

**EMERGENCY CORE COOLING SYSTEMS
SINGLE FAILURE ANALYSIS**

SAN ONOFRE NUCLEAR GENERATING STATION

UNIT 1

**M-41383
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PDR ADOCK 05000206
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RECORD OF REVISIONS

REVISION 0: Original issue.

REVISION 1: Adds Appendix B to identify Revision 0 errata and Appendix C to identify the action items resulting from each of the 26 categories of Revision 0 findings. Miscellaneous changes also made to the report text to clarify assumptions used in Revision 0. The Revision 0 FMEA and Boundary Valve Analysis tables are not updated as part of Revision 1. (Update of the FMEA and Boundary Valve Tables, including Cycle 11 modifications, will be performed as part of Revision 2.)

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SORT FOR COMMON-CAUSE FAILURES

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EMERGENCY CORE COOLING SYSTEMS SINGLE FAILURE ANALYSIS
SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1

I. INTRODUCTION AND BACKGROUND:

- A. In response to the NRC (R. A. Purple) letter to SCE dated April 8, 1976, a single failure analysis was performed for the systems required to mitigate a postulated loss of coolant accident (LOCA), including safety injection, charging, containment spray and recirculation, component cooling water, salt water cooling, and the auxiliary power system. This analysis, which used failure modes and effects methodology, was submitted by SCE letter dated December 21, 1976. However, the analysis did not evaluate the single failure susceptibility of the main feedwater isolation function associated with emergency core cooling systems (ECCS) operation during a LOCA or secondary system rupture, and was never updated to reflect subsequent plant design changes, including those implemented as a result of the analysis findings.
- B. On July 30, 1986, a failure of main steam pressure transmitter PT-459 at SONGS 1 caused a transient in all three channels of the feedwater control system and concurrent inoperability of all three channels of the steam/feedwater flow mismatch scram in the Reactor Protection System. In response to this event, SCE committed to several actions, including completion of single failure analyses (SFAs) for the SONGS 1 Reactor Protection System (RPS) and Engineered Safety Features (ESF) Systems to determine susceptibility of the SONGS 1 design to single failures.
- C. The RPS single failure analysis, submitted to the NRC by SCE letter dated March 11, 1987, identified single failure and event-specific failure susceptibilities in the steam/feedwater flow mismatch and RCS low flow scram functions.
- D. The ESF single failure analysis, submitted to the NRC by SCE letter dated November 6, 1987, included: 1) a failure modes and effects evaluation of the design changes which had been implemented to correct the single failure susceptibilities identified by the 1976 ECCS Single Failure Analysis, 2) a failure modes and effects analysis of the ESF functions not addressed by the 1976 ECCS single failure analysis (including containment isolation, main feedwater isolation, overpressure mitigation, and auxiliary feedwater), and 3) an event-specific single failure response analysis of those ESF functions identified as having potential common-cause, time- or event-dependent

failure susceptibilities. Single failure and event-specific failure susceptibilities were identified in the main feedwater isolation function and in realignment of swing 480 V Switchgear #3 (affecting recirculation and charging), reflecting errors in the 1976 ECCS analysis.

- E. An environmental qualification related review of outside containment equipment, in February 1988 (during the mid-cycle outage), identified that the modifications implemented as a result of the 1976 ECCS single failure analysis were insufficient to correct the single failure susceptibilities of refueling tank isolation valve MOV-883. Additionally, as a result of reviews performed in response to NRC Generic Letter 88-14, dated August 8, 1988, single and common-cause failure susceptibilities were identified for the component cooling water system (ie, TCV-601A/B), and a follow-up review of other ESF systems for similar susceptibilities identified a single failure susceptibility in containment recirculation and spray (ie, CV-92).
- F. All identified RPS and ESF single and common-cause failure susceptibilities were corrected prior to restart from the Cycle 10 refueling outage, and the applicable single failure analyses updated as applicable. Additionally, as a result of the identification of errors and omissions in the 1976 ECCS analysis, SCE, in a letter to NRC Region V dated March 17, 1989, committed to reanalyze the ECCS for single failures within 9 months of restart from the Cycle 10 refueling outage.

II. SCOPE:

The reanalysis of the SONGS 1 Emergency Core Cooling Systems (ECCS) for single failures addresses the ECCS functions required for LOCA, SGTR and MSLB, both with and without a loss of offsite power. These events are bounding for the ECCS functions required for other events and involve the most limiting common-cause effects. The following ECCS functions were evaluated:

- o Safety Injection, including main feedwater isolation and auto-termination of SI/FW flow on low RWST level
- o Cold Leg Recirculation (required for LOCA only)
- o Hot Leg Recirculation (required for cold leg LOCA only)
- o Secondary Recirculation (required for MSLB or FWLB-D inside containment only)

- o Containment Spray and Hydrazine Injection (required for LOCA, MSLB or FWLB inside containment only)
- o Component Cooling Water
- o Saltwater Cooling
- o Safety Injection Actuation System
- o Containment Spray Actuation System (required for LOCA, MSLB or FWLB inside containment only)
- o Standby Power System (Diesel Generators)
- o Vital and Regulated Power System
- o Auxiliary Power System

The Reactor Protection System (RPS), Auxiliary Feedwater (AFW) system, Residual Heat Removal (RHR) system, Main Steam Dump system, Power Operated Relief Valves (PORVs), Reactor Coolant Pumps (RCPs) and various Ventilating/Cooling (HVAC) systems may also be required in some ECCS-initiating events.

Two of these additional systems, RPS and AFW, are addressed in existing single failure analyses M39405 and M39416 (respectively) and event-specific analysis M39419. The availability of RCPs (for SGTR events) and HVAC is evaluated as part of the ECCS Auxiliary Power System review. The PORVs, RHR and Main Steam Dump systems have not been specifically evaluated, since they were previously identified as not meeting single failure criteria for accident conditions.

III. METHODOLOGY:

- A. The ECCS Single Failure Analysis was performed per the criteria discussed in Section IV below, in five sequential, overlapping parts:
- o A boundary valve analysis of each ECCS fluid system function
 - o A failure modes and effects analysis of each ECCS fluid system function, including interface device and power supply dependencies
 - o A failure modes and effects analysis of each ECCS actuation system
 - o A failure modes and effects analysis of the vital, regulated and auxiliary power systems common to the ECCS fluid and actuation systems

- o Identification of ECCS functions potentially susceptible to time or event-specific single failures (as discussed in Section IV, below). The ECCS single failure response evaluations are part of a separate document, the Event Specific Single Failure Response Evaluation (M-39419).

B. The detailed methodology was as follows:

1. The piping and instrumentation diagrams (P&IDs) for each ECCS function were marked up to show process flow path and boundary devices, based on the Emergency Operating Instructions (EOIs) and other applicable references. Instruments essential to the ECCS function (eg. flow rate indication required for valve modulation) were included as flow path devices.
2. A boundary valve analysis was performed for each ECCS function. This analysis tabulated the branch line isolation valve configurations as to:
 - o Normal valve position (open, closed or automatically closed),
 - o Whether the valve is locked,
 - o Safety related backups (valves, caps or blind flanges) and their normal positions, and
 - o Non-safety related backups and their normal positions.

Boundaries were taken at the first normally or automatically closed safety related valve or at the safety related/non-safety related class boundary valve, whichever comes first. Check and relief valves were included but treated as passive devices. A DBASE program (included in Appendix A) was then used to automatically sort the boundary valve analysis database and flag those configurations which do not meet single failure criteria.

3. For each power-operated device (including essential instruments) identified in Step 1 above, the applicable elementary diagrams were marked up to show interface devices and dependencies (eg. Sequencer inputs, interlock inputs/outputs, power supplies, etc.). The circuits were otherwise treated as black boxes for simplicity.
4. For each train, the flow path and boundary devices, including interface device and power dependencies, were

evaluated in the Failure Modes and Effects Analysis (FMEA). To limit the FMEA database to a workable size, manual valves and check valves for each function were grouped into flow path and boundary entries for each train and backup boundary devices were included in the FMEA database only if both the first boundary device and its backup are power-operated. Check valves were included in the data base, but identified as "passive" devices. The electrical devices from Step 3 above as well as the applicable power sources (air, backup nitrogen, electrical bus, etc.) were included as "loop" devices for each power-operated item, similar to the RPS SFA. Differences between SIS and SISLOP actuation and common-cause (eg. EQ or seismic) susceptibility, were identified where applicable.

5. An automated sort of the FMEA database for all ECCS functions was performed to identify the ECCS actuation device dependencies.
6. The applicable elementaries, load schedules, etc. for the ECCS actuation systems were marked up similar to Steps 1 and 3 above. Using the automated sort from Step 5, the applicable devices were evaluated in the FMEA, including differences between SIS and SISLOP actuation and common-cause susceptibility, where applicable.
7. An automated sort of the FMEA database for all ECCS functions was performed to identify the control and motive power dependencies.
8. The one line diagrams and applicable elementaries for the Vital/Regulated Power and Auxiliary Power systems were marked up similar to Steps 1 and 3 above. Using the automated sort from Step 7, the applicable devices were evaluated in the FMEA, including differences between SIS and SISLOP events and common-cause susceptibility, where applicable.
9. Using the criteria discussed in Section IV below, the ECCS functions which are potentially susceptible to time or event-specific single failures were identified for further evaluation in M-39419 (Event-Specific Single Failure Response Evaluation).

IV. CRITERIA:

- A. To the extent practical, the single failure analyses for the ECCS functions were performed using notation, format and assumptions consistent with the RPS and ESF single failure analyses submitted to the NRC on March 11, 1987 and November 6, 1987, respectively. Specifically:

1. The module level failure mode and effects analyses were performed in accordance with the applicable criteria of IEEE Standard 279-1971. Specifically, Parts 2, 4.2 and 4.7 of the Standard were applied as follows:

- a. Single failures were postulated at the level of tag-numbered devices (modules) which resulted in the most limiting effects or combination of effects on the ECCS functions. Credit was conservatively not taken for module internal design features (components) which could preclude such failures except where specifically identified. All tag-numbered and interface devices which could affect the ECCS output functions (ie, not excluded by the "black box" methodology and criteria addressed in paragraph III.B.3 above and IV.A.1.c below) were so addressed.
- b. The failure modes for each device which result in the most limiting effects or combination of effects were selected so that all pertinent ECCS output and interface (including isolation device) failure combinations were bounded. The failure modes typically considered for each type of device were:
 - o Transmitter (eg. PT, LT, FT): SIGNAL HIGH or LOW
 - o Power Supply (eg. YE): OUTPUT VOLTS HIGH or ZERO
 - o Indicator (eg. PI, LI, FI): INPUT OPEN or SHORT
 - o Test Switch (eg. Y): OPEN or SHORT (CLOSED)
 - o Controller or Bistable (eg. PC, LC, FC): INPUT OPEN or SHORT; OUTPUT TRIPPED or UNTRIPPED, HIGH or LOW
 - o Relay: INPUT OPEN or SHORT; OUTPUT TRIPPED or UNTRIPPED, ON or OFF, CONTACTS OPEN or CLOSED as applicable. Combinations such as CONTACTS OPEN (ON) were used as needed for clarity.
 - o Valve/Actuator: OPEN or CLOSED
 - o Pump/Motor: OUTPUT LOW

In addition, single pole or phase GROUNDS were postulated in all grounded circuits. In some cases, another failure mode (eg. INPUT SHORT) was identified as bounding for the affected circuit, rather than creating a separate database entry.

- c. Where a portion of a channel had only a single output and the net effect of the failures could be expressed in terms of that output, the devices in that portion of the circuit were permitted to be treated as a single entity. For example: a) postulated failures of the pressure regulating valve or solenoid operated pilot valve for a pneumatically actuated isolation valve are bounded by failures of the isolation valve itself, and b) postulated failures of control components in a manually-controlled power operated valve are bounded by those of the valve/actuator and its control power and interlock dependencies.
 - d. The failure modes for any channel-common or train-common devices (eg. selector switches, transfer switches, auctioneering or signal comparison devices) were conservatively considered to result in channel-common or train-common failures, respectively, if unisolated signals were present in the device and channel/train separation and identity were not maintained through the device. The postulated failure modes were:
 - o OPEN (at all input channels/trains)
 - o SHORT (of all like poles or phases, resulting in paralleling of all inputs)
 - o GROUND (of all like poles or phases)
 - e. It was assumed that events requiring ECCS actuation could be initiated from any applicable plant condition.
 - f. The only applicable ECCS actuation instrumentation which have control functions are associated with the Reactor Protection System, and have been previously analyzed for control/protection interactions. Accordingly, a control/protection system interaction (multiple failure) analysis was not performed as part of the ECCS evaluation.
- B. Because the ECCS systems include fluid system components (eg. pumps and valves) as actuated devices, the applicable criteria of ANSI Standard N658-1976 (Single Failure Criteria for PWR Fluid Systems) were also applied to the single failure analyses for these functions. Specifically, Parts 2, 3.4, 3.5, 3.6, 3.7, 3.10 and 4 were applied as follows:
- 1. Single failures were postulated in all ECCS process flow path and flow path boundary devices, including manual

valves and applicable valve control circuits, considering both failure to actuate and spurious actuation (eg. due to operator error), except as provided in item 2 and as follows:

- a. Passive devices such as orifice plates, flanges and similar pressure boundary parts were excluded.
 - b. Check valves were included, but considered passive devices, in accordance with the SONGS 1 design basis.
 - c. Credit was taken for administrative controls (including valve locking) to preclude spurious actuation of applicable manual valves.
 - d. Credit was taken for the provisions of NRC Branch Technical Position ICSB-18 to preclude spurious actuation of applicable manually-controlled electrically operated valves.
2. Only active failures were considered as single failures, in accordance with the SONGS 1 design basis. Failure of passive devices or process pressure boundaries were not postulated in addition to the initiating event.
 3. Compressed air (ISA) system failure was considered as a potential failure for pneumatically actuated valves. Failure of non-seismic systems, including ISA, was conservatively considered as a common-cause effect except where credit was specifically permitted by the Standard Review Plan (eg. SRP Section 15.1.5 for secondary pipe rupture inside containment).

C. Common Cause and Pre-Existing Failures

1. Except as specifically provided above, loss of non-seismic systems and of any devices not qualified for the applicable post-accident harsh environment were considered to be potential common-cause failures.
 - a. Common-cause failures of the non-seismic 220kV Switchyard were considered to result in a loss of offsite power. Failures of individual 220kV switchyard components were evaluated as described in Table 12-1.
 - b. Common-cause seismic failure was not postulated for systems and devices qualified to Seismic Interaction B/A criteria (in accordance with Regulatory Guide 1.29 position C.2).

2. The probability of a loss of offsite power (LOP) to the San Onofre switchyard due to failure of the offsite distribution system was previously determined to be less than 10^{-12} per year (eg. San Onofre Units 2/3 UFSAR Section 8.2.2.3), which is insignificant relative to the probability of a LOP due to failure of onsite equipment (ie, breakers, transformers, cabling, etc.). Consequently, common-cause failure of non-safety related Auxiliary Transformer C was considered as a potential cause of the postulated LOP for SISLOP events.
3. Transfer switches, disconnect switches, etc. whose positions are not alarmed, indicated or otherwise supervised in the control room were considered to be potential pre-existing failures unless included in an administratively controlled locking and/or periodic surveillance program.
4. Credit was taken for indirect indication of failures to preclude an undetected pre-existing condition. For example, loss of power ("VOLTS LOW") to a valve or pump control circuit is considered detectable by the dimming or loss of the associated control room status indication, and is therefore identified as CONTROL ROOM INDICATION in the method of detection field in the FMEA.
5. Common-cause and pre-existing failures were considered to occur in addition to the random single active failure, consistent with the provisions of ANSI Standard N658-1976.

D. Other Assumptions

1. Except as otherwise stated, it was assumed that operation in accordance with existing procedures (including EOIs) would preclude equipment damage due to overheating, pump gas-binding, minimum flow conditions, run-out or cavitation.
2. Other assumptions and criteria pertinent to a given system were applied as stated in the NOTES for each Section.

E. Notation / Numbering

1. Each item in the boundary valve analysis was assigned a unique item number, made up of:

[system].[train].[device]

and each item in the module-level FMEA was assigned a unique item number, made up of:

[system].[train].[device].[dependency].[failure mode]

similar to the RPS and ESF Single Failure Analyses. Train (or channel) common devices for a system were generally addressed following the items for each train; for example, in a system with 2 trains or channels:

[system].3.[device].[dependency].[failure mode]

would be a train-common or third-of-a-kind device in the FMEA table.

2. Due to the field length limitations of DBASE III (ie, 254 characters), abbreviations were needed in the FMEA tables. The meaning is generally clear from the context (eg. ALT for ALTERNATE, BRKR for BREAKER, SEQ for Safeguards Load SEQUENCER System, SWYD for SWITCHYARD, etc.).

E. Screening Criteria for Event-Specific Susceptibilities

Based on the analyses previously completed (eg. in M-39419), an evaluation of event-specific single failure response is required if:

1. The flow requirements for a system are dependent on the response of another system which is actuated from separate instrumentation (eg. the RPS/AFWS integrated response evaluation in M-39419). This requires an event-dependent evaluation of the integrated response of the applicable systems. Or,
2. The system has two or more safe states for the same equipment (eg. must be on during one part of the accident but off during another part, or in different alignments for different events, etc.) This requires a time-dependent evaluation of the response to applicable single failures. Or,
3. System components or supporting equipment are susceptible to location-dependent common-cause failures (eg. due to the environment for inside vs. outside containment line breaks). This requires a location-dependent evaluation of the response to applicable single failures. Or,
4. The system has train-common suction or discharge piping in which misoperation of one train could divert flow from or otherwise adversely impact operation of the redundant train. This requires a time-dependent

evaluation of the response to applicable single failures.

V. SUMMARY OF RESULTS

A. FMEA and Boundary Valve Analysis Results

Revision 0 of this analysis identified 283 potential single failure susceptibilities and 428 other items, such as procedure changes and calculation revisions (472 total FMEA line item findings), falling into the 26 categories listed below. Action items were developed to address each of the 26 categories to support SONGS 1 restart. The resolution of each of the individual line item findings by the specified action items is tabulated in Appendix C.

1. The common-header ECCS fluid systems (Safety Injection, Cold Leg, Hot Leg and Secondary Recirculation, Containment Spray and Component Cooling Water) could be disabled by flow or inventory diversion through boundary valves which are not locked or provided with a backup isolation valve, cap or blind flange. These are principally vent and drain valves, which as a category were excluded from the valve locking procedure.

Unlocked boundary valves with only a non-safety related backup are considered acceptable based on the scoping criteria for Systematic Evaluation Program (SEP) Topic III-6, "Seismic Design Considerations".

2. Potentially unacceptable diversion of post-LOCA recirculation inventory could occur through RCS boundary valves (eg. CV-202, 203, 204) and critical valves in the post-LOCA recirculation systems (eg. RWST outlet check valve CRS-301) which are not seat leakage tested as part of the ASME Section XI Inservice Test Program for valves.
3. Several manual valves which must be operated locally to mitigate single failures in the Safety Injection and Recirculation systems following a small break LOCA would be inaccessible with TMI source terms, although core damage would not occur for these failures.
4. Potential inventory diversions to the Reactor Coolant Drain Tank, Pressurizer Relief Tank and Radioactive Liquid Waste system, due to normal operation of check and relief valves in the Safety Injection and Letdown system boundaries, are not presently accounted for in the calculations for the Technical Specification RWST

level and low-low level trip setpoint for the Safety Injection (SI) and Main Feedwater (MFW) pumps.

5. RWST boron dilution could occur just prior to a MSLB, due to a failure open of the RWST miniflow valve for either MFW pump during normal operation. This case (with operation of 2 SI/MFW pump trains and 2 SI paths open) has not been considered in the present MSLB analyses.
6. Loss of recirculation and spray could occur due to spurious opening of either recirculation pump discharge valve (MOV-866A, MOV-866B) prior to reaching the minimum containment flood level for post-accident recirculation pump operation.
7. Loss of both charging pumps from gas binding could occur prior to a SIS/SISLOP signal during a small break LOCA, due to failure of the VCT level control loop or isolation valve (MOV-1100C). Loss of both charging pumps from suction isolation due to spurious closure of MOV-1100C is presently prevented only by a non-safety related (NSRFP) suction bypass.
8. It could not be determined from the FMEA whether potentially unacceptable Cold Leg Recirculation (CLR) and Hot Leg Recirculation (HLR) primary path flow imbalances could occur due to failure of the flow monitoring instruments or control valves. An event-specific response evaluation is needed to determine if redundant instrumentation is required to distinguish between valve and instrument failures post-LOCA.
9. Potential common-cause loss of the charging pumps could occur during combined Hot and Cold Leg Recirculation due to pump run-out following a failure open of seal injection valves FCV-1115A, B and C on loss of the non-safety related Instrument and Service Air (ISA) system.
10. The Hot Leg Recirculation deficiencies previously identified to the NRC will be corrected by DCP 1-3548.
11. Common-mode loss of both charging pumps could occur from loss of NPSH during post-LOCA recirculation, due to failure of a recirculation pump or failure open of one or more control valves, if only one recirculation pump is run at a time as per the current EOIs.
12. Secondary Recirculation, for a MSLB inside containment, could be disabled due to failure as-is of the normally closed manual RWST recirculation valve, or failure to reset of AFWAS or SIS/SISLOP control relays which

prevent reopening the MFW bypass regulating valves (CV-142, -143, -144). The MFW bypass regulating valves could also be disabled by a common-mode failure of both Sequencer block permissive relay circuits, due to inadequate electrical isolation between the two trains at the block permissive relay circuits.

13. Common-mode loss of both charging pumps could occur from loss of NPSH during post-LOCA recirculation, due to failure to close or spurious reopening of CV-517 or CV-518, if only one recirculation pump is run at a time as per the current EOIs.
14. Component Cooling Water heat removal from critical loads could be degraded or disabled due to flow imbalances resulting from mispositioning of unlocked throttling or critical load isolation valves.
15. Component Cooling Water (CCW) heat removal for all loads could be degraded due to an unisolable 50% flow bypass of the operable CCW heat exchanger resulting from a loss of one train of 480V electrical power post-LOCA.
16. The Saltwater Cooling (SWC) system could be disabled by a common-cause failure of the non-Seismic circulating water system intake gate (MOV-9) or intake recirculation gate (MOV-11, during heat treatment) resulting in intake drawdown below the SWC pump suctions by the circulating water pumps.
17. Both electrical trains could be subjected to an unanalyzed bus voltage transient during SISLOP due to out-of-sequence starting of the CCW and SWC pumps. These pumps were determined to auto-start on low-discharge pressure concurrently with Load Group A instead of waiting for the SISLOP in Load Group D.
18. Both trains of ECCS actuation, electrical power or Cold Leg Recirculation could be subjected to an unanalyzed common-mode loss of cooling for critical equipment in the control room, switchgear rooms and reactor auxiliary building, due to failure of the non-redundant HVAC or its power supply for these areas. (The HVAC review performed as part of Systematic Evaluation Program Topic IX-5 did not address accident conditions.)
19. A loss of redundant actuation and control could occur following a spurious auto-transfer of Vital Bus #1, 2 or 3/3A caused by common-cause failure of unqualified Vital Bus loads. (Automatic re-transfer capability from the Train B backup source to the normal Train A inverter source is not presently provided.) The reliability of

all Vital, Regulated and 125 VDC busses could be degraded by the lack of Regulatory Guide 1.75 or IEEE Standard 384 isolation provisions for unqualified loads (ie, presently isolated only by overcurrent trips).

20. Potential loss of both electrical trains or containment integrity could occur due to common-cause faults of the reactor coolant pump (RCP) motors or main generator exciter, fed by the main generator and main transformer, following a loss of 125 VDC Bus #1.
21. Both electrical trains could be degraded or disabled:
 - a) during a SISLOP event if Bus #1C or 2C is energized from the alternate offsite source with the main generator on line (with or without a single failure),
 - b) during a SISLOP event if the periodic diesel generator surveillance test is in progress and the diesel generator breaker fails in the closed position, or
 - c) during a SIS with degraded offsite voltage and the normal feeder breaker for either bus (11C02 or 12C02) fails in the closed position. (Loss of both electrical trains occurs in these cases because the Sequencers will detect loss of voltage on only one of the two redundant 4 kV busses but require detection on both busses to satisfy the SISLOP logic for diesel generator loading.)
22. A potential loss of long-term electrical power for both trains could occur in a SIS event with a postulated concurrent Auxiliary Transformer-C related Loss of Offsite Power (LOP) and a single failure of the Main Transformer or other components for the alternate offsite source. (The diesel generators would remain available to provide power electrical power in this scenario, but have only a 7 day supply of fuel stored onsite.)
23. A potential loss of both ECCS trains could occur due to a fire or explosion resulting from a common-cause fault of the Main Transformer or Auxiliary Transformer-C, with concurrent failure of the redundant 125VDC control power for the SCE 220 kV Switchyard breakers. (Both switchyard control power busses for the affected breakers are presently fed from the same 125VDC distribution panel, DP2.)
24. The Residual Heat Removal (RHR) system could be disabled for Steam Generator Tube Rupture (SGTR) events by failure of any of 5 valves (MOV-813, 814, 833, 834 or HCV-602) in the closed position. The Reactor Coolant Pumps (RCPs) could also be disabled for SGTR events by a concurrent LOP or failure of the Main Transformer, due to the inability of the electrical system to support

restart of an RCP from Auxiliary Transformer-C or the diesel generators while running ECCS loads.

25. The ventilation and cooling fans inside containment could be disabled by a common-cause failure of their unqualified motors or by a loss of electrical power (eg. on SISLOP), leaving only containment spray and the hydrogen recombiners available for post-LOCA hydrogen mixing.
26. Other miscellaneous changes to procedures were identified as needed to clarify surveillance requirements and Technical Specification action entry for specific single failures.

B. Single Failure Response Screening Evaluation Results

In Revision 0 of this analysis, six ECCS functions were identified by the screening criteria as requiring an event-specific single failure response evaluation, four of which were already addressed in the SONGS 1 event-specific analysis document, M-39419:

1. The SI and MFW pumps, and MFW realignment valves meet the screening criteria for time-dependent failures affecting inadvertent injection of condensate, low-low RWST level pump trip, and Secondary Recirculation. (The associated event-specific evaluations were previously performed as part of M-39419 and a supporting Bechtel calculation.)
2. The main feedwater isolation function of Safety Injection meets the screening criteria for event-dependent failures relative to LOCA, MSLB and SIS/SISLOP dependencies. (The associated event-specific evaluation was previously performed as part of M-39419.)
3. The charging pumps, suction valves and normal charging path meet the screening criteria for time and initial alignment-dependent failures affecting the availability of the charging pumps for Hot and Cold Leg Recirculation. (The associated event-specific evaluation previously performed as part of M-39419 was revised to address the charging system modifications scheduled for implementation prior to restart from the Cycle 11 refueling outage.)
4. The recirculation pumps, refueling water (containment spray) pumps and spray flow limiter valves meet the screening criteria for time-dependent and interactive failures affecting containment spray, charging pump and recirculation pump flow and NPSH. (These effects were

addressed in the FMEA, but M-39419 was revised to include an associated event-specific evaluation.)

5. The Cold Leg Recirculation (CLR) and primary path Hot Leg Recirculation (HLR) flow control valves and flow indication meet the screening criteria for interactive failures affecting CLR and HLR flow balance and charging pump NPSH. (M-39419 was revised to include an event-specific evaluation of this function.)
6. The re-alignment of swing 480V Switchgear #3 meets the screening criteria for time and initial alignment-dependent failures affecting the ability to re-energize the MOV-358/850C UPS battery charger. (The associated event-specific evaluation previously performed as part of M-39419 was revised to address the 480V system reconfiguration scheduled for implementation prior to restart from the Cycle 11 refueling outage.)

The recirculation and spray evaluation confirmed the susceptibilities identified in the FMEA. The CLR/HLR flow balancing evaluation identified new susceptibilities resulting from the inability to distinguish between time-dependent valve and flow rate indication failures in the cold leg recirculation lines. The event-specific evaluations for these functions will be revised to address the modifications and procedure changes which resolve the susceptibilities, prior to restart from the Cycle 11 refueling outage.

VI. ANALYSIS TABLES

SECTION 1: SAFETY INJECTION

SAFETY INJECTION SYSTEM NOTES

1. Item numbers in this section have been assigned as follows:
 - 01.1: Train A SI/MFW pumping, SI flow path to RCS Loop B and boundary devices
 - 01.2: Train B SI/MFW pumping, SI flow path to RCS Loop A and boundary devices
 - 01.3: SI flow path to RCS Loop C and boundary devices
 - 01.4: Common flow path and boundary devices.
2. Table 1-1 is the Failure Modes and Effects Analysis (FMEA) for the SI function. Table 1-2 is the associated boundary valve analysis.
3. The functions evaluated in Table 1-1 are:
 - a. Alignment of pumps and valves for safety injection flow,
 - b. Auto-termination of safety injection flow on low-low RWST level, and
 - c. Realignment of pumps and valves for secondary recirculation flow to the steam generators following termination of safety injection flow. (Secondary recirculation is used for long-term cooling following an MSLB inside containment.)
4. Flow control and alignment of valves unique to the secondary recirculation function are addressed in Section 4 of this analysis.
5. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.
6. Potential single failure susceptibilities in the Boundary Valve Analysis table are flagged with "*" in the unlabelled field adjacent to REMARKS. Items flagged with "#" in the unlabelled field adjacent to REMARKS are acceptable from a single failure standpoint subject to credit for SEP Topic III-6 seismic boundary criteria.

SAFETY INJECTION SYSTEM REFERENCES

Piping and Instrumentation Diagrams

5178100 Reactor Coolant System
5178115 Safety Injection System
5178120 Containment Spray and Recirculation System
5178130 Letdown and Residual Heat Removal System
5178135 Volume Control and Charging (Sh 1)
5178150 Reactor Cycle Sample System
5178167 Radwaste Liquid Processing System (Sh 3)
5178201 Condensate System (Sh 1)
5178205 Main Feedwater System (Sh 1)
5178206 Main Feedwater System (Sh 2)
5178207 Main Feedwater System (Sh 3)
5178211 First, Second and Third Point FW Htrs (Sh 2)
5178213 First, Second and Third Point FW Htrs (Sh 4)
5178220 Auxiliary Feedwater System (Sh 1)
5178403 Gaseous Nitrogen System (Sh 4)
5178409 Gaseous Nitrogen System (Sh 10)
5178410 Gaseous Nitrogen System (Sh 11)

Elementary Diagrams

449408 (Sh 1-3) FCV-456 and CV-142
455368 MOV-850A and MOV-850B
455370 (Sh 1-2) G-50A and G-50B (Safety Injection Pumps)
455371 MOV-356, MOV-357, MOV-358
455372 HV-853A and HV-853B
455373 HV-851A and HV-851B
455374 HV-854A and HV-854B
455375 HV-852A and HV-852B
455379 MOV-20, MOV-21, MOV-22
455448 CV-202, CV-203, CV-204, CV-287
455516 MOV-850C
5149858 G-3A and G-3B (Main Feedwater Pumps), CV-36,
CV-37, CV-875A, CV-875B
5149918 G-36A and G-36B (Heater Drain Pumps)
5149970 G-1A, G-1B, G-1C, G-1D (Condensate Pumps)
5151796 MOV-833 and MOV-834
5159551 Containment Isolation Valves, CIS Train A
5159552 Containment Isolation Valves, CIS Train B
5159553 Containment Isolation Valves, CIS
5159559 MOV-1204
5159757 SV-702B and SV-702D
5159758 SV-702A and SV-702C
5159760 Containment Isolation System, Train A
5159776 Containment Isolation System, Train B
5159802 SV-3302
5159842 (Sh1-2) Auxiliary Feedwater Actuation (AFWAS), Train A
5159843 Auxiliary Feedwater Actuation (AFWAS), Train B
5180714 CV-955 and CV-956
5202910 (Sh1-3) FCV-457, FCV-458, CV-142, CV-143, CV-144

Other Drawings

237700	Loop: Steam Generator NR Level, Loop A
237702	Loop: Steam Generator NR Level, Loop B
237704	Loop: Steam Generator NR Level, Loop C
5112416	Schematic: Auxiliary Relay Rack R12 (Front)
5149178	Load Sequence Table, Train 1 (Sh 1)
5149179	Load Sequence Table, Train 1 (Sh 2)
5149181	Load Sequence Table, Train 2 (Sh 1)
5149182	Load Sequence Table, Train 2 (Sh 2)
5149957	Emergency Operating Condition, Train 1
5149958	Emergency Operating Condition, Train 2

Procedures

S01-1.0-10	Reactor Trip or Safety Injection
S01-1.0-12	SI Termination
S01-1.0-20	Loss of Reactor Coolant
S01-1.0-23	Transfer to Cold Leg Injection and Recirculation
S01-1.0-30	Loss of Secondary Coolant
S01-1.0-32	Loss of RHR Following Loss of Secondary Coolant in Containment
S01-1.0-40	Steam Generator Tube Rupture
S01-12.3-7	Monthly Sequencer Testing
S01-14-40	Control of Locked Valves

Other Documents

SD-S01-580	System Description: Safety Injection, Recirculation and Containment Spray Systems
SD-S01-590	System Description: Safeguard Load Sequencing System
M89048	Response to Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety Related Systems", dated July 5, 1989

TABLE 1-1: SAFETY INJECTION FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS OPERB UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.01.01.1	MANUAL VALVES, TRAIN A FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION. INCLUDES SIS-301
01.1.01.01.2	MANUAL VALVES, TRAIN A FLOW		CLOSED	TRAIN A SI PUMP SUCTION OR DISCHARGE BLOCKED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	
01.1.01.02.1	CHECK VALVES, TRAIN A FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES SIS-303, 010, PWS-439
01.1.02.01.1	MANUAL VALVES TRAIN A BOUNDARY		OPEN	DIVERSION OF TRAIN A SI FLOW	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR FLOW, BACKUP VALVES AND/OR ADMINISTRATIVELY CONTROLLED VALVE LOCKING FOR RWST INVENTORY	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, DIVERSION OF RWST INVENTORY	*SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. DIVERSION BOUNDED BY CV-36/37 FAILURE WITH LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TRIPS NORMAL POSITION
01.1.02.01.2	MANUAL VALVES TRAIN A BOUNDARY		CLOSED	NO EFFECT ON INJECTION, AUTO-TERMINATION OF SI FLOW OR SECONDARY RECIRCULATION	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
01.1.02.02.1	CHECK OR RELIEF VALVES, TRAIN A BOUNDARY		NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
01.1.03.01.1	G-508	PUMP/MOTOR	LOW FLOW	REDUCED SI PUMP OUTPUT TO TRAIN A PW PUMP	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	
01.1.03.02.1	G-508	BUS #1C (152-11C05)	OPEN	TRAIN A SI PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	NORMAL POSITION. SI PUMP BREAKEB.
01.1.03.02.2	G-508	BUS #1C (152-11C05)	CLOSED	TRAIN A SI PUMP STARTS, OR FAILS TO TRIP ON LOW RWST LEVEL	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, INOPERABILITY OF TRAIN A PUMPING FOR SECONDARY RECIRC	PUMP COULD BE UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURE FOLLOWING DEPLETION OF RWST BY CONTAINMENT SPRAY
01.1.03.03.1	G-508	LSL/LSLE-2215 LSL/LSLE-2216 LSL/LSLE-2217	OFF (HIGH)	1/3 LOW RWST LEVEL TRIP INPUTS DISABLED TO TRAIN A SI AND PW PUMP. TRAIN A TRIP LOGIC BECOMES 2/2 ON REMAINING INPUTS	PERIODIC TESTING	(SAME AS 1.1.3.2.2)	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, REDUCED RELIABILITY OF TRAIN A PUMPING FOR SECONDARY RECIRC	NORMAL POSITION. INCLUDES TEST SWITCHES
01.1.03.03.2	G-508	LSL/LSLE-2015 LSL/LSLE-2016 LSL/LSLE-2017	ON (LOW)	1/3 LOW RWST LEVEL INPUTS TRIPPED TO TRAIN A. TRAIN A TRIP LOGIC BECOMES 1/2 ON REMAINING INPUTS	ANNUNCIATION	REDUNDANT TRAIN	REDUCED REDUNDANCY AGAINST TRAIN A SI/PW PUMP TRIP	RELAYS ENERGIZED ON LOW RWST LEVEL
01.1.03.04.1	G-508	RTX (PW) RTX (SI)	CONTACTS CLOSED (OFF)	PW OR SI PUMP TRIP AND INPUT DISABLED FOR TRAIN A INPUT TO LOW RWST LEVEL TRIP OF NOV-850A/B/C. LOGIC TO RTXB1, RTXA1, RTXC1 BECOMES 1/1 ON REMAINING RTX	PERIODIC TESTING	(SAME AS 1.1.3.2.2)	(SAME AS 1.1.3.2.2)	NORMAL RELAY POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS CONDENSER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PHSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.03.04.2	G-50B	RTI (RW) RTI (RI)	CONTACTS OPEN (ON)	TRAIN A LOW RWST LEVEL SIGNAL TO NOV-850A/B/C VIA RTI81, RTI81, RTIC1 AND TRIP OF AFFECTED PUMP	CONTROL ROOM INDICATION	INPUTS FROM REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BCCIRC	REDUCED REDUNDANCY AGAINST NOV-850A/B/C CLOSURE (1/1 ON TRAIN B INPUT TO EACH VALVE) FOR SI, NONE FOR SECONDARY BCCIRC	RELAY ENERGIZED ON 2/3 LO-LO RWST LEVEL WITH SIS/SISLOP IN RESPECTIVE PUMP CONTROL CIRCUIT
01.1.03.05.1	G-50B	RTI81 RTI81 RTIC1	OFF (LOW)	TRAIN A LOW RWST LEVEL SIGNAL TO ONE OF NOV-850A/B/C. NO EFFECT ON SI PUMP	PERIODIC TESTING	REDUNDANT VALVES FOR SI, NONE REQUIRED FOR SECONDARY BCCIRC	REDUCED REDUNDANCY AGAINST NOV-850A, B, OR C CLOSURE (1/1 ON TRAIN B INPUT) FOR SI, NONE FOR SECONDARY BCCIRC	INCLUDES TEST SWITCH NS-2850. RELAYS DE-ENERGIZE ON LO-LO RWST LEVEL WITH SIS/SISLOP
01.1.03.05.2	G-50B	RTI81 RTI81 RTIC1	ON (HIGH)	TRAIN A LOW RWST INPUT DISABLED TO ONE OF NOV-850A/B/C	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BCCIRC, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL	NONE FOR SI OR SECONDARY BCCIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION
01.1.03.06.1	G-50B	NS-2218 NS-2218A	CONTACTS CLOSED (OFF)	SI SEAL-IN TO TRAIN A SI AND PW PUMPS CANNOT BE RESET AFTER 90S LOCK/RESET (ONE SWITCH)	PERIODIC TESTING	NONE REQUIRED FOR INJECTION OR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY BCCIRC	NONE FOR INJECTION OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, IMPROBABILITY OF TRAIN A PUMPING FOR SECONDARY BCCIRC	NORMAL POSITION. BOTH SWITCHES MUST OPEN FOR RESET. FAILURE OF EITHER SWITCH PREVENTS RESTART OF PUMP AFTER LO-LO RWST LEVEL TRIP (POST-MSLB IN CONTAINMENT) FOR SECONDARY BCCIRC
01.1.03.06.2	G-50B	NS-2218 NS-2218A	CONTACTS OPEN (ON)	TRAIN A SI SEAL-IN REDUNDANCY FOR LOW RWST LEVEL TRIP REDUCED TO 1/1 ON REMAINING RESET SWITCH	PERIODIC TESTING	(SAME AS 1.1.3.2.2)	(SAME AS 1.1.3.3.1)	
01.1.03.07.1	G-50B	SRQ 1 (37-1, 3)	CONTACTS OPEN (OFF)	TRAIN A SI PUMP FAILS TO START. NO EFFECT ON LOW RWST LEVEL TRIP AFTER START DUE TO SEAL-IN WITHIN PUMP CONTROL CIRCUIT	PERIODIC TESTING	(SAME AS 1.1.3.1.1)	(SAME AS 1.1.3.1.1)	NORMAL POSITION. FAILURE OF SI PUMP TO AUTO-START COULD RESULT IN CAVITATION FAILURE OF PW PUMP
01.1.03.07.2	G-50B	SRQ 1 (37-1, 3)	CONTACTS CLOSED (ON)	TRAIN A SI PUMP STARTS, OR CANNOT BE RESTARTED AFTER LOW RWST LEVEL TRIP	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED FOR SI OR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY BCCIRC	NONE FOR SI OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, IMPROBABILITY OF TRAIN A PUMPING FOR SECONDARY BCCIRC	
01.1.03.08.1	G-50B	SRQ 1 (41-9, 11)	CONTACTS CLOSED (OFF)	TRAIN A SI PUMP OVERLOAD TRIP NOT DEPRATED UNTIL 83-5 CONTACTS OPEN UPON HV-853B NOT CLOSED	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY BCCIRC, NONE REQUIRED FOR LO-LO RWST LEVEL TRIP	REDUCED RELIABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BCCIRC, NONE FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION
01.1.03.08.2	G-50B	SRQ 1 (41-9, 11)	CONTACTS OPEN (ON)	TRAIN A SI PUMP OVERLOAD TRIP DEPRATED	PERIODIC TESTING	(SAME AS 1.1.3.8.1)	(SAME AS 1.1.3.8.1)	INCREASED RISK OF SI PUMP MOTOR DAMAGE DURING NORMAL SURVEILLANCE TESTING
01.1.03.09.1	G-50B	83-5 (RBLAT)	CONTACTS CLOSED (OFF)	TRAIN A SI PUMP OVERLOAD TRIP NOT DEPRATED AFTER SRQ BLOCK/RESET	PERIODIC TESTING	(SAME AS 1.1.3.8.1)	(SAME AS 1.1.3.8.1)	NORMAL RELAY POSITION. INTERLOCK FROM SUCTION VALVE HV-853B POSITION
01.1.03.09.2	G-50B	83-5 (RBLAT)	CONTACTS OPEN (ON)	(SAME AS 1.1.3.8.2)	PERIODIC TESTING	(SAME AS 1.1.3.8.1)	(SAME AS 1.1.3.8.1)	(SAME AS 1.1.3.8.2)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION PH2A

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.02.10.1	G-508	BUS 11C 125VDC CONTROL POWER	VOLTS LOW	TRAIN A SI PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SI AND SECONDARY BCCIRC, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BCCIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	
01.1.04.01.1	HV-853B	VALVE/ACTUATOR	OPEN	CONDENSATE FLOW DIVERTED TO RWST VIA SI MINIFLOW IF PRIOR TO SIS/SISLOP. NO EFFECT AFTER SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC SURVEILLANCE	ADMINISTRATIVE CONTROLS ON RWST BORON CONCENTRATION	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	INCLUDES SV-1, SV-2, SV-530. TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST
01.1.04.01.2	HV-853B	VALVE/ACTUATOR	CLOSED	TRAIN A SI PUMP DISCHARGE TO FW PUMP SUCTION BLOCKED	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BCCIRC	NORMAL POSITION (FW PUMP IN FW MODE)
01.1.04.02.1	HV-853B	83-1 (RELAY)	ON	NONE. CONTACTS JUMPERED TO TRAIN A HEATER DRAIN PUMP (SAME AS 1.1.4.2.1)	PERIODIC TESTING	NONE REQUIRED	NONE	RELAY ENERGIZED BY HV-853B OPEN LIMIT SWITCHES
01.1.04.02.2	HV-853B	83-1 (RELAY)	OFF	SUCTION VALVE HV-853B CLOSED	PERIODIC TESTING	(SAME AS 1.1.4.2.1)	(SAME AS 1.1.4.2.1)	NORMAL POSITION
01.1.04.03.1	HV-853B	83-2 (RELAY)	ON	SIGNAL WILL NOT CLEAR TO TRAIN A FW PUMP PROTECTIVE TRIP CIRCUIT AFTER SIS/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A FW PUMP WILL TRIP 30 SEC AFTER SIS/SISLOP	RELAY ENERGIZED BY HV-853B CLOSED LIMIT SWITCHES
01.1.04.03.2	HV-853B	83-2 (RELAY)	OFF	SUCTION VALVE HV-853B CLOSED PROTECTIVE TRIP DISABLED FOR TRAIN A FW PUMP	PERIODIC TESTING	NONE REQUIRED	NONE	
01.1.04.04.1	HV-853B	83-3 (RELAY)	ON	NONE. CONTACTS JUMPERED IN CONDENSATE PUMP CIRCUITS	NONE REQUIRED	NONE REQUIRED	NONE	RELAY ENERGIZED BY HV-853B OPEN LIMIT SWITCHES
01.1.04.04.2	HV-853B	83-3 (RELAY)	OFF	NONE. CONTACTS JUMPERED IN CONDENSATE PUMP CIRCUITS	NONE REQUIRED	NONE REQUIRED	NONE	
01.1.04.05.1	HV-853B	83-5 (RELAY)	ON	TRAIN A SI/PW PUMP OVERLOAD TRIPS DEPRATED, FW PUMP MINIFLOW REALIGNS TO RWST. NO EFFECT AFTER SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.1.4.1.1)	*(SAME AS 1.1.4.1.1)	RELAY ENERGIZED BY HV-853B NOT CLOSED LIMIT SWITCHES
01.1.04.05.2	HV-853B	83-5 (RELAY)	OFF	TRAIN A FW PUMP MINIFLOW VALVE REALIGNMENT AND SI/PW PUMP OVERLOAD TRIP DEPRATED NOT SEALED IN, RESULTING IN REALIGNMENT OF MINIFLOW TO CONDENSER AFTER SEQ BLOCK/RSBT	PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW. BACKUP MANUAL MINIFLOW ISOLATION VALVES (FWS-473, 477) FOR RWST INVENTORY	*PARTIAL DIVERSION OF SI FLOW FROM TRAIN A AFTER SEQ BLOCK/RSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS
01.1.04.06.1	HV-853B	8BQ 1 (19-1, 3)	CONTACTS OPEN (OFF)	HV-853B FAILS TO OPEN (REMAINS CLOSED) ON SIS/SISLOP. NO EFFECT IF AFTER SIS/SISLOP, DUE TO SIGNAL SEAL-IN VIA 83-4 RELAY CONTACTS WITHIN VALVE CONTROL CIRCUIT	PERIODIC TESTING	(SAME AS 1.1.4.1.2)	(SAME AS 1.1.4.1.2)	NORMAL POSITION
01.1.04.06.2	HV-853B	8BQ 1 (19-1, 3)	CONTACTS CLOSED (ON)	(SAME AS 1.1.4.1.1)	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.1.4.1.1)	*(SAME AS 1.1.4.1.1)	
01.1.04.07.1	HV-853B	125VDC BUS #1 (72-130)	VOLTS LOW	HV-853B FAILS TO OPEN (REMAINS CLOSED) ON SIS/SISLOP, RELAY 83-2 FAILS OFF, DISABLING TRAIN A FW PUMP SUCTION VALVE CLOSED PROTECTIVE TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BCCIRC	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS QUOPRR UNIT 1

TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION FNSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.04.08.1	HV-8548	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR SYSTEM RESET AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-530. VALVE REQUIRED TO REMAIN OPEN FOR SI AND SECONDARY RECIRC
01.1.05.01.1	HV-8548	VALVE/ACTUATOR	OPEN	TRAIN A PW PUMP SUCTION NOT ISOLATED FROM CONDENSATE AND HEATER DRAIN PUMPS ON SIS/SISLOP. VALVE POSITION INTERLOCK BLOCS HV-8518 OPENING	PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW. CONDENSATE, HEATER DRAIN PUMP TRIPS AND DISCHARGE VALVE INTERLOCK PREVENT CONDENSATE INJECTION	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	NORMAL POSITION (PW PUMP IN FW MODE). INCLUDES SV-1, SV-2, SV-511
01.1.05.01.2	HV-8548	VALVE/ACTUATOR	CLOSED	LOSS OF CONDENSATE FLOW TO TRAIN A PW PUMP IF PRIOR TO SIS/SISLOP, INABILITY TO RESET TO PW ALIGNMENT FOLLOWING INJECTION IF AFTER SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC IF PW PUMP FAILURE OCCURS	TRAIN A PW PUMP FAILURE COULD OCCUR DUE TO CAVITATION PRIOR TO SIS/SISLOP
01.1.05.02.1	HV-8548	ZSC-2851B1 ZSC-2851B3	CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR SEAL-IN OF VALVE CLOSURE SIGNAL AFTER SBQ BLOCK/RESET (ONE LIMIT SWITCH). NO EFFECT ON SIS/SISLOP SIGNAL SEAL-IN OR CONDENSATE, HEATER DRAIN PUMP TRIPS	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. VALVE POSITION INTERLOCK FROM HV-8518. INTERLOCK BLOCS MANUAL ACTUATION OPEN AFTER SBQ BLOCK/RESET AND RESET OF SIS/SISLOP SIGNAL SEAL-IN BY HV-8548 HANDSWITCH
01.1.05.02.2	HV-8548	ZSC-2851B1 ZSC-2851B3	CONTACTS CLOSED (ON)	(SAME AS 1.1.5.1.2)	CONTROL ROOM INDICATION	(SAME AS 1.1.5.1.2)	(SAME AS 1.1.5.1.2)	
01.1.05.03.1	HV-8548	SV-3900	OFF (CLOSED)	LOSS OF INTER-DISC PRESSURE VENT/BLT/FP FOR HV-8518. NO EFFECT ON HV-8548	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	INOPERABILITY OF TRAIN A PUMPING FOR SI, NONE FOR SECONDARY RECIRC	NORMAL POSITION. INTERDISC CAVITY VENT/BLT/FP REQUIRED TO OPEN HV-8518 FOR SI. HV-8518 CLOSED IS NORMAL FOR SECONDARY RECIRC
01.1.05.03.2	HV-8548	SV-3900	ON (OPEN)	HV-8518 INTER-DISC CAVITY CONTINUOUSLY VENTED TO PW PUMP SID. NO EFFECT ON HV-8518 OR HV-8548 REALIGNMENT, BUT DISABLES CONTAINMENT ISOLATION FUNCTION OF HV-8518	PERIODIC TESTING	NONE REQUIRED	NONE	CONTAINMENT ISOLATION FUNCTION EVALUATED IN ESP SPA. NOV-450A/B/C ARE REDUNDANT CONTAINMENT ISOLATION VALVES TO HV-851A/B AND SV-2900/3900, BUT PENETRATIONS AND VALVES NOT TYPE C LEAK TESTED PER IOPRESO APPENDIX J
01.1.05.04.1	HV-8548	ZSO-2854B2 ZSO-2854B4	CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR HV-8548 CLOSED INTERLOCK TO HV-8518 CIRCUIT (ONE SWITCH). REMAINING SWITCH PROVIDES SIGNAL AS REQUIRED	PERIODIC TESTING	(SAME AS 1.1.5.3.1)	RELIABILITY REDUCED FOR TRAIN A SI PUMPING, NONE FOR SECONDARY RECIRC	NORMAL POSITION. VALVE POSITION INTERLOCK TO HV-8518. CONTACTS CLOSED WHEN HV-8548 CLOSED
01.1.05.04.2	HV-8548	ZSO-2854B2 ZSO-2854B4	CONTACTS CLOSED (ON)	HV-8548 CLOSED INTERLOCK TO HV-8518 OPERATED. HV-8518 WILL BEGIN OPENING CONCURRENTLY WITH HV-8548 CLOSING	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED (MSLB ANALYSIS BOUNDS POTENTIAL CONDENSATE INJECTION)	INJECTION OF CONDENSATE FROM ONE TRAIN DURING PW PUMP REALIGNMENT	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM OPERATOR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FM ISOLATION PHSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.05.05.1	HV-8548	SRQ 1 (20-5, 7)	CONTACTS OPEN (OFF)	HV-8548 FAILS TO CLOSE (REMAINS OPEN) ON SIS/SISLOP. NO EFFECT IF AFTER SIS/SISLOP DUE TO SIGNAL SEAL-IN IN VALVE CIRCUIT	PERIODIC TESTING	(SAME AS 1.1.5.1.1)	(SAME AS 1.1.5.1.1)	NORMAL POSITION
01.1.05.05.2	HV-8548	SRQ 1 (20-5, 7)	CONTACTS CLOSED (ON)	(SAME AS 1.1.5.1.2)	PERIODIC TESTING	(SAME AS 1.1.5.1.2)	(SAME AS 1.1.5.1.2)	
01.1.05.06.1	HV-8548	125VDC BUS #1 (72-130)	VOLTS LOW	HV-8548 FAILS TO CLOSE (REMAINS OPEN) ON SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR FLOW, CONDENSATE, HEATER DRAIN PUMP TRIPS AND DISCHARGE VALVE INTERLOCK PREVENT CONDENSATE INJECTION	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	
01.1.05.07.1	HV-8548	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE OPEN FOR SYSTEM RESET AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-531. VALVE REQUIRED TO CLOSE FOR SI AND SECONDARY RECIRC
01.1.06.01.1	G-3B	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN A FM PUMP FLOW	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	INCLUDES LUBE OIL FAN COOLER R-178. PUMP REQUIRED FOR SECONDARY RECIRC UNTIL SI PUMP CAN DELIVER REQUIRED FLOW VIA IDLR/MINDRILLING FM PUMP
01.1.06.02.1	G-3B	BUS #1C (152-11C04)	OPEN	TRAIN A FM PUMP FAILS TO RESTART FOR SI (ON SIS/SISLOP) OR FOR SECONDARY RECIRC (MANUALLY) OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	
01.1.06.02.2	G-3B	BUS #1C (152-11C04)	CLOSED	TRAIN A FM PUMP FAILS TO TRIP DURING SIS/SISLOP STARTING SEQUENCE OR ON LO-LO RWST LEVEL. MAINTAINS DIFFERENTIAL PRESSURE ON HV-8518 VALVE DISC AND DEGRADES TRAIN A BUS VOLTAGES DURING LOAD SEQUENCE	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, INCREASED RESPONSE TIME FOR TRAIN A ROTOR-OPERATED VALVES (NOV-850B, NOV-20, NOV-22), REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION. BREAKER TRIPPED AND RECLOSD ON 11 SRC TIME DELAY FOLLOWING SIS/SISLOP. PUMP UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURE AFTER SI PUMP TRIP ON LO-LO RWST LEVEL
01.1.06.03.1	G-3B	LSL1-2215 LSL/LSL1-2216 LSL/LSL1-2217	OPP (HIGH)	1/3 LOW RWST LEVEL TRIP INPUTS DISABLED TO TRAIN A FM PUMP. TRAIN A FM PUMP TRIP LOGIC BECOMES 2/2 ON REMAINING INPUTS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. INTERLOCK FROM G-50B CONTROL CIRCUIT
01.1.06.03.2	G-3B	LSL1-2215 LSL/LSL1-2216 LSL/LSL1-2217	ON (LOW)	1/3 LOW RWST LEVEL INPUTS TRIPPED, TRAIN A FM PUMP TRIP LOGIC BECOMES 1/2 ON REMAINING INPUTS	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	REDUCED RELIABILITY OF TRAIN A PUMPING FOR SI, NONE FOR SECONDARY RECIRC	
01.1.06.04.1	G-3B	RT1 (FM)	OPP	TRAIN A FM PUMP TRIP ON LOW RWST LEVEL AND TRAIN A FM PUMP INPUT TO NOV-850A/B/C CLOSURE DISABLED	PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT INPUT FROM SI PUMP FOR NOV CLOSURE ON LO-LO RWST LEVEL	NONE FOR SI, REDUCED RELIABILITY OF AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION AREA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.06.01.2 G-3B		RTI (PW)	ON	TRAIN A PW PUMP TRIPS, CANNOT BE RESTARTED. TRAIN A LOW RWST LEVEL SIGNAL TO MOV-850A/B/C VIA RELAYS RTI#1, RTI#1, RTI#1	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC PUMPING, INPUTS FROM REDUNDANT TRAIN TO PREVENT PREMATURE MOV-850A/B/C CLOSURE	(SAME AS 1.1.6.1.1)	
01.1.06.05.1 G-3B	HS-221B HS-221BA	CONTACTS CLOSED (OFF)	CONTACTS CLOSED (OFF)	SI/SISLOP SIGNAL SEAL-IN TO TRAIN A SI/PW PUMPS CANNOT BE RESET AFTER SEQ BLOCK/RESET (ONE SWITCH)	PERIODIC TESTING	NONE REQUIRED FOR SI OR LO-LO RWST LEVEL TRIP, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, IMPROBABILITY OF TRAIN A PUMPING FOR SECONDARY RECIRC	NORMAL POSITION. BOTH SWITCHES MUST OPEN FOR RESET. RESET REQUIRED TO PERMIT PUMP RESTART FOR SECONDARY RECIRC AFTER LO-LO RWST LEVEL TRIP
01.1.06.05.2 G-3B	HS-221B HS-221BA	CONTACTS OPEN (ON)	CONTACTS OPEN (ON)	TRAIN A SI/SISLOP SIGNAL SEAL-IN REDUNDANCY FOR LOW RWST LEVEL TRIP REDUCED TO 1/1 ON REMAINING RESET SWITCH	PERIODIC TESTING	REDUNDANT INPUTS FROM SI PUMP FOR MOV CLOSURE ON LO-LO RWST LEVEL, NONE REQUIRED FOR SI AND SECONDARY RECIRC	REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, NONE FOR SI OR SECONDARY RECIRC	
01.1.06.06.1 G-3B	152-11C04 "b" CONTACT	OPEN	OPEN	TRAIN A HEATER DRAIN PUMP DOES NOT TRIP AUTOMATICALLY ON PW PUMP TRIP. SI/SISLOP TRIP UNEXPECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. HEATER DRAIN PUMP TRIPS ON SEPARATE SEQ INPUT FOR SI, CAN ALSO BE TRIPPED MANUALLY FOR SECONDARY RECIRC
01.1.06.06.2 G-3B	152-11C04 "b" CONTACT	CLOSED	CLOSED	TRAIN A HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	(SAME AS 1.1.6.6.1)	(SAME AS 1.1.6.6.1)	
01.1.06.07.1 G-3B	83-2 (RELAY)	CONTACTS OPEN (OFF)	CONTACTS OPEN (OFF)	TRAIN A PW PUMP PROTECTIVE TRIP ON SUCTION VALVE HV-853B CLOSED DISABLED	PERIODIC TESTING	(SAME AS 1.1.6.6.1)	(SAME AS 1.1.6.6.1)	NORMAL POSITION
01.1.06.07.2 G-3B	83-2 (RELAY)	CONTACTS CLOSED (ON)	CONTACTS CLOSED (ON)	SUCTION VALVE HV-853B CLOSED SIGNAL WILL TRIP TRAIN A PW PUMP 30 SEC AFTER SI/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	IMPROBABILITY OF TRAIN A PUMPING FOR SI, NONE FOR SECONDARY RECIRC	SI/SISLOP BLOCK/RESET WOULD OCCUR BEFORE PUMP RESTART FOR SECONDARY RECIRC
01.1.06.08.1 G-3B	83-5 (RELAY)	OFF	OFF	SI/SISLOP SEAL-IN DISABLED TO TRAIN A PW PUMP SUCTION VALVE PROTECTIVE TRIP, OVERLOAD TRIP DEPRAT AND RWST MINIFLOW VALVE CV-875B. PW PUMP MINIFLOW VALVES WILL REALIGN TO CONDENSER AFTER SEQ BLOCK/RESET	PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW, BACKUP MANUAL MINIFLOW ISOLATION VALVES (PWS-473, 477) FOR RWST INVENTORY AND SECONDARY RECIRC	*PARTIAL DIVERSION OF TRAIN A SI FLOW AFTER SEQ BLOCK/RESET VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS
01.1.06.08.2 G-3B	83-5 (RELAY)	ON	ON	SI/SISLOP SEAL-IN SIGNAL TO TRAIN A PW PUMP MINIFLOW VALVE CV-875B AND OVERLOAD TRIP DEPRATS, CAUSING REALIGNMENT OF TRAIN A PW PUMP MINIFLOW TO RWST. NO EFFECT AFTER SI/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	ADMINISTRATIVE CONTROLS ON RWST BORON CONCENTRATION	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SI/SISLOP. NO EFFECT IF AFTER.	TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST
01.1.06.09.1 G-3B	CV-875B	OPEN	OPEN	PARTIAL DIVERSION OF CONDENSATE FLOW FROM TRAIN A PW PUMP TO RWST IF PRIOR TO SI/SISLOP. NO EFFECT IF AFTER	CONTROL ROOM INDICATION	(SAME AS 1.1.6.8.2)	(SAME AS 1.1.6.8.2)	INCLUDES SV-875B, LS-2 (ZSC-1875B)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.06.09.2 G-30	CV-875B		CLOSED	LOSS OF TRAIN A PW PUMP MINIFLOW PROTECTION FOLLOWING SIS/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BECIRC	NORMAL POSITION. MINIFLOW REQUIRED TO PREVENT PUMP FAILURE FOR SBLOCA AND NSLO
01.1.06.10.1 G-30	CV-37		OPEN	DIVERSION OF TRAIN A PW PUMP MINIFLOW TO CONDENSER	PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW. BACKUP MANUAL MINIFLOW ISOLATION VALVES (PMS-473, 477) FOR BUST INVENTORY	*PARTIAL DIVERSION OF TRAIN A PW PUMP FLOW TO CONDENSER VIA MINIFLOW VALVE CV-37	*INCLUDES SV-18, 18A. BUST INVENTORY CALCULATION INCLUDES LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE HOURCH TRMS
01.1.06.10.2 G-30	CV-37		CLOSED	LOSS OF TRAIN A PW PUMP MINIFLOW PROTECTION DURING NORMAL OPERATION	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BECIRC	NORMAL POSITION AT POWER. VALVE OPENS PNEUMATICALLY ON LOW CONDENSATE FLOW (SG, FOLLOWING PW PUMP TRIP)
01.1.06.11.1 G-30	SRQ 1 (20-9, 11)		CONTACTS OPEN (OFF)	TRAIN A PW PUMP FAILS TO TRIP ON SIS/SISLOP, MAINTAINING DIFFERENTIAL PRESSURE ON HV-851B VALVE DISC AND DEGRADING TRAIN A BUS VOLTAGES DURING LOAD SEQUENCE. AUTO-TRIP ON LO-LO BUST LEVEL ALSO DEGRADED	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY BECIRC, REDUNDANT INPUTS FROM SI PUMP FOR NOV CLOSURE ON LO-LO BUST LEVEL	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BECIRC, INCREASED RESPONSE TIME OF TRAIN A MOTOR OPERATED VALVES (NOV-8508, NOV-20, NOV-22), REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO BUST LEVEL	NORMAL POSITION. PW PUMP TRIP REQUIRED FOR HV-851A/B REALIGNMENT. PUMP COULD BE UNAVAILABLE FOR SECONDARY BECIRC DUE TO CAVITATION FAILURE AFTER SI PUMP TRIP ON LO-LO BUST LEVEL
01.1.06.11.2 G-30	SRQ 1 (20-9, 11)		CONTACTS CLOSED (ON)	TRAIN A PW PUMP TRIPS, RESTARTS 11 SEC LATER. CANNOT BE RESTARTED AFTER LOW BUST LEVEL TRIP	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY BECIRC, NONE REQUIRED FOR LO-LO BUST LEVEL	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BECIRC, NONE FOR AUTO-TERMINATION OF SI ON LO-LO BUST LEVEL	FAILURE OCCURRING PRIOR TO SIS/SISLOP WOULD HAVE SAME EFFECT ON SI FUNCTION AS AUTO-TERMINATION OF SI ON LO-LO FAILURE TO TRIP
01.1.06.12.1 G-30	SRQ 1 (42-1, 3)		CONTACTS CLOSED (OFF)	TRAIN A PW PUMP OVERLOAD TRIP DEPRAT DISABLED UNTIL HV-853B BEGINS TO OPEN	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A SI PUMPING	NORMAL POSITION
01.1.06.12.2 G-30	SRQ 1 (42-1, 3)		CONTACTS OPEN (ON)	TRAIN A PW PUMP OVERLOAD TRIP DEGRADED	PERIODIC TESTING	(SAME AS 1.1.6.12.1)	(SAME AS 1.1.6.12.1)	
01.1.06.13.1 G-30	SRQ 1 (53-1, 3)		CONTACTS OPEN (OFF)	TRAIN A PW PUMP MINIFLOW DOES NOT ISOLATE TO CONDENSER ON SIS/SISLOP, PW PUMP PROTECTIVE TRIP ON SUCTION VALVE HV-853B CLOSED ALSO DISABLED	PERIODIC TESTING	(SAME AS 1.1.6.10.1)	*(SAME AS 1.1.6.10.1)	NORMAL POSITION
01.1.06.13.2 G-30	SRQ 1 (53-1, 3)		CONTACTS CLOSED (ON)	TRIPS TRAIN A PW PUMP AFTER 30 SEC AND PROVIDES CLOSE PERMISSIVE TO TRAIN A PW PUMP MINIFLOW VALVE CV-37 IF PRIOR TO SIS/SISLOP. AFTER SIS/SISLOP, HV-853B OPENING WILL CLEAR PW PUMP PROTECTIVE TRIP SIGNAL	CONTROL ROOM INDICATION NONE REQUIRED	NONE		TRAIN A VALVES WILL RESPOND NORMALLY AND PW PUMP WILL RESTART AS REQUIRED
01.1.06.14.1 G-30	SRQ 1 (38-9, 11)		CONTACTS OPEN (OFF)	TRAIN A PW PUMP MINIFLOW VALVES WILL NOT REALIGN TO BUST UNTIL HV-853B BEGINS TO OPEN	PERIODIC TESTING	REDUNDANT CONTACT FROM HV-853B AND REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BECIRC	REDUCED RELIABILITY OF TRAIN A PUMPING FOR SI, NONE FOR SECONDARY BECIRC	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.06.14.2 G-3B	S90.1 (38-9, 11)		CONTACTS CLOSED (ON)	TRAIN A PW PUMP MINIFLOW VALVES REALIGN TO RWST	CONTROL ROOM INDICATION, PERIODIC TESTING	ADMINISTRATIVE CONTROLS ON RWST BORON CONCENTRATION	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	TECHNICAL SPECIFICATIONS 1.1.1 AND 4.1.1 GOVERN THE RWST
01.1.06.15.1 G-3B	BUS A1C 125VDC CONTROL POWER		VOLTS LOW	TRAIN A PW PUMP CANNOT BE TRIPPED OR RESTARTED, AND ITS MINIFLOW REMAINS ALIGNED TO CONDENSER	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY BRCIRC PUMPING, BACKUP MANUAL MINIFLOW ISOLATION VALVES (PWS-473, 477) FOR RWST INVENTORY	*IMOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BRCIRC, OR PARTIAL DIVERSION OF TRAIN A FLOW TO CONDENSER VIA CV-37	*RWST CALCULATIONS INCLUDE CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 10 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS
01.1.06.16.1 G-3B	MCC-1A (42-11A15)		VOLTS LOW	LOSS OF TRAIN A PW PUMP LUBE OIL COOLER	CONTROL ROOM INDICATION	REDUNDANT TRAIN	*IMOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BRCIRC	LUBE OIL PAN COOLER R-17B REQUIRED FOR EXTENDED PW PUMP OPERATION DURING SBLOCA OR NSLB INSIDE CONTAINMENT
01.1.06.17.1 G-3B	ISA		PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION PW PUMP MINIFLOW VALVES CV-37 AND CV-875B	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	NONE. TRAIN A PW PUMP MINIFLOW VALVES REPOSITION AS REQUIRED USING SAFETY RELATED BACK-UP NITROGEN	ISA IS A NON-SAFETY RELATED, NON-SEISMIC SYSTEM
01.1.06.18.1 G-3B	GNI		PRESSURE LOW	BACKUP NITROGEN UNAVAILABLE TO PERIODIC SURVEILLANCE REPOSITION PW PUMP MINIFLOW VALVES CV-37 AND CV-875B	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY BRCIRC PUMPING, MANUAL BACKUP MINIFLOW ISOLATION VALVES (PWS-473, 477) FOR RWST INVENTORY	*IMOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BRCIRC, OR PARTIAL DIVERSION OF TRAIN A FLOW TO CONDENSER	*TRAIN A PW PUMP MAY FAIL DURING SBLOCA OR NSLB IF CV-875B CLOSED. RWST INVENTORY CALCULATIONS INCLUDE CV-36/37 FAILURE OPEN, LOCAL MANUAL BACKUP ISOLATION AFTER 10 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS
01.1.07.01.1 HV-851B	VALVE/ACTUATOR		OPEN	TRAIN A PW FLOW ALIGNED TO SI HEADER (IF PARTIALLY OPEN) OR SUCTION VALVE HV-851B CLOSERS (VIA INTERLOCK IF HV-851B FULLY OPEN) IF PRIOR TO SIS/SISLOP. NO EFFECT ON SI AFTER SIS/SISLOP, BUT CANNOT BE RECLOSURE FOR SECONDARY BRCIRC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW, REDUNDANT NOV-850A/B/C CLOSURE FOR SECONDARY BRCIRC BOUNDARY. NSLB ANALYSIS BOUNDS POSSIBLE AGAINST INJECTION OF CONDENSATE TO RCS	*IMOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY BRCIRC, REDUCED REDUNDANCY	TRAIN A PW PUMP FAILURE MAY OCCUR DUE TO CAVITATION IF INTERLOCK CLOSERS HV-851B PRIOR TO SIS/SISLOP
01.1.07.01.2 HV-851B	VALVE/ACTUATOR		CLOSED	TRAIN A PW PUMP SI FLOW PATH BLOCKED	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BRCIRC	*IMOPERABILITY OF TRAIN A PUMPING FOR SI, NONE FOR SECONDARY BRCIRC	NORMAL POSITION. FAILURE CAN RESULT FROM INADEQUATE ACTUATOR THRUST TO OVERCOME DRAG FORCES IF HV-2900/3900 FAILS TO VENT INTER-DISC CAVITY OR PW PUMP FAILS TO TRIP
01.1.07.02.1 HV-851B	ZSO-285482 ZSO-285484		CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR OPEN PERMISSIVE TO HV-851B (ONE SWITCH). REMAINING SWITCH PROVIDES SIGNAL AS REQUIRED	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BRCIRC	RELIABILITY REDUCED FOR TRAIN A SI PUMPING, NONE FOR SECONDARY BRCIRC	NORMAL POSITION. INTERLOCK FROM HV-851B NOT CLOSED LIMIT SWITCHES

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PHA

ITER #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.07.02.2	NV-851B	ZSC-2851B2 ZSC-2851B4	CONTACTS CLOSED (ON)	INTERLOCK FROM NV-851B DEPRATED, NV-851B WILL BEGIN OPENING CONCURRENTLY WITH NV-851B CLOSING	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED INSLE ANALYSIS BOUNDS POTENTIAL CONDENSATE INJECTION)	INJECTION OF CONDENSATE FROM TRAIN A DURING PW PUMP REALIGNMENT	
01.1.07.03.1	NV-851B	ZSC-2851B1 ZSC-2851B3	CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR CLOSE SIGNAL SEAL-IN TO NV-851B AFTER SRQ BLOCK/RESET (ONE LIMIT SWITCH)	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT LIMIT SWITCH, CONDENSATE AND HEATER DRAIN PUMP TRIPS	REDUCED REDUNDANCY AGAINST CONDENSATE INJECTION FROM TRAIN A PW PUMP	NORMAL POSITION
01.1.07.03.2	NV-851B	ZSC-2851B1 ZSC-2851B3	CONTACTS CLOSED (ON)	CLOSE INTERLOCK SIGNAL TO NV-851B, CAUSING LOSS OF CONDENSATE FLOW TO TRAIN A PW PUMP PRIOR TO SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT TRAIN	IMOPRABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC IF PW PUMP FAILS	TRAIN A PW PUMP FAILURE MAY RESULT FROM CAVITATION PRIOR TO SIS/SISLOP
01.1.07.04.1	NV-851B	SRQ 1 (17-1, 3)	CONTACTS CLOSED (ON)	NV-851B WILL OPEN AS REQUIRED ON NV-851B CLOSED INTERLOCK SIGNAL. VALVE CANNOT BE RECLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION	PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT NOV-850A/B/C CLOSURE FOR SECONDARY RECIRC BOUNDARY	NONE FOR SI, REDUCED REDUNDANCY NOV-850A/B/C PROVIDE REDUNDANT AGAINST CONDENSATE INJECTION TO ISOLATION RCS FOR SECONDARY RECIRC	
01.1.07.04.2	NV-851B	SRQ 1 (17-1, 3)	CONTACTS OPEN (OFF)	(SAME AS 1.1.7.1.2)	PERIODIC TESTING	(SAME AS 1.1.7.1.2)	(SAME AS 1.1.7.1.2)	NORMAL POSITION
01.1.07.05.1	NV-851B	125VDC BUS #1 (12-130)	VOLTS LOW	TRAIN A PW PUMP SI FLOW PATH BLOCKED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	IMOPRABILITY OF TRAIN A PUMPING FOR SI, NONE FOR SECONDARY RECIRC	
01.1.07.06.1	NV-851B	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	NONE. VALVE WILL REPOSITION AS REQUIRED USING SAFETY-RELATED BACKUP NITROGEN	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-520
01.1.07.07.1	NV-851B	GNI	PRESSURE LOW	BACKUP NITROGEN UNAVAILABLE TO REPOSITION VALVE CLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	PERIODIC SURVEILLANCE	NONE REQUIRED FOR SI, ISA AND REDUNDANT NOV-850A/B/C FOR SECONDARY RECIRC BOUNDARY	NONE FOR SI, REDUCED RELIABILITY FOR SECONDARY RECIRC ALIGNMENT	NON-SAFETY RELATED ISA SYSTEM CAN BE CREDITED FOR NSLB IN CONTAINMENT PER SRP SECTION 15.1.5
01.1.08.01.1	NV-852B	VALVE/ACTUATOR	OPN	SI FLOW FROM BOTH TRAINS DIVERTED INTO NON-SEISMIC PORTION OF MAIN PW HEADER UNTIL BACKUP VALVES CLOSED. REQUIRED POSITION FOR SECONDARY RECIRCULATION	PERIODIC TESTING	REDUNDANT PW ISOLATION VALVES PCV-456, 457, 458, CV-142, 143, 144, NOV-20, 21, 22 ASSUMED IN LOCA/MSLB ANALYSES. NONE FOR NON-SEISMIC HEADER DURING SI	*SI DELIVERY TIME INCREASED, SI RELIABILITY REDUCED (VIA NON-SEISMIC PORTION OF PW HEADER).	NORMAL POSITION. INCLUDES SV-1, SV-2, SV-529. BACKUP VALVES ARE SAFETY RELATED, SEISMIC CATEGORY A. VALVE OPEN NORMAL FOR SECONDARY RECIRC
01.1.08.01.2	NV-852B	VALVE/ACTUATOR	CLOSED	VALVE CANNOT BE OPENED FOR SYSTEM RESET OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, IMOPRABILITY OF TRAIN A PUMPING FOR SECONDARY RECIRC	
01.1.08.02.1	NV-852B	SRQ 1 (17-5, 7)	CONTACTS OPEN (OFF)	(SAME AS 1.1.8.1.1)	PERIODIC TESTING	(SAME AS 1.1.8.1.1)	(SAME AS 1.1.8.1.1)	NORMAL POSITION
01.1.08.02.2	NV-852B	SRQ 1 (17-5, 7)	CONTACTS CLOSED (ON)	(SAME AS 1.1.8.1.2)	PERIODIC TESTING	(SAME AS 1.1.8.1.2)	(SAME AS 1.1.8.1.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM OPERATOR UNIT 1

TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
01.1.09.01.1	MOV-852B	125VDC BUS #1 (72-130)	VOLTS LOW	SI FLOW FROM BOTH TRAINS DIVERTED INTO NON-BRISMIC PORTION OF MAIN PW BRADER UNTIL BACKUP VALVES CLOSED. REQUIRED POSITION FOR SECONDARY RECIRCULATION	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT PW ISOLATION VALVES PCV-456, 457, 458, CV-142, 143, 144, MOV-20, 21, 22 ASSUMED IN LOCA/MSLB ANALYSIS. NONE FOR NON-BRISMIC BRADER DURING SI	SI DELIVERY TIME INCREASED, SI VALVE OPEN NORMAL FOR RELIABILITY REDUCED (VIA NON-BRISMIC PORTION OF PW BRADER)	SECONDARY RECIRC
01.1.09.04.1	MOV-852B	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE OPEN FOR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, IMOPRABILITY OF TRAIN A PUMPING FOR SECONDARY RECIRC	NON-SAFETY RELATED ISA SYSTEM CAN BE CREDITED FOR MSLB IN CONTAINMENT PER SRP SECTION 15.1.5. AIR-OPERATED HYDRAULIC PUMP IN VALVE ACTUATOR ISOLATED BY SV-529
01.1.09.01.1	MOV-850B	VALVE/ACTUATOR	OPEN	NO EFFECT ON INJECTION. VALVE CANNOT BE RECLOSED ON LO-LO RWST LEVEL TO TERMINATE INJECTION FLOW OR RESET MANUALLY FOR SECONDARY RECIRC BOUNDARY	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL, REDUNDANT VALVES FOR SECONDARY RECIRC BOUNDARY	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, AND FOR SECONDARY RECIRC	
01.1.09.01.2	MOV-850B	VALVE/ACTUATOR	CLOSED	INJECTION PATH BLOCKED TO RCS LOOP B	PERIODIC TESTING	REDUNDANT FLOW PATHS TO RCS LOOPS A AND C FOR SI, NONE REQUIRED FOR SECONDARY RECIRC OR LO-LO RWST LEVEL	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR MSLB (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). NONE FOR SECONDARY RECIRC OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION. MOV-850C ASSUMED COMMON-CAUSE FAILURE DURING MSLB OUTSIDE CONTAINMENT DUE TO UNQUALIFIED POWER SUPPLY IN TURBINE BUILDING
01.1.09.01.1	MOV-850B	BTIA1 BTIA2	CONTACTS CLOSED (OFF)	REDUCED REDUNDANCY AGAINST AUTO-CLOSURE OF MOV-850B ON LO-LO RWST LEVEL (ONE RELAY)	CONTROL ROOM ANNUNCIATION, INDICATION	REDUNDANT FLOW PATHS TO LOOPS A AND C FOR SI, NONE REQUIRED FOR LO-LO RWST LEVEL OR FOR SECONDARY RECIRC	REDUCED RELIABILITY OF LOOP B INJECTION PATH FOR SI, NONE FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL OR FOR SECONDARY RECIRC	VALVE AUTO-CLOSE LOGIC BECOMES 1/1 ON REMAINING RELAY INPUT
01.1.09.01.2	MOV-850B	BTIA1 BTIA2	CONTACTS OPEN (ON)	AUTO-CLOSURE OF MOV-850B ON LO-LO RWST LEVEL DEPRATED	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY RECIRC, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL	NONE FOR SI OR SECONDARY RECIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION
01.1.09.01.1	MOV-850B	SBQ 1 (21-1,3)	CONTACTS OPEN (OFF)	(SAME AS 1.1.9.1.2)	PERIODIC TESTING	(SAME AS 1.1.9.1.2)	(SAME AS 1.1.9.1.2)	NORMAL POSITION
01.1.09.01.2	MOV-850B	SBQ 1 (21-1,3)	CONTACTS CLOSED (ON)	MOV-850B OPENS DURING NORMAL OPERATION. NO EFFECT ON INJECTION OR AUTO-CLOSURE ON LOW RWST LEVEL	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	FAILURE MAY RESULT IN INCREASED MAIN PW PUMP ACCELERATION TIME DURING LOLOCA, BUT BOTH TRAINS WOULD BE AVAILABLE WITH THIS FAILURE
01.1.09.04.1	MOV-852B	125VDC BUS #1 (72-130)	VOLTS LOW	INJECTION PATH NOT AUTOMATICALLY ALIGNED TO RCS LOOP B ON SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND C FOR SI, NONE REQUIRED FOR LO-LO RWST LEVEL OR FOR SECONDARY RECIRC	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR MSLB (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). NONE FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL OR FOR SECONDARY RECIRC	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION PHSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.09.05.1	HV-8508	HCC-1 (42-1180)	VOLTS LOW	VALVE WILL NOT OPEN ON SIS/SISLOP OR RECLOSE ON LOW RMST LEVEL	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND C FOR SI, REDUNDANT PUMP TRIPS FOR LO-LO RMST LEVEL, REDUNDANT VALVES (HV-851A/B) FOR SECONDRY RECIRC BOUNDARY	SI FLOW REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR NSLD (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RMST LEVEL AND FOR SECONDARY RECIRC	
01.1.10.01.1 (NOT USED)								
01.1.11.01.1	G-1C, G-1D	BUS 81C (152-11C06) (152-11C08)	OPEN	1 OF 2 CONDENSATE PUMPS TRIPPED TO TRAIN A PW PUMP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	TRAIN A POWERED CONDENSATE PUMP WOULD BE TRIPPED ON SIS/SISLOP IF RUNNING NORMAL POSITION
01.1.11.01.2	G-1C, G-1D	BUS 81C (152-11C06) (152-11C08)	CLOSED	1 OF 2 CONDENSATE PUMPS CANNOT BE TRIPPED TO TRAIN A PW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE HV-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN A	
01.1.11.02.1	G-1C, G-1D	194-5 (RBLAT)	CONTACTS OPEN (OFF)	TRAIN A CONDENSATE PUMPS WILL NOT TRIP ON BUS UNDERVOLTAGE. SIS/SISLOP TRIP FROM SRQ UNAPFFECTED	PERIODIC TESTING	(SAME AS 1.1.11.1.2)	(SAME AS 1.1.11.1.2)	NORMAL POSITION
01.1.11.02.2	G-1C, G-1D	194-5 (RBLAT)	CONTACTS CLOSED (ON)	BOTH TRAIN A CONDENSATE PUMPS TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.1.11.03.1	G-1C, G-1D	SRQ 1 (19-6, 8) (19-9, 11)	CONTACTS OPEN (OFF)	TRAIN A CONDENSATE PUMPS WILL NOT TRIP ON SRQ SIGNAL. BUS UNDERVOLTAGE TRIP UNAPFFECTED	PERIODIC TESTING	(SAME AS 1.1.11.1.2)	(SAME AS 1.1.11.1.2)	NORMAL POSITION
01.1.11.03.2	G-1C, G-1D	SRQ 1 (19-6, 8) (19-9, 11)	CONTACTS CLOSED (ON)	1 OF 2 TRAIN A CONDENSATE PUMPS TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.1.11.04.1	G-1C, G-1D	BUS 81C 125VDC CONTROL POWER	VOLTS LOW	TRAIN A CONDENSATE PUMPS WILL NOT TRIP ON SRQ OR BUS UNDERVOLTAGE SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE HV-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED RELIABILITY AGAINST INJECTION OF CONDENSATE BY TRAIN A	
01.1.12.01.1	G-36B	BUS 81C (152-11C09)	OPEN	HEATER DRAIN PUMP TRIPPED TO TRAIN A PW PUMP SUCTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	HEATER DRAIN PUMP TRIPPED ON SIS/SISLOP
01.1.12.01.2	G-36B	BUS 81C (152-11C09)	CLOSED	HEATER DRAIN PUMP CANNOT BE TRIPPED TO TRAIN A PW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE HV-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN A	NORMAL POSITION
01.1.12.02.1	G-36B	152-11C04 "b" CONTACT	OPEN	HEATER DRAIN PUMP WILL NOT TRIP ON TRAIN A PW PUMP TRIP. SRQ TRIP UNAPFFECTED	PERIODIC TESTING	(SAME AS 1.1.12.1.2)	(SAME AS 1.1.12.1.2)	NORMAL POSITION DURING POWER OPERATION
01.1.12.02.2	G-36B	152-11C04 "b" CONTACT	CLOSED	TRAIN A HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.1.12.03.1	G-36B	194 (RBLAT)	CONTACTS OPEN (OFF)	TRAIN A HEATER DRAIN PUMP WILL NOT TRIP ON BUS UNDERVOLTAGE, SRQ AND PW PUMP TRIPS UNAPFFECTED	PERIODIC TESTING	(SAME AS 1.1.12.1.2)	(SAME AS 1.1.12.1.2)	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FBSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
01.1.12.03.2	G-368	191 (RELAY)	CONTACTS CLOSED (ON)	TRAIN A HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.1.12.04.1	G-368	89Q 1 (18-10, 12)	CONTACTS OPEN (OFF)	TRAIN A HEATER DRAIN PUMP WILL NOT TRIP ON 89Q SIGNAL. TRIP ON PW PUMP TRIP UNEXPECTED	PERIODIC TESTING	(SAME AS 1.1.12.1.2)	(SAME AS 1.1.12.1.2)	NORMAL POSITION
01.1.12.04.2	G-368	89Q 1 (18-10, 12)	CONTACTS CLOSED (ON)	TRAIN A HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.1.12.05.1	G-368	BUS SIC 125VDC CONTROL POWER	VOLTS LOW	TRAIN A HEATER DRAIN PUMP WILL NOT TRIP ON 89Q OR PW PUMP TRIP SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW. CLOSURE OF SUCTION VALVE BY-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN A	
01.2.01.01.1			OPN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION. INCLUDES SIS-302
01.2.01.01.2			CLOSED	TRAIN B SI PUMP SUCTION OR DISCHARGE BLOCKED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	
01.2.01.02.1			NONE (PASSIVE)		PERIODIC TESTING			INCLUDES SIS-304, 003, FWS-438
01.2.02.01.1			OPN	DIVERSION OF TRAIN B SI FLOW	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR SI FLOW, BACKUP VALVES AND/OR ADMINISTRATIVELY CONTROLLED VALVE LOCKING FOR RWST INVENTORY	INOPERABILITY OF TRAIN B SI PUMPING, DIVERSION OF RWST INVENTORY	REFER TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. DIVERSION BOUNDED BY CV-36/37 FAILURE WITH LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS
01.2.02.01.2			CLOSED	NO EFFECT ON INJECTION, AUTO-TERMINATION OF SI FLOW OR SECONDARY RECIRCULATION	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION
01.2.02.02.1			NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
01.2.03.01.1			LOW FLOW	REDUCED SI PUMP OUTPUT TO TRAIN B FW PUMP	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	
01.2.03.02.1			OPN	TRAIN B SI PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	NORMAL POSITION. SI PUMP BREAKER.
01.2.03.02.2			CLOSED	TRAIN B SI PUMP STARTS, OR FAILS TO TRIP ON LOW RWST LEVEL	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, REDUNDANT MOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, INOPERABILITY OF TRAIN B PUMPING FOR SECONDARY RECIRC	PUMP COULD BE UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURE FOLLOWING DEPLETION OF RWST BY CONTAINMENT SPRAY
01.2.03.03.1			OFF (HIGH)	1/3 LOW RWST LEVEL TRIP INPUTS DISABLED TO TRAIN B SI AND FW PUMP. TRAIN B TRIP LOGIC BECOMES 2/2 ON REMAINING INPUTS	PERIODIC TESTING	(SAME AS 1.2.3.2.2)	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, REDUