3.5.1 REACTOR TRIP SYSTEM INSTRUMENTATION

APPLICABILITY: As shown in Table 3.5.1-1.

OBJECTIVE: To delineate the conditions of the Plant instrumentation and safety circuits necessary to ensure reactor safety.

SPECIFICATION: As a minimum, the reactor trip system instrumentation channels and interlocks of Table 3.5.1-1 shall be OPERABLE.

ACTION: As shown in Table 3.5.1-1.

BASIS: During plant operations, the complete instrumentation systems will normally be in service.(1) Reactor safety is provided by the Reactor Protection System, which automatically initiates appropriate action to prevent exceeding established limits.(2) Safety is not compromised, however, by continuing operation with certain instrumentation channels out of service since provisions were made for this in the plant design.(1)(3) This Standard outlines limiting conditions for operation necessary to preserve the effectiveness of the reactor control and protection system when any one or more of the channels is out of service.

REFERENCES:

(1) Final Engineering Report and Safety Analysis, Section 6.

(2) Final Engineering Report and Safety Analysis, Section 6.2.

(3) NIS Safety Review Report, April 1988

TABLE 3.5.1-1

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTION UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
1. Manual Reactor Trip	2 2	1 1	2 2	1, 2 3*, 4*, 5*	1 7
2. Power Range, Neutron Flux, Overpower Trip	4	2	3	1, 2	2#
3. Power Range, Neutron Flux, Dropped Rod Rod Stop	4	1**	4	1, 2	28#
4. Intermediate Range, Neutron Flux	2	1	2	1####, 2***	3
5. Source Range, Neutron Flux					
A. Startup	2	1**	2	2##	4
B. Shutdown	2	1**	2	3*, 4*, 5*	7
C. Shutdown	2	0	1	3, 4, and 5	5
6. NIS Coincidentor Logic	2	1	2	1, 2 3*, 4*, 5*	29 7
7. Pressurizer Variable Low Pressure	3	2	2	1#####	6#
8. Pressurizer Fixed High Pressure	3	2	2	1, 2	6#
9. Pressurizer High Level	3	2	2	1	6#

TABLE 3.5.1-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTION UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
10. Reactor Coolant Flow					
A. Single Loop (Above 50% of Full Power)	1/loop	1/loop in any operating loop	1/loop in each operating loop	1	6#
B. Two Loops (Below 50% of Full Power)	1/loop	1/loop in two operating loops	1/loop in each operating loop	1####	6#
11. Steam/Feedwater Flow Mismatch	3	2	2	1#####	6#
12. Turbine Trip-Low Fluid Oil Pressure	3	2	2	1####	6#
13. Reactor Coolant Pump Breaker Position					
A. Single Loop (Above 50% of Full Power)	1/loop	1/loop in any operating loop	1/loop in each operating loop	1	6#
B. Two Loops (Below 50% of Full Power)	1/loop	1/loop in two operating loops	1/loop in each operating loop	1####	6#

TABLE 3.5.1-1 (Continued)

TABLE NOTATION

- * With the reactor trip system breakers in the closed position, the control rod drive system capable of rod withdrawal.
- ** A "TRIP" will stop all rod withdrawal.
- *** Startup rate circuit enabled at 10⁻% reactor power.
- # The provisions of Specification 3.0.4 are not applicable.
- ## Below the Source Range High Voltage Cutoff Setpoint.
- ### Below the P-7 (At Power Reactor Trip Defeat) Setpoint.
- #### Above the P-7 (At Power Reactor Trip Defeat) Setpoint.
- ##### Above the P-8 Setpoint.

ACTION STATEMENTS

ACTION 1 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in HOT STANDBY within the next 6 hours.

ACTION 2 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are met:

a. The inoperable channel is placed in the tripped condition within 1 hour.

b. The Minimum Channels OPERABLE requirement is met; however, the inoperable channel may be returned to the untripped condition for up to 2 hours for surveillance testing of other channels per Specification 4.1.

ACTION 3 - With the number of channels OPERABLE one less than the Minimum Channels OPERABLE requirement and with the THERMAL POWER level:

a. Below the Source Range High Voltage Cutoff Setpoint, restore the inoperable channel to OPERABLE status prior to increasing THERMAL POWER above the Source Range High Voltage Cutoff Setpoint.

b. Above the Source Range High Voltage Cutoff Setpoint but below 10 percent of RATED THERMAL POWER, restore the inoperable channel to OPERABLE status prior to increasing THERMAL POWER above 10 percent of RATED THERMAL POWER.

However, one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.1, provided the other channel is OPERABLE.

ACTION 4 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement suspend all operations involving positive reactivity changes.

ACTION 5 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, verify compliance with the SHUTDOWN MARGIN requirements of Specification 3.5.2 as applicable, within 1 hour and at least once per 12 hours thereafter.

ACTION 6 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed until performance of the next required OPERATIONAL TEST provided the inoperable channel is placed in the tripped condition within 8 hours.

ACTION 7 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or open the reactor trip breakers within the next hour.

ACTION 28 - With the number of OPERABLE channels less than the Minimum Channels OPERABLE requirements, within one hour reduce THERMAL POWER such that T_{ave} is less than or equal to 551.5°F, and place the rod control system in manual mode.

ACTION 29 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirements, be in at least HOT STANDBY within 6 hours; however, one channel may be removed from service for up to 2 hours for surveillance testing per Specification 4.1, provided the other channel is OPERABLE.

3.7 AUXILIARY ELECTRICAL SUPPLY

3.7.1 ELECTRICAL SUPPLY: OPERATING

APPLICABILITY: MODES 1, 2, 3, and 4

OBJECTIVE: To define those conditions of electrical power availability necessary to provide for safe reactor operation and to provide for the continuing availability of engineered safeguards.

SPECIFICATION:

a. One Southern California Edison Company and one San Diego Gas & Electric Company high voltage transmission line to the switchyard and two transmission circuits from the switchyard, one immediate and one delayed access, to the onsite safety-related distribution system shall be OPERABLE. This configuration constitutes the two required offsite circuits.

b. Two redundant and independent diesel generators shall be OPERABLE each with:

   1. A separate day tank containing a minimum of 290 gallons of fuel,

   2. A separate fuel storage system containing a minimum of 37,500 gallons of fuel, and

   3. A separate fuel transfer pump.

c. Train A Emergency AC Buses shall be OPERABLE, comprised of:

   1. 4160 volt Bus 1C,
   2. 480 volt Buses 1 and 3, and associated station service transformers with tie breaker open.

d. Train B Emergency AC Buses shall be OPERABLE, comprised of:

   1. 4160 volt Bus 2C,
   2. 480 volt Buses 2 and 4, and associated station service transformers with tie breaker open.

e. 120 volt AC Vital Buses 1, 2, 3, 3A, and 4 energized from associated inverters connected to DC Bus 1.

f. 120 volt AC Vital Buses 5 and 6 energized from associated inverters connected to DC Bus 2.

g. 125 volt DC Bus 1 shall be OPERABLE and energized from Battery No. 1, with at least one full capacity charger.

h. 125 volt DC Bus 2 shall be OPERABLE and energized from Battery No. 2, with at least one full capacity charger.

i. Two trains of Safeguards Load Sequencing Systems (SLSS) shall be OPERABLE.*

j. The MOV-850C Uninterruptible Power Supply (UPS) OPERABLE and energized from the battery with its full capacity charger.**

k. Manual Transfer Switch 7 (MTS-7) shall be OPERABLE and energized from MCC-2.

l. Manual Transfer Switch 8 (MTS-8) shall be OPERABLE and energized from MCC-4.

ACTION: A. With one of the required offsite circuits inoperable, demonstrate the operability of the remaining AC sources by performing Surveillance Requirement A of Technical Specification 4.4 within one hour and at least once per 8 hours thereafter and Surveillance Requirement B.1.a within 24 hours. Restore the circuit to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

B. If one diesel generator is declared inoperable, demonstrate the operability of the two offsite transmission circuits and the remaining diesel generator by performing Surveillance Requirement A of Technical Specification 4.4 within one hour and at least once per 8 hours thereafter and Surveillance Requirement B.1.a within 24 hours. Restore the inoperable diesel generator to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

C. With one offsite circuit and one diesel generator of the above required AC electrical power sources inoperable, demonstrate the operability of the remaining AC sources by performing Surveillance Requirement A of Technical Specification 4.4 within one hour and at least once per 8 hours thereafter and Surveillance Requirement B.1.a within 8 hours. Restore at least one of the inoperable sources to OPERABLE status within 12 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Have at least two offsite circuits and two diesel generators OPERABLE within 72 hours from the time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

D. With one diesel generator inoperable as in B or C above, verify that: (1) all required systems, subsystems, trains,

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*The automatic load function may be blocked in Mode 3 at a pressurizer pressure $\leq$ 1900 psig.

**Applicable in MODES 1, 2, and 3 above 500 psig.

components, and devices that depend on the remaining OPERABLE diesel generator as a source of emergency power are also OPERABLE; and (2) the steam-driven auxiliary feedwater pump is OPERABLE in MODES 1, 2, and 3. If these conditions are not satisfied within 2 hours, be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

E. With two required offsite circuits inoperable, demonstrate the operability of two diesel generators by performing Surveillance Requirement B.1.a of Technical Specification 4.4 within 8 hours, unless the diesel generators are already operating. Restore at least one of the inoperable sources to OPERABLE status within 24 hours or be in at least HOT STANDBY within the next 4 hours. Have at least two offsite circuits and two diesel generators OPERABLE within 72 hours from the time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

F. With two of the above required diesel generators inoperable, demonstrate the operability of two offsite circuits by performing Surveillance Requirement A of Technical Specification 4.4 within one hour and at least once per 2 hours thereafter. Restore at least one of the inoperable diesel generators to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore both diesel generators to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

G. With less than the above trains of Emergency AC buses OPERABLE, restore the inoperable buses within 8 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

H. With one AC Vital Bus either not energized from its associated inverter, or with the inverter not connected to its associated DC Bus: (1) re-energize the AC Vital Bus within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours; and (2) re-energize the AC Vital Bus from its associated inverter connected to its associated DC bus within 24 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

I. With one DC bus inoperable or not energized from its associated battery and at least one full capacity charger, re-energize the DC Bus from its associated battery and at least one full capacity charger within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

J. With one Safeguards Load Sequencing System inoperable, restore the inoperable sequencer to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

K. With the MOV-850C UPS inoperable, or not energized from its associated battery and its full capacity charger, restore the UPS to OPERABLE status and re-energize the UPS from its associated battery and its full capacity charger within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

L. With MTS-7 inoperable or not energized from MCC-2, restore MTS-7 to OPERABLE status and re-energize MTS-7 from MCC-2 within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

M. With MTS-8 inoperable or not energized from MCC-4, restore MTS-8 to OPERABLE status and re-energize MTS-8 from MCC-4 within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

BASIS: The station is connected electrically to the Southern California Edison Company and San Diego Gas & Electric Company system via either of two physically independent high voltage transmission routes composed of four Southern California Edison Company high voltage lines and four San Diego Gas & Electric Company high voltage lines.

Of the four Southern California Edison Company lines, any one can serve as a source of power to the station auxiliaries at any time. Similarly, any of the four San Diego Gas & Electric Company lines can serve as a source of power to the station auxiliaries at any time. By specifying one transmission line from each of the two physically independent high voltage transmission routes, redundancy of sources of auxiliary power for an orderly shutdown is provided.

Similarly, either transformer A or B, along with transformer C, provide redundancy of 4160 volt power to the auxiliary equipment, and in particular to the safety injection trains. In addition, each 4160 volt bus has an onsite diesel generator as backup.

In MODES 1, 2, 3 and 4, two diesel generators provide the necessary redundancy to protect against a failure of one of the diesel generator systems or in case one diesel generator system is taken out for maintenance, without requiring a reactor shutdown. This also eliminates the necessity for depending on one diesel generator to operate for extended periods without shutdown if it were required for post-accident conditions.

When one diesel generator is inoperable, there is an additional ACTION requirement to verify that all required systems, subsystems, trains, components and devices, that depend on the remaining OPERABLE diesel generator as a source of emergency power, are also OPERABLE. In addition, the ACTION STATEMENT requires a verification that the steam-driven auxiliary feedwater pump is OPERABLE in MODES 1, 2, and 3.

These requirements are intended to provide assurance that a loss of offsite power event will not result in a complete loss of safety function of critical systems during the period one of the diesel generators is inoperable. The term verify as used in this context means to administratively check by examining logs or other information to determine if certain components are out-of-service for maintenance or other reasons. It does not mean to perform the surveillance requirements needed to demonstrate the operability of the component.

The total connected design load on each diesel generator is restricted to 6,000 kW or less. This requirement was the result of a crankshaft crack propagation analysis (see Reference 1). The analysis postulated that the crankshaft initially has stress-induced surface cracks. The analysis then considered the effect of four types of diesel load histories on the growth of these cracks. Each load history consisted of repeated start-stop cycles with some steady state operation at full load (6,000 kW) between each start and its stop. The analysis concluded that for a crankshaft with a detectable size crack (10 mils deep), the number of start-stop cycles required to enlarge the crack until it becomes self-propagating (18 mils deep) under the full load steady state stresses represents the effective life of the crankshaft.

During normal operations, the 480 volt system is considered OPERABLE if the four 480 volt buses and four station service transformers are OPERABLE with respective tie breakers open. This will ensure that the 480V main breakers and transformers remain OPERABLE during the worst loading condition in case of a SIS without LOP.

The primary power source for Vital Buses 1, 2, 3, 3A, and 4 is Train A DC Bus 1. The alternate power source is available from MCC-2 through MTS-7. The 1987 RPS and ESF single failure analyses credited the Train B backup power to these vital buses through MTS-7.

Correct operation of the safety injection system is assured by the operability of the load sequencers and the UPS for MOV-850C and MOV-358 (MOV-850C UPS). Correct operation of the recirculation system is assured by the operability of the MOV-850C UPS which also supplies MOV-358.

Manual Transfer Switch 8 (MTS-8) provides the means to power MOV-883 and the MOV-850C UPS from either Train A or Train B.

However, due to single failure considerations and environmental effects, MTS-8 is normally powered from MCC-4 on Train B. MOV-883 is the discharge valve from the RWST and must remain open during the safety injection phase and close with initiation of recirculation.

REFERENCE: (1) Report No FaAA-84-12-14 (Revision 1.0), Evaluation of Transient Conditions on Emergency Diesel Generator Crankshafts at San Onofre Nuclear Generating Station, Unit 1.

4.1.1 OPERATIONAL SAFETY ITEMS

APPLICABILITY: Applies to surveillance requirements for items directly related to Safety Standards and Limiting Conditions for Operation.

OBJECTIVE: To specify the minimum frequency and type of surveillance to be applied to plant equipment and conditions.

SPECIFICATION:

A. Reactor Trip System instrumentation shall be checked, tested, and calibrated as indicated in Table 4.1.1.

B. Equipment and sampling tests shall be as specified in Table 4.1.2.

C. The specific activity and boron concentration of the reactor coolant shall be determined to be within the limits by performance of the sampling and analysis program of Table 4.1.2., Item 1a.

D. The specific activity of the secondary coolant system shall be determined to be within the limit by performance of the sampling and analysis program of Table 4.1.2., Item 1b.

E. All control rods shall be determined to be above the rod insertion limits shown in Figure 3.5.2.1 by verifying that each analog detector indicates at least 21 steps above the rod insertion limits, to account for the instrument inaccuracies, at least once per shift during Startup conditions with K_{eff} equal to or greater than one.

F. The position of each rod shall be determined to be within the group demand limit and each rod position indicator shall be determined to be OPERABLE by verifying that the rod position indication system (Analog Detection System) and the step counter indication system (Digital Detection System) agree within 35 steps at least once per shift during Startup and Power Operation except during time intervals when the Rod Position Deviation Monitor is inoperable, then compare the rod position indication system (Analog Detection System) and the step counter indication system (Digital Detection System) at least once per 4 hours.

G. During MODE 1 or 2 operation each rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 10 steps in any one direction at least once per 31 days.

H. Instrumentation shall be checked, tested, and calibrated as indicated in Table 4.1.3.

TABLE 4.1.1

REACTOR TRIP SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST
1. Manual Reactor Trip	N.A.	N.A.	N.A.	R	N.A.
2. Power Range, Neutron Flux	S	D (2,3) R (3,4)	M	N.A.	N.A.
3. Power Range, Neutron Flux, Dropped Rod Rod Stop	N.A.	N.A.	M	N.A.	N.A.
4. Intermediate Range, Neutron Flux	S	R (3,4)	S/U (1), M	N.A.	N.A.
5. Source Range, Neutron Flux	S	R (3)	S/U (1), M	N.A.	N.A.
6. NIS Coincidentor Logic	N.A.	N.A.	N.A.	N.A.	M (5)
7. Pressurizer Variable Low Pressure	S	R	M	N.A.	N.A.
8. Pressurizer Pressure	S	R	M	N.A.	N.A.
9. Pressurizer Level	S	R	M	N.A.	N.A.
10. Reactor Coolant Flow	S	R	Q	N.A.	N.A.
11. Steam/Feedwater Flow Mismatch	S	R	M	N.A.	N.A.
12. Turbine Trip-Low Fluid Oil Pressure	N.A.	N.A.	N.A.	S/U (1,6)	N.A.
13. Reactor Coolant Pump Breaker Position*	S	R	R	N.A.	N.A.

*Applicable to Item 6 in Table 2.1

TABLE 4.1.1 (Continued)

TABLE NOTATION

(1) - If not performed in previous 31 days.

(2) - Heat balance only, above 15% of RATED THERMAL POWER. Adjust channel if absolute difference greater than 2 percent.

(3) - Neutron detectors may be excluded from CHANNEL CALIBRATION.

(4) - The provisions of Specification 4.0.4 are not applicable for entry into MODE 2 or 1.

(5) - Each train shall be tested at least every 62 days on a STAGGERED TEST BASIS.

(6) - Setpoint verification is not applicable.

TABLE 4.1.2
MINIMUM EQUIPMENT CHECK AND SAMPLING FREQUENCY

		Check	Frequency
1a. Reactor Coolant Samples	1.	Gross Activity Determination	At least once per 72 hours. Required during MODES 1, 2, 3 and 4.
	2.	Isotopic Analysis for DOSE EQUIVALENT I-131 Concentration	1 per 14 days. Required only during MODE 1.
	3.	Spectroscopic for E(1) Determination	1 per 6 months(2) Required only during MODE 1.
	4.	Isotopic Analysis for Iodine Including I-131, I-133, and I-135.	a) Once per 4 hours,(3) whenever the specific activity exceeds 1.0 μCi/gram DOSE EQUIVALENT I-131 or 100/ E (1) μCi/gram. b) One sample between 2 and 6 hours following a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER within a one hour period.
	5.	Boron concentration	Twice/Week

(1) E is defined in Section 1.0.

(2) Sample to be taken after a minimum of 2 EFPD and 20 days of POWER OPERATION have elapsed since reactor was last subcritical for 48 hours or longer.

(3) Until the specific activity of the reactor coolant system is restored within its limits.

TABLE 4.1.2 (continued)

	Check		Frequency
1.b Secondary Coolant Samples	1.	Gross Activity Determination	At least once per 72 hours. Required only during MODES 1, 2, 3 and 4.
	2.	Isotopic Analysis for DOSE EQUIVALENT I-131 Concentration	a) 1 per 31 days, whenever the gross activity determination indicates iodine concentrations greater than 10% of the allowable limit. Required only during MODES 1, 2, 3 and 4. b) 1 per 6 months, whenever the gross activity determination indicates iodine concentrations below 10% of the allowable limit. Required only during MODES 1, 2, 3, and 4.

TABLE 4.1.2 (continued)

		Check	Frequency
2.	Safety Injection Line and RWST Water Samples	a. Boron Concentration	Monthly when the reactor is critical and prior to return of criticality when a period of subcriticality extends the test beyond 1 month
3.	Control Rod Drop	a. Verify that all rods move from full out to full in, in less than 2.44 seconds	At each refueling shutdown
4.	(Deleted)		
5.	Pressurizer Safety Valves	a. Pressure Setpoint	At each refueling shutdown
6.	Main Steam Safety Valves	a. Pressure Setpoint	At each refueling shutdown
7.	Main Steam Power Operated Relief Valves	a. Test for OPERABILITY	At each refueling shutdown
8.	Trisodium Phosphate Additive	a. Check for system availability as delineated in Technical Specification 4.2	At each refueling shutdown
9.	Hydrazine Tank Water Samples	a. Hydrazine concentration	Once every six months when the reactor is critical and prior to return of criticality when a period of subcriticality extends the test interval beyond six months
10.	Not used.		

TABLE 4.1.2 (continued)

		Check	Frequency
11.	MOV-LCV-1100 C Transfer Switch	a. Verify that the fuse block for either breaker 8-1198 to MCC 1 or breaker 42-12A76 to MCC 2A is removed.	Same as Item 10 above
12.	Emergency Siren Transfer Switch	a. Verify that the fuse block for either breaker 8-1145 to MCC 1 or breaker 8-1293A to MCC 2 is removed	Same as Item 10 above
13.	Communication Power Panel Transfer Switch	a. Verify that the fuse block for either breaker 8-1195 to MCC 1 or breaker 8-1293B to MCC 2 is removed	Same as Item 10 above
14a.	Spent Fuel Pool Water Level	Verify water level per Technical Specification 3.8	a. Once every seven days when spent fuel is being stored in the pool.
b.	Refueling Pool Water Level		b. Within two hours prior to start of and at least once per 24 hours thereafter during movement of fuel assemblies or RCC's.
15.	Reactor Coolant Loops/ Residual Heat Removal Loops	a. Per Technical Specifications 3.1.2.C and 3.1.2.D, in MODE 1 and MODE 2 and in MODE 3 with reactor trip breakers closed, verify that all required reactor coolant loops are in operation and circulating reactor coolant.	a. Once per 12 hours
		b. Per Technical Specification 3.1.2.E, in MODE 3 with the reactor trip breakers open, verify	

TABLE 4.1.2 (continued)

Check	Frequency
1. At least two required reactor coolant pumps are operable with correct breaker alignments and indicated power availability.	1. Once per 7 days
2. The steam generators associated with the two required reactor coolant pumps are operable with secondary side water level ≥ 256 inches (wide range).	2. Once per 12 hours
3. At least one reactor coolant loop is in operation and circulating reactor coolant.	3. Once per 12 hours
c. Per Technical Specification 3.1.2.F, in MODE 4 verify	
1. At least two required (RC or RHR) pumps are operable with correct breaker alignments and indicated power availability.	1. Once per 7 days
2. The required steam generators are operable with secondary side water level ≥ 256 inches (wide range).	2. Once per 12 hours
3. At least one reactor coolant loop/RHR TRAIN is in operation and circulating reactor coolant.	3. Once per 12 hours
d. Per Technical Specifications 3.1.2.G and 3.1.2.H, in MODE 5 verify, as applicable:	

	Check	Frequency
	1. At least one RHR TRAIN is in operation and circulating reactor coolant.	1. Once per 12 hours
	2. When required, one additional RHR TRAIN is operable with correct pump breaker alignments and indicated power availability.	2. Once per 7 days
	3. When required, the secondary side water level of at least two steam generators is ≥ 256 inches (wide range).	3. Once per 12 hours
	e. Per Technical Specification 3.8.A.3, in MODE 6, with water level in refueling pool greater than elevation 40 feet 3 inches, verify that at least one method of decay heat removal is in operation and circulating reactor coolant at a flow rate of at least 400 gpm.	e. Once per 12 hours
	f. Per Technical Specification 3.8.A.4, in MODE 6, with water level in refueling pool less than elevation 40 feet 3 inches, verify	
	1. At least one decay heat removal method is in operation and circulating reactor coolant.	1. Once per 12 hours
	2. One additional decay heat removal method is operable with correct pump breaker alignments and indicated power availability.	2. Once per 7 days
16. RWST Contained Water Volume	a. Verify volume ≥ 50 ft. plant elevation	a Monthly when the reactor is critical and prior to return of criticality when a period of subcriticality extends the surveillance beyond 1 month

TABLE 4.1.3

MINIMUM FREQUENCIES FOR TESTING, CALIBRATING, AND/OR CHECKING OF INSTRUMENT CHANNELS

Channels	Surveillance	Minimum Frequency
1. Axial Offset	Calibration	At each refueling shutdown
	Check	Once per shift
2. Reactor Coolant Temperature	Calibration	At each refueling shutdown
	Test	Once per month
	Check	Once per shift
3. Pressurizer Pressure Input to Safety Injection Actuation	Calibration	At each refueling shutdown
	Test	Once per month
4. Rod Position Recorder	Calibration	At each refueling shutdown
	Check, comparison with digital readouts	Once per shift during operation
5. Charging Flow	Calibration	At each refueling shutdown
6. Boric Acid Tank Level	Calibration	At each refueling shutdown
	Test	Once per month
7. Residual Heat Pump Flow	Calibration	At each refueling shutdown
8. Volume Control Tank Level	Calibration	At each refueling shutdown.
	Test	Once per month during MODES 1 and 2
9. Hydrazine Tank Level	Calibration	At each refueling shutdown
	Test	One per month during operation

BASIS: **CALIBRATION**

CALIBRATION should be performed at every reasonable opportunity in order to ensure the presentation and acquisition of accurate information.

The nuclear flux (linear level) channels should be calibrated daily against a heat balance standard to account for errors induced by, changing rod patterns and core physics parameters.

Other channels are subject only to the "drift" errors induced within the instrumentation itself and, consequently, can tolerate longer intervals between CALIBRATION. Process system instrumentation errors induced by drift can be expected to remain within acceptable tolerances if recalibration is performed at intervals of approximately one year.

Substantial CALIBRATION shifts within a channel (essentially a channel failure) will be revealed during routine checking and testing procedures.

Thus, minimum CALIBRATION frequencies of once-per-day for the nuclear flux (linear level) channels, and once-per-year (approximately) for the process system channels is considered acceptable.

TESTING

The minimum testing frequency for those instrument channels connected to the safety system is based on an assumed "unsafe failure" rate of one per channel every four years. This assumption is, in turn, based on operating experience at conventional and nuclear plants. An "unsafe failure" is defined as one which negates channel operability and which, due to its nature, is revealed only when the channel is tested or attempts to respond to a bona fide signal.

The failure rate of one per channel every four years and the testing interval of two weeks imply that, on the average, each channel will be inoperable for 1.75 days per year, or 1.75/365 year. Since two channels must fail in order to negate the safety function, the probability of simultaneous failure of two channels (assuming only two to be in service) is 1.75/365 squared, or 2.3×10^{-5}. From this it can be inferred that in a three channel system the probability of simultaneous failure of two channels is approximately 6.9×10^{-5}. This represents the fraction of time in which each three channel system would have one operable and two inoperable channels, and equals $6.9 \times 10^{-5} \times 8760$ hours per year, or (approximately) 36 minutes/year.

It must also be noted that to thoroughly and correctly test a channel, the channel components must be made to respond in the same manner and to the same type of input as they would be expected to respond to during their normal operation. This, of necessity, requires that during the test the channel be made inoperable for a short period of time. This factor must be, and has been, taken into consideration in determining testing frequencies.

Because of their greater degree of redundancy, the 1/3 and 2/4 logic arrays provide an even greater measure of protection and are thereby acceptable for the same testing interval. Those items specified for monthly testing are associated with process components where other means of verification provide additional assurance that the channel is operable, thereby requiring less frequent testing.

During a 2-year testing period, the Reactor Coolant Flow Trips for each loop were tested 40 times. In all the tests the trips operated precisely on set point. Also, during this period, there were no 'unsafe failures' as defined above in the Reactor Coolant Flow Trips or any similar trip circuitry. All of these channels represent more than 30 years of service without a single 'unsafe failure'. Because of the demonstrated reliability of these instrument channels and particularly the Reactor Coolant Flow Trip, the testing interval of the Reactor Coolant Flow Trip has been extended to 3 months.

CHECK

Failures such as blown instrument fuses, defective indicators, faulted amplifiers which result in "upscale" or "downscale" indication, etc. can be easily recognized by simple observation of the functioning of an instrument or system. Furthermore, such failures are, in many cases, revealed by alarm or annunciator action, and a check supplements this type of built-in surveillance.

Based on experience in operation of both conventional and nuclear plant systems, the minimum checking frequency of once per shift is deemed adequate.

4.4 EMERGENCY POWER SYSTEM PERIODIC TESTING

APPLICABILITY: Applies to testing of the Emergency Power System.

OBJECTIVE: To verify that the Emergency Power System will respond promptly and properly when required.

SPECIFICATION:

A. The required offsite circuits shall be determined OPERABLE at least once per 7 days by verifying correct breaker alignments and power availability.

B. The required diesel generators shall be demonstrated OPERABLE:

1. At least once per 31 days on a STAGGERED TEST BASIS by:

   a. Verifying the diesel performs a DG SLOW START from standby conditions,

   b. Verifying a fuel transfer pump can be started and transfers fuel from the storage system to the day tank,

   c. Verifying the diesel generator is synchronized and running at 6000 kW (+100 kW, -500 kW) for $\geq$ 60 minutes,

   d. Verifying the diesel generator is aligned to provide standby power to the associated emergency buses,

   e. Verifying the day tank contains a minimum of 290 gallons of fuel, and

   f. Verifying the fuel storage tank contains a minimum of 37,500 gallons of fuel.

2. At least once per 3 months by verifying that a sample of diesel fuel from the required fuel storage tanks is within the acceptable limits as specified by the supplier when checked for viscosity, water and sediment.

C. AC Distribution

1. The required buses specified in Technical Specification 3.7, Auxiliary Electrical Supply, shall be determined OPERABLE and energized from AC sources other than the diesel generators with tie breakers without automatic SIS/SISLOP tripping circuitry open between redundant buses at least once per 7 days by verifying correct breaker alignment and power availability.

D. The required DC power sources specified in Technical Specification 3.7 shall meet the following:

1. Each DC Bus train shall be determined OPERABLE and energized at least once per 7 days by verifying correct breaker alignment and power availability.

2. Each 125 volt battery bank and charger shall be demonstrated OPERABLE:

a. At least once per 7 days by verifying that:

(1) The parameters in Table 4.4-1 meet the Category A limits, and

(2) The total battery terminal voltage is greater than or equal to 129 volts on float charge.

b. At least once per 92 days and within 7 days after a battery discharge with battery terminal voltage below 110 volts, or battery overcharge with battery terminal voltage above 150 volts, by verifying that:

(1) The parameters in Table 4.4-1 meet the Category B limits,

(2) There is no visible corrosion at either terminals or connectors, or the connection resistance of these items is less than 150×10^{-6} ohms, and

(3) The average electrolyte temperature of ten connected cells is above 61°F for battery banks associated with DC Bus No. 1 and DC Bus No. 2 and above 48°F for the UPS battery bank.

c. At least once per 18 months by verifying that:

(1) The cells, cell plates and battery racks show no visual indication of physical damage or abnormal deterioration,

(2) The cell-to-cell and terminal connections are clean, tight and coated with anticorrosion material,

(3) The resistance of each cell-to-cell and terminal connection is less than or equal to 150×10^{-6} ohms,

(4) The battery charger for 125 volt DC Bus No. 1 will supply at least 800 amps DC at 130 volts DC for at least 8 hours,

(5) The battery charger for 125 volt DC Bus No. 2 will supply at least 45 amps DC at 130 volts DC for at least 8 hours, and

(6) The battery charger for the UPS will supply at least 10 amps AC at 480 volts AC for at least 8 hours as measured at the output of the UPS inverter.

d. At least once per 18 months, during shutdown, by verifying that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated emergency loads for the design duty cycle when the battery is subjected to a battery service test.

e. At least once per 60 months, during shutdown, by verifying that the battery capacity is at least 80%, 85% for Battery Bank No. 1, of the manufacturer's rating when subjected to a performance discharge test. Once per 60 month interval, this performance discharge test may be performed in lieu of the battery service test required by Surveillance Requirement 4.4.D.2.d.

f. Annual performance discharge tests of battery capacity shall be given to any battery that shows signs of degradation or has reached 85% of the service life expected for the application. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its average on previous performance tests, or is below 90% of the manufacturer's rating.

E. The required Safeguards Load Sequencing Systems (SLSS) shall be demonstrated OPERABLE at least once per 31 days on a STAGGERED TEST BASIS, by simulating SISLOP* conditions and verifying that the resulting interval between each load group is within ± 10% of its design interval.

F. The required diesel generators and the Safeguards Load Sequencing Systems (SLSS) shall be demonstrated OPERABLE at least once per 18 months during shutdown by:

1. Subjecting the diesel to an inspection in accordance with procedures prepared in conjunction with its manufacturer's recommendations for this class of standby service.

2. Simulating SISLOP*, and:

   a. Verifying operation of circuitry which locks out non-critical equipment,

   b. Verifying the diesel performs a DG FAST START from standby condition on the auto-start signal, energizes the emergency buses with permanently connected loads and the auto connected emergency loads** through the load sequencer (with the exception of the feedwater, safety injection, charging and refueling water pumps whose respective breakers may be racked-out to the test position) and operates for $\geq$ 5 minutes while its generator is loaded with the emergency loads,

   c. Verifying that on the safety injection actuation signal, all diesel generator trips, except engine overspeed and generator differential, are automatically bypassed.

3. Verifying the generator capability to reject a load of 4,000 kW without tripping. The generator voltage shall not exceed 4,800 volts and the generator speed shall not exceed 500 rpm (nominal speed plus 75% of the difference between nominal speed and the overspeed trip setpoint) during and following the load rejection.

G. Manual Transfer Switches

1. Verify once every 31 days that the fuse block for breaker 8-1181 in MCC-1 for MTS-7 is removed.

2. Verify once every 31 days that MTS-8 is energized from breaker 8-1480B from MCC-4 and the cabinet door is locked, and that breaker 8-1122 from MCC-1 is locked open.

---

*SISLOP is the signal generated by coincident loss of offsite power (loss of voltage on Buses 1C and 2C) and demand for safety injection.

**The sum of all loads on the engine shall not exceed 6,000 kW.

TABLE 4.4-1

BATTERY SURVEILLANCE REQUIREMENTS

	CATEGORY A[1]	CATEGORY B[2]	
Parameter	Limits for each designated pilot cell	Limits for each connected cell	Allowable[3] value for each connected cell
Electrolyte Level	>Minimum level indication mark, and ≤1/4" above maximum level indication mark	>Minimum level indication mark, and ≤1/4" above maximum level indication mark	Above top of plates, and not overflowing
Float Voltage	≥2.13 volts	≥2.13 volts[c]	>2.07 volts
Specific[a] Gravity	≥1.200[b]	≥1.195	Not more than .020 below the average of all connected cells
		Average of all connected cells >1.205	Average of all connected cells ≥1.195[b]

(a) Corrected for electrolyte temperature and level.
(b) Or battery charging current is less than 2 amps when on charge.
(c) Corrected for average electrolyte temperature in accordance with IEEE STD 450-1980.
(1) For any Category A parameter(s) outside the limit(s) shown, the battery may be considered OPERABLE provided that within 24 hours all the Category B measurements are taken and found to be within their allowable values, and provided all Category A and B parameter(s) are restored to within limits within the next 6 days.
(2) For any Category B parameter(s) outside the limit(s) shown, the battery may be considered OPERABLE provided that the Category B parameter(s) are within their allowable values and provided the Category B parameter(s) are restored to within limits within 7 days.
(3) Any Category B parameter not within its allowable value indicates an inoperable battery.

BASIS: The normal plant Emergency Power System is normally in continuous operation, and periodically tested.[1]

The tests specified above will be completed without any preliminary preparation or repairs which might influence the results of the test except as required to perform the DG SLOW START test set forth in T.S. 4.4.B.1.a. The tests will demonstrate that components which are not normally required will respond properly when required.

DG SLOW STARTS are specified for the monthly surveillances in order to reduce the cumulative fatigue damage to the engine crankshafts to levels below the threshold of detection under a program of augmented inservice inspection. In the event that the DG SLOW START inadvertently achieves steady state voltage and frequency in less than 24 seconds, the surveillance will not be considered a failure and require restart of the diesel generator.

The surveillance requirements for demonstrating the OPERABILITY of the station batteries are based on the recommendations of Regulatory Guide 1.129, "Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," February 1978, and IEEE Std 450-1980, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations."

Verifying average electrolyte temperature above the minimum for which the battery was sized, total battery terminal voltage on float charge, connection resistance values and the performance of battery service and discharge tests ensure the effectiveness of the charging system, the ability to handle high discharge rates and compares the battery capacity at that time with the rated capacity.

Table 4.4-1 specifies the normal limits for each designated pilot cell and each connected cell for electrolyte level, float voltage and specific gravity. The limits for the designated pilot cells float voltage and specific gravity, greater than 2.13 volts and .020 below normal full charge specific gravity or a battery charger current that has stabilized at a low value, is characteristic of a charged cell with adequate capacity. The normal limits for each connected cell for float voltage and specific gravity, greater than 2.13 volts and not more than .020 below normal full charge specific gravity with an average specific gravity of all the connected cells not more than .010 below normal full charge specific gravity, ensures the OPERABILITY and capability of the battery.

Operating with a battery cell's parameter outside the normal limit but within the allowable value specified in Table 4.4-1 is permitted for up to 7 days. During this 7 day period: (1) the allowable values for electrolyte level ensures no physical damage to the plates with an adequate electron transfer capability; (2) the allowable value for the average specific gravity of all the cells, not more than .020 below normal full charge specific gravity, ensures that the decrease in rating will be less than the safety margin provided in sizing; (3) the allowable value for an individual cell's specific gravity, ensures that an individual cell's specific gravity will not be more than .040 below normal full charge specific gravity and that the overall capability of the battery will be maintained within an acceptable limit; and (4) the allowable value for an individual cell's float voltage, greater than 2.07 volts, ensures the battery's capability to perform its design function.

Verifying required positions for manual transfer switches ensure single failure and environmental interaction requirements are satisfied. The normal alignments for MTS-7 and MTS-8 are MCC-2 and MCC-4, respectively.

<u>REFERENCE:</u> (1) Supplement No. 1 to Final Engineering Report and Safety Analysis, Section 3, Questions 6 and 8.

ATTACHMENT 2

PROPOSED TECHNICAL SPECIFICATIONS

3.5 INSTRUCTIONS AND CONTROL

3.5.1 REACTOR TRIP SYSTEM INSTRUMENTATION

APPLICABILITY: As shown in Table 3.5.1-1.

OBJECTIVE: To delineate the conditions of the Plant instrumentation and safety circuits necessary to ensure reactor safety.

SPECIFICATION: As a minimum, the reactor trip system instrumentation channels and interlocks of Table 3.5.1-1 shall be OPERABLE with the SETPOINTS and RESPONSE TIMES as shown in Tables 3.5.1-2 and 3.5.1-3, respectively.

ACTION: As shown in Table 3.5.1-1.

BASIS: During plant operations, the complete instrumentation systems will normally be in service.(1) Reactor safety is provided by the Reactor Protection System, which automatically initiates appropriate action to prevent exceeding established limits.(2) Safety is not compromised, however, by continuing operation with certain instrumentation channels out of service since provisions were made for this in the plant design.(1)(3) This Standard outlines limiting conditions for operation necessary to preserve the effectiveness of the reactor control and protection system when any one or more of the channels is out of service.

REFERENCES:

(1) Final Engineering Report and Safety Analysis, Section 6.

(2) Final Engineering Report and Safety Analysis, Section 6.2.

(3) NIS Safety Review Report, April 1988

TABLE 3.5.1-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTION UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
10. Reactor Coolant Flow					
A. Single Loop (Above 50% of Full Power)	1/loop	1/loop in any operating loop	1/loop in each operating loop	1	6#
B. Two Loops (Below 50% of Full Power)	1/loop	1/loop in two operating loops	1/loop in each operating loop	1####	6#
11. Steam/Feedwater Flow Mismatch	3	2	2	1#####	6#
12. Turbine Trip-Low Fluid Oil Pressure	3	2	2	1####	6#
13. Reactor Coolant Pump Breaker Position					
A. Single Loop (Above 50% of Full Power)	1/loop	1/loop in any operating loop	1/loop in each operating loop	1	6#
B. Two Loops (Below 50% of Full Power)	1/loop	1/loop in two operating loops	1/loop in each operating loop	1####	6#
14. 4kV Bus 1C and Bus 2C Undervoltage	2/bus	1/bus from both buses	1/bus from both buses	1,2,3*,4*	1#

TABLE 3.5.1-2

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUES
1. 4 kV Bus 1C and 2C Undervoltage	See Figure 3.5.1-1	See Figure 3.5.1-1

TABLE 3.5.1-3

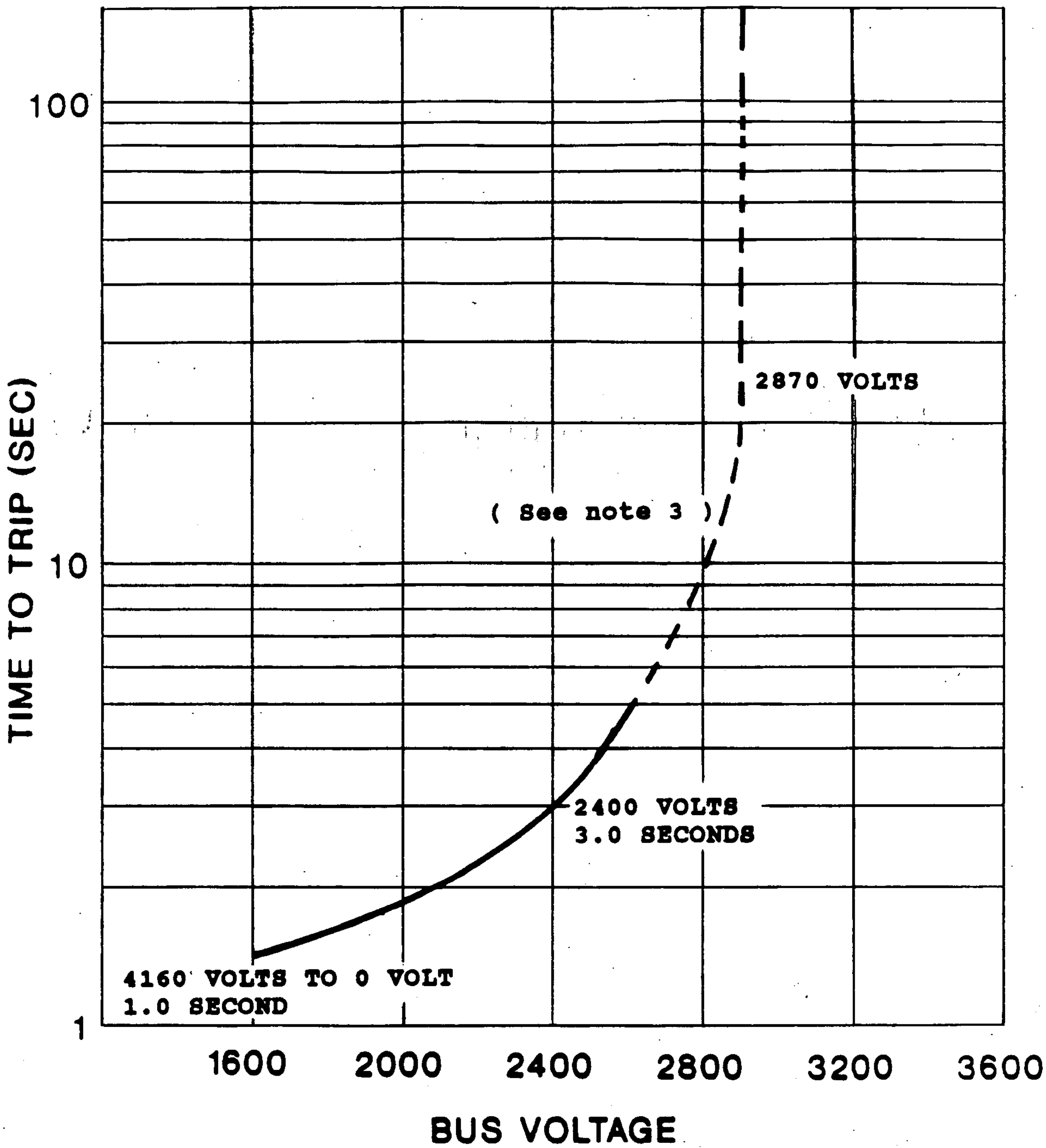
REACTOR TRIP SYSTEM INSTRUMENTATION RESPONSE TIMES

FUNCTIONAL UNIT	RESPONSE TIME
1. 4 kV Bus 1C and 2C Undervoltage	See Figure 3.5.1-1

FIGURE 3.5.1-1

4 KV BUSES 1C & 2C UNDER-VOLTAGE TRIP SETTING

LOSS OF BUS VOLTAGE (CV-7)



Notes: 1. Trip voltage tolerance: ± 3 %
2. Trip time tolerance: ± 5 %
3. Range for accurate relay operation: < 90 % of the tap voltage

3.5.2 CONTROL ROD INSERTION LIMITS

APPLICABILITY: MODES 1 and 2

OBJECTIVE: This specification defines the insertion limits for the control rods in order to ensure (1) an acceptable core power distribution during power operation, (2) a limit on potential reactivity insertions for a hypothetical control rod ejection, and (3) core subcriticality after a reactor trip.

SPECIFICATION:

A. Except during low power physics tests or surveillance testing pursuant to Specification 4.1.1.G, the Shutdown Groups and Control Group 1 shall be fully withdrawn, and the position of Control Group 2 shall be at or above the 21-step uncertainty limit shown in Figure 3.5.2.1.

B. The energy weighted average of the positions of Control Group 2 shall be at least 90% (i.e. > Step 288) withdrawn after the first 20% burnup of a core cycle. The average shall be computed at least twice every month and shall consist of all Control Group 2 positions during the core cycle.

ACTION:

A. With the control groups inserted beyond the above insertion limits either:

1. Restore the control groups to within the limits within 2 hours, or

2. Reduce THERMAL POWER within 2 hours to less than or equal to that fraction of RATED THERMAL POWER which is allowed by the group position using the above figure, or

3. Be in at least HOT STANDBY within 6 hours.

B. With a single dropped rod from a shutdown group or control group, the provisions of Action A are not applicable, and retrieval shall be performed without increasing THERMAL POWER beyond the THERMAL POWER level prior to dropping the rod. An evaluation of the effect of the dropped rod shall be made to establish permissible THERMAL POWER levels for continued operation. If retrieval is not successful within 3 hours from the time the rod was dropped, appropriate action, as determined from the evaluation, shall be taken. In no case shall operation longer than 3 hours be permitted if the dropped rod is worth more than 0.4% Δ k/k.

BASIS: During STARTUP and POWER OPERATION, the shutdown groups and control group 1 are fully withdrawn and control of the reactor is maintained by control group 2. The control group insertion limits are set in consideration of maximum specific shutdown capability, and the rod ejection accident. The considerations associated with each of these quantities are as follows:

1. The initial design maximum value of specific power is 15 kW/ft. The values of $F^N_{\Delta}H$ and F_Q total associated with this specific power are 1.75 and 3.23, respectively.

   A more restrictive limit on the design value of specific power, $F^N_{\Delta}H$ and F_Q is applied to operation in accordance with the current safety analysis including fuel densification and ECCS performance. The values of the specific power, $F^N_{\Delta}H$ and F_Q are 13.2 kW/ft, 1.57 and 2.78, respectively.(8) At partial power, the $F^N_{\Delta}H$ maximum values (limits) increase according to the following equation, $F^N_{\Delta}H\ (P) = 1.57\ [1 + 0.2\ (1-P)]$, where P is the fraction of RATED THERMAL POWER. The control group insertion limits in conjunction with Specification B prevent exceeding these values even assuming the most adverse Xe distribution.

2. The minimum shutdown capability required is 1.25% $\Delta\rho$ at BOL, 1.9% $\Delta\rho$ at EOL and defined linearly between these values for intermediate cycle lifetimes. The rod insertion limits ensure that the available SHUTDOWN MARGIN is greater than the above values.

3. The worst case ejected rod accident (9) covering HFP-BOL, HZP-BOL, HFP-EOL shall satisfy the following accident safety criteria:

   a) Average fuel pellet enthalpy at the hot spot below 225 cal/gm for nonirradiated fuel and 220 cal/gm for irradiated fuel.

   b) Fuel melting is limited to less than the innermost 10% of the fuel pellet at the hot spot.

   Low power physics tests are conducted approximately one to four times during the core cycle at or below 10% RATED THERMAL POWER. During such tests, rod configurations different from those specified in Figure 3.5.2.1 may be employed.

   It is understood that other rod configurations may be used during physics tests. Such configurations are permissible based on the low probability of occurrence of steam line break or rod ejection during such rod configurations.

Operation of the reactor during cycle stretch out is conservative relative to the safety considerations of the control rod insertion limits, since the positioning of the rods during stretch out results in an increasing net available SHUTDOWN MARGIN.

Compliance with Specification B prevents unfavorable axial power distributions due to operation for long intervals at deep control rod insertions.

The presence of a dropped rod leads to abnormal power distribution in the core. The location of the rod and its worth in reactivity determines its effect on the temperatures of nearby fuel. Under certain conditions, continued operation could result in fuel damage, and it is the intent of ACTION B to avoid such damage.

<u>References</u>:

(1) Final Engineering Report and Safety Analysis, revised July 28, 1970.

(2) Amendment No. 18 to Docket No. 50-206.

(3) Amendment No. 22 to Docket No. 50-206.

(4) Amendment No. 23 to Docket No. 90-206.

(5) Description and Safety Analysis, Proposed Change No. 7, dated October 22, 1971.

(6) Description and Safety Analysis Including Fuel Densification, San Onofre Nuclear Generating Station, Unit 1, Cycle 4, WCAP 8131, May, 1973.

(7) Description and Safety Analysis Including Fuel Densification, San Onofre Nuclear Generating Station, Unit 1, Cycle 5, January, 1975, Westinghouse Non-Proprietary Class 3.

(8) Reload Safety Evaluation, San Onofre Nuclear Generating Station, Unit 1, Cycle 10, edited by J. Skaritka, Revision 1, Westinghouse, March, 1989.

(9) An Evaluation of the Rod Ejection Accident in Westinghouse Pressurized Water Reactors Using Spatial Kinetics Methods, WCAP-7588, Revision 1-A, January, 1975.

CONTROL GROUP INSERTION LIMITS

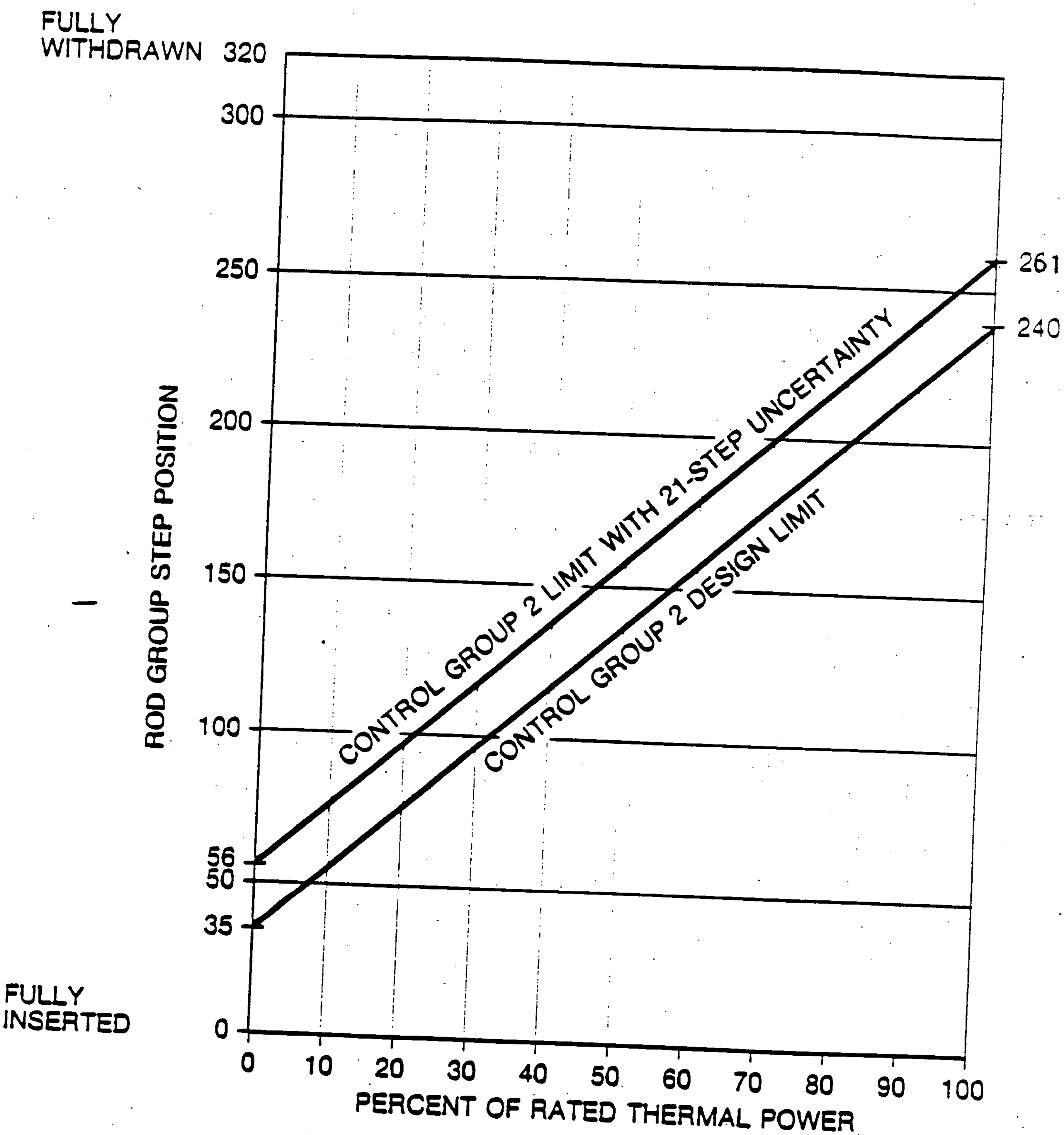


FIGURE 3.5.2.1

3.5.3 CONTROL AND SHUTDOWN ROD MISALIGNMENT

APPLICABILITY: Applies to the number of steps an individual control or shutdown rod may be misaligned from its group position during STARTUP and POWER OPERATION.

OBJECTIVE: To ensure that the effects of rod misalignment from the group position do not exceed the core design margins.

SPECIFICATION: A. During STARTUP and POWER OPERATION, all rods shall be OPERABLE and maintained within ±35 steps (indicated by the Analog Detection System) of their step counter indicated bank position (indicated by the Digital Detection System), except during low power physics tests.

ACTION: B. With Specification A, above, not met, the following specifications are applicable.

1. With one or more rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine that the SHUTDOWN MARGIN BASIS of Specification 3.5.2 is satisfied within 1 hour and be in HOT STANDBY within 6 hours.

2. With more than one rod inoperable or misaligned from the step counter indicated position by more than ±35 steps (indicated by the Analog Detection System), be in HOT STANDBY within 6 hours.

3. With one rod inoperable due to causes other than addressed by Specification B.1, above, or misaligned from its step counter indicated height by more than ±35 steps (indicated by the Analog Detection System), POWER OPERATION may continue provided that within one hour either:

   a. The rod is restored to OPERABLE status within the above alignment requirements, or

   b. The rod is declared inoperable and the SHUTDOWN MARGIN BASIS of Specification 3.5.2 is satisfied. POWER OPERATION may then continue provided that:

      1) A reevaluation of each accident analysis of Table 3.5.3-1 is performed within 5 days; this reevaluation shall confirm that the previously analyzed results of these accidents remain valid for the duration of operation under these conditions.

2) The SHUTDOWN MARGIN BASIS of Specification 3.5.2 is determined at least once per 12 hours.

3) A power distribution map is obtained from the movable incore detectors and $F_Q(Z)$ and $F^N_{\Delta H}$ are verified to be within their limits within 72 hours.

4) Either the THERMAL POWER level is reduced to less than or equal to 75% of RATED THERMAL POWER within one hour and within the next 4 hours the high neutron flux trip setpoint is reduced to less than or equal to 85% of RATED THERMAL POWER, or

5) The remainder of the rods in the group with the inoperable rod are aligned to within ±35 steps of the inoperable rod within one hour while maintaining the rod insertion limits of Figure 3.5.2.1.

<u>BASIS</u>: The specifications of this section ensure that (1) acceptable power distribution limits are maintained, (2) the minimum SHUTDOWN MARGIN is maintained, and (3) limit the potential affects of rod misalignment on associated accident analyses.

The misalignment allowance of Specification B, assures core performance within allowed design margins including allowance for the inaccuracy of the position signals.

TABLE 3.5.3-1

ACCIDENT ANALYSES REQUIRING REEVALUATION IN THE EVENT OF AN INOPERABLE ROD

Rod Cluster Control Assembly Insertion Characteristics

Rod Cluster Control Assembly Misalignment

Loss of Reactor Coolant From Small Ruptured Pipes or From Cracks In Large Pipes Which Actuates the Emergency Core Cooling System

Single Rod Cluster Control Assembly Withdrawal At Full Power

Major Reactor Coolant System Pipe Ruptures (Loss of Coolant Accident)

Major Secondary System Pipe Rupture

Rupture of a Control Rod Drive Mechanism Housing (Rod Cluster Control Assembly Ejection)

3.5.4 ROD POSITION INDICATING SYSTEM

APPLICABILITY: Applies to the operating status of the Rod Position Indicating System.

OBJECTIVE: To ensure the ability to accurately detect the position of control and shutdown rods.

SPECIFICATION:

A. During STARTUP and POWER OPERATION the Analog Detection System and the Digital Detection System shall be OPERABLE and capable of determining the control rod positions within ±21 steps.

B. The Analog Detection System remains OPERABLE if the specified rod position indications can be obtained from direct LVDT voltage measurements.

ACTION:

C. With specifications A and B, above, not met, the following specifications are applicable.

1. With a maximum of one rod position indicator (Analog Detection System) per bank inoperable either:

   a. Determine the position of the non-indicating rod(s) indirectly by the movable incore detectors within 8 hours, and at least once per 8 hours thereafter and immediately after any motion of the non-indicating rod which exceeds 56 steps in one direction since the last determination of the rod's position, or

   b. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

2. With a maximum of one step counter indicator (Digital Detection System) per bank inoperable either:

   a. Verify that all rod position indicators (Analog Detection System) for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of 35 steps of each other at least once per 8 hours, or

   b. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

3. With more than one rod position indicator (Analog Detection System) per bank inoperable or more than one step counter indicator (Digital Detection System) per bank inoperable be in HOT STANDBY within 6 hours.

BASIS:

Control rod position and OPERABILITY of the rod position indicators are required to be verified on a nominal basis of once per shift with more frequent verifications required if an automatic monitoring channel is inoperable. These verification frequencies are adequate for assuring that the applicable LCO's are satisfied.

The indicator inoperability allowance of Specification C requires indirect measurement of rod position or a restriction in THERMAL POWER; either of these restrictions provide assurance of fuel rod integrity during continued operation.

3.5.5 CONTAINMENT ISOLATION INSTRUMENTATION

APPLICABILITY: Applies to instrumentation which actuates the containment sphere isolation valves, containment sphere purge and exhaust valves, and containment sphere instrumentation vent header valves.

OBJECTIVE: To ensure reliability of the containment sphere isolation provisions.

SPECIFICATION: The instrumentation channels shown in Table 3.5.5-1 shall be OPERABLE with their trip setpoints set consistent with the values shown in the Trip Setpoint column of Table 3.5.5-2.

ACTION:

A. With an instrumentation channel trip setpoint less conservative than the Allowable Values column of Table 3.5.5-2, declare the channel inoperable and apply the applicable ACTION requirement of Table 3.5.5-1 until the channel is restored to OPERABLE status with the trip setpoint adjusted consistent with the Trip Setpoint Value.

B. With an instrumentation channel inoperable, take the ACTION shown in Table 3.5.5-1.

BASIS: The OPERABILITY of these instrumentation systems ensure that 1) the associated action will be initiated when the parameter monitored by each channel or combination thereof reaches its setpoint, 2) the specified coincidence logic is maintained, 3) sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance, and 4) sufficient system functional capability is available from diverse parameters.

The OPERABILITY of these systems is required to provide the overall reliability, redundancy, and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses.

REFERENCES:

(1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

TABLE 3.5.5-1

CONTAINMENT ISOLATION INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
Containment Isolation (Valves listed in Table 3.6.2-1)					
a) Manual	2	1	2	1, 2, 3, 4	11
b) Containment Pressure-High	3/train	2/train	2/train	1, 2, 3	9
c) Sequencer Subchannels	2/sequencer	2/sequencer	2/sequencer	1, 2, 3, 4	8
d) Safety Injection					
1) Containment Pressure-High	3/train	2/train	2/train	1, 2, 3	9*
2) Pressurizer Pressure-Low	3/train	2/train	2/train	1, 2, 3	9*
Purge and Exhaust Isolation (POV-9, POV-10, CV-10, CV-40, CV-116)					
a) Manual	1	1	1	1, 2, 3, 4	10
b) Containment Radioactivity-High	1	1	1	1, 2, 3, 4	10

TABLE 3.5.5-1 (Continued)

TABLE NOTATION

ACTION STATEMENTS

* The provisions of Specification 3.0.4 are not applicable.

ACTION 8 - With the number of OPERABLE channels one less than the Total Number of Channels, be in HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours; however, one channel may be bypassed for up to 2 hours for surveillance testing .er Specification 4.1.4.

ACTION 9 - With the number of OPERABLE channels one less than the Total Number of Channels, operation may proceed until performance of the next required CHANNEL FUNCTIONAL TEST provided the inoperable channel is placed in the tripped condition within 8 hours.

ACTION 10 - With less than the Minimum Channels OPERABLE, operation may continue provided the containment purge and exhaust valves (POV-9 & POV-10) are maintained closed.

ACTION 11 - With the number of OPERABLE Channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

TABLE 3.5.5-2

CONTAINMENT ISOLATION INSTRUMENTATION TRIP SET POINTS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUES
Containment Isolation		
a) Manual	Not Applicable	Not Applicable
b) Containment Pressure-High	≤ 1.4 psig	≤ 2.0 psig
c) Sequencer Subchannels	Not Applicable	Not Applicable
d) Safety Injection		
1) Containment Pressure-High	≤ 1.4 psig	≤ 2.0 psig
2) Pressurizer Pressure-Low	≥ 1735 psig	≥ 1675 psig
Purge and Exhaust Isolation		
a) Manual	Not Applicable	Not Applicable
b) Containment Radioactivity-High	≤ 2 x Background	≤ 2.5 x Background

3.5.6 ACCIDENT MONITORING INSTRUMENTATION

APPLICABILITY: MODES 1, 2 and 3.

OBJECTIVE: To ensure reliability of the accident monitoring instrumentation.

SPECIFICATION: The accident monitoring instrumentation channels shown in Table 3.5.6-1 shall be OPERABLE.

ACTION:

A. With the number of OPERABLE accident monitoring instrumentation channels less than the Total Number of Channels shown in Table 3.5.6-1, except as noted in ACTIONS B and C, either restore the inoperable channel(s) to OPERABLE status within 7 days, or be in at least HOT SHUTDOWN within the next 12 hours.

B. With one or more channels of Auxiliary Feedwater Flow Rate or Steam Generator Water Level or RCS Loop Delta-T indication inoperable, restore the inoperable channel(s) to OPERABLE status within 72 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

C. With channels from more than one type of Auxiliary Feedwater Flow Indication inoperable, restore the inoperable channel(s) to OPERABLE status such that no more than one type of indication has an inoperable channel(s) within 6 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

D. With the number of OPERABLE accident monitoring instrumentation channels less than the MINIMUM CHANNELS OPERABLE requirements of Table 3.5.6-1, except as noted in ACTIONS B and C, either restore the inoperable channel(s) to OPERABLE status within 48 hours or be in at least HOT SHUTDOWN within the next 12 hours.

E. The provisions of Specification 3.0.4 are not applicable for Specifications A and D above.

BASIS: The OPERABILITY of the accident monitoring instrumentation ensures that sufficient information is available on selected plant parameters to monitor and assess these variables during and following an accident. This capability is consistent with the recommendations of Regulatory Guide 1.97, "Instrumentation for Light Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," December 1975 and NUREG-0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations."

The Auxiliary Feedwater flow indication is subject to the more restrictive ACTION requirements for the AFW system. In order to satisfy decay heat removal requirements and minimize the potential for exceeding water hammer flow limits for a main feedwater line break upstream of the in-containment check valve, the OPERABILITY of AFW Train B is subject to the ability to equalize flow to the steam generators. Verification of equalization is provided by the AFW flow transmitters. If the capability to equalize flow or the ability to verify equalization is not available, Train A would be utilized to provide the necessary decay heat removal capability. AFW Train A provides adequate flow for this scenario without reliance on operator action to equalize flow.(3) The steam generator wide range level indicators and the RCS loop delta-T indicators provide backup means for verification of auxiliary feedwater flow to the steam generators, and also provide alternate means for identification of a broken loop.

REFERENCES:

(1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

(2) NRC letter dated November 1, 1983, from D. G. Eisenhut to all Pressurized Water Reactor Licensees, NUREG-0737 Technical Specification (Generic Letter No. 83-37).

(3) SCE letter dated November 6, 1987, from M. O. Medford to NRC Document Control Desk.

TABLE 3.5.6-1

ACCIDENT MONITORING INSTRUMENTATION

INSTRUMENT	TOTAL NO. OF CHANNELS	MINIMUM CHANNELS OPERABLE
Pressurizer Water Level	3	2
Auxiliary Feedwater Flow Indication*		
o Auxiliary Feedwater Flow Rate	1/steam generator	1/steam generator
o Steam Generator Water Level (Wide Range)	1/steam generator	1/steam generator
o Reactor Coolant System Loop Delta-T Indication	1/loop	1/loop
Reactor Coolant System Subcooling Margin Monitor		2 1
PORV Position Indicator (Limit Switch)	1/valve	1/valve
PORV Block Valve Position Indicator (Limit Switch)	1/valve	1/valve
Safety Valve Position Indicator (Limit Switch)	1/valve	1/valve
Containment Pressure (Wide Range)	2	1
Refueling Water Storage Tank Level	2	1
Containment Sump Water Level (Narrow Range)**	2	1
Containment Water Level (Wide Range)	2	1
Neutron Flux (Wide Range)		2 1

* Auxiliary feedwater flow indication for each steam generator is provided by one channel of auxiliary feedwater flow rate (Train B), one channel of environmentally qualified steam generator wide range level (Train A), and one channel of RCS Loop Delta-T indication. These comprise the three types of indication of auxiliary feedwater flow for each steam generator.

** Operation may continue up to 30 days with one less than the total number of channels OPERABLE.

3.5.7 AUXILIARY FEEDWATER INSTRUMENTATION

APPLICABILITY: Applies to the auxiliary feedwater system instrumentation and interlocks in MODES 1, 2, and 3.

OBJECTIVE: To ensure reliability of automatic initiation of the auxiliary feedwater system.

SPECIFICATIONS: A. The instrumentation channels shown in Table 3.5.7-1 shall be OPERABLE with their trip setpoints set consistent with the Trip Setpoint column of Table 3.5.7-2.

ACTION: B. With an instrumentation channel trip setpoint less conservative than the value shown in the Allowable Values column of Table 3.5.7-2, declare the channel inoperable and apply the applicable ACTION requirement of Table 3.5.7-1 until the channel is restored to OPERABLE status with the trip setpoint adjusted consistent with the Trip Setpoint Value.

C. With one instrumentation channel inoperable, take the action shown in Table 3.5.7-1.

BASIS: The OPERABILITY of the auxiliary feedwater instrumentation ensures that 1) the associated action will be initiated when the parameter monitored by each channel or combination thereof reaches its setpoint, 2) the specified coincidence logic is maintained, 3) sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance, and 4) sufficient system functional capability is available from diverse parameters.

The OPERABILITY of this instrumentation is required to provide the overall reliability, redundancy, and diversity assumed available for the protection and mitigation of accident and transient conditions. The operation of this instrumentation is consistent with the assumptions used in the accident analyses.

REFERENCES:

(1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

TABLE 3.5.7-1

AUXILIARY FEEDWATER INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
a. Manual Actuation	2	1	2	1, 2, 3	12
b. Automatic Actuation Logic	2	1	2	1, 2, 3	13
c. Steam Generator Water Level-Low					
i. Train A	3	2	2	1, 2, 3	14, 15
ii. Train B	3	2	2	1, 2, 3	14, 15
d. AFW Train Interlocks*					
i. Low Flow Train B/ Start Train A Fow					
1) Start Pump G10S/Open Pump G10 Discharge Valve CV-2620, AND	2	1	2	1, 2, 3	35, 36
2) Start Pump G10/Open Pump G10S Discharge Valve MOV-1202	2	1	2	1, 2, 3	35, 36
ii. Normal Flow Train B/ Stop Train A Flow					
1) Stop Pump G10S/Close Pump G10 Discharge Valve CV-2620, OR	2	2**	2	1, 2, 3	35, 36
2) Stop Pump G10/Close Pump G10S Discharge Valve MOV-1202	2	2**	2	1, 2, 3	35, 36

* A total of 4 flow switches monitor Train B flow and each switch represents a channel which provides the specified signals to Train A.

** Only 1 of 2 Channels is required to trip of 1 Channel has been disconnected per the requirements of ACTION 35.

ACTION 12 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 72 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 13 - With the number of OPERABLE Channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 72 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours; however, one channel may be bypassed for up to 8 hours for surveillance testing per Specification 4.1.8 provided the other channel to OPERABLE.

ACTION 14 - With the number of OPERABLE channels one less than the Total Number of Channels, operation may proceed until performance of the next required CHANNEL TEST provided the inoperable channel is placed in the tripped condition within 1 hour, or an operator shall assume continuous surveillance and actuate manual initiation of auxiliary feedwater, if necessary.

ACTION 15 - With more than one channel inoperable, an operator shall assume continuous surveillance and actuate manual initiation of auxiliary feedwater, if necessary. Restore the system to no more than one channel inoperable within 7 days, or be in HOT STANDBY within the following 6 hours and in HOT SHUTDOWN within the following 6 hours.

ACTION 35 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 72 hours or disconnect the inoperable channel within 1 hour.

ACTION 36 - With the total number of OPERABLE channels monitoring Train B flow less than 3, restore the number of OPERABLE channels to no less than 3 within 72 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

TABLE 3.5.7-2

AUXILIARY FEEDWATER INSTRUMENTATION
SETPOINTS

FUNCTIONAL UNIT	SETPOINT	ALLOWABLE VALUES
a. Manual Actuation	Not Applicable	Not Applicable
b. Automatic Actuation Logic	Not Applicable	Not Applicable
c. Steam Generator Water Level-Low	≥ 5% of narrow range instrument span for each steam generator	≥ 0% of narrow range instrument span for each steam generator
d. AFW Train Interlocks		
i. Decreasing Flow in Train B/ Start Train A Flow	23 gpm*	≥ 10 gpm
ii. Increasing Flow in Train B/ Stop Train A Flow	37 gpm*	≤ 48 gpm

* Each flow switch monitoring Train B flow utilizes its set and reset points for permissive signals for starting and stopping Train A.

3.5.8 RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION

APPLICABILITY: During releases via this pathway.

OBJECTIVE: Monitor and control radioactive liquid effluent releases.

SPECIFICATION:

A. The radioactive liquid effluent monitoring instrumentation channels shown in Table 3.5.8.1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 3.15.1 are not exceeded.

B. ACTION:

1. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure that the limits of 3.15.1 are met, without delay suspend the release of radioactive liquid effluents monitored by the affected channel or declare the channel inoperable, or change the setpoint so it is acceptably conservative.

2. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.5.8.1. If the inoperable instruments remain inoperable for greater than 30 days, explain in the next Semiannual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

3. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

BASIS: The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases. The alarm/trip setpoints for these instruments are calculated in accordance with methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

TABLE 3.5.8.1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION
1. Gross Radioactive Monitors Providing Automatic Termination of Release		
a. Liquid Radwaste Effluent Line (R-1218)	(1)	16
b. Steam Generator Blowdown[a] Effluent Line (R-1216)	(1)	17
c. Turbine Building Sumps Effluent Line (Reheater Pit Sump) (R-2100)	(1)	18
d. Yard Sump (R-2101)	(1)	18
e. Component Cooling Water System[b] (R-1217)	(1)	19
2. Flow Rate Measurement Devices		
a. Liquid Radwaste Effluent Line (FE-16, FE-18)	(1)	20
b. Circulating Water Outfall*		
c. Steam Generator Blowdown Effluent* Line		

---

* Pump status, valve turns or calculations are utilized to estimate flow.

(a) Secondary coolant samples and activity analysis performed in accordance with T.S. 4.1, Table 4.1.2.

(b) Closed loop system. Monitor closes vent valve to isolate surge tank.

TABLE 3.5.8.1
(Continued)

TABLE NOTATION

ACTION 16 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases may continue provided that prior to initiating a release:

1. At least two separate samples which can be taken by a single person are analyzed in accordance with Specification 4.5.1.A., and;

2. At least two technically qualified persons verify the release rate calculations and discharge valving.

ACTION 17 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue, provided grab samples are analyzed for gross radioactivity (beta or gamma) at a lower limit of detection of at least 10^{-7} microcurie/ml;

1. At least once per 12 hours when the specific activity of the secondary coolant is > 0.01 mCi/gram DOSE EQUIVALENT I-131.

2. At least once per 24 hours when the specific activity of the secondary coolant is $\leq$ 0.01 mCi/gram DOSE EQUIVALENT I-131.

ACTION 18 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that, at least once per 12 hours, grab samples are collected and analyzed for gross radioactivity (beta or gamma) at a lower limit of detection of at least 10^{-7} microcurie/ml.

ACTION 19 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, determine if there is leakage from the Component Cooling Water System to the Salt Water Cooling System. If leakage exists sample the Component Cooling Water System to estimate the activity being released via the Salt Water Cooling System at least once per 24 hours for gross activity (beta or gamma) at a lower limit of detection of at least 10^{-7} microcurie/ml.

ACTION 20 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in-situ may be used to estimate flow.

3.5.9 RADIOACTIVE GASEOUS PROCESS AND EFFLUENT MONITORING INSTRUMENTATION

APPLICABILITY: During releases via this pathway.

OBJECTIVE: Monitor and control radioactive gaseous releases.

SPECIFICATION:

A. The radioactive gaseous process and effluent monitoring instrumentation channels shown in Table 3.5.9.1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 3.16.1 are not exceeded.

B. ACTION:

1. With a radioactive gaseous process or effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure that the limits of 3.16.1 are met, without delay suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel inoperable, or change the setpoint so it is acceptably conservative.

2. With less than the minimum number of radioactive gaseous process or effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.5.9.1. If the inoperable instruments remain inoperable for greater than 30 days, explain in the next Semiannual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

3. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

BASIS: The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm/trip setpoints for these instruments are calculated in accordance with methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

TABLE 3.5.9.1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION
1. Stack Monitoring System[1]		
a. Gross Activity Monitor - Providing Alarm (R-1214 or (R-1219[2], 1220 and 1221))	(1)	21
b. Noble Gas Activity Monitor (R1219[2] or 1212[3] or 1254*)	(1)	22
c. Iodine Sampler Cartridge (R1221 or 1254*)	(1)	23
d. Particulate Sampler Filter (R-1211 or 1220 or 1254*)	(1)	23
e. Stack Fan Flow Indication (R-1254*)	(1)	24
f. Sampler Flow Rate Measuring Device	(1)	24

1. Includes the following subsystems:
   a. Spent Fuel Building Ventilation, Auxiliary Building Ventilation, and Waste Gas Treatment (CVI) Building Ventilation system.
   b. Containment Monitoring System.
   c. Air Ejector System.

2. Provides for auto-termination of release from the Waste Gas Holdup System.

3. Provides for auto-termination of containment purge.

* Does not perform any isolation function. Does not provide control room alarm annunciation when the instrument controls are set in the "not operate" mode.

TABLE 3.5.9.1
(Continued)

TABLE NOTATION

ACTION 21 With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement and instrument 1b inoperable the contents of a waste gas decay tank may be released to the environment provided that prior to initiating the release:

1. At least two separate samples which can be taken by a single person of the tank's contents are analyzed; and

2. At least two technically qualified persons verify the release rate calculations and discharge valve lineup.

All other effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 22 With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement and instrument 1a inoperable, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 23 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue provided samples are continuously collected with auxiliary sampling equipment as required in Table 4.6.1.1.

ACTION 24 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flowrate is estimated at least once per 8 hours.

3.5.10 RADIATION MONITORING INSTRUMENTATION

APPLICABILITY: As shown in Table 3.5.10-1.

OBJECTIVE: To ensure reliability of the radiation monitoring instrumentation.

SPECIFICATION: The radiation monitoring instrumentation shown in Table 3.5.10-1 shall be OPERABLE with their alarm setpoints within the specified limits.

ACTION:

A. With a radiation monitoring channel alarm setpoint exceeding the value shown in Table 3.5.10-1, adjust the setpoint to within the limit within 4 hours or declare the channel inoperable.

B. With one or more radiation monitoring channels inoperable, take the ACTION shown in Table 3.5.10-1.

C. The provisions of Specification 3.0.3 and 3.0.4 are not applicable.

BASIS: The OPERABILITY of the radiation monitoring channels ensures that (1) the radiation levels are continually measured in the areas served by the individual channels, and (2) the alarm is initiated when the radiation level trip setpoint is exceeded.

REFERENCES:

(1) NRC letter dated November 1, 1983, from D. G. Eisenhut to all Pressurized Water Reactor Licensees, NUREG-0737 Technical Specification (Generic Letter No. 83-37).

TABLE 3.5.10-1

RADIATION MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ALARM SETPOINT	MEASUREMENT RANGE	ACTION
1. AREA MONITORS					
a. Control Room Area (R-1231)	1	All	1 mR/hr	10^{-2} - 10^{2}mR/hr	25
b. Spent Fuel Pool Area (R-1236)	1	*	25 mR/hr	10^{-2} - 10^{2}mR/hr	26
c. Containment Radiation Monitor-High Range (R-1255, R-1257)	2	1, 2, 3 & 4	10 R/hr	1-10^{8} R/hr	27
2. PROCESS MONITORS					
a. Wide Range Gas Monitor (R-1254)	1	1, 2, 3 & 4	per ODCM	10^{-7}-10^{5} mCi/cc	27
b. Main Steam Dump and Safety Valve Channels (R-1256A&B, R-1258A&B)	1/steamline	1, 2, 3 & 4	1mR/hr (low) 1 R/hr (high)	10^{-1}-10^{4} mR/hr 10^{-1}-10^{4} R hr	27

* With fuel in the spent fuel pool or building

TABLE 3.5.10-1 (Continued)

ACTION STATEMENTS

ACTION 25 - With the number of OPERABLE channels less than the Minimum Channels OPERABLE requirement; within 1 hour: (1) either initiate and maintain operation of the control room emergency ventilation system in the recirculation mode of operation, or (2) initiate the preplanned alternate method of monitoring and alarming the area radiation.

ACTION 26 - With the number of OPERABLE channels less than the Minimum Channels OPERABLE requirement, perform area surveys of the monitored area with portable monitoring instrumentation at least once per 24 hours.

ACTION 27 - With the number of OPERABLE channels less than required by the Minimum Channels OPERABLE requirement of Table 3.5.10-1, initiate the preplanned alternate method of monitoring the appropriate parameter(s) within 72 hours, and:

(1) either restore the inoperable channel(s) to OPERABLE status within 7 days of initiating the preplanned alternate method, or

(2) prepare and submit a Special Report to the Commission pursuant to Specification 6.9.2, within 14 days following initiating the preplanned alternate method, outlining the action taken, the cause of the inoperability and the plans and schedule for restoring the system to OPERABLE status.

When one diesel generator is inoperable, there is an additional ACTION requirement to verify that all required systems, subsystems, trains, components and devices, that depend on the remaining OPERABLE diesel generator as a source of emergency power, are also OPERABLE. In addition, the ACTION STATEMENT requires a verification that the steam-driven auxiliary feedwater pump is OPERABLE in MODES 1, 2, and 3.

These requirements are intended to provide assurance that a loss of offsite power event will not result in a complete loss of safety function of critical systems during the period one of the diesel generators is inoperable. The term verify as used in this context means to administratively check by examining logs or other information to determine if certain components are out-of-service for maintenance or other reasons. It does not mean to perform the surveillance requirements needed to demonstrate the operability of the component. The Safeguards Load Sequencing System is designed so that each sequencer starts and loads its associated diesel generator and sequences the ECCS loads upon receipt of a safety injection signal (SIS) and concurrent loss of voltage on its respective 4160 volt bus (i.e., upon a SISLOP).

The total connected design load on each diesel generator is restricted to 6,000 kW or less. This requirement was the result of a crankshaft crack propagation analysis (see Reference 1). The analysis postulated that the crankshaft initially has stress-induced surface cracks. The analysis then considered the effect of four types of diesel load histories on the growth of these cracks. Each load history consisted of repeated start-stop cycles with some steady state operation at full load (6,000 kW) between each start and its stop. The analysis concluded that for a crankshaft with a detectable size crack (10 mils deep), the number of start-stop cycles required to enlarge the crack until it becomes self-propagating (18 mils deep) under the full load steady state stresses represents the effective life of the crankshaft.

During normal operations, the 480 volt system is considered OPERABLE if the four 480 volt buses and four station service transformers are OPERABLE with respective tie breakers open. This will ensure that the 480V main breakers and transformers remain OPERABLE during the worst loading condition in case of a SIS without LOP.

The primary power source for Vital Buses 1, 2, 3, 3A, and 4 is Train A DC Bus 1. The alternate power source is available from MCC-2 through MTS-7. The 1987 RPS and ESF single failure analyses credited the Train B backup power to these vital buses through MTS-7.

Correct operation of the safety injection system is assured by the operability of the load sequencers and the UPS for MOV-850C and MOV-358 (MOV-850C UPS). Correct operation of the recirculation system is assured by the operability of the MOV-850C UPS which also supplies MOV-358.

Manual Transfer Switch 8 (MTS-8) provides the means to power MOV-883 and the MOV-850C UPS from either Train A or Train B. However, due to single failure considerations and environmental effects, MTS-8 is normally powered from MCC-4 on Train B. MOV-883 is the discharge valve from the RWST and must remain open during the safety injection phase and close with initiation of recirculation.

REFERENCE: (1) Report No FaAA-84-12-14 (Revision 1.0), Evaluation of Transient Conditions on Emergency Diesel Generator Crankshafts at San Onofre Nuclear Generating Station, Unit 1.

I. The reactor trip system response time of each reactor trip function listed in Table 3.5.1-3 shall be demonstrated to be within its limit at least once per 18 months. Each test shall include at least one train such that both trains are tested at least once per 36 months and one channel per function such that all channels are tested at least once every N times 18 months where N is the total number of redundant channels in a specific reactor trip function as shown in the "Total No. of Channels" column of Table 3.5.1-1.

TABLE 4.1.1

REACTOR TRIP SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST
1. Manual Reactor Trip	N.A.	N.A.	N.A.	R	N.A.
2. Power Range, Neutron Flux	S	D (2,3) R (3,4)	M	N.A.	N.A.
3. Power Range, Neutron Flux, Dropped Rod Stop	N.A.	N.A.	M	N.A.	N.A.
4. Intermediate Range, Neutron Flux	S	R (3,4)	S/U (1), M	N.A.	N.A.
5. Source Range, Neutron Flux	S	R (3)	S/U (1), M	N.A.	N.A.
6. NIS Coincidentor Logic	N.A.	N.A.	N.A.	N.A.	M (5)
7. Pressurizer Variable Low Pressure	S	R	M	N.A.	N.A.
8. Pressurizer Pressure	S	R	M	N.A.	N.A.
9. Pressurizer Level	S	R	M	N.A.	N.A.
10. Reactor Coolant Flow	S	R	Q	N.A.	N.A.
11. Steam/Feedwater Flow Mismatch	S	R	M	N.A.	N.A.
12. Turbine Trip-Low Fluid Oil Pressure	N.A.	N.A.	N.A.	S/U (1,6)	N.A.
13. Reactor Coolant Pump Breaker Position*	S	R	R	N.A.	N.A.
14. 4kV Bus 1C and Bus 2C Voltage	N.A.	R	R	N.A.	N.A.

*Applicable to Item 6 in Table 2.1

TABLE 4.1.1 (Continued)

TABLE NOTATION

(1) - If not performed in previous 31 days.

(2) - Heat balance only, above 15% of RATED THERMAL POWER. Adjust channel if absolute difference greater than 2 percent.

(3) - Neutron detectors may be excluded from CHANNEL CALIBRATION.

(4) - The provisions of Specification 4.0.4 are not applicable for entry into MODE 2 or 1.

(5) - Each train shall be tested at least every 62 days on a STAGGERED TEST BASIS.

(6) - Setpoint verification is not applicable.

TABLE 4.1.2
MINIMUM EQUIPMENT CHECK AND SAMPLING FREQUENCY

		Check	Frequency
1a. Reactor Coolant Samples	1.	Gross Activity Determination	At least once per 72 hours. Required during MODES 1, 2, 3 and 4.
	2.	Isotopic Analysis for DOSE EQUIVALENT I-131 Concentration	1 per 14 days. Required only during MODE 1.
	3.	Spectroscopic for E(1) Determination	1 per 6 months(2) Required only during MODE 1.
	4.	Isotopic Analysis for Iodine Including I-131, I-133, and I-135.	a) Once per 4 hours,(3) whenever the specific activity exceeds 1.0 μCi/gram DOSE EQUIVALENT I-131 or 100/ E (1) μCi/gram. b) One sample between 2 and 6 hours following a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER within a one hour period.
	5.	Boron concentration	Twice/Week

(1) E is defined in Section 1.0.

(2) Sample to be taken after a minimum of 2 EFPD and 20 days of POWER OPERATION have elapsed since reactor was last subcritical for 48 hours or longer.

(3) Until the specific activity of the reactor coolant system is restored within its limits.

TABLE 4.1.2 (continued)

	Check	Frequency
1.b Secondary Coolant Samples	1. Gross Activity Determination	At least once per 72 hours. Required only during MODES 1, 2, 3 and 4.
	2. Isotopic Analysis for DOSE EQUIVALENT I-131 Concentration	a) 1 per 31 days, whenever the gross activity determination indicates iodine concentrations greater than 10% of the allowable limit. Required only during MODES 1, 2, 3 and 4. b) 1 per 6 months, whenever the gross activity determination indicates iodine concentrations below 10% of the allowable limit. Required only during MODES 1, 2, 3, and 4.

TABLE 4.1.2 (continued)

		Check	Frequency
2.	Safety Injection Line and RWST Water Samples	a. Boron Concentration	Monthly when the reactor is critical and prior to return of criticality when a period of subcriticality extends the test beyond 1 month
3.	Control Rod Drop	a. Verify that all rods move from full out to full in, in less than 2.44 seconds	At each refueling shutdown
4.	(Deleted)		
5.	Pressurizer Safety Valves	a. Pressure Setpoint	At each refueling shutdown
6.	Main Steam Safety Valves	a. Pressure Setpoint	At each refueling shutdown
7.	Main Steam Power Operated Relief Valves	a. Test for OPERABILITY	At each refueling shutdown
8.	Trisodium Phosphate Additive	a. Check for system availability as delineated in Technical Specification 4.2	At each refueling shutdown
9.	Hydrazine Tank Water Samples	a. Hydrazine concentration	Once every six months when the reactor is critical and prior to return of criticality when a period of subcriticality extends the test interval beyond six months
10.	Not used.		

TABLE 4.1.2 (continued)

		Check	Frequency
11.	MOV-LCV-1100 C Transfer Switch	a. Verify that the fuse block for either breaker 8-1198 to MCC 1 or breaker 42-12A76 to MCC 2A is removed.	Same as Item 10 above
12.	Emergency Siren Transfer Switch	a. Verify that the fuse block for either breaker 8-1145 to MCC 1 or breaker 8-1293A to MCC 2 is removed	Same as Item 10 above
13.	Communication Power Panel Transfer Switch	a. Verify that the fuse block for either breaker 8-1195 to MCC 1 or breaker 8-1293B to MCC 2 is removed	Same as Item 10 above
14a.	Spent Fuel Pool Water Level	Verify water level per Technical Specification 3.8	a. Once every seven days when spent fuel is being stored in the pool.
b.	Refueling Pool Water Level		b. Within two hours prior to start of and at least once per 24 hours thereafter during movement of fuel assemblies or RCC's.
15.	Reactor Coolant Loops/ Residual Heat Removal Loops	a. Per Technical Specifications 3.1.2.C and 3.1.2.D, in MODE 1 and MODE 2 and in MODE 3 with reactor trip breakers closed, verify that all required reactor coolant loops are in operation and circulating reactor coolant.	a. Once per 12 hours
		b. Per Technical Specification 3.1.2.E, in MODE 3 with the reactor trip breakers open, verify	

TABLE 4.1.2 (continued)

Check	Frequency
1. At least two required reactor coolant pumps are operable with correct breaker alignments and indicated power availability.	1. Once per 7 days
2. The steam generators associated with the two required reactor coolant pumps are operable with secondary side water level $\geq$ 256 inches (wide range).	2. Once per 12 hours
3. At least one reactor coolant loop is in operation and circulating reactor coolant.	3. Once per 12 hours
c. Per Technical Specification 3.1.2.F, in MODE 4 verify	
1. At least two required (RC or RHR) pumps are operable with correct breaker alignments and indicated power availability.	1. Once per 7 days
2. The required steam generators are operable with secondary side water level $\geq$ 256 inches (wide range).	2. Once per 12 hours
3. At least one reactor coolant loop/RHR TRAIN is in operation and circulating reactor coolant.	3. Once per 12 hours
d. Per Technical Specifications 3.1.2.G and 3.1.2.H, in MODE 5 verify, as applicable:	

TABLE 4.1.2 (continued)

		Check	Frequency
		1. At least one RHR TRAIN is in operation and circulating reactor coolant.	1. Once per 12 hours
		2. When required, one additional RHR TRAIN is operable with correct pump breaker alignments and indicated power availability.	2. Once per 7 days
		3. When required, the secondary side water level of at least two steam generators is $\geq$ 256 inches (wide range).	3. Once per 12 hours
	e.	Per Technical Specification 3.8.A.3, in MODE 6, with water level in refueling pool greater than elevation 40 feet 3 inches, verify that at least one method of decay heat removal is in operation and circulating reactor coolant at a flow rate of at least 400 gpm.	e. Once per 12 hours
	f.	Per Technical Specification 3.8.A.4, in MODE 6, with water level in refueling pool less than elevation 40 feet 3 inches, verify	
		1. At least one decay heat removal method is in operation and circulating reactor coolant.	1. Once per 12 hours
		2. One additional decay heat removal method is operable with correct pump breaker alignments and indicated power availability.	2. Once per 7 days
16. RWST Contained Water Volume	a.	Verify volume $\geq$ 50 ft. plant elevation	a Monthly when the reactor is critical and prior to return of criticality when a period of subcriticality extends the surveillance beyond 1 month

TABLE 4.1.3

MINIMUM FREQUENCIES FOR TESTING, CALIBRATING, AND/OR CHECKING OF INSTRUMENT CHANNELS

Channels	Surveillance	Minimum Frequency
1. Axial Offset	Calibration	At each refueling shutdown
	Check	Once per shift
2. Reactor Coolant Temperature	Calibration	At each refueling shutdown
	Test	Once per month
	Check	Once per shift
3. Pressurizer Pressure Input to Safety Injection Actuation	Calibration	At each refueling shutdown
	Test	Once per month
4. Rod Position Recorder	Calibration	At each refueling shutdown
	Check, comparison with digital readouts	Once per shift during operation
5. Charging Flow	Calibration	At each refueling shutdown
6. Boric Acid Tank Level	Calibration	At each refueling shutdown
	Test	Once per month
7. Residual Heat Pump Flow	Calibration	At each refueling shutdown
8. Volume Control Tank Level	Calibration	At each refueling shutdown.
	Test	Once per month during MODES 1 and 2
9. Hydrazine Tank Level	Calibration	At each refueling shutdown
	Test	One per month during operation

BASIS: CALIBRATION

CALIBRATION should be performed at every reasonable opportunity in order to ensure the presentation and acquisition of accurate information.

The nuclear flux (linear level) channels should be calibrated daily against a heat balance standard to account for errors induced by, changing rod patterns and core physics parameters.

Other channels are subject only to the "drift" errors induced within the instrumentation itself and, consequently, can tolerate longer intervals between CALIBRATION. Process system instrumentation errors induced by drift can be expected to remain within acceptable tolerances if recalibration is performed at intervals of approximately one year.

Substantial CALIBRATION shifts within a channel (essentially a channel failure) will be revealed during routine checking and testing procedures.

Thus, minimum CALIBRATION frequencies of once-per-day for the nuclear flux (linear level) channels, and once-per-year (approximately) for the process system channels is considered acceptable.

TESTING

The minimum testing frequency for those instrument channels connected to the safety system is based on an assumed "unsafe failure" rate of one per channel every four years. This assumption is, in turn, based on operating experience at conventional and nuclear plants. An "unsafe failure" is defined as one which negates channel operability and which, due to its nature, is revealed only when the channel is tested or attempts to respond to a bona fide signal.

The failure rate of one per channel every four years and the testing interval of two weeks imply that, on the average, each channel will be inoperable for 1.75 days per year, or 1.75/365 year. Since two channels must fail in order to negate the safety function, the probability of simultaneous failure of two channels (assuming only two to be in service) is 1.75/365 squared, or 2.3×10^{-5}. From this it can be inferred that in a three channel system the probability of simultaneous failure of two channels is approximately 6.9 x 10^{-5}. This represents the fraction of time in which each three channel system would have one operable and two inoperable channels, and equals 6.9 x 10^{-5} x 8760 hours per year, or (approximately) 36 minutes/year.

It must also be noted that to thoroughly and correctly test a channel, the channel components must be made to respond in the same manner and to the same type of input as they would be expected to respond to during their normal operation. This, of necessity, requires that during the test the channel be made inoperable for a short period of time. This factor must be, and has been, taken into consideration in determining testing frequencies.

Because of their greater degree of redundancy, the 1/3 and 2/4 logic arrays provide an even greater measure of protection and are thereby acceptable for the same testing interval. Those items specified for monthly testing are associated with process components where other means of verification provide additional assurance that the channel is operable, thereby requiring less frequent testing.

During a 2-year testing period, the Reactor Coolant Flow Trips for each loop were tested 40 times. In all the tests the trips operated precisely on set point. Also, during this period, there were no 'unsafe failures' as defined above in the Reactor Coolant Flow Trips or any similar trip circuitry. All of these channels represent more than 30 years of service without a single 'unsafe failure'. Because of the demonstrated reliability of these instrument channels and particularly the Reactor Coolant Flow Trip, the testing interval of the Reactor Coolant Flow Trip has been extended to 3 months.

CHECK

Failures such as blown instrument fuses, defective indicators, faulted amplifiers which result in "upscale" or "downscale" indication, etc. can be easily recognized by simple observation of the functioning of an instrument or system. Furthermore, such failures are, in many cases, revealed by alarm or annunciator action, and a check supplements this type of built-in surveillance.

Based on experience in operation of both conventional and nuclear plant systems, the minimum checking frequency of once per shift is deemed adequate.

4.1.2 RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION

APPLICABILITY: During releases via this pathway.

OBJECTIVE: To specify the minimum frequency and type of surveillance to be applied to the radioactive liquid instrumentation.

SPECIFICATION:

A. The setpoints shall be determined in accordance with procedures as described in the ODCM.

B. Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL TEST operations at the frequencies shown in Table 4.1.2.1.

BASIS: The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases. The alarm/trip setpoints for these instruments are calculated in accordance with methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

TABLE 4.1.2.1

RADIOACTIVE LIQUID EFFLUENT MONITORING
INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL TEST
1. Gross Beta or Gamma Radioactivity Monitoring Providing Alarm and Automatic Isolation				
a. Liquid Radwaste Effluents Line (R-1218)	D	P	R(3)	Q(1)
b. Steam Generator Blowdown Effluent Line (R-1216)	D	M	R(3)	Q(1)
c. Turbine Building Sumps Effluent Line (Reheater Pit Sump R-2100*)	D	M	R(3)	Q(1)
d. Yard Sump (R-2101*)	D	M	R(3)	Q(1)
e. Component Cooling Water System (R-1217)	D	M	R(3)	Q(1)
2. Flow Rate Monitors				
Liquid Radwaste Effluent Line (FE 16 and FE 18)	D(4)	N/A	R	N/A

*Does not provide control room alarm annunciation when the instrument controls are set in the "not operate" mode.

TABLE 4.1.2.1
(Continued)

TABLE NOTATION

(1) The CHANNEL TEST also demonstrates the following:

1. Automatic isolation of this pathway and control room alarm annunciation occurs when the instrument indicates measured levels above the alarm/trip setpoint.

2. Control Room alarm annunciation when the instrument controls are not set in the operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Bureau of Standards or using standards that have been obtained from the suppliers that participate in measurement assurance activities with NBS. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used. (Operating plants may substitute previously established calibration procedures for this requirement.)

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once daily on any day on which continuous, periodic, or batch releases are made.

4.1.3 RADIOACTIVE GASEOUS PROCESS AND EFFLUENT MONITORING INSTRUMENTATION

APPLICABILITY: During releases via this pathway.

OBJECTIVE: To specify the minimum frequency and type of surveillance to be applied to the radioactive gaseous monitoring instrumentation.

SPECIFICATION:

A. The setpoints shall be determined in accordance with procedures as described in the ODCM.

B. Each radioactive gaseous process or effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL TEST operations at the frequencies shown in Table 4.1.3.1.

BASIS: The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm/trip setpoints for these instruments are calculated in accordance with methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

TABLE 4.1.3.1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL TEST
1. Stack Monitoring System				
a. Gross Activity Monitor (R-1214**)	D	M	R(2)	Q
b. Noble Gas Activity Monitor (R-1219, 1212, 1254*)	D	M	R(2)	Q(1)
c. Iodine Sampler Cartridge (R-1221, 1254*)	W	N/A	N/A	N/A
d. Particulate Sampler Filter (R-1211, 1220, 1254*)	W	N/A	N/A	N/A
e. Stack Fan Flow Indication (R-1254*)	D	N/A	Q	Q
f. Sampler Flow Rate Measuring Device	D	N/A	R	N/A

*Does not perform any isolation function. Does not provide control room alarm annunciation when the instrument controls are set in the "not operate" mode.

**Alarm only, does not perform any isolation function.

TABLE 4.1.3.1
(Continued)

TABLE NOTATION

(1) The CHANNEL TEST also demonstrates the following:

1. Automatic isolation of this pathway and control room alarm annunciation occurs when the instrument indicates measured levels above the alarm/trip setpoint.

2. Control room alarm annunciation when the instrument controls are not set in the operate mode.

(2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Bureau of Standards or using standards that have been obtained from suppliers that participate in measurement assurance activities with NBS. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used. (Operating plants may substitute previously established calibration procedures for this requirement.)

4.1.4 CONTAINMENT ISOLATION INSTRUMENTATION

APPLICABILITY: Applies to instrumentation which actuates the containment sphere isolation valves, containment sphere purge and exhaust valves, and containment sphere instrumentation vent header valves.

OBJECTIVE: To ensure reliability of the containment sphere isolation provisions.

SPECIFICATION:

A. Each instrumentation channel shall be demonstrated OPERABLE by the performance of the CHANNEL CHECK, CHANNEL CALIBRATION, and CHANNEL TEST operations for the MODES and at the frequencies shown in Table 4.1.4-1.

B. The total bypass function shall be demonstrated OPERABLE at least once per 18 months during CHANNEL CALIBRATION testing of each channel affected by bypass operation.

BASIS: The surveillance requirements specified for these systems ensure that the overall system functional capability is maintained comparable to the original design standard. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

REFERENCES:

(1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

TABLE 4.1.4-1

CONTAINMENT ISOLATION INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
Containment Isolation (Valves listed in Table 3.6.2-1)				
a) Manual	N.A.	N.A.	M(1)	1, 2, 3, 4
b) Containment Pressure-High	N.A.	R	M(2)	1, 2, 3
c) Sequencer Subchannels	N.A.	N.A.	M	1, 2, 3, 4
d) Safety Injection				
1) Containment Pressure-High	N.A.	R	M(2)	1, 2, 3
2) Pressurizer Pressure-Low	N.A.	R	M	1, 2, 3, 4
Purge and Exhaust Isolation (POV-9, POV-10, CV-10, CV-40, CV-116)				
a) Manual	N.A.	N.A.	M(1)	1, 2, 3, 4
b) Containment Radioactivity-High	S	R	M	1, 2, 3, 4

TABLE 4.1.4-1 (Continued)

TABLE NOTATION

(1) Manual actuation switches shall be tested at least once per 18 months during shutdown. All other circuitry associated with manual safeguards actuation shall receive a CHANNEL TEST at least once per 31 days.

(2) The CHANNEL TEST shall include exercising the transmitter by applying either a vacuum or pressure to the appropriate side of the transmitter.

4.1.5 ACCIDENT MONITORING INSTRUMENTATION

APPLICABILITY: MODES 1, 2 and 3.

OBJECTIVES: To ensure the reliability of the accident monitoring instrumentation shown in Table 4.1.5-1.

SPECIFICATION: Each accident monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK and CHANNEL CALIBRATION operations at the frequencies shown in Table 4.1.5-1.

BASIS: The surveillance requirements specified for these systems ensure that the overall functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

References: (1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

TABLE 4.1.5-1

ACCIDENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
Pressurizer Water Level	M	R
Auxiliary Feedwater Flow Indication*	M	R
o Auxiliary Feedwater Flow Rate	M	R
o Steam Generator Water Level (Wide Range)	M	R
o Reactor Coolant System Loop Delta-T Indication	M	R
Reactor Coolant System Subcooling Margin Monitor	M	R
PORV Position Indicator	M	R
PORV Block Valve Position Indicator	M	R
Safety Valve Position Indicator	M	R
Containment Pressure (Wide Range)	M	R
Refueling Water Storage Tank Water Level	M	R
Containment Sump Water Level (Narrow Range)	M	R
Containment Water Level (Wide Range)	M	R
Neutron Flux (Wide Range)	M	R**

* See footnote of Table 3.5.6-1.
** Neutron detectors may be excluded from CHANNEL CALIBRATION.

4.1.6 PRESSURIZER RELIEF VALVES

APPLICABILITY: Applies to the power operated relief valves (PORVs) an their associated block valves for MODES 1, 2 and 3.

OBJECTIVE: To ensure the reliability of the PORVs and block valves.

SPECIFICATION:

A. Each PORV shall be demonstrated OPERABLE:

1. At least once per 31 days by performance of a CHANNEL TEST, which may include valve operation, and

2. At least once per 18 months by performance of a CHANNEL CALIBRATION.

B. Each block valve shall be demonstrated OPERABLE at least once per 92 days by operating the valve through one complete cycle of full travel, unless the block valve is being maintained closed in order to meet the requirements of Specification 3.1.5.A.

C. The backup nitrogen supply for the PORVs and block valves shall be demonstrated OPERABLE at least once per 18 months by transferring motive power from the normal air supply to the nitrogen supply and operating the valves through a complete cycle of full travel.

BASIS: The power operated relief valves (PORVs) operate to relieve RCS pressure below the getting of the pressurizer code safety valves. These relief valves have remotely operated block valves to provide a positive shutoff capability should a relief valve become inoperable. The air supply for both the relief valves and the block valves is capable of being supplied from a backup passive nitrogen source to ensure the ability to seal this possible RCS leakage path.

REFERENCES:

(1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

4.1.7 PRESSURIZER

APPLICABILITY: Applies to pressurizer heaters and pressurizer water level for MODES 1, 2 and 3.

OBJECTIVE: To ensure proper pressurizer water volume and to ensure the capability to energize the pressurizer heaters from the emergency diesel generator.

SPECIFICATION:

A. The pressurizer water level shall be determined to be between 5% and 70% at least once per 12 hours.

B. The emergency power supply for the pressurizer heaters shall be demonstrated OPERABLE at least once per 18 months by transferring power from the normal supply to the emergency diesel generator and energizing the heaters.

BASIS: The requirement that the pressurizer heaters and their associated controls be capable of being supplied electrical power from an emergency diesel generator provides assurance that these heaters can be energized during a loss of offsite power condition to maintain natural circulation at HOT STANDBY.

REFERENCES:

(1) NRC Letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

4.1.8 AUXILIARY FEEDWATER INSTRUMENTATION

APPLICABILITY: Applies to the auxiliary feedwater instrumentation and interlocks in MODES 1, 2 and 3.

OBJECTIVE: To ensure reliability of automatic initiation of the auxiliary feedwater system.

SPECIFICATION: A. Each instrumentation channel shall be demonstrated OPERABLE by the performance of the surveillance requirements specified in Table 4.1.8-1.

BASIS: The surveillance requirements specified for this instrumentation ensure that the overall system functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

REFERENCES: (1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

TABLE 4.1.8-1

AUXILIARY FEEDWATER INSTRUMENTATION

SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
a. Manual	N/A	N/A	N/A	R	1, 2, 3
b. Automatic Actuation Logic	N/A	N/A	M	N/A	1, 2, 3
c. Steam Generator Water Level-Low	S	R	M	N/A	1, 2, 3
d. AFW Train Interlocks	N/A	R	M	N/A	1, 2, 3

4.1.9 AUXILIARY FEEDWATER SYSTEM SURVEILLANCE

APPLICABILITY: Applies to the auxiliary feedwater pumps and valves for MODES 1, 2 and 3.

OBJECTIVE: To ensure the reliability of the auxiliary feedwater system.

SPECIFICATION:

A. Each auxiliary feedwater pump shall be demonstrated OPERABLE by testing each pump in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i).

B. At least once per 31 days an inspection shall be made to verify that each non-automatic valve in the emergency flow path that is not locked, sealed, or otherwise secured in position is in its correct position.

C. Each auxiliary feedwater Train shall be demonstrated OPERABLE at least once per 18 months by:

1. Verifying that the AFW Train B pump starts as designed automatically upon receipt of an auxiliary feedwater actuation test signal.

2. Verifying that AFW Train A motor driven pump starts as designed automatically upon receipt of auxiliary feedwater actuation AND Train B low flow test signals. Subsequently, verify the pump stops upon receipt of a Train B positive flow test signal.

3. Within 72 hours after entering MODE 3, verifying that the AFW Train A steam driven pump enters warm-up mode upon receipt of an auxiliary feedwater actuation test signal. Subsequently, verify pump starts upon receipt of a Train B low flow test signal, and returns to warm-up mode upon receipt of Train B positive flow test signal.

4. Verifying that each automatic valve in the flow path actuates to its correct position upon receipt of actuation test signals.

D. When the reactor coolant system pressure remains less than 500 psig for a period longer than thirty (30) days, flow tests shall be performed to verify the emergency flow paths from the auxiliary feedwater storage tank to each steam generator, using each motor driven auxiliary feedwater pump prior to increasing reactor coolant system pressure above 500 psig. The flow tests shall be conducted with the auxiliary feedwater system valves in their emergency alignment. Within 72 hours after entering MODE 3, the steam driven auxiliary feedwater pump shall be similarly tested.

E. The provisions of Specification 4.0.4 are not applicable for entry into MODE 3 for the steam driven auxiliary feedwater pump. However, the steam driven AFW pump must be OPERABLE in all other respects.

BASIS: The OPERABILITY of the auxiliary feedwater system ensures that the Reactor Coolant System can be cooled down to less than 350°F from normal operating conditions in the event of a total loss of offsite power.

The design of the auxiliary feedwater system further ensures sufficient AFW flow into the intact feedwater lines without exceeding pump run-out or water hammer limits for any applicable design basis event with or without concurrent loss of offsite power and a single active failure.[2,3]

REFERENCES:

(1) NRC letter dated July 2, 1980 from D. G. Eisenhut to all pressurized water reactor licensees.

(2) SCE letter dated November 6, 1987, from M. O. Medford to NRC Document Control Desk.

(3) SCE letter dated November 20, 1987, from M. O. Medford to NRC Document Control Desk.

4.1.10 AUXILIARY FEEDWATER STORAGE TANK SURVEILLANCE

APPLICABILITY: Applies to the auxiliary feedwater storage tank for MODES 1, 2 and 3.

OBJECTIVE: To ensure the availability of an adequate auxiliary feedwater supply.

SPECIFICATION: A. The auxiliary feedwater storage tank shall be demonstrated OPERABLE at least once per 12 hours by verifying the contained water volume is within its limits when the tank is the supply source for the auxiliary feedwater pumps.

BASIS: See Basis for 3.4.4.

4.1.11 RADIATION MONITORING INSTRUMENTATION

APPLICABILITY: As shown in Table 4.1.11-1.

OBJECTIVE: To ensure the reliability of the radiation monitoring instrumentation.

SPECIFICATION: A. Each radiation monitoring instrumentation channel shall be demonstrated OPERABLE by the performance of the CHANNEL CHECK, CHANNEL CALIBRATION and CHANNEL TEST operations for the MODES and at the frequencies shown in Table 4.1.11-1.

BASIS: The surveillance requirements specified for these systems ensure that the overall functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

REFERENCES: (1) NRC letter dated November 1, 1983, from D. G. Eisenhut to all Pressurized Water Reactor Licensees, NUREG-0737 Technical Specification (Generic Letter No. 83-37).

TABLE 4.1.11-1

RADIATION MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL TEST	APPLICABLE MODES
1. AREA MONITORS				
a. Spent Fuel Pool Area (R-1236)	S	R	M	*
b. Control Room Area (R-1231)	S	R	M	All
c. Containment Radiation Monitor-High Range (R-1255, R-1257)	S	R	M	1, 2, 3 & 4
2. PROCESS MONITORS				
a. Wide Range Gas Monitor (R-1254)	**	**	**	1, 2, 3 & 4
b. Main Steam Dump and Safety Valve Channels (R-1256A&B, R-1258A&B)	S	R	M	1, 2, 3 & 4

* See footnote of Table 3.5.10-1

** In accordance with Table 4.1.3.1 surveillance requirements for this instrument channel.

4.1.12 <u>REACTOR COOLANT SYSTEM VENTS</u>

<u>APPLICABILITY</u>: MODES 1, 2, 3 and 4.

<u>OBJECTIVE</u>: To ensure the reliability of the reactor coolant vent system.

<u>SPECIFICATION</u>: Each reactor coolant system vent path shall be demonstrated OPERABLE at least once per 18 months by:

1. Verifying all manual isolation valves in each vent path are locked in the open position.
2. Cycling each valve in the vent path through at least one complete cycle of full travel from the control room during COLD SHUTDOWN or REFUELING.
3. Verifying flow through the reactor coolant vent system vent paths during venting during COLD SHUTDOWN.

<u>BASIS</u>: See basis for 3.1.7, Reactor Coolant System Vents.

<u>REFERENCES</u>: NRC letter dated November 1, 1983, from D. G. Eisenhut to all Pressurized Water Reactor Licensees, NUREG 0737 Technical Specifications (Generic Letter No. 83-37).

4.1.13 LEAKAGE AND LEAKAGE DETECTION SYSTEMS

APPLICABILITY: Applies to the reactor coolant leakage and detection systems delineated in Specification 3.1.4.

OBJECTIVE: To ensure the reactor coolant system leakage limits are maintained and to ensure the OPERABILITY of those systems that are used to detect leakage from the reactor coolant system.

SPECIFICATION:

A. Reactor Coolant System leakage shall be demonstrated to be within limits by:

1. Monitoring the containment atmosphere radioactivity at least once per 12 hours.

2. Performance of a Reactor Coolant System water inventory balance at least once per 72 hours.

3. Monitoring the steam generator blowdown effluent radioactivity at least once per 12 hours.

4. Monitoring the containment sump level indicator (LIS 2001 or 3001)at least once per 12 hours.

B. The leakage detection systems shall be demonstrated OPERABLE by the performance of CHANNEL CHECK, SOURCE CHECK, CHANNEL TEST, and CHANNEL CALIBRATION at the frequencies specified in Table 4.1.13-1;

BASIS: The monitoring of reactor coolant system leakage and maintenance of OPERABILITY of the reactor coolant leakage detection systems will assure that the sources of leakage are monitored and/or identified. The methods described above provide an acceptable means of verifying the OPERABILITY required by Specification 3.1.4.

REFERENCES:

1. SEP Topic V-5, Reactor Coolant Pressure Boundary Leakage, NUREG-0829, December 1986

2. Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," May 1973

3. Standard Technical Specifications for Westinghouse Pressurized Water Reactors, Revision 4, NUREG-0452

TABLE 4.1.13-1

LEAKAGE DETECTION SYSTEMS

	INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL TEST	CHANNEL CALIBRATION
1.	Containment Atmosphere Particulate Monitor (R1211)	D	M	N/A	R
2.	Containment Atmosphere Gaseous Monitor (R1212)	*	*	*	*
3.	Sphere Sump Level Control System (LS80 and 82)	N/A	N/A	N/A	R
4.	Containment Sphere Sump Level Monitor (LIS 2001 and 3001)	**	N/A	N/A	**
5.	Steam Generator Blowdown Effluent Monitor (R1216)	***	***	***	***

* In accordance with Table 4.1.3.1, surveillance requirements for this instrument channel.
** In accordance with Table 4.1.5-1, surveillance requirements for these instrument channels.
*** In accordance with Table 4.1.2.1, surveillance requirements for this instrument channel.

2. Simulating SISLOP*, and:

   a. Verifying operation of circuitry which locks out non-critical equipment,

   b. Verifying the diesel performs a DG FAST START from standby condition on the auto-start signal, energizes the emergency buses with permanently connected loads and the auto connected emergency loads** through the load sequencer (with the exception of the feedwater, safety injection, charging and refueling water pumps whose respective breakers may be racked-out to the test position) and operates for ≥ 5 minutes while its generator is loaded with the emergency loads,

   c. Verifying that on the safety injection actuation signal, all diesel generator trips, except engine overspeed and generator differential, are automatically bypassed.

3. Verifying the generator capability to reject a load of 4,000 kW without tripping. The generator voltage shall not exceed 4,800 volts and the generator speed shall not exceed 500 rpm (nominal speed plus 75% of the difference between nominal speed and the overspeed trip setpoint) during and following the load rejection.

G. Manual Transfer Switches

1. Verify once every 31 days that the fuse block for breaker 8-1181 in MCC-1 for MTS-7 is removed.

2. Verify once every 31 days that MTS-8 is energized from breaker 8-1480B from MCC-4 and the cabinet door is locked, and that breaker 8-1122 from MCC-1 is locked open.

---

* SISLOP is the signal generated by a sequencer on coincident loss of voltage on its associated 4160 volt bus (Bus 1C or 2C) and demand for safety injection.

** The sum of all loads on the engine shall not exceed 6,000 kW.

ATTACHMENT 3

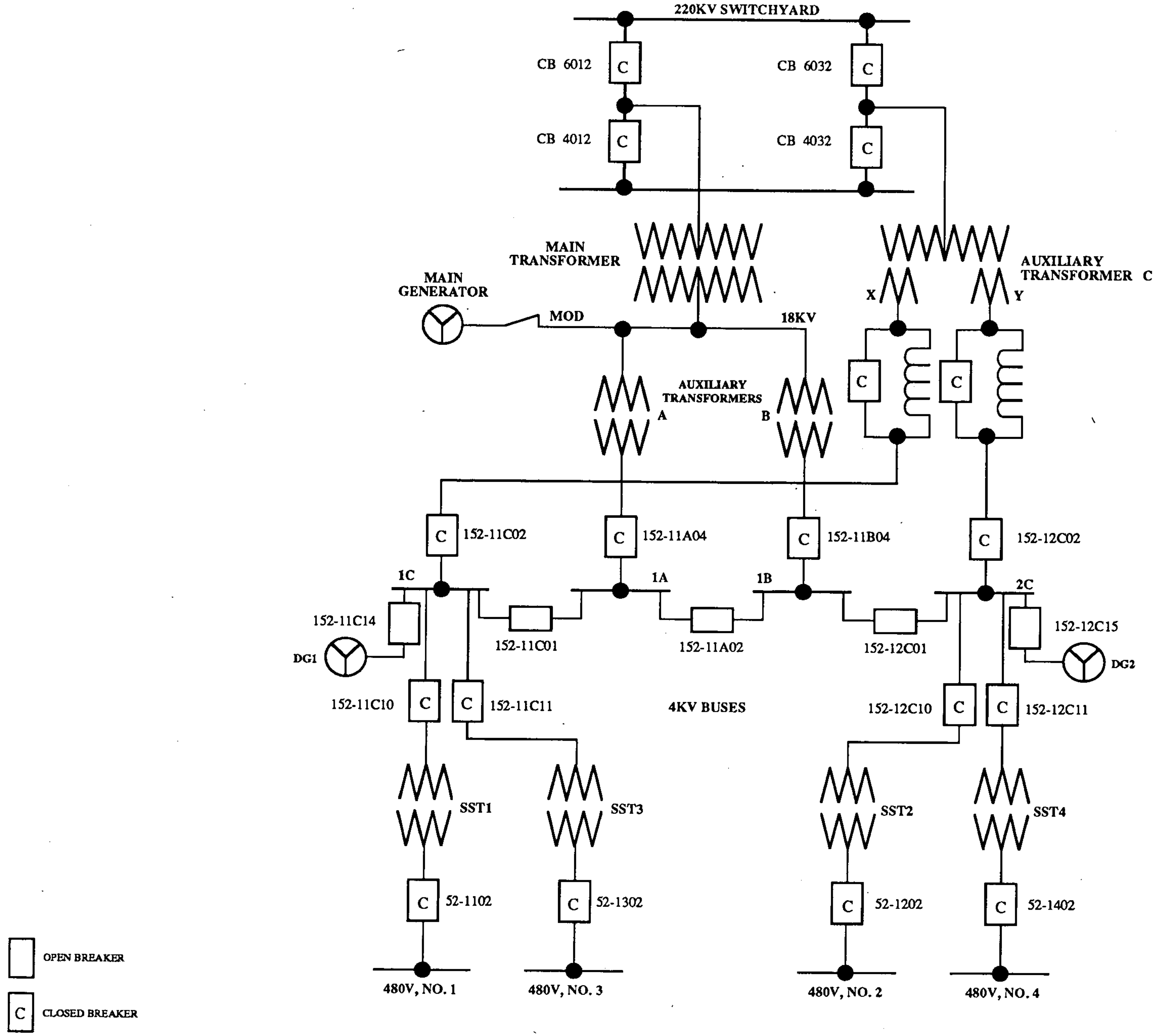
PROPOSED LICENSE CONDITION

N. Plant Modification to Eliminate Single Failure Susceptibility of Vital Bus Automatic Transfer Function

Southern California Edison Company shall modify the electrical distribution system to ensure that the availability of a power source for vital buses 1, 2, 3, and 3A is not subject to a single failure susceptibility. The plant modification shall satisfy the design requirements of the safety-related portions of the existing electrical distribution system and shall be operable prior to restart from the Cycle 12 refueling outage.

ATTACHMENT 4

ELECTRICAL DISTRIBUTION SYSTEM
(Normal Operation Configuration)



ATTACHMENT 5

PROBABILISTIC RISK ASSESSMENT OF CONTINUING PLANT OPERATION WITH PRESENT VITAL BUS AUTOMATIC TRANSFER CAPABILITY, REVISION 1

PROBABILISTIC RISK ASSESSMENT OF UNIT 1
VITAL BUS TRANSFER SINGLE FAILURE, REVISION 1

PURPOSE

Evaluate the risk associated with continuing plant operation with the present vital bus automatic transfer capability. As part of that evaluation, determine the annual probability of core damage and/or containment failure resulting from failures of vital 120 VAC buses 1, 2, 3/3A, and 4. The evaluation addresses a single failure susceptibility in the 120 VAC system concerning automatic transfer between the two power sources for the Train A vital buses. This single failure susceptibility was identified in the recently completed SONGS 1 emergency core cooling system single failure analysis (Reference 1).

Revision 1 of this evaluation modifies some of the assumptions made in the probabilistic risk assessment (PRA) that was included with the original Amendment Application No. 189, dated September 28, 1990. The revised assumptions more accurately reflect the design of the SONGS 1 electrical distribution system as it will be configured upon return to service. In addition, additional explanation of each assumption is provided as requested by the NRC.

BACKGROUND

Vital buses 1, 2, 3/3A, and 4 (hereafter referred to as the Train A vital buses) are normally powered through inverters 1, 2, 3, and 4 from DC Bus #1 (Reference 2). Vital 120 VAC buses 5, 6 and the Containment Spray Actuation System (CSAS) inverter bus (hereafter referred to as the Train B vital buses) are normally powered through inverters from DC Bus #2. The vital 120 VAC buses provide power to safety-related and non-safety related instrumentation, control circuits, and solenoid valves.

The vital 120 VAC buses are reliable power sources for essential plant instrumentation and controls. The random failure rate of the vital 120 VAC buses during normal operation is dominated by low probability events such as inverter failures, DC bus failure, and bus shorts.

The Train A vital buses also provide power for unqualified loads for components that are located inside containment or near the main steam/feedwater lines outside containment. A loss of coolant accident (LOCA) or main steam/feedwater line break (MSLB/MFLB) could cause shorting of these environmentally unqualified loads and challenge bus integrity.

The primary power source for the Train A vital buses is DC Bus #1 via four inverters. Each inverter is current limited. Single or multiple shorts on the Train A vital buses can cause a voltage drop on the buses that is sufficient to prevent the protective circuit breakers and fuses on the shorted loads from tripping and isolating the bus from the shorted loads. Upon detection of low voltage on a vital bus, the auto-transfer switch for that bus will rapidly transfer to the backup power source (480 volt motor control center no. 2). The backup power source has sufficient current capacity to trip/isolate the shorted loads on the 120 VAC vital buses.

Although all four Train A vital buses will automatically transfer from the primary to the backup source, the auto-transfer switches for vital buses 1, 2, and 3/3A are not designed to automatically transfer back to the primary source should the backup source fail. The vital buses can be manually transferred back to their primary source by the operator in the control room.

Table 1 provides a listing of essential ECCS loads supplied from the Train A vital buses. The Train A vital buses may automatically transfer to the backup source during a LOCA or MSLB/MFLB event due to shorts of environmentally unqualified loads. Since the backup source is non-redundant, the ECCS single failure analysis identified the Train A vital buses as non-single failure proof.

This probabilistic risk assessment (PRA) estimates the annual probability of core damage or containment failure occurring during a design basis LOCA, MSLB, or MFLB due to failures of the Train A vital buses. The initiating events for which the Train A vital bus failures were evaluated include large LOCA, small LOCA, MSLB, and MFLB. Conditional loss of off-site power was considered for each of these events.

ASSUMPTIONS

The following are assumptions made in the analysis:

1. The mission time for uninterrupted supply of 120 VAC power from the vital buses is conservatively assumed to be six hours. After that time, brief losses of power (e.g., for manual retransfer to the primary source) would be acceptable since all actuation signals and valve positioning operations should have been completed by that time.

   The actual time that uninterrupted power is needed from the vital buses is dependent on the size of the LOCA. For a large LOCA, recirculation cooling is established within an hour after the accident. For a small LOCA, it is estimated to occur within approximately five and a half hours. After that time, all actuation signals and valve positioning operations would be completed and failure of a vital bus would have no effect on initiation of accident mitigating equipment. After six hours, brief power interruptions to allow for manual power transfer operations are acceptable. Six hours was conservatively chosen to bracket the longest time (i.e., after a small LOCA) that rapid, automatic system alignments must be completed to mitigate the effects of a LOCA.

2. Most environmentally unqualified loads on the vital buses are fed through an individual overcurrent protection breaker and fuse. Some environmentally unqualified loads are fed only through an overcurrent protection breaker, without a fuse (see Figures 1, 2, and 3 for details). The protection breaker and fuse design is such that the unqualified loads are coordinated to isolate on overcurrent without tripping safety-related loads or bus feeder breakers.

   For a short circuit to be of sufficient magnitude to affect the bus, it must exceed the trip ratings of the individual circuit breaker and fuse, if provided. The probability of a low voltage protection breaker failing to trip on overcurrent is 4×10^{-4} per demand (Reference 3, page 119). The probability of a low voltage fuse failing to blow on overcurrent is considered to be negligibly low (Reference 4). Therefore, the probability of a shorted load failing to isolate from a 120 VAC vital bus (when connected to its backup power supply) is assumed to be negligible for loads utilizing fuses. Non-qualified loads using only protection breakers (i.e., no fuses) are assumed to fail the affected bus if the protection breaker fails. The fault tree models reflect the potential failure of a protection breaker where no fuse is provided.

3. If multiple, simultaneous shorts were to occur on a 120 VAC vital bus, the bus current could exceed the backup source feeder breaker overcurrent protection limit before the individual load breakers and/or fuses isolate the shorted loads. However, the likelihood of such multiple, simultaneous shorts is assumed to be negligible due to vertical and horizontal differences in locations of unqualified loads on each bus.

4. Interruption of the vital bus power due to failure of the environmentally unqualified loads on the vital 120 VAC buses following a RCS leak having a diameter of 3/8 inch or less is acceptable. This assumption is based on: i) the amount of energy released in this size of a LOCA can be accommodated without initiating containment spray, and ii) the containment sump has sufficient volume to hold all the break flow until well after safeguards have been automatically or manually actuated.

   Containment spray is not expected to be actuated for this event. The electronic signal to actuate containment spray is initiated if the containment pressure reaches approximately 7 psig. However, the containment coolers and the reactor coolant pump motor coolers have sufficient cooling capacity to limit the containment pressure after a 3/8 inch diameter leak to less than 6 psig. Therefore, the unqualified loads on the vital buses are not susceptible to failure from the presence of containment spray water after this size of leak.

   In addition, flooding of components due to a 3/8 inch diameter leak will not occur until approximately 16 hours after the event. Until that time, the containment sump volume (approximately 100,000 gallon capacity) will be able to hold the accumulated break flow (approximately 100 gpm) without the possibility of component flooding. Therefore, leaks of 3/8 inch diameter or less were not considered in this analysis as possible initiators leading to core damage.

5. Shorting of environmentally unqualified vital bus loads is assumed to begin within several seconds of a small LOCA, large LOCA, MSLB, or MFLB. In reality, it is expected that load shorting would not occur until some time later, once moisture buildup and/or flooding from the break or containment spray is sufficient to affect the component. Assuming rapid shorting of the unqualified loads is conservative since that assumption maximizes the challenge to correct operation of the vital bus during the early stages of the transient.

6. Instrumentation and equipment necessary for generation of a safety injection actuation signal or a containment spray signal are powered from the affected Train A vital buses. However, these components are required to operate only for several seconds after a large LOCA or MSLB/MFLB. It is unlikely that the vital buses would be disabled at such an early point in the accident. A finite time will transpire before containment conditions are significantly affected by the flooding from the break or by water deluge from containment spray. For instance, containment spray is initiated approximately 30 seconds after receipt of a SIS. Therefore, our PRA assumed the probability

of short circuits which are sufficient to cause bus transfer, occurring before generation of a SIS is quite low (i.e., 0.01). In any case, the results of our PRA are not significantly affected by the probability assumed for this event. The estimated risk of core damage due to the vital bus transfer single failure susceptibility is increased by only 6 per cent if the probability of this scenario had been assumed to be 0.1 rather than 0.01.

The Train B instrumentation and logic was assumed to fail with a probability of 1.0. This assumption results in a large conservatism in the evaluation of SIS actuation failure. In any case, the contribution of the SIS actuation failure scenarios to the total core damage probability is negligible.

7. Vital bus 4 is designed to be adequately protected from failure of the backup power source. This bus was equipped with a new inverter and static auto-transfer switch as part of the plant modifications completed as a result of the 1985 water hammer event. That auto-transfer switch is designed to automatically switch back to the primary source upon loss of the backup source. Nonetheless, failure of the transfer switch to successfully transfer and re-transfer the bus between primary and backup sources is considered in the fault tree models.

8. A shorted load on a vital bus is assumed to clear if the bus power supply has sufficient current capacity. Failure to clear a shorted load would require the failure of a protection breaker and, in most cases, at least one fuse. As indicated in Assumption No. 2, the probability of loads fed through fuses failing to clear is assumed to be negligible and the probability of loads fed only through a protection breaker are considered in the fault tree models.

9. Vital buses 1, 2, 3/3A, and 4, are each assumed to immediately fail if the associated auto-transfer switch fails to connect the respective bus to its backup source. The bus inverters (the primary power supply) are assumed not to have sufficient current capacity to clear all faults and may fail after a brief time in the current limited condition. This assumption is very conservative for vital bus 4 because the inverter for that bus is designed to operate in a current limited mode for a brief period which should clear the faulted loads.

10. Environmentally unqualified loads are assumed to short in a sequential manner throughout the accident. This assumption maximizes the number of demands upon the bus transfer switches. It is also assumed that each transfer switch will be challenged once for every three environmentally unqualified loads on each bus.

This assumption affects the number of transfer switch operations considered in the analysis. As discussed in Assumption No. 3, environmentally unqualified loads are assumed to short in a sequential manner (i.e., they will not all fail at once). It is assumed that the operators will manually actuate each bus transfer switch, realigning the primary power supply to each 120 VAC vital bus, after an average of three environmentally unqualified loads on each bus have shorted.

This assumption considers that the operators have no procedural direction to manually realign the vital buses to their primary power source as long as the backup power source is available. The vital buses are expected to remain on the backup power source, after initial auto-transfer on the first short, for at least a day following an accident. Environmentally unqualified loads would most likely short in a random, sequential manner during the first few days following the accident. This would not impact 120 VAC bus operation. Failures of the transfer switches during re-transfers 24 hours or more after an accident would not have a significant impact on accident response since all vital control operations fed from the 120 VAC buses would already have occurred. Thus, the assumption that the operators will manually operate the transfer switches once after every three shorts on a bus is considered conservative.

11. For small break LOCA scenarios, the operators will likely have time to manually initiate safety injection and containment spray to prevent core damage and containment failure. However, it was conservatively assumed in the fault tree models that automatic actuation of these systems is required to prevent core damage and containment failure in a small LOCA.

12. Failure to automatically actuate containment spray is assumed to lead to containment failure. This assumption was made even though the SONGS 1 safety analysis indicates that the pressure rise in the containment due to failure of containment spray would not be significantly above the design limit. The peak containment pressure due to a loss of containment spray after an MSLB slightly exceeds the containment design limit. However, containment failure is not expected due to conservatisms included in the design limit. Nonetheless, containment failure upon loss of containment spray was assumed in our PRA.

13. Following a small break LOCA, MSLB, or MFLB, natural circulation continues in the Reactor Coolant System for a period of 30 minutes. This allows sufficient time for operator action to manually initiate steam generator makeup via the Auxiliary Feedwater System (AFWS).

    The acceptability of delayed manual actuation of the AFWS to mitigate the effects of feedwater line breaks (which bound the consequences of a MSLB per UFSAR Section 6.5.2.5.1) and small break LOCAs is evaluated in UFSAR Sections 15.6 and 15.16.3, respectively. Section 15.6 considered two different MFLB locations (i.e., upstream and downstream of the in-containment check valve) at 100% and 50% reactor power levels. Manual actuation of the AFWS was assumed to occur within 15 to 30 minutes of the accident depending on break location and power level. The results of those evaluations demonstrate that delayed manual AFWS actuation is adequate to maintain a coolable core geometry after a MFLB.

    Section 15.16.3 evaluated the consequences of a small break LOCA for equivalent break diameters ranging from less than 3/8 inch to 8 inches. For conservatism, the analyses assumed that the AFWS was manually actuated 10 minutes after the initiating event. The results of those evaluations demonstrate that delayed manual actuation of the AFWS after a small break LOCA is acceptable.

14. For the purposes of the fault tree modeling, the following numbers of environmentally unqualified loads are considered powered from the Train A 120 VAC vital buses:

VITAL BUS NO.	TOTAL NUMBER OF FEEDERS	NUMBER OF UNQUALIFIED LOADS	LOCATION OF UNQUALIFIED LOADS
1	15	3	1 outside containment* 2 inside containment**
2	16	4	4 inside containment**
3,3A	21	9	1 outside containment* 8 inside containment**
4	16	6	2 outside containment* 4 inside containment**

* Loads unqualified for MSLB/MFLB.
** Loads unqualified for LOCA/MSLB/MFLB.

In cases where multiple loads are fed through a single fuse or protection breaker, only one load is considered since all the loads would be isolated upon shorting of any single load. Figures 1, 2, and 3 provide a simplified one-line diagram of the unqualified loads on the Train A 120 VAC vital buses.

15. The Auxiliary Feedwater System (AFWS) is needed to remove decay heat from the Reactor Coolant System after a small break LOCA, MSLB, or MFLB. The failure of the Train A 120 VAC vital buses would result in failure of the Train A AFWS actuation and valve control logic. In the event of an unrelated random failure of the Train B AFWS, the operators have two additional means of providing feedwater to the steam generators: (1) manual operation of Train A AFW pump G10W and the associated valves in the flow path to the steam generators, and (2) use of the Feedwater and Condensate System as described in Emergency Operating Instruction (EOI) S01-1.3-1.

    Manual operation of the Train A AFW pump G10W and associated valves can provide sufficient feedwater to avoid steam generator dryout in all cases except feedwater line breaks upstream of the feedwater line check valves. If the break is upstream of the feedwater line check valves, then manual equalization of feedwater line flow rates is required to ensure sufficient flow to the steam generators. This flow equalization would be achieved based upon readings from instrumentation that is powered from the Train B vital buses. The likelihood of successful operation of this feedwater path is conservatively assumed to be 0.9, since sufficient time is available (i.e., to manually operate G10W and associated valves within approximately 30 minutes of initiating event) for its use and the operators receive training on this procedure.

    The use of the Feedwater and Condensate System as described in EOI S01-1.3-1 for post-accident steam generator feedwater makeup is more time consuming and difficult to align than the manual Train A AFWS alignment described above. If a SIS is generated in the event, the operators must realign one train of the Safety Injection System to obtain feedwater makeup. The likelihood of successful operation of this feedwater path prior to steam generator dryout is assumed to be 0.5.

ANALYSIS

The sequences described below were considered for a large and small LOCA, MSLB, and MFLB events. The sequences are based upon the essential ECCS loads fed from the Train A vital buses (Table 1) which potentially may fail during an accident. Each sequence is developed and quantified via an event tree (Figures 4 through 7).

Large LOCA:

LL1: Large LOCA with subsequent SIS and containment spray failure (due to vital bus failure at the start of the accident). Core damage is assumed to occur due to delayed initiation of safety injection flow.

LL2: Large LOCA with high flow containment spray failure caused by closure of valve CV-517 (due to vital bus 3/3A failure) and independent failure of valve CV-518. High flow containment spray is assumed to be required for one hour following a LOCA. This sequence does not result in core damage, but potentially may result in radioactive releases due to containment failure.

LL3: Large LOCA with long-term recirculation cooling failure caused by loss of two of three flow indications of cold leg injection flow rate (due to vital bus 3/3A failure).

Small LOCA:

SL1: Small LOCA with AFWS failure to provide secondary heat removal caused by loss of Train A AFWS (due to loss of vital bus 3/3A) and concurrent failure of the Train B AFWS.

SL2: Small LOCA with long-term recirculation cooling failure due to loss of two of the three cold leg injection flow rate indicators (similar to sequence LL3).

Main Steam Line Break:

MSLB1: MSLB with SIS and containment spray failure at the beginning of the accident (similar to sequence LL1).

MSLB3: MSLB with high-flow containment spray failure (similar to sequence LL2, except that high-flow spray is required for 2 hours post-MSLB).

Main Feedwater Line Break:

MFLB1: MFLB with immediate containment spray failure (similar to the MSLB1 sequence, except that this sequence results only in containment failure).

MFLB2: MFLB with AFWS failure to provide secondary heat removal (similar to sequence MSLB3).

The fault trees developed to support the quantification of the event trees are provided in Appendix A. The component failure rates used in the fault trees were obtained from the SONGS 1 Partial PRA (Reference 4), except as noted otherwise. The frequency of MSLB and MFLB initiating events were extracted from the Oconee

PRA (Reference 5) since those accidents were not analyzed in the SONGS 1 Partial PRA.

RESULTS

The fault trees and event trees for this analysis were solved using the PRA software (REBECA) being used to conduct the SONGS Individual Plant Examinations. Minimal failure combinations (i.e., cutsets) were calculated for each fault tree and event tree sequence. A truncation limit of 1×10^{-8} was used for the solution of each fault tree. A truncation limit of 1×10^{-10} was employed for each event tree sequence.

Table 2 summarizes the overall results of the analysis. The annual probability of core damage from failure of the Train A vital buses is estimated to be 1.7×10^{-7}. The annual probability of containment failure, without core damage exceeding design basis, is estimated to be 5×10^{-7}. The annual probability of core damage with containment failure is estimated to be 2.1×10^{-8}.

The dominant cutsets contributing to core damage and/or containment failure for each sequence are identified (in order of importance) in Appendix B. The dominant cutsets leading to core damage are comprised of failures of the vital bus 3 transfer switch and AFWS pump G10W, and failures of diesel generator B and DSD diesel given a loss of off-site power. These cutsets lead to core damage from a failure of AFWS supply to the steam generators. The dominant contributors to containment failure are comprised of failures of diesel generator B given a loss of off-site power leading to containment spray failure.

CONCLUSIONS

This PRA estimates that the annual probability of core damage due to the loss of the Train A vital buses is less than 2×10^{-7} per year. This contribution to the overall core damage frequency (estimated to be approximately 2×10^{-4} per year) is quite low, accounting for less than 0.1% of the total.

The annual probability of containment failure with core damage is estimated to be less than 5×10^{-7} per year. This contribution to design basis containment failure probability (estimated to be 1×10^{-4} per year) is low (0.5%). Also, there is large conservatism in the assumption that failure of containment spray will lead to containment failure.

The annual probability of core damage with containment failure is estimated to be less than 3×10^{-8} per year. This contribution to significant radioactive release probability is less than 3% of the NRC goal of 1×10^{-6} per year. As indicated above, there is large conservatism in the estimation of containment failure probability due to failure of containment spray.

REFERENCES

1. SONGS 1 Emergency Core Cooling System Single Failure Analysis, M41383 Rev. 0.

2. SONGS 1 One-line Diagram 5102174-46.

3. IEEE Std. 500-1984, "IEEE Guide to the Collection and Presentation of Electrical, Electronic, Sensing Component, and Mechanical Equipment

Reliability Data for Nuclear-Power Generating Stations," Institute of Electrical and Electronic Engineers, 1983.

4. SONGS 1 Partial PRA, July 1987.

5. NSAC/60, "Oconee PRA, A Probabilistic Risk Assessment of Oconee Unit 3," Nuclear Safety Analysis Center and Duke Power Company, June 1984.

TABLE 1

Critical ECCS Loads on Train A 120 VAC Vital Buses For First 6 Hours Post-Accident

VITAL BUS	LOAD	IMPACT OF LOSS ON ECCS PERFORMANCE
1	PT-430	If lose 2 of 3 channels near front end of large break LOCA or MSLB, then would not get SI in sufficient time if train B SI lost.
1	CV-517	Lose hi flow containment spray for large break LOCA or MSLB during injection mode if CV-518 fails or train B vital 120 VAC buses lost.
1	CS Control A	Lose auto containment spray actuation signal for large break LOCA, MSLB, or MFLB if CS control power B and train B containment spray also lost.
2	PT-431	If lose 2 of 3 channels near front end of large break LOCA or MSLB, then would not get SI in sufficient time if train B SI is lost.
3/3A	PT-432	If lose 2 of 3 channels near front end of large break LOCA or MSLB, then would not get SI in sufficient time if train B SI lost.
3/3A	CS Control B	Lose auto containment spray actuation signal for large break LOCA, MSLB, or MFLB if CS control power A and train B containment spray also lost.
3/3A	FT-2114B/C	Lose 2 of 3 cold leg recirculation flow indicators for large and small break LOCA [note: FT-3114A on train B vital 120 VAC bus 5, however, may need more than one leg of flow indication].
3/3A	AFWAS	Lose AFW auto-initiate and flow control for small break LOCA, MSLB, and MFLB if AFWAS B on train B vital 120 VAC bus 5 is also lost.
4	FY-1115A-F	Lose all cold leg recirculation flow control for large and small break LOCA if train B controllers on CSAS inverters also lost.

TABLE 2

Event Tree Accident Class Report for the Vital Bus Transfer

ACCIDENT CLASS	SEQUENCE PROBABILITY
Core Damage (w/o Containment Failure)	1.53E-07
Containment Failure	4.95E-07
Core Damage/Containment Failure	2.11E-08
Core Damage (incl. Core Damage/Containment Failure)	1.74E-07

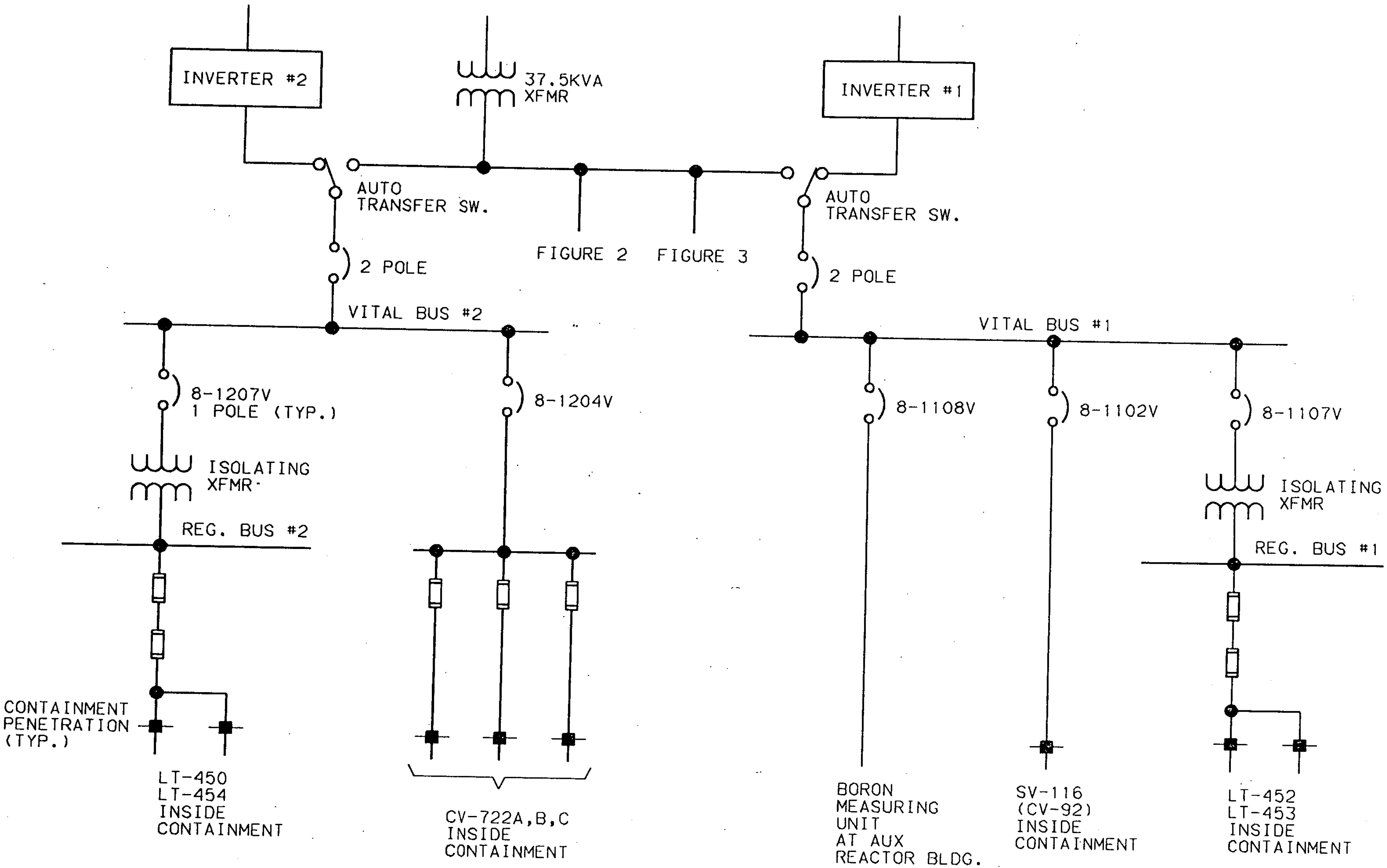

INVERTER #2
37.5KVA
XFMR
INVERTER #1
AUTO
TRANSFER SW.
AUTO
TRANSFER SW.
FIGURE 2
FIGURE 3
2 POLE
2 POLE
VITAL BUS #2
VITAL BUS #1
8-1207V
1 POLE (TYP.)
8-1204V
8-1108V
8-1102V
8-1107V
ISOLATING
XFMR
ISOLATING
XFMR
REG. BUS #2
REG. BUS #1
CONTAINMENT
PENETRATION
(TYP.)
LT-450
LT-454
INSIDE
CONTAINMENT
CV-722A,B,C
INSIDE
CONTAINMENT
BORON
MEASURING
UNIT
AT AUX
REACTOR BLDG.
SV-116
(CV-92)
INSIDE
CONTAINMENT
LT-452
LT-453
INSIDE
CONTAINMENT

FIGURE 1

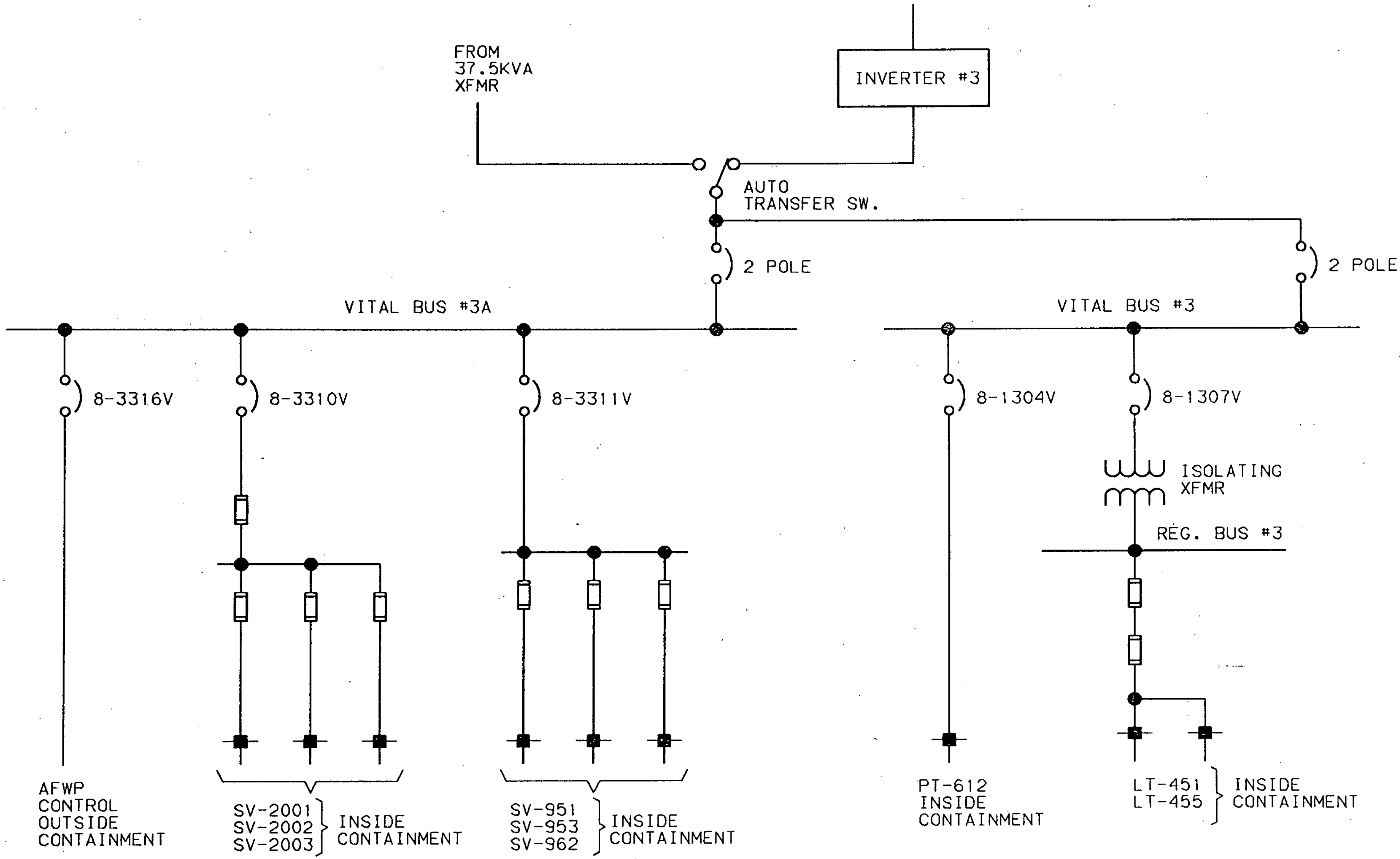
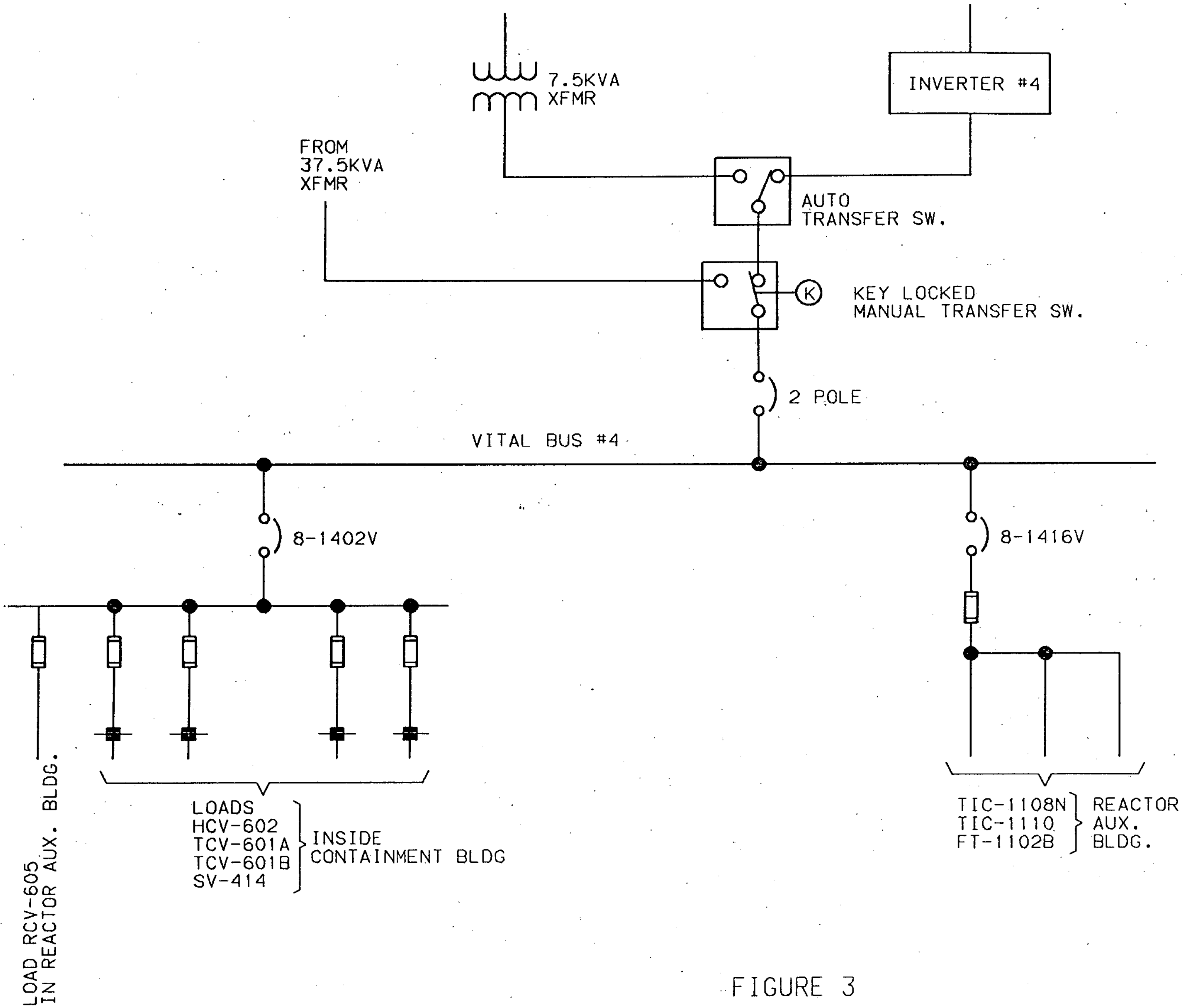

FROM
37.5KVA
XFMR
INVERTER #3
AUTO
TRANSFER SW.
2 POLE
2 POLE
VITAL BUS #3A
VITAL BUS #3
8-3316V
8-3310V
8-3311V
8-1304V
8-1307V
ISOLATING
XFMR
REG. BUS #3
AFWP
CONTROL
OUTSIDE
CONTAINMENT
SV-2001
SV-2002
SV-2003
INSIDE
CONTAINMENT
SV-951
SV-953
SV-962
INSIDE
CONTAINMENT
PT-612
INSIDE
CONTAINMENT
LT-451
LT-455
INSIDE
CONTAINMENT

FIGURE 2



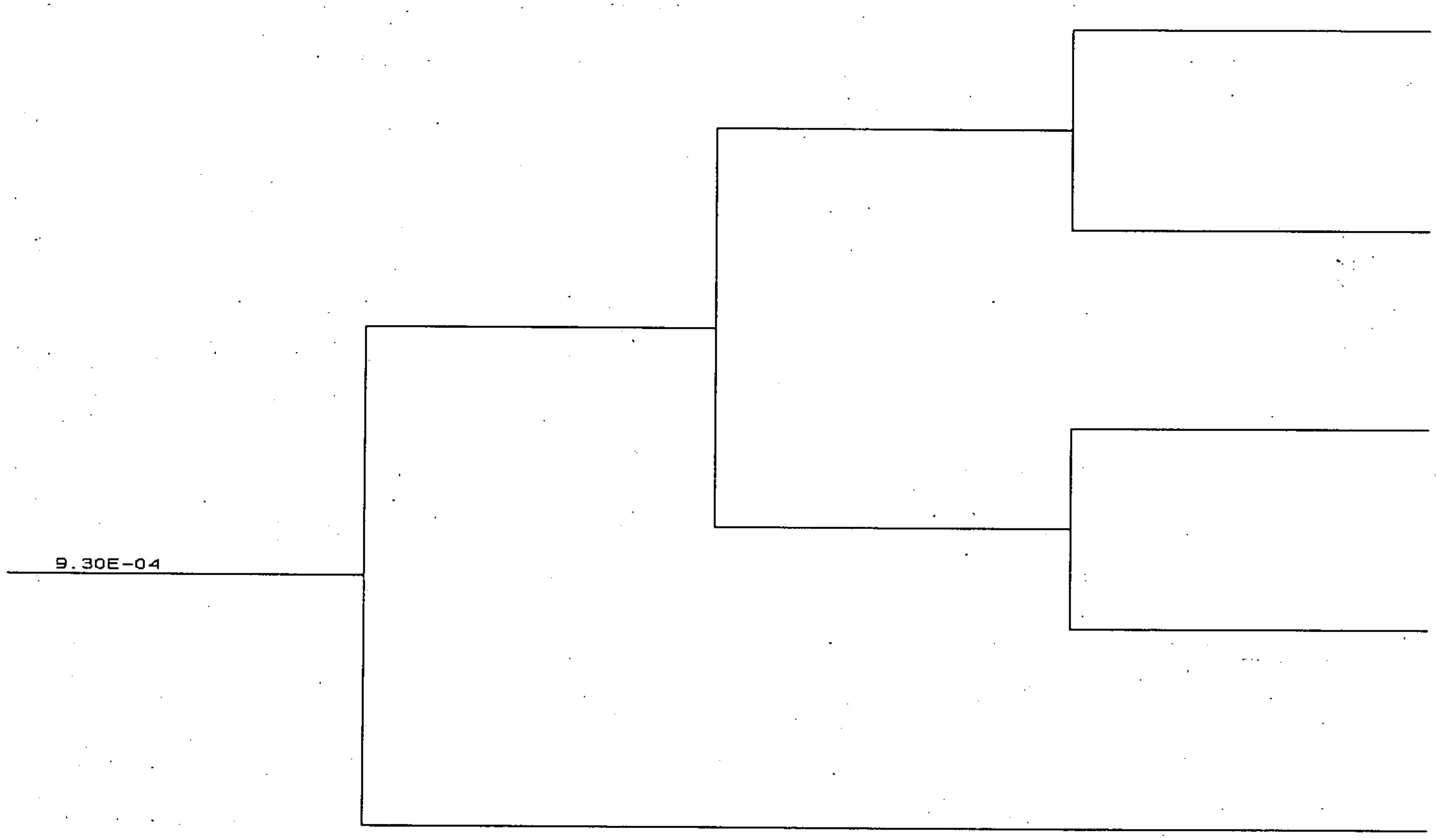
7.5KVA
XFMR
INVERTER #4
FROM
37.5KVA
XFMR
AUTO
TRANSFER SW.
K
KEY LOCKED
MANUAL TRANSFER SW.
2 POLE
VITAL BUS #4
8-1402V
8-1416V
LOAD RCV-605
IN REACTOR AUX. BLDG.
LOADS
HCV-602
TCV-601A
TCV-601B
SV-414
INSIDE
CONTAINMENT BLDG
TIC-1108N
TIC-1110
FT-1102B
REACTOR
AUX.
BLDG.

FIGURE 3

FIG 4

CORE DAMAGE DUE TO VITAL BUS FAILURE DURING LARGE LOCA

LARGE LOCA	SIS/CSAS FAILURE	HIGH FLOW CONT. SPRAY FAILURE IN 1 HOUR	RECIRC FAILURE
L	KS	CH	R

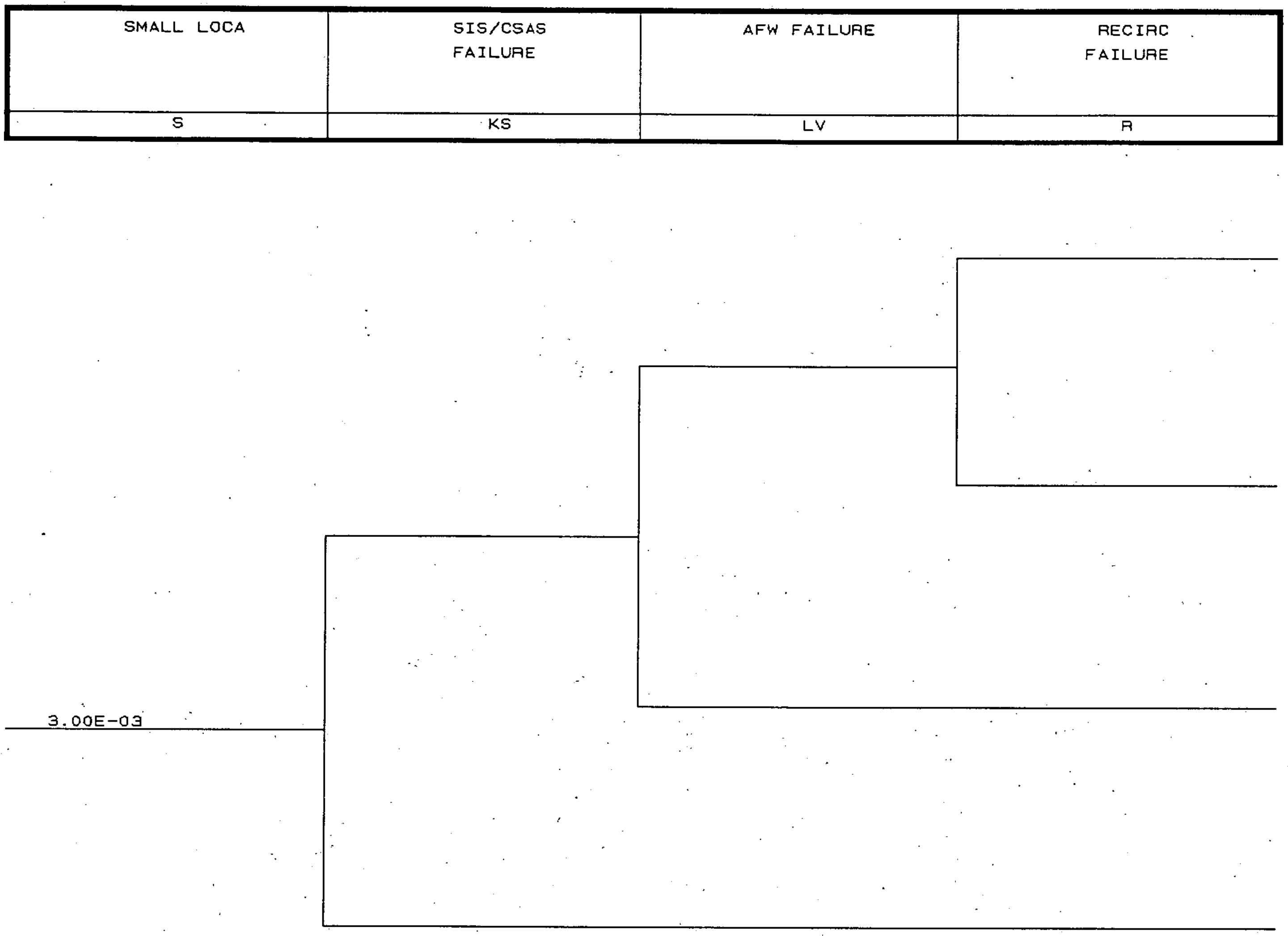


NUMBER	SEQUENCE DESIGNATION	ACCIDENT CLASS	SEQUENCE FREQUENCY
1	L	SAFE	
2	L-R	CD	1.71E-08
3	L-CH	CTMT FAIL	1.15E-07
4	L-CH-R	CD/CTMT FL	4.56E-10
5	L-KS	CD/CTMT FL	7.35E-10

REBECA (C) ERIN Engineering and Research, Inc. Version 1.1 | Filename: VBTLL | Date: 01-02-91 | Total Probability: 1.33E-07

FIGURE 5

CORE DAMAGE DUE TO VITAL BUS FAILURE DURING SMALL LOCA

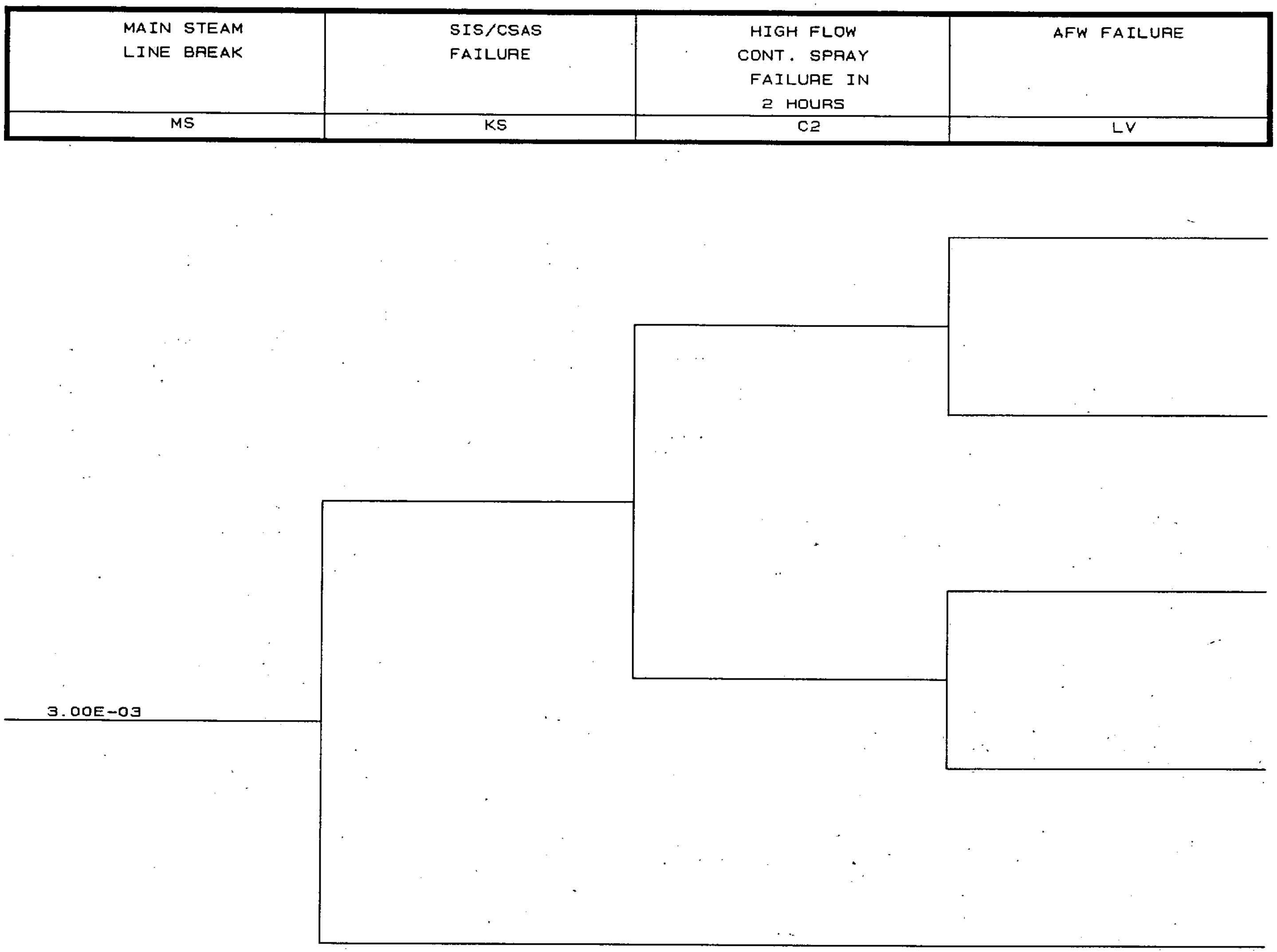


NUMBER	SEQUENCE DESIGNATION	ACCIDENT CLASS	SEQUENCE FREQUENCY
1	S	SAFE	
2	S-R	CD	5.82E-08
3	S-LV	CD	3.02E-08
4	S-KS	CD/CTMT FL	2.64E-09

REBECA (C) ERIN Engineering and Research, Inc. Version 1.1 | Filename: VBTSL | Date: 01-02-91 | Total Probability: 9.10E-08

FIGURE 6

CORE DAMAGE DUE TO VITAL BUS FAILURE DURING MSLB

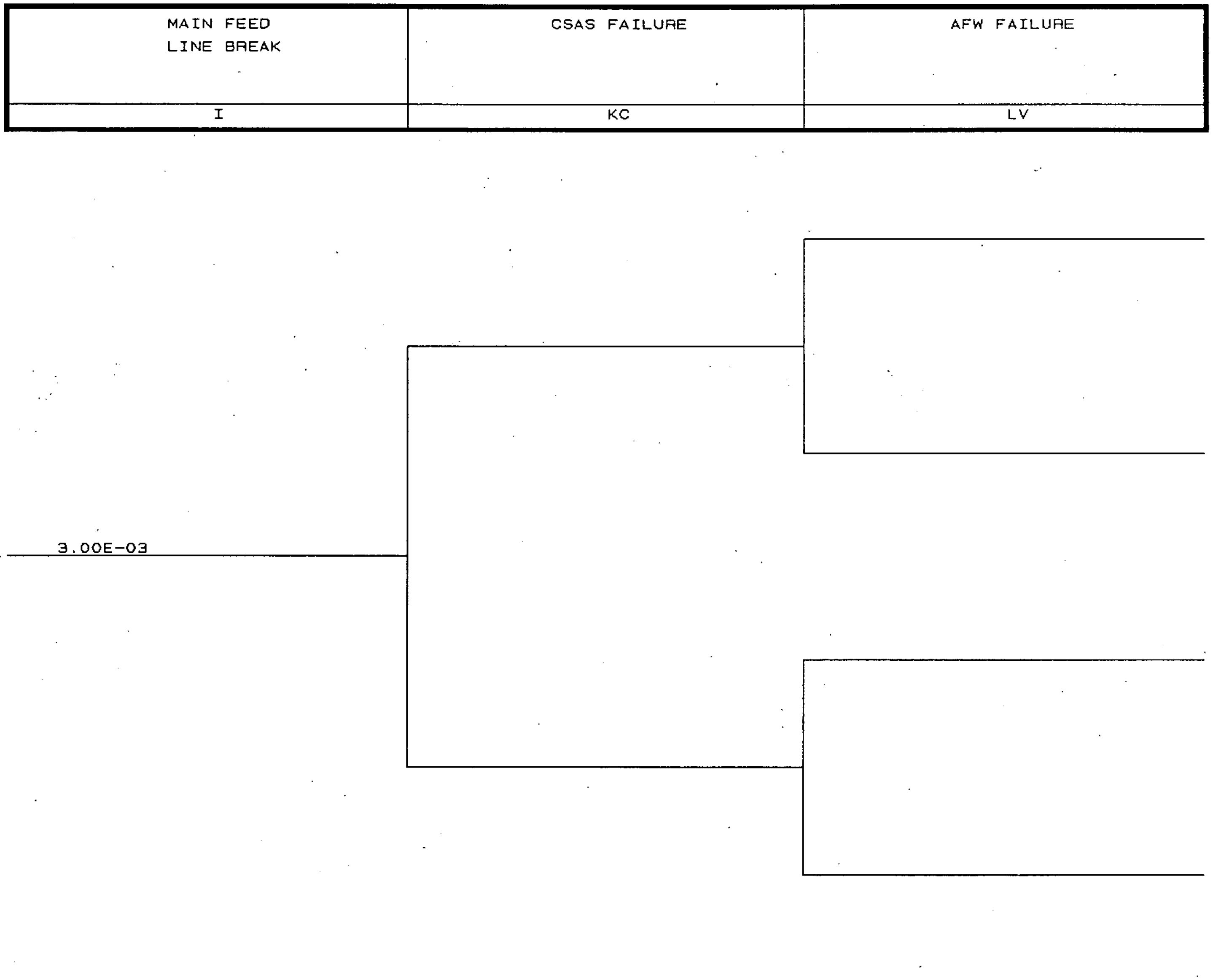


NUMBER	SEQUENCE DESIGNATION	ACCIDENT CLASS	SEQUENCE FREQUENCY
1	MS	SAFE	
2	MS-LV	CD	1.68E-08
3	MS-C2	CTMT FAIL	3.77E-07
4	MS-C2-LV	CD/CTMT FL	1.34E-08
5	MS-KS	CD/CTMT FL	2.64E-09

REBECA (C) ERIN Engineering and Research, Inc. Version 1.1 | Filename: VBTMS | Date: 01-02-91 | Total Probability: 4.10E-07

FI 7

CORE DAMAGE DUE TO VITAL BUS FAILURE DURING MFLB



NUMBER	SEQUENCE DESIGNATION	ACCIDENT CLASS	SEQUENCE FREQUENCY
1	I	SAFE	
2	I-LV	CD	3.02E-08
3	I-KC	CTMT FAIL	2.64E-09
4	I-KC-LV	CD/CTMT FL	1.18E-09

REBECA (C) ERIN Engineering and Research, Inc. Version 1.1 | Filename: VBTMF | Date: 01-02-91 | Total Probability: 3.40E-08

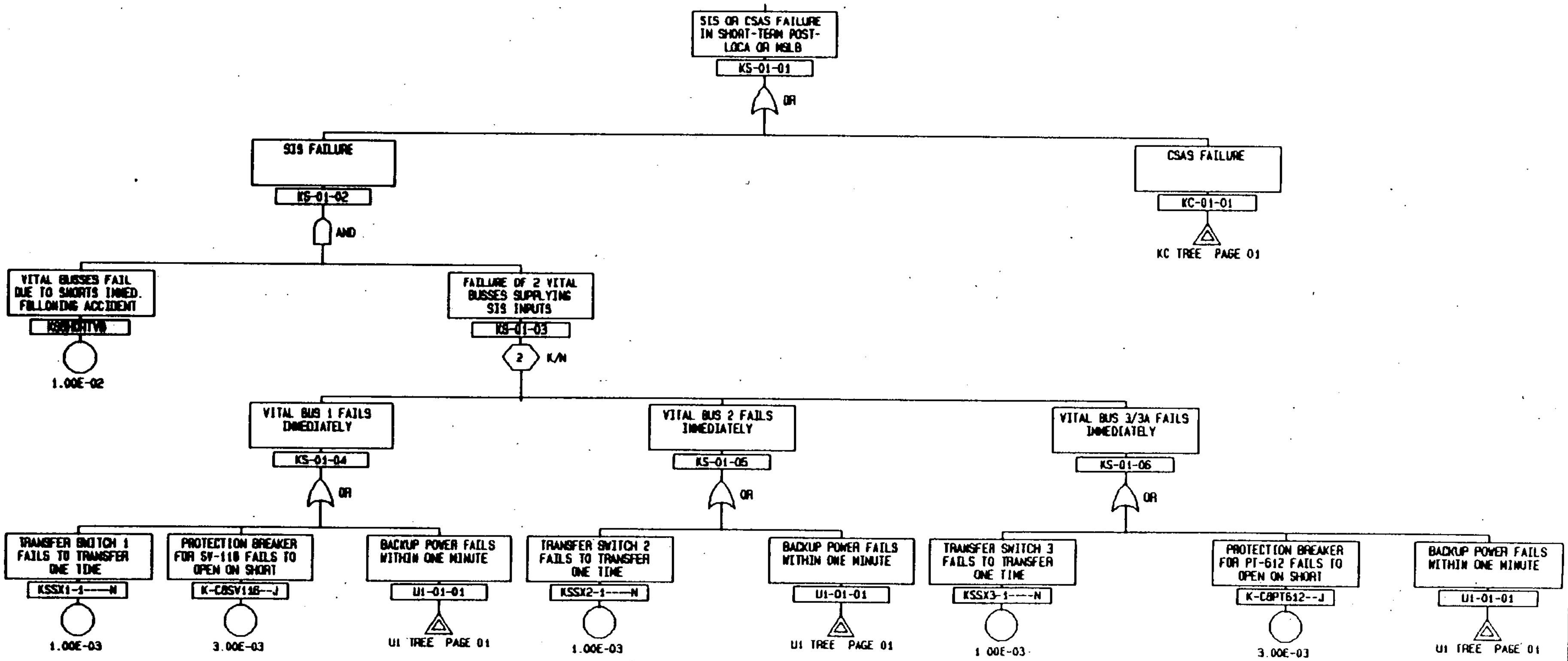
APPENDIX A*

Fault Trees Developed to Support Evaluation of Event Trees

* Note: Fault trees have been revised since original submittal of amendment application.

SIS/CSAS FAILURE DUE TO VITAL BUS LOSS - SHORT-TERM

12-31-1990



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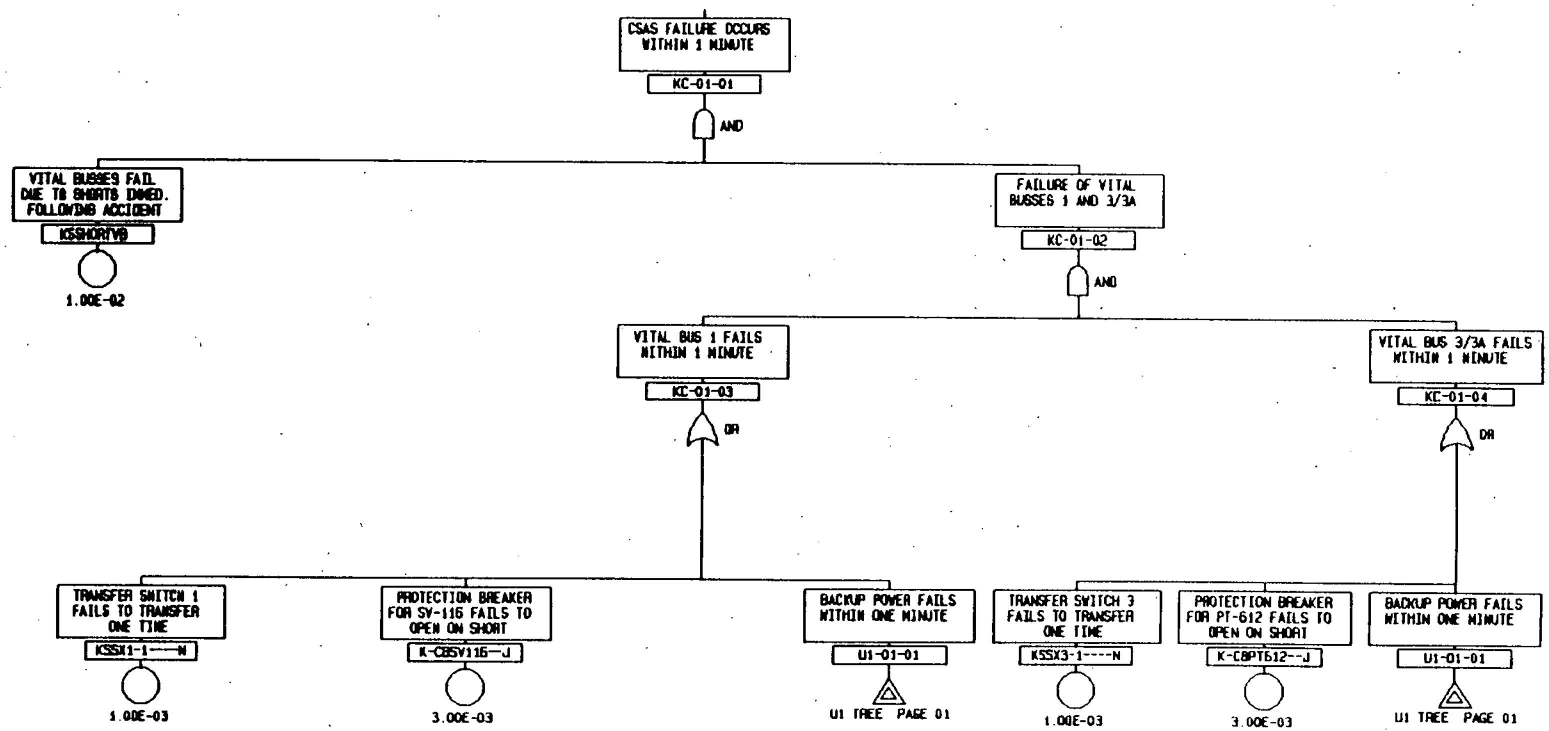
FAILURE OF THE CSAS SIGNAL - SHORT-TERM

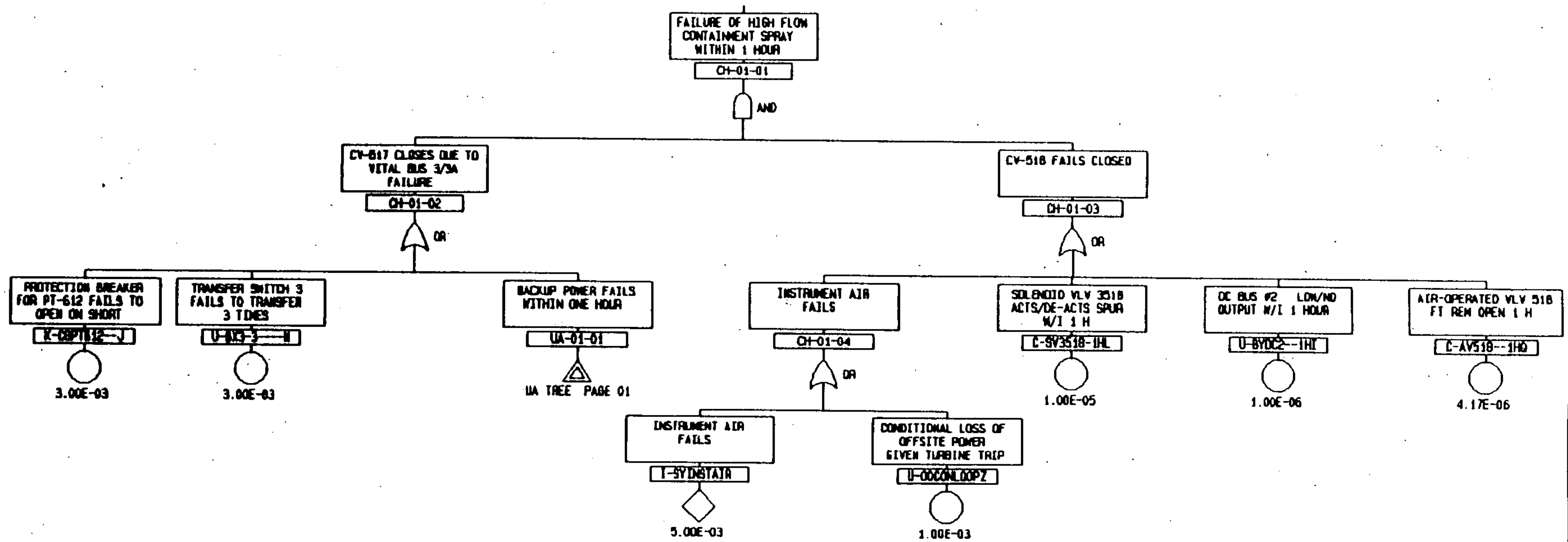
12-31-1990



REBECA (C)ERIN Engineering and Research, Inc   Version 1.1

FAILURE OF HIGH FLOW CONTAINMENT SPRAY WITHIN 1 HOUR

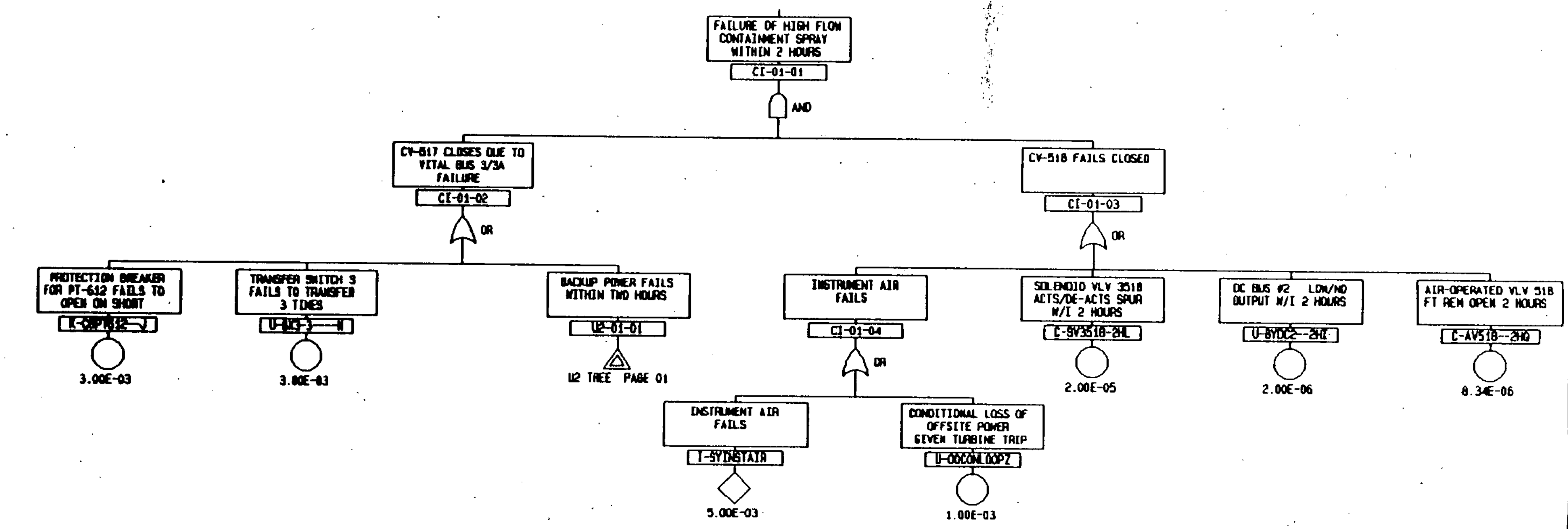
01-02-1991



REBECA (C)ERIN Engineering and Research, Inc Version 1.1

FAILURE OF HIGH FLOW CONTAINMENT SPRAY WITHIN 2 HOURS

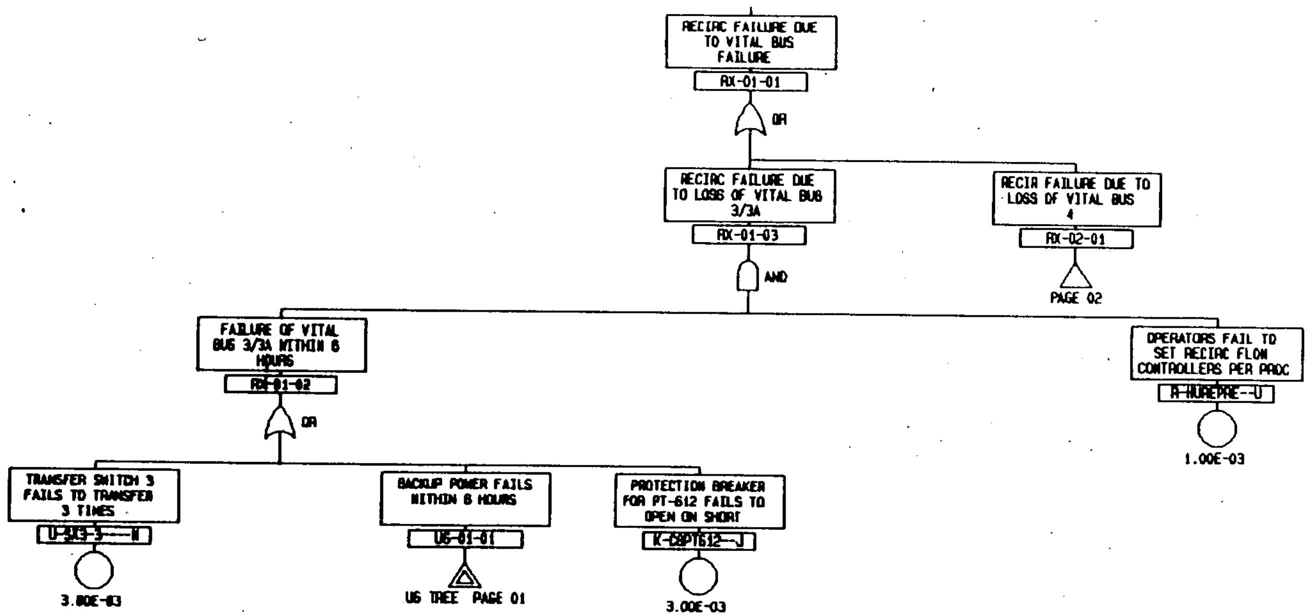
01-02-1991



REBECA (C) ERIN Engineering and Research, Inc Version 1.1

FAILURE OF RECIRCULATION DUE TO VITAL BUS FAILURE

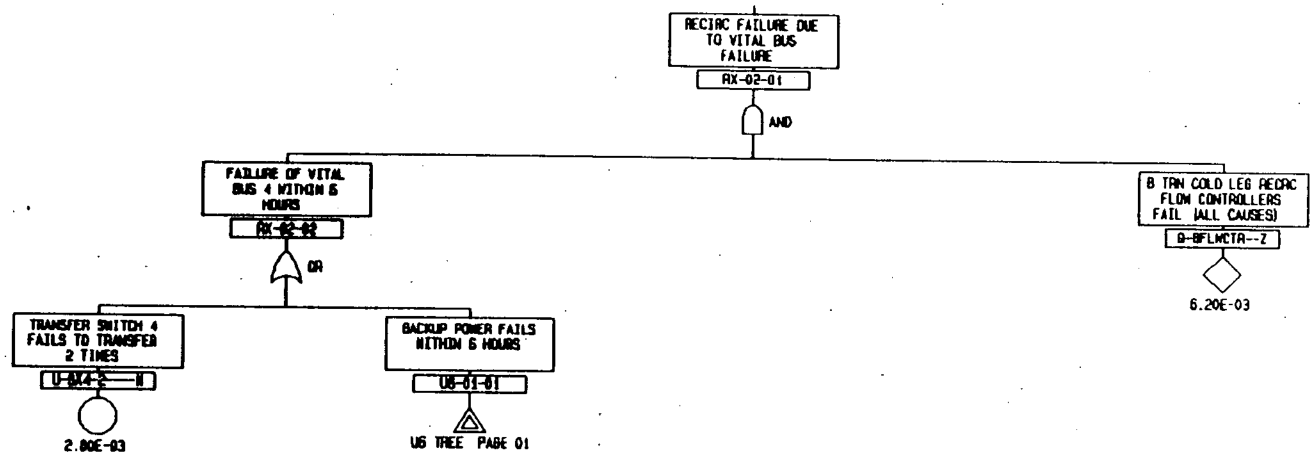
01-02-1991



REBECA (C)ERIN Engineering and Research, Inc Version 1.1

FAILURE OF RECIRCULATION DUE TO VITAL BUS FAILURE

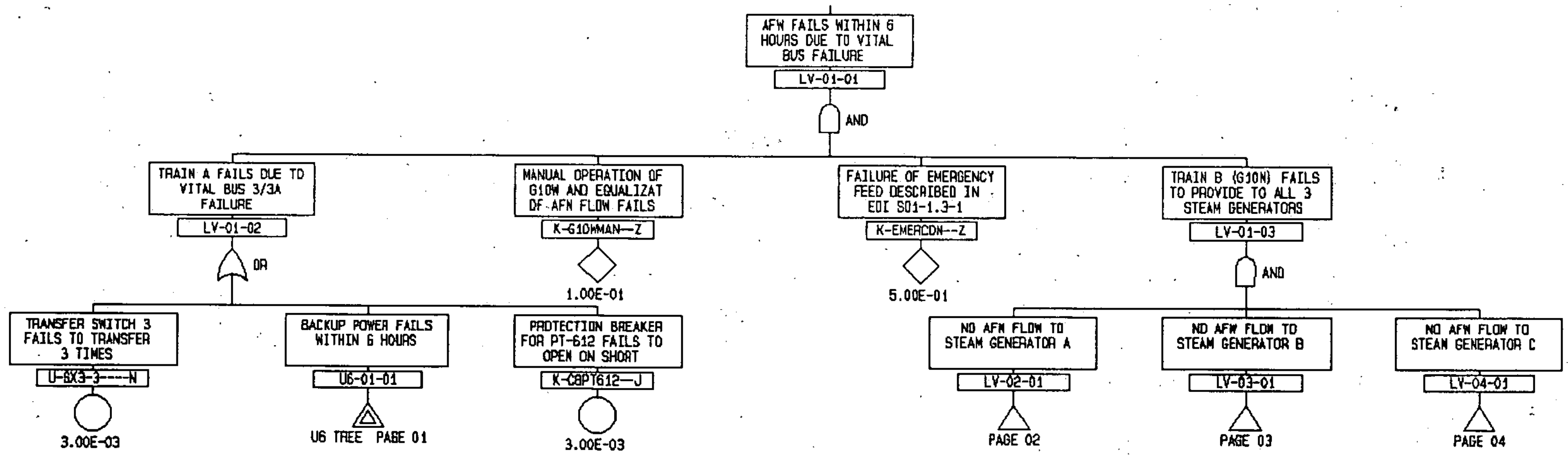
01-02-1991



REBECA (C) ERIN Engineering and Research, Inc Version 1 1

FAILURE OF AFW DUE TO VITAL BUS FAILURE

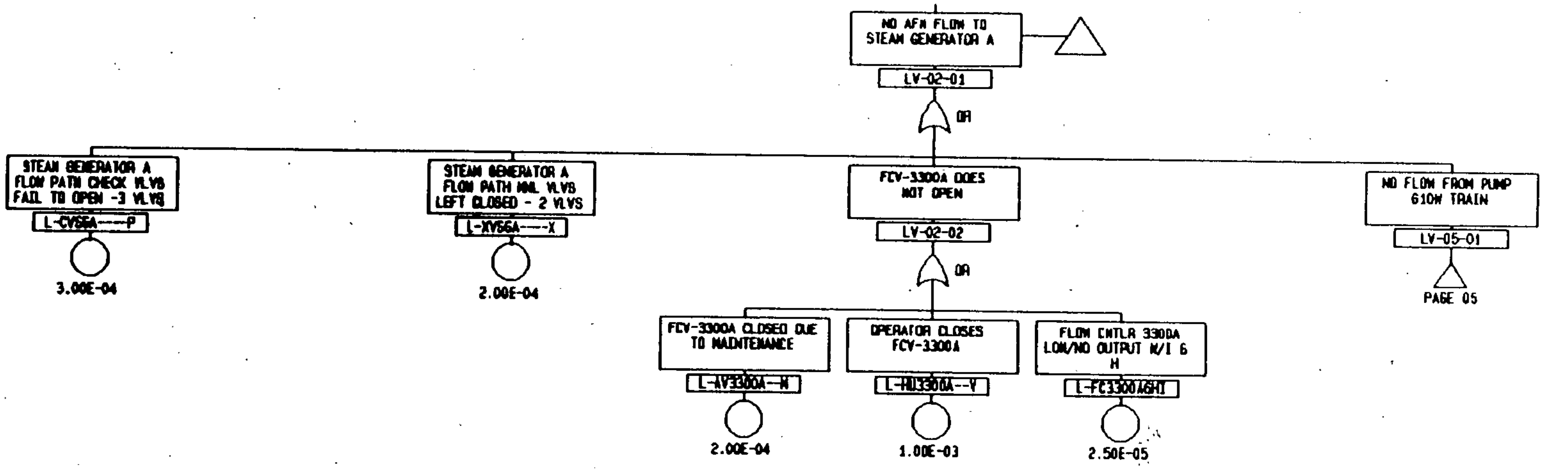
01-08-1991



REBECA (C)ERIN Engineering and Research, Inc. Version 1.1

FAILURE OF AFW DUE TO VITAL BUS FAILURE

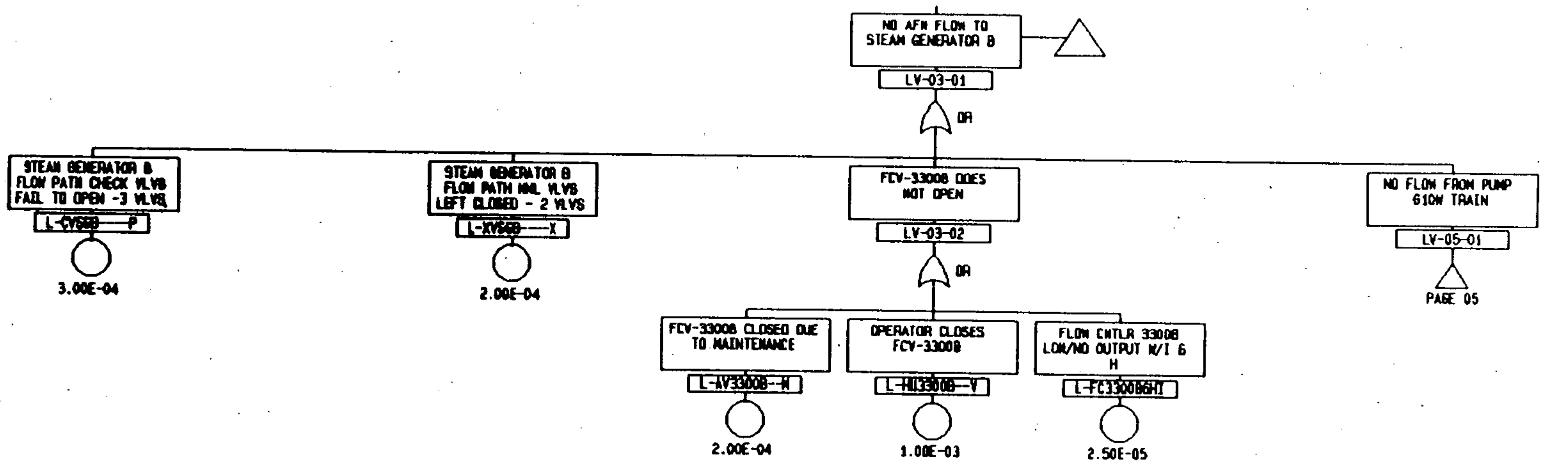
01-02-1991



REBECA (C) ERIN Engineering and Research, Inc Version 1.1

FAILURE OF AFW DUE TO VITAL BUS FAILURE

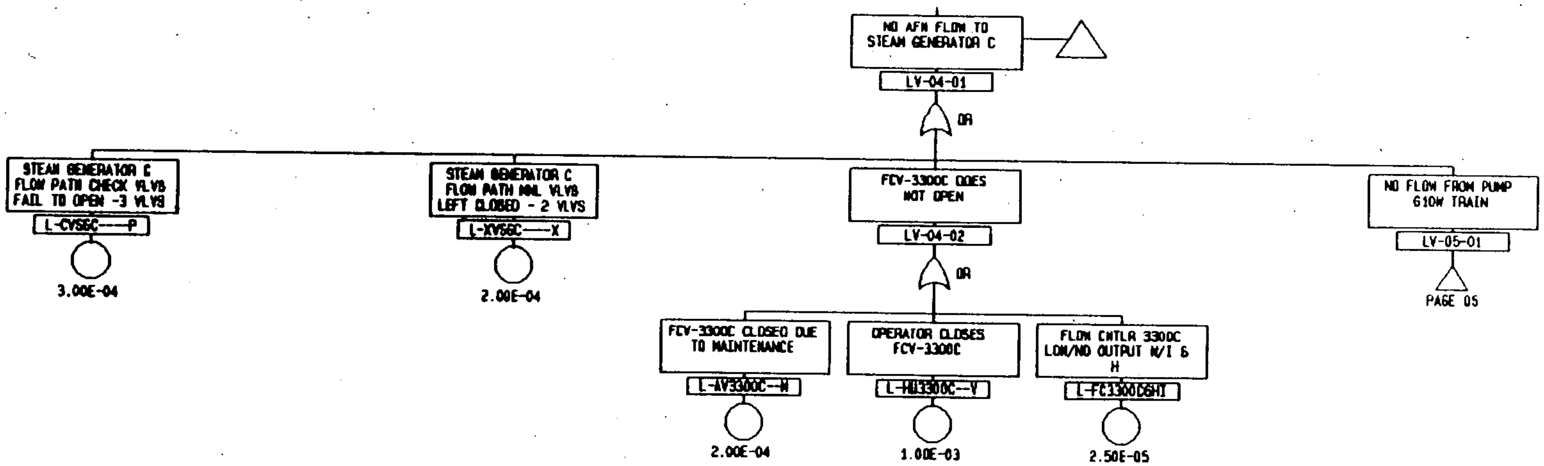
01-02-1991



REBECA (C)ERIN Engineering and Research, Inc Version 1.1

FAILURE OF AFW DUE TO VITAL BUS FAILURE

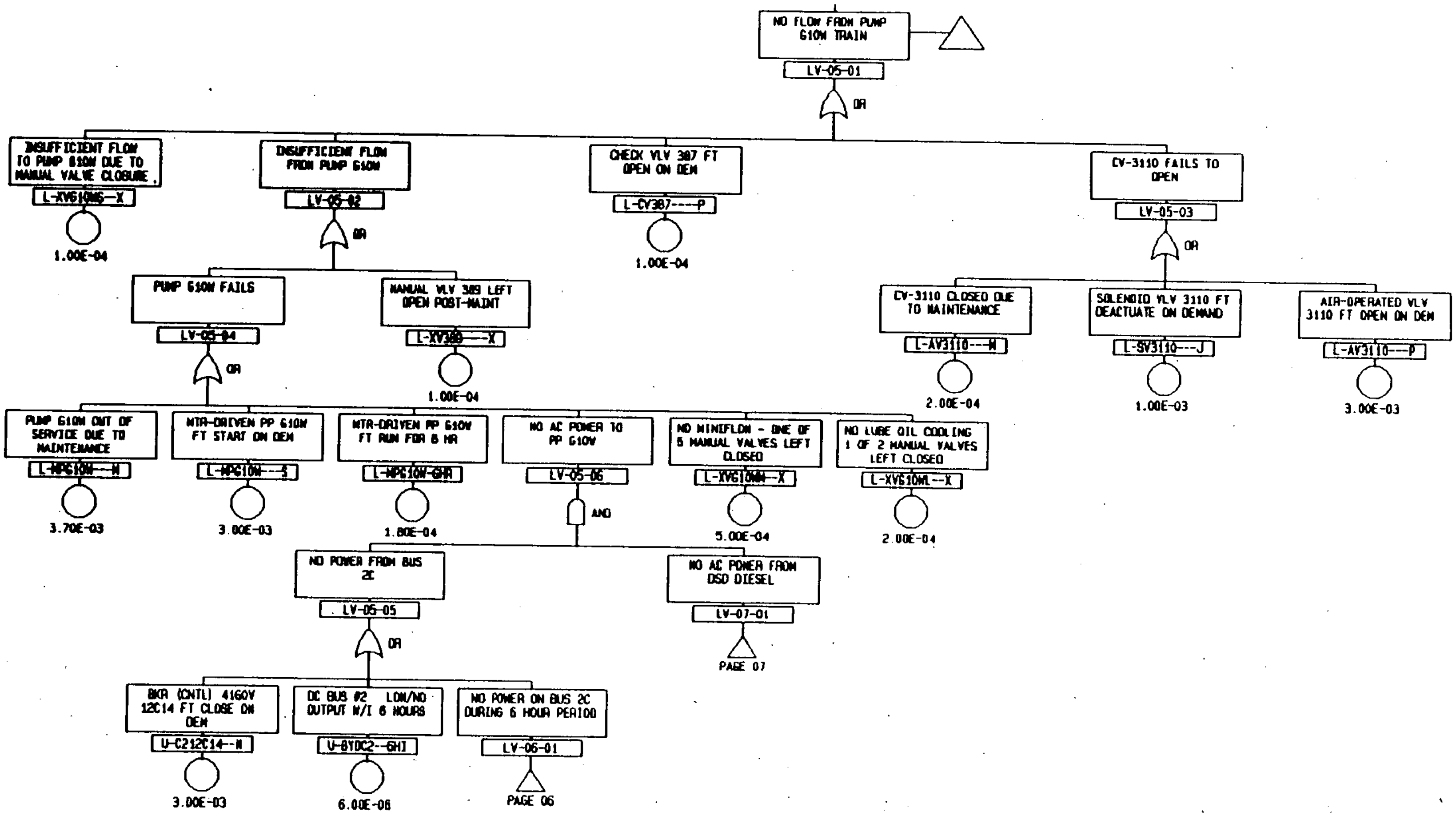
01-02-1991



REBECA (C)ERIN Engineering and Research, Inc Version 1 1

FAILURE OF AFW DUE TO VITAL BUS FAILURE

01-02-1991

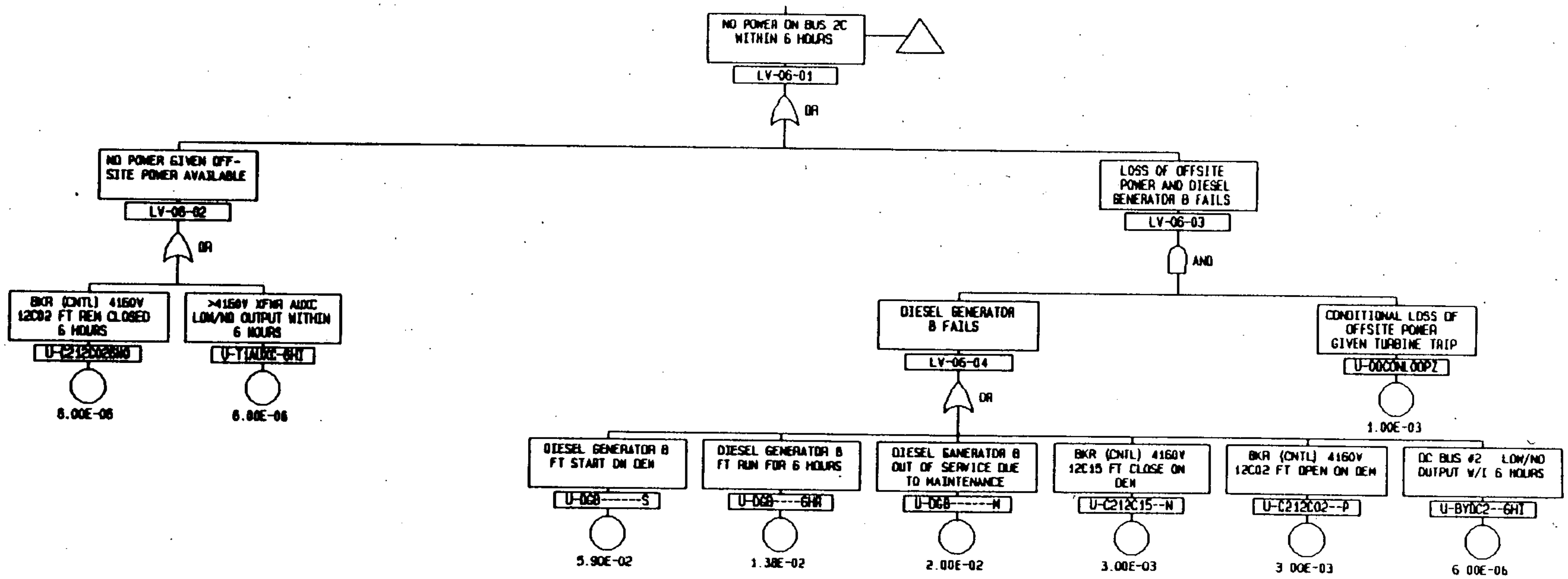


FAILURES OF AFWAS B ACTUATION SIGNAL ARE IGNORED

REBECA (C) ERIN Engineering and Research, Inc   Version 1.1

FAILURE OF AFW DUE TO VITAL BUS FAILURE

01-02-1991

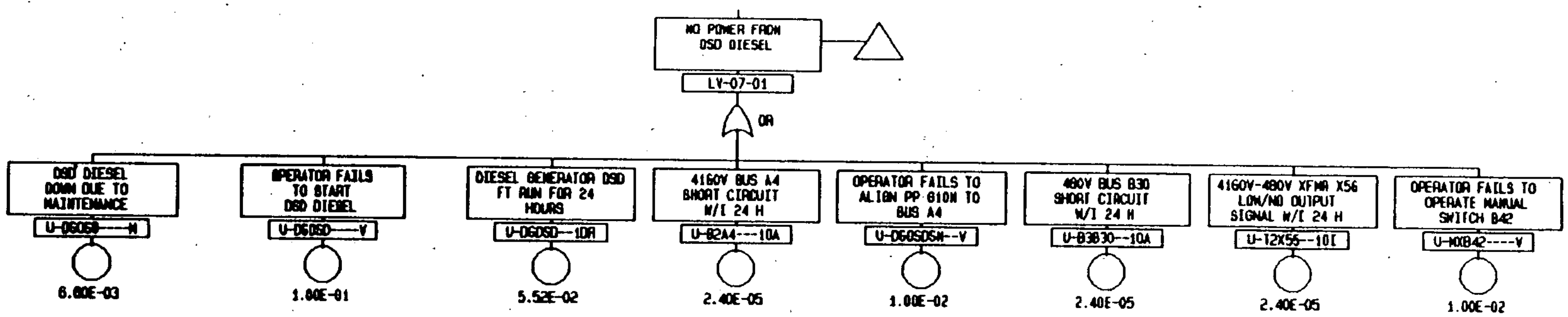


BUS FAILURES ARE IGNORED

REBECA (C)ERIN Engineering and Research, Inc Version 1.1

FAILURE OF AFW DUE TO VITAL BUS FAILURE

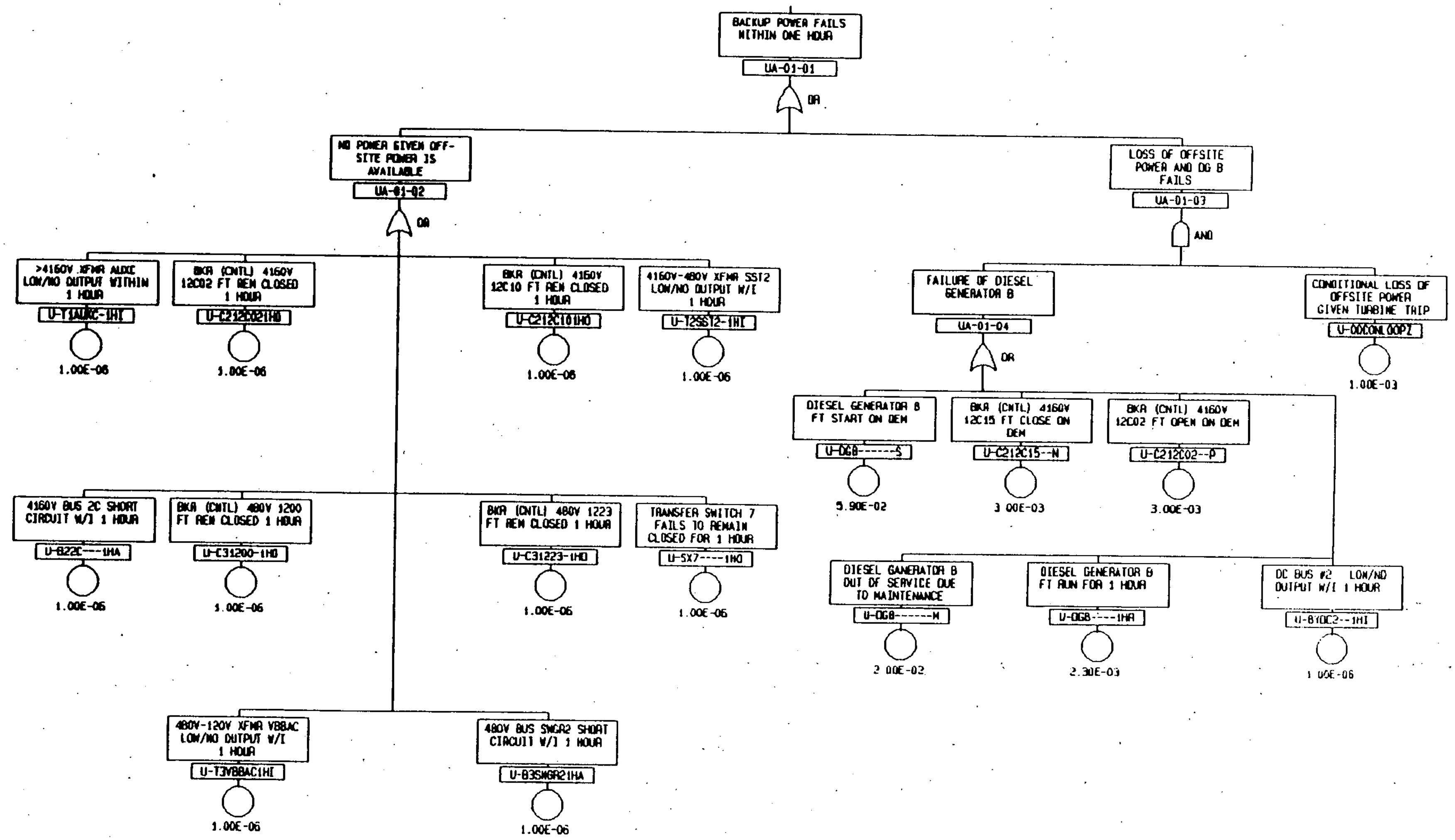
01-02-1991



REBECA (C) EHIN Engineering and Research, Inc   Version 1.1

BACKUP POWER FAILS WITHIN ONE HOUR

09-22-1990



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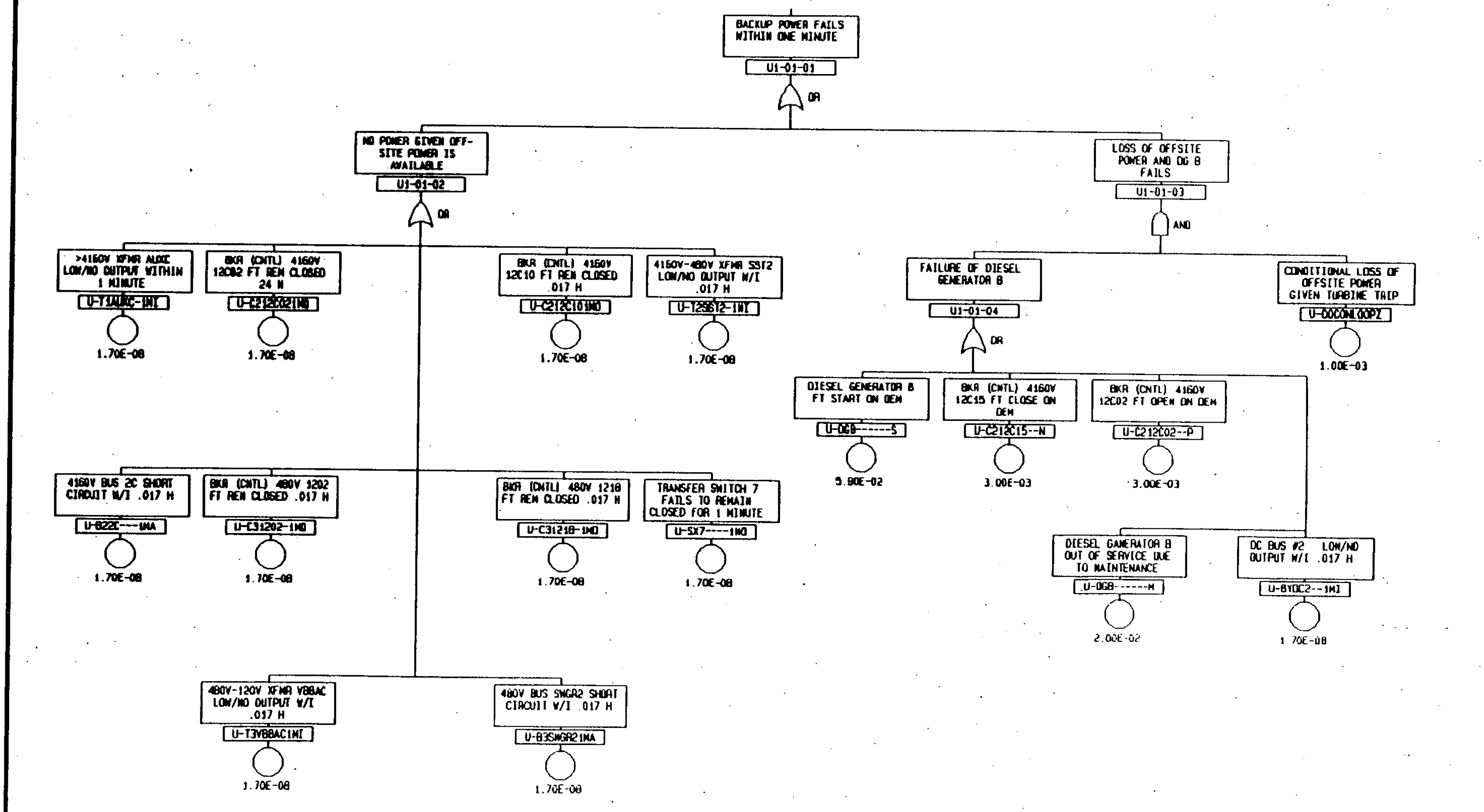
REBECA (C) ERIN Engineering and Research, Inc Version 1.1

BACKUP POWER FAILS WITHIN ONE MINUTE

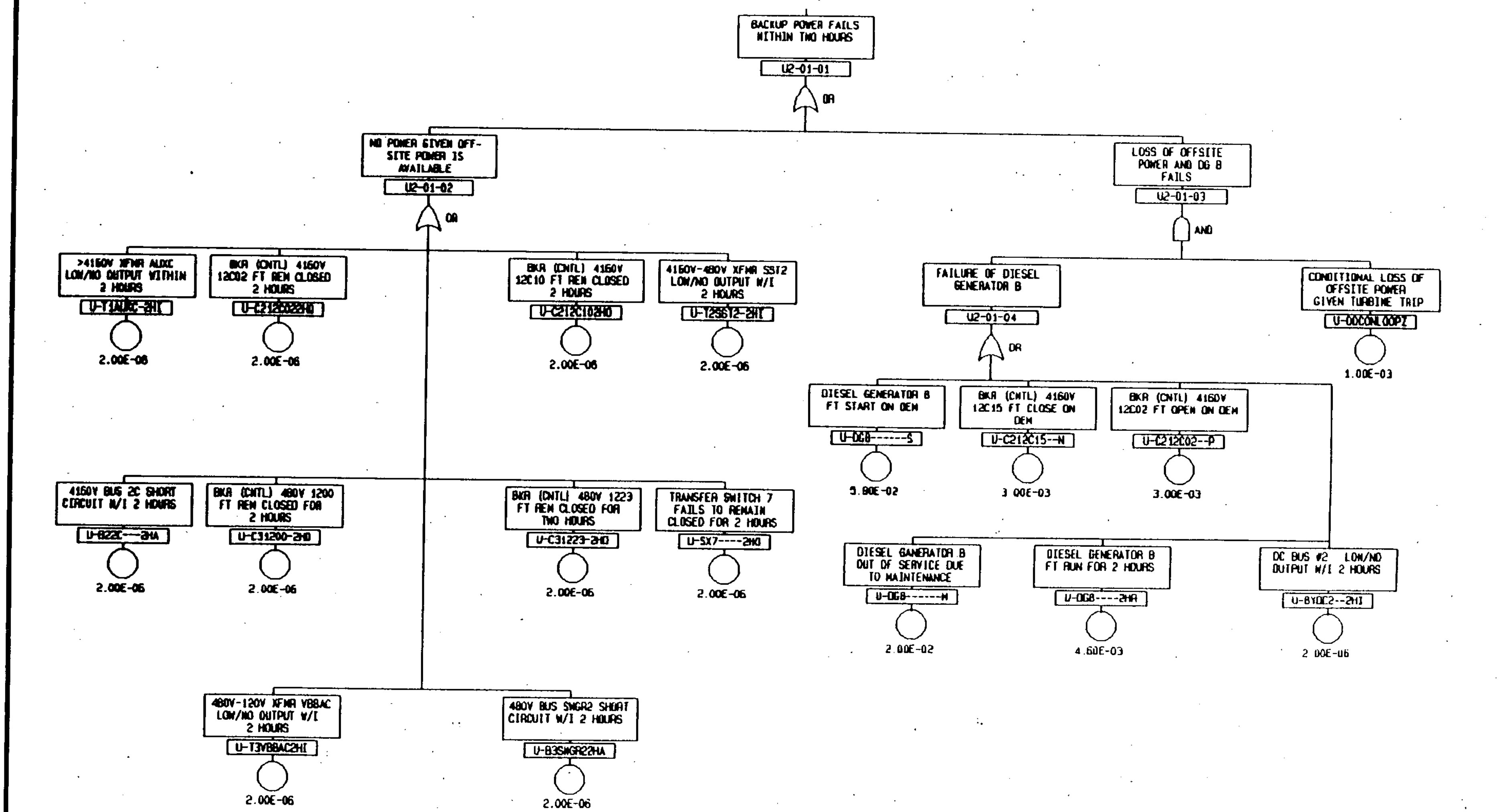
09-24-1990



REBECCA (C) EHIN Engineering and Research, Inc   Version 1.1

BACKUP POWER FAILS WITHIN TWO HOURS

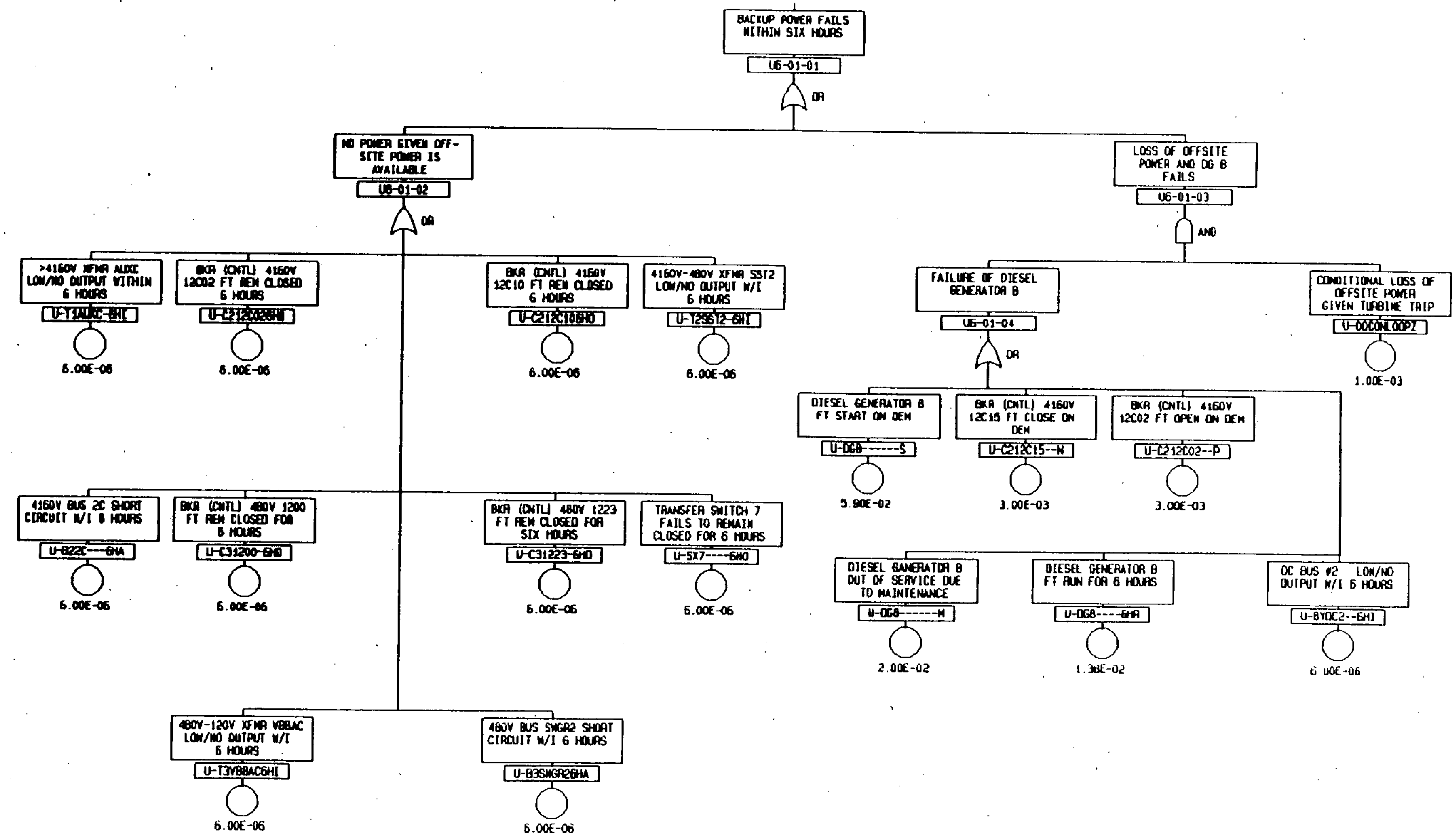
09-22-1990



REBECA (C) ERIN Engineering and Research, Inc   Version 1.1

BACKUP POWER FAILS WITHIN SIX HOURS

09-22-1990



REBLCA (C) ERIN Engineering and Research, Inc. Version 1.1

APPENDIX B*

Cutset Results from Quantification of each Event Tree Sequence

* Note: Cutset results have been revised since original submittal of amendment application.

Sequence-level Cutset Report for VBTLL02 Data File

Top Event: VBTLL02 Top Event Probability: 1.711E-08

This file was created on 1- 8-1991 at 13:47:38

Rank	Cutset Importance	Cutset Probability
1	6.739E-01	1.153E-08

INIT-L---LL 9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-SX4-2----N 2.000E-03 - TRANSFER SWITCH 4 FAILS TO TRANSFER 2 TIMES

2 1.630E-01 2.790E-09

INIT-L---LL 9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
R-HUREPRE--U 1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC

2 1.630E-01 2.790E-09

INIT-L---LL 9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
R-HUREPRE--U 1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

Sequence-level Cutset Report for VBTLL03 Data File

Top Event: VBTLL03 Top Event Probability: 1.147E-07

This file was created on 1- 8-1991 at 13:48:10

Rank	Cutset Importance	Cutset Probability
1	4.785E-01	5.487E-08

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

2 1.622E-01 1.860E-08

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

3 1.217E-01 1.395E-08

```
I-SYINSTAIR   5.000E-03 - INSTRUMENT AIR FAILS
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

3 1.217E-01 1.395E-08

```
I-SYINSTAIR   5.000E-03 - INSTRUMENT AIR FAILS
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
```

4 2.433E-02 2.790E-09

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
U-C212C15--N  3.000E-03 - BKR (CNTL) 4160V 12C15 FT CLOSE ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

4 2.433E-02 2.790E-09

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

4 2.433E-02 2.790E-09

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
U-C212C02--P  3.000E-03 - BKR (CNTL) 4160V 12C02 FT OPEN ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

4 2.433E-02 2.790E-09

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Sequence-level Cutset Report for VBTLL03 Data File

Top Event: VBTLL03 Top Event Probability: 1.147E-07

This file was created on 1- 8-1991 at 13:48:10

Rank	Cutset Importance	Cutset Probability
5	1.865E-02	2.139E-09

INIT-L---LL 9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
U-DGB----1HR 2.300E-03 - DIESEL GENERATOR B FT RUN FOR 1 HOUR
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTLL04 Data File

Top Event: VBTLL04 Top Event Probability: 4.555E-10

This file was created on 1- 8-1991 at 13:48:42

Rank	Cutset Importance	Cutset Probability
1	7.468E-01	3.402E-10

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
Q-BFLWCTR--Z  6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
2	2.532E-01	1.153E-10

```
INIT-L---LL   9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
Q-BFLWCTR--Z  6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Sequence-level Cutset Report for VBTLL05 Data File

Top Event: VBTLL05 Top Event Probability: 7.347E-10

This file was created on 1- 8-1991 at 13:49:13

Rank	Cutset Importance	Cutset Probability
1	7.468E-01	5.487E-10

INIT-L---LL 9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
KSSHORTVB 1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Rank	Cutset Importance	Cutset Probability
2	2.532E-01	1.860E-10

INIT-L---LL 9.300E-04 - INITIATING EVENT L FOR EVENT TREE 'VBTLL'
KSSHORTVB 1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------M 2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTSL02 Data File

Top Event: VBTSL02 Top Event Probability: 5.822E-08

This file was created on 1- 8-1991 at 13:53:23

Rank	Cutset Importance	Cutset Probability
1	6.390E-01	3.720E-08

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-SX4-2----N 2.000E-03 - TRANSFER SWITCH 4 FAILS TO TRANSFER 2 TIMES

2 1.546E-01 9.000E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
R-HUREPRE--U 1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC

2 1.546E-01 9.000E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
R-HUREPRE--U 1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

3 1.885E-02 1.097E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

4 6.390E-03 3.720E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB------M 2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

5 4.409E-03 2.567E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB----6HR 1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

6 3.040E-03 1.770E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
R-HUREPRE--U 1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTSL02 Data File

Top Event: VBTSL02 Top Event Probability: 5.822E-08

This file was created on 1- 8-1991 at 13:53:23

Rank	Cutset Importance	Cutset Probability
7	1.917E-03	1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C212C026HO 6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C212C106HO 6.000E-06 - BKR (CNTL) 4160V 12C10 FT REM CLOSED 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-T1AUXC-6HI 6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-T2SST2-6HI 6.000E-06 - 4160V-480V XFMR SST2 LOW/NO OUTPUT W/I 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-B3SWGR26HA 6.000E-06 - 480V BUS SWGR2 SHORT CIRCUIT W/I 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C31200-6HO 6.000E-06 - BKR (CNTL) 480V 1200 FT REM CLOSED FOR 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C31223-6HO 6.000E-06 - BKR (CNTL) 480V 1223 FT REM CLOSED FOR SIX HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-T3VBBAC6HI 6.000E-06 - 480V-120V XFMR VBBAC LOW/NO OUTPUT W/I 6 HOURS

Sequence-level Cutset Report for VBTSL02 Data File

Top Event: VBTSL02 Top Event Probability: 5.822E-08

This file was created on 1- 8-1991 at 13:53:23

Rank	Cutset Importance	Cutset Probability
7	1.917E-03	1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-SX7----6HO 6.000E-06 - TRANSFER SWITCH 7 FAILS TO REMAIN CLOSED FOR 6 HOURS

Rank	Cutset Importance	Cutset Probability
7	1.917E-03	1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-B22C---6HA 6.000E-06 - 4160V BUS 2C SHORT CIRCUIT W/I 6 HOURS

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:53:58

Rank	Cutset Importance	Cutset Probability
1	2.934E-01	8.850E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
2	9.944E-02	3.000E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
3	6.861E-02	2.070E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
4	5.519E-02	1.665E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Rank	Cutset Importance	Cutset Probability
4	5.519E-02	1.665E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03   Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:53:58

Rank	Cutset Importance	Cutset Probability
5	4.475E-02	1.350E-09

```
INIT-S---SL    3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---S   3.000E-03 - MTR-DRIVEN PP G10W FT START ON DEM
U-SX3-3----N   3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Rank	Cutset Importance	Cutset Probability
5	4.475E-02	1.350E-09

```
INIT-S---SL    3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J   3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-AV3110---P   3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM
```

Rank	Cutset Importance	Cutset Probability
5	4.475E-02	1.350E-09

```
INIT-S---SL    3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-AV3110---P   3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM
U-SX3-3----N   3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Rank	Cutset Importance	Cutset Probability
5	4.475E-02	1.350E-09

```
INIT-S---SL    3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C14--N   3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD----V   1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-SX3-3----N   3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Rank	Cutset Importance	Cutset Probability
5	4.475E-02	1.350E-09

```
INIT-S---SL    3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J   3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---S   3.000E-03 - MTR-DRIVEN PP G10W FT START ON DEM
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:53:58

Rank	Cutset Importance	Cutset Probability
5	4.475E-02	1.350E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C14--N 3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL

6 2.983E-02 9.000E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-T1AUXC-6HI 6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS

6 2.983E-02 9.000E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C026HO 6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL

7 1.619E-02 4.885E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGDSD--1DR 5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

8 1.492E-02 4.500E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-SV3110---J 1.000E-03 - SOLENOID VLV 3110 FT DEACTUATE ON DEMAND
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:53:58

Rank	Cutset Importance	Cutset Probability

8 1.492E-02 4.500E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C15--N  3.000E-03 - BKR (CNTL) 4160V 12C15 FT CLOSE ON DEM
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

8 1.492E-02 4.500E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C02--P  3.000E-03 - BKR (CNTL) 4160V 12C02 FT OPEN ON DEM
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

8 1.492E-02 4.500E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-SV3110---J  1.000E-03 - SOLENOID VLV 3110 FT DEACTUATE ON DEMAND
```

9 7.458E-03 2.250E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-XVG10WM--X  5.000E-04 - NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

9 7.458E-03 2.250E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-XVG10WM--X  5.000E-04 - NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:53:58

Rank	Cutset Importance	Cutset Probability
10	5.489E-03	1.656E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------M 2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD--1DR 5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Rank	Cutset Importance	Cutset Probability
11	3.788E-03	1.143E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB----6HR 1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-DGDSD--1DR 5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTSL04 Data File

Top Event: VBTSL04 Top Event Probability: 2.640E-09

This file was created on 1- 8-1991 at 13:54:32

Rank	Cutset Importance	Cutset Probability
1	6.705E-01	1.770E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
KSSHORTVB     1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
2	2.273E-01	6.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
KSSHORTVB     1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
3	1.023E-01	2.700E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-C8SV116--J  3.000E-03 - PROTECTION BREAKER FOR SV-116 FAILS TO OPEN ON SHORT
KSSHORTVB     1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
```

Sequence-level Cutset Report for VBTMF02 Data File

Top Event: VBTMF02 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:49:47

Rank	Cutset Importance	Cutset Probability
1	2.934E-01	8.850E-09

```
INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

2 9.944E-02 3.000E-09

```
INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

3 6.861E-02 2.070E-09

```
INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

4 5.519E-02 1.665E-09

```
INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

4 5.519E-02 1.665E-09

```
INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
```

Sequence-level Cutset Report for VBTMF02 Data File

Top Event: VBTMF02 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:49:47

Rank	Cutset Importance	Cutset Probability
5	4.475E-02	1.350E-09

```
INIT-I---MF    3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---S   3.000E-03 - MTR-DRIVEN PP G10W FT START ON DEM
U-SX3-3----N   3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

5 4.475E-02 1.350E-09

```
INIT-I---MF    3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-C8PT612--J   3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-AV3110---P   3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM
```

5 4.475E-02 1.350E-09

```
INIT-I---MF    3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-AV3110---P   3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM
U-SX3-3----N   3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

5 4.475E-02 1.350E-09

```
INIT-I---MF    3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C14--N   3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD----V   1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-SX3-3----N   3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

5 4.475E-02 1.350E-09

```
INIT-I---MF    3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-C8PT612--J   3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z   5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z   1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---S   3.000E-03 - MTR-DRIVEN PP G10W FT START ON DEM
```

Sequence-level Cutset Report for VBTMF02 Data File

Top Event: VBTMF02 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:49:47

```
      Cutset      Cutset
Rank  Importance  Probability

  5  4.475E-02   1.350E-09

     INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
     K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
     U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL

  6  2.983E-02   9.000E-10

     INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
     U-T1AUXC-6HI  6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS

  6  2.983E-02   9.000E-10

     INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     U-C212C026HO  6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
     U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL

  7  1.619E-02   4.885E-10

     INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
     U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
     U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

  8  1.492E-02   4.500E-10

     INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     L-SV3110---J  1.000E-03 - SOLENOID VLV 3110 FT DEACTUATE ON DEMAND
     U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Top Event: VBTMF02 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:49:47

Rank	Cutset Importance	Cutset Probability
8	1.492E-02	4.500E-10

INIT-I---MF 3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C15--N 3.000E-03 - BKR (CNTL) 4160V 12C15 FT CLOSE ON DEM
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

8 1.492E-02 4.500E-10

INIT-I---MF 3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C02--P 3.000E-03 - BKR (CNTL) 4160V 12C02 FT OPEN ON DEM
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

8 1.492E-02 4.500E-10

INIT-I---MF 3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-SV3110---J 1.000E-03 - SOLENOID VLV 3110 FT DEACTUATE ON DEMAND

9 7.458E-03 2.250E-10

INIT-I---MF 3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-XVG10WM--X 5.000E-04 - NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

9 7.458E-03 2.250E-10

INIT-I---MF 3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-XVG10WM--X 5.000E-04 - NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED

Sequence-level Cutset Report for VBTMF02 Data File

Top Event: VBTMF02 Top Event Probability: 3.017E-08

This file was created on 1- 8-1991 at 13:49:47

Rank	Cutset Importance	Cutset Probability
10	5.489E-03	1.656E-10

INIT-I---MF 3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------M 2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD--1DR 5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Rank	Cutset Importance	Cutset Probability
11	3.788E-03	1.143E-10

INIT-I---MF 3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB----6HR 1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-DGDSD--1DR 5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTMF03 Data File

Top Event: VBTMF03 Top Event Probability: 2.640E-09

This file was created on 1- 8-1991 at 13:50:21

Rank	Cutset Importance	Cutset Probability			
1	6.705E-01	1.770E-09			
			INIT-I---MF	3.000E-03	INITIATING EVENT I FOR EVENT TREE 'VBTMF'
			KSSHORTVB	1.000E-02	VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
			U-DGB------S	5.900E-02	DIESEL GENERATOR B FT START ON DEM
			U-OOCONLOOPZ	1.000E-03	CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
2	2.273E-01	6.000E-10			
			INIT-I---MF	3.000E-03	INITIATING EVENT I FOR EVENT TREE 'VBTMF'
			KSSHORTVB	1.000E-02	VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
			U-DGB------M	2.000E-02	DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
			U-OOCONLOOPZ	1.000E-03	CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
3	1.023E-01	2.700E-10			
			INIT-I---MF	3.000E-03	INITIATING EVENT I FOR EVENT TREE 'VBTMF'
			K-C8PT612--J	3.000E-03	PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
			K-C8SV116--J	3.000E-03	PROTECTION BREAKER FOR SV-116 FAILS TO OPEN ON SHORT
			KSSHORTVB	1.000E-02	VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT

Sequence-level Cutset Report for VBTMF04 Data File

Top Event: VBTMF04 Top Event Probability: 1.185E-09

This file was created on 1- 8-1991 at 12:00:52

Rank	Cutset Importance	Cutset Probability
1	7.468E-01	8.850E-10

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INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
KSSHORTVB     1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
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Rank	Cutset Importance	Cutset Probability
2	2.532E-01	3.000E-10

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INIT-I---MF   3.000E-03 - INITIATING EVENT I FOR EVENT TREE 'VBTMF'
K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
KSSHORTVB     1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Sequence-level Cutset Report for VBTMS02 Data File

Top Event: VBTMS02 Top Event Probability: 1.676E-08

This file was created on 1- 8-1991 at 13:51:08

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      Cutset      Cutset
Rank  Importance  Probability

   1  1.235E-01   2.070E-09

      INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
      K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
      K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
      U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
      U-DGDSD----V  1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
      U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

   2  9.932E-02   1.665E-09

      INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
      K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
      K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
      L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
      U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

   2  9.932E-02   1.665E-09

      INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
      K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
      K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
      K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
      L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE

   3  8.053E-02   1.350E-09

      INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
      K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
      K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
      K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
      L-MPG10W---S  3.000E-03 - MTR-DRIVEN PP G10W FT START ON DEM

   3  8.053E-02   1.350E-09

      INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
      K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
      K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
      K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
      L-AV3110---P  3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM

   3  8.053E-02   1.350E-09

      INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
      K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI SO1-1.3-1
      K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
      L-AV3110---P  3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM
      U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Sequence-level Cutset Report for VBTMS02 Data File

Top Event: VBTMS02   Top Event Probability: 1.676E-08

This file was created on 1- 8-1991 at 13:51:08

Rank	Cutset Importance	Cutset Probability
3	8.053E-02	1.350E-09

INIT-MS--MS	3.000E-03	- INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-C8PT612--J	3.000E-03	- PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-EMERCON--Z	5.000E-01	- FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z	1.000E-01	- MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C14--N	3.000E-03	- BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD----V	1.000E+00	- OPERATOR FAILS TO START DSD DIESEL

Rank	Cutset Importance	Cutset Probability
3	8.053E-02	1.350E-09

INIT-MS--MS	3.000E-03	- INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z	5.000E-01	- FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z	1.000E-01	- MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C14--N	3.000E-03	- BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD----V	1.000E+00	- OPERATOR FAILS TO START DSD DIESEL
U-SX3-3----N	3.000E-03	- TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

Rank	Cutset Importance	Cutset Probability
3	8.053E-02	1.350E-09

INIT-MS--MS	3.000E-03	- INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z	5.000E-01	- FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z	1.000E-01	- MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
L-MPG10W---S	3.000E-03	- MTR-DRIVEN PP G10W FT START ON DEM
U-SX3-3----N	3.000E-03	- TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

Rank	Cutset Importance	Cutset Probability
4	5.369E-02	9.000E-10

INIT-MS--MS	3.000E-03	- INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z	5.000E-01	- FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z	1.000E-01	- MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C026HO	6.000E-06	- BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
U-DGDSD----V	1.000E+00	- OPERATOR FAILS TO START DSD DIESEL

Rank	Cutset Importance	Cutset Probability
4	5.369E-02	9.000E-10

INIT-MS--MS	3.000E-03	- INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z	5.000E-01	- FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z	1.000E-01	- MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGDSD----V	1.000E+00	- OPERATOR FAILS TO START DSD DIESEL
U-T1AUXC-6HI	6.000E-06	- >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS

Sequence-level Cutset Report for VBTMS02 Data File

Top Event: VBTMS02 Top Event Probability: 1.676E-08

This file was created on 1- 8-1991 at 13:51:08

Rank	Cutset Importance	Cutset Probability

```
 5  2.684E-02   4.500E-10

     INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     L-SV3110---J  1.000E-03 - SOLENOID VLV 3110 FT DEACTUATE ON DEMAND
     U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

 5  2.684E-02   4.500E-10

     INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
     K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     L-SV3110---J  1.000E-03 - SOLENOID VLV 3110 FT DEACTUATE ON DEMAND

 6  1.342E-02   2.250E-10

     INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     L-XVG10WM--X  5.000E-04 - NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED
     U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

 6  1.342E-02   2.250E-10

     INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
     K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     L-XVG10WM--X  5.000E-04 - NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED

 7  6.816E-03   1.143E-10

     INIT-MS--MS   3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
     K-EMERCON--Z  5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
     K-G10WMAN--Z  1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
     U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
     U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
     U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Sequence-level Cutset Report for VBTMS03 Data File

Top Event: VBTMS03 Top Event Probability: 3.772E-07

This file was created on 1- 8-1991 at 13:51:42

Rank	Cutset Importance	Cutset Probability
1	4.693E-01	1.770E-07

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

2 1.591E-01 6.000E-08

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-DGB------M 2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

3 1.193E-01 4.500E-08

I-SYINSTAIR 5.000E-03 - INSTRUMENT AIR FAILS
INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT

3 1.193E-01 4.500E-08

I-SYINSTAIR 5.000E-03 - INSTRUMENT AIR FAILS
INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

4 3.659E-02 1.380E-08

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-DGB----2HR 4.600E-03 - DIESEL GENERATOR B FT RUN FOR 2 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

5 2.386E-02 9.000E-09

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

5 2.386E-02 9.000E-09

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-C212C02--P 3.000E-03 - BKR (CNTL) 4160V 12C02 FT OPEN ON DEM
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

5 2.386E-02 9.000E-09

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

Sequence-level Cutset Report for VBTMS03 Data File

Top Event: VBTMS03   Top Event Probability: 3.772E-07

This file was created on 1- 8-1991 at 13:51:42

Rank	Cutset Importance	Cutset Probability
5	2.386E-02	9.000E-09

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-C212C15--N 3.000E-03 - BKR (CNTL) 4160V 12C15 FT CLOSE ON DEM
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Rank	Cutset Importance	Cutset Probability
6	4.773E-04	1.800E-10

C-SV3518-2HL 2.000E-05 - SOLENOID VLV 3518 ACTS/DE-ACTS SPUR W/I 2 HOURS
INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

Rank	Cutset Importance	Cutset Probability
6	4.773E-04	1.800E-10

C-SV3518-2HL 2.000E-05 - SOLENOID VLV 3518 ACTS/DE-ACTS SPUR W/I 2 HOURS
INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT

Sequence-level Cutset Report for VBTMS04 Data File

Top Event: VBTMS04 Top Event Probability: 1.340E-08

This file was created on 1- 8-1991 at 13:52:17

Rank	Cutset Importance	Cutset Probability
1	6.602E-01	8.850E-09

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

2 2.238E-01 3.000E-09

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------M 2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

3 3.645E-02 4.885E-10

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGDSD--1DR 5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

4 3.357E-02 4.500E-10

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C02--P 3.000E-03 - BKR (CNTL) 4160V 12C02 FT OPEN ON DEM
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

4 3.357E-02 4.500E-10

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z 5.000E-01 - FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z 1.000E-01 - MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-C212C15--N 3.000E-03 - BKR (CNTL) 4160V 12C15 FT CLOSE ON DEM
U-DGDSD----V 1.000E+00 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTMS04 Data File

Top Event: VBTMS04 Top Event Probability: 1.340E-08

This file was created on 1- 8-1991 at 13:52:17

Rank	Cutset Importance	Cutset Probability
5	1.235E-02	1.656E-10

INIT-MS--MS	3.000E-03	- INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-EMERCON--Z	5.000E-01	- FAILURE OF EMERGENCY FEED DESCRIBED IN EOI S01-1.3-1
K-G10WMAN--Z	1.000E-01	- MANUAL OPERATION OF G10W AND EQUALIZAT OF AFW FLOW FAILS
U-DGB------M	2.000E-02	- DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD--1DR	5.520E-02	- DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ	1.000E-03	- CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTMS05 Data File

Top Event: VBTMS05   Top Event Probability: 2.640E-09

This file was created on 1- 8-1991 at 13:52:49

Rank	Cutset Importance	Cutset Probability
1	6.705E-01	1.770E-09

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
KSSHORTVB 1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Rank	Cutset Importance	Cutset Probability
2	2.273E-01	6.000E-10

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
KSSHORTVB 1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT
U-DGB------M 2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Rank	Cutset Importance	Cutset Probability
3	1.023E-01	2.700E-10

INIT-MS--MS 3.000E-03 - INITIATING EVENT MS FOR EVENT TREE 'VBTMS'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
K-C8SV116--J 3.000E-03 - PROTECTION BREAKER FOR SV-116 FAILS TO OPEN ON SHORT
KSSHORTVB 1.000E-02 - VITAL BUSSES FAIL DUE TO SHORTS IMMED. FOLLOWING ACCIDENT

Sequence-level Cutset Report for VBTSL02 Data File

Top Event: VBTSL02 Top Event Probability: 5.822E-08

This file was created on 1- 2-1991 at 16:05:10

Rank	Cutset Importance	Cutset Probability

1 6.390E-01 3.720E-08

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z  6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-SX4-2----N  2.000E-03 - TRANSFER SWITCH 4 FAILS TO TRANSFER 2 TIMES
```

2 1.546E-01 9.000E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
R-HUREPRE--U  1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC
```

2 1.546E-01 9.000E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
R-HUREPRE--U  1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

3 1.885E-02 1.097E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z  6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

4 6.390E-03 3.720E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z  6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

5 4.409E-03 2.567E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z  6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

6 3.040E-03 1.770E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
R-HUREPRE--U  1.000E-03 - OPERATORS FAIL TO SET RECIRC FLOW CONTROLLERS PER PROC
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Top Event: VBTSL02 Top Event Probability: 5.822E-08

This file was created on 1- 2-1991 at 16:05:10

Rank	Cutset Importance	Cutset Probability
7	1.917E-03	1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C212C026HO 6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C212C106HO 6.000E-06 - BKR (CNTL) 4160V 12C10 FT REM CLOSED 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-T1AUXC-6HI 6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-T2SST2-6HI 6.000E-06 - 4160V-480V XFMR SST2 LOW/NO OUTPUT W/I 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-B3SWGR26HA 6.000E-06 - 480V BUS SWGR2 SHORT CIRCUIT W/I 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C31200-6HO 6.000E-06 - BKR (CNTL) 480V 1200 FT REM CLOSED FOR 6 HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-C31223-6HO 6.000E-06 - BKR (CNTL) 480V 1223 FT REM CLOSED FOR SIX HOURS

7 1.917E-03 1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-T3VBBAC6HI 6.000E-06 - 480V-120V XFMR VBBAC LOW/NO OUTPUT W/I 6 HOURS

Sequence-level Cutset Report for VBTSL02 Data File

Top Event: VBTSL02 Top Event Probability: 5.822E-08

This file was created on 1- 2-1991 at 16:05:10

Rank	Cutset Importance	Cutset Probability
7	1.917E-03	1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-SX7----6HO 6.000E-06 - TRANSFER SWITCH 7 FAILS TO REMAIN CLOSED FOR 6 HOURS

Rank	Cutset Importance	Cutset Probability
7	1.917E-03	1.116E-10

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
Q-BFLWCTR--Z 6.200E-03 - B TRN COLD LEG RECRC FLOW CONTROLLERS FAIL (ALL CAUSES)
U-B22C---6HA 6.000E-06 - 4160V BUS 2C SHORT CIRCUIT W/I 6 HOURS

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability		
1	1.148E-01	3.330E-08		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	L-MPG10W---M	3.700E-03	-	PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
	U-SX3-3----N	3.000E-03	-	TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
1	1.148E-01	3.330E-08		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	K-C8PT612--J	3.000E-03	-	PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
	L-MPG10W---M	3.700E-03	-	PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
2	9.308E-02	2.700E-08		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	K-C8PT612--J	3.000E-03	-	PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
	L-AV3110---P	3.000E-03	-	AIR-OPERATED VLV 3110 FT OPEN ON DEM
2	9.308E-02	2.700E-08		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	L-AV3110---P	3.000E-03	-	AIR-OPERATED VLV 3110 FT OPEN ON DEM
	U-SX3-3----N	3.000E-03	-	TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
2	9.308E-02	2.700E-08		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	K-C8PT612--J	3.000E-03	-	PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
	L-MPG10W---S	3.000E-03	-	MTR-DRIVEN PP G10W FT START ON DEM
2	9.308E-02	2.700E-08		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	L-MPG10W---S	3.000E-03	-	MTR-DRIVEN PP G10W FT START ON DEM
	U-SX3-3----N	3.000E-03	-	TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
3	6.102E-02	1.770E-08		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	U-DGB------S	5.900E-02	-	DIESEL GENERATOR B FT START ON DEM
	U-DGDSD----V	1.000E-01	-	OPERATOR FAILS TO START DSD DIESEL
	U-OOCONLOOPZ	1.000E-03	-	CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability			
4	3.368E-02	9.770E-09			
			INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
			U-DGB------S	5.900E-02	- DIESEL GENERATOR B FT START ON DEM
			U-DGDSD--1DR	5.520E-02	- DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
			U-OOCONLOOPZ	1.000E-03	- CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
5	3.103E-02	9.000E-09			
			INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
			K-C8PT612--J	3.000E-03	- PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
			L-SV3110---J	1.000E-03	- SOLENOID VLV 3110 FT DEACTUATE ON DEMAND
5	3.103E-02	9.000E-09			
			INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
			L-SV3110---J	1.000E-03	- SOLENOID VLV 3110 FT DEACTUATE ON DEMAND
			U-SX3-3----N	3.000E-03	- TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
6	2.068E-02	6.000E-09			
			INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
			U-DGB------M	2.000E-02	- DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
			U-DGDSD----V	1.000E-01	- OPERATOR FAILS TO START DSD DIESEL
			U-OOCONLOOPZ	1.000E-03	- CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
7	1.551E-02	4.500E-09			
			INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
			L-XVG10WM--X	5.000E-04	- NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED
			U-SX3-3----N	3.000E-03	- TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
7	1.551E-02	4.500E-09			
			INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
			K-C8PT612--J	3.000E-03	- PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
			L-XVG10WM--X	5.000E-04	- NO MINIFLOW - ONE OF 5 MANUAL VALVES LEFT CLOSED
8	1.427E-02	4.140E-09			
			INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
			U-DGB----6HR	1.380E-02	- DIESEL GENERATOR B FT RUN FOR 6 HOURS
			U-DGDSD----V	1.000E-01	- OPERATOR FAILS TO START DSD DIESEL
			U-OOCONLOOPZ	1.000E-03	- CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability
9	1.142E-02	3.312E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
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10 9.308E-03 2.700E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD----V  1.000E-01 - OPERATOR FAILS TO START DSD DIESEL
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

10 9.308E-03 2.700E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD----V  1.000E-01 - OPERATOR FAILS TO START DSD DIESEL
```

11 7.878E-03 2.285E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

12 6.205E-03 1.800E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C026HO  6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
U-DGDSD----V  1.000E-01 - OPERATOR FAILS TO START DSD DIESEL
```

12 6.205E-03 1.800E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGDSD----V  1.000E-01 - OPERATOR FAILS TO START DSD DIESEL
U-T1AUXC-6HI  6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS
```

12 6.205E-03 1.800E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-XVG10WL--X  2.000E-04 - NO LUBE OIL COOLING 1 OF 2 MANUAL VALVES LEFT CLOSED
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability
12	6.205E-03	1.800E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
L-XVG10WL--X 2.000E-04 - NO LUBE OIL COOLING 1 OF 2 MANUAL VALVES LEFT CLOSED

12 6.205E-03 1.800E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
L-AV3110---M 2.000E-04 - CV-3110 CLOSED DUE TO MAINTENANCE

12 6.205E-03 1.800E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-AV3110---M 2.000E-04 - CV-3110 CLOSED DUE TO MAINTENANCE
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

13 6.102E-03 1.770E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-MXB42----V 1.000E-02 - OPERATOR FAILS TO OPERATE MANUAL SWITCH B42
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

13 6.102E-03 1.770E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB------S 5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGDSDSW--V 1.000E-02 - OPERATOR FAILS TO ALIGN PP G10W TO BUS A4
U-OOCONLOOPZ 1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP

14 5.585E-03 1.620E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J 3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
L-MPG10W-6HR 1.800E-04 - MTR-DRIVEN PP G10W FT RUN FOR 6 HR

14 5.585E-03 1.620E-09

INIT-S---SL 3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-MPG10W-6HR 1.800E-04 - MTR-DRIVEN PP G10W FT RUN FOR 6 HR
U-SX3-3----N 3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability

15 5.138E-03 1.490E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

15 5.138E-03 1.490E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
```

16 4.027E-03 1.168E-09

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-DGOSO----M  6.600E-03 - DSD DIESEL DOWN DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

17 3.425E-03 9.936E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C026HO  6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
```

17 3.425E-03 9.936E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-T1AUXC-6HI  6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS
```

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C15--N  3.000E-03 - BKR (CNTL) 4160V 12C15 FT CLOSE ON DEM
U-DGDSD----V  1.000E-01 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C02--P  3.000E-03 - BKR (CNTL) 4160V 12C02 FT OPEN ON DEM
U-DGDSD----V  1.000E-01 - OPERATOR FAILS TO START DSD DIESEL
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
L-XV389----X  1.000E-04 - MANUAL VLV 389 LEFT OPEN POST-MAINT
```

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
L-XVG10WS--X  1.000E-04 - INSUFFICIENT FLOW TO PUMP G10W DUE TO MANUAL VALVE CLOSURE
```

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-XVG10WS--X  1.000E-04 - INSUFFICIENT FLOW TO PUMP G10W DUE TO MANUAL VALVE CLOSURE
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-CV387----P  1.000E-04 - CHECK VLV 387 FT OPEN ON DEM
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
L-CV387----P  1.000E-04 - CHECK VLV 387 FT OPEN ON DEM
```

18 3.103E-03 9.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-XV389----X  1.000E-04 - MANUAL VLV 389 LEFT OPEN POST-MAINT
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

19 2.258E-03 6.549E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability

20 2.068E-03 6.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-MXB42----V  1.000E-02 - OPERATOR FAILS TO OPERATE MANUAL SWITCH B42
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

20 2.068E-03 6.000E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGDSDSW--V  1.000E-02 - OPERATOR FAILS TO ALIGN PP G10W TO BUS A4
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

21 1.830E-03 5.310E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-MPG10W---S  3.000E-03 - MTR-DRIVEN PP G10W FT START ON DEM
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

21 1.830E-03 5.310E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-AV3110---P  3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM
U-DGB------S  5.900E-02 - DIESEL GENERATOR B FT START ON DEM
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

22 1.713E-03 4.968E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C02--P  3.000E-03 - BKR (CNTL) 4160V 12C02 FT OPEN ON DEM
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

22 1.713E-03 4.968E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C15--N  3.000E-03 - BKR (CNTL) 4160V 12C15 FT CLOSE ON DEM
U-DGDSD--1DR  5.520E-02 - DIESEL GENERATOR DSD FT RUN FOR 24 HOURS
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

23 1.427E-03 4.140E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-DGDSDSW--V  1.000E-02 - OPERATOR FAILS TO ALIGN PP G10W TO BUS A4
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability
23	1.427E-03	4.140E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-MXB42----V  1.000E-02 - OPERATOR FAILS TO OPERATE MANUAL SWITCH B42
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
24	1.365E-03	3.960E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-DGOSO----M  6.600E-03 - DSD DIESEL DOWN DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
25	9.419E-04	2.732E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGB----6HR  1.380E-02 - DIESEL GENERATOR B FT RUN FOR 6 HOURS
U-DGOSO----M  6.600E-03 - DSD DIESEL DOWN DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

Rank	Cutset Importance	Cutset Probability
26	9.308E-04	2.700E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-MXB42----V  1.000E-02 - OPERATOR FAILS TO OPERATE MANUAL SWITCH B42
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Rank	Cutset Importance	Cutset Probability
26	9.308E-04	2.700E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSDSW--V  1.000E-02 - OPERATOR FAILS TO ALIGN PP G10W TO BUS A4
U-SX3-3----N  3.000E-03 - TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
```

Rank	Cutset Importance	Cutset Probability
26	9.308E-04	2.700E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-MXB42----V  1.000E-02 - OPERATOR FAILS TO OPERATE MANUAL SWITCH B42
```

Rank	Cutset Importance	Cutset Probability
26	9.308E-04	2.700E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
K-C8PT612--J  3.000E-03 - PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
U-C212C14--N  3.000E-03 - BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
U-DGDSDSW--V  1.000E-02 - OPERATOR FAILS TO ALIGN PP G10W TO BUS A4
```

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability
27	7.653E-04	2.220E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-MPG10W---M  3.700E-03 - PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

28 6.205E-04 1.800E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C026HO  6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
U-MXB42----V  1.000E-02 - OPERATOR FAILS TO OPERATE MANUAL SWITCH B42
```

28 6.205E-04 1.800E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-C212C026HO  6.000E-06 - BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
U-DGDSDSW--V  1.000E-02 - OPERATOR FAILS TO ALIGN PP G10W TO BUS A4
```

28 6.205E-04 1.800E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-MPG10W---S  3.000E-03 - MTR-DRIVEN PP G10W FT START ON DEM
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

28 6.205E-04 1.800E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
L-AV3110---P  3.000E-03 - AIR-OPERATED VLV 3110 FT OPEN ON DEM
U-DGB------M  2.000E-02 - DIESEL GANERATOR B OUT OF SERVICE DUE TO MAINTENANCE
U-OOCONLOOPZ  1.000E-03 - CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
```

28 6.205E-04 1.800E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-MXB42----V  1.000E-02 - OPERATOR FAILS TO OPERATE MANUAL SWITCH B42
U-T1AUXC-6HI  6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS
```

28 6.205E-04 1.800E-10

```
INIT-S---SL   3.000E-03 - INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGDSDSW--V  1.000E-02 - OPERATOR FAILS TO ALIGN PP G10W TO BUS A4
U-T1AUXC-6HI  6.000E-06 - >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS
```

Top Event: VBTSL03 Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability		
29	6.143E-04	1.782E-10		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	U-C212C14--N	3.000E-03	-	BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
	U-DGOSO----M	6.600E-03	-	DSD DIESEL DOWN DUE TO MAINTENANCE
	U-SX3-3----N	3.000E-03	-	TRANSFER SWITCH 3 FAILS TO TRANSFER 3 TIMES
29	6.143E-04	1.782E-10		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	K-C8PT612--J	3.000E-03	-	PROTECTION BREAKER FOR PT-612 FAILS TO OPEN ON SHORT
	U-C212C14--N	3.000E-03	-	BKR (CNTL) 4160V 12C14 FT CLOSE ON DEM
	U-DGOSO----M	6.600E-03	-	DSD DIESEL DOWN DUE TO MAINTENANCE
30	6.102E-04	1.770E-10		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	L-SV3110---J	1.000E-03	-	SOLENOID VLV 3110 FT DEACTUATE ON DEMAND
	U-DGB------S	5.900E-02	-	DIESEL GENERATOR B FT START ON DEM
	U-OOCONLOOPZ	1.000E-03	-	CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
31	5.281E-04	1.532E-10		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	L-MPG10W---M	3.700E-03	-	PUMP G10W OUT OF SERVICE DUE TO MAINTENANCE
	U-DGB----6HR	1.380E-02	-	DIESEL GENERATOR B FT RUN FOR 6 HOURS
	U-OOCONLOOPZ	1.000E-03	-	CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
32	4.281E-04	1.242E-10		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	L-MPG10W---S	3.000E-03	-	MTR-DRIVEN PP G10W FT START ON DEM
	U-DGB----6HR	1.380E-02	-	DIESEL GENERATOR B FT RUN FOR 6 HOURS
	U-OOCONLOOPZ	1.000E-03	-	CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
32	4.281E-04	1.242E-10		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	L-AV3110---P	3.000E-03	-	AIR-OPERATED VLV 3110 FT OPEN ON DEM
	U-DGB----6HR	1.380E-02	-	DIESEL GENERATOR B FT RUN FOR 6 HOURS
	U-OOCONLOOPZ	1.000E-03	-	CONDITIONAL LOSS OF OFFSITE POWER GIVEN TURBINE TRIP
33	4.095E-04	1.188E-10		
	INIT-S---SL	3.000E-03	-	INITIATING EVENT S FOR EVENT TREE 'VBTSL'
	U-C212C026HO	6.000E-06	-	BKR (CNTL) 4160V 12C02 FT REM CLOSED 6 HOURS
	U-DGOSO----M	6.600E-03	-	DSD DIESEL DOWN DUE TO MAINTENANCE

Sequence-level Cutset Report for VBTSL03 Data File

Top Event: VBTSL03   Top Event Probability: 2.901E-07

This file was created on 1- 2-1991 at 16:05:48

Rank	Cutset Importance	Cutset Probability
33	4.095E-04	1.188E-10

INIT-S---SL	3.000E-03	- INITIATING EVENT S FOR EVENT TREE 'VBTSL'
U-DGOSO----M	6.600E-03	- DSD DIESEL DOWN DUE TO MAINTENANCE
U-T1AUXC-6HI	6.000E-06	- >4160V XFMR AUXC LOW/NO OUTPUT WITHIN 6 HOURS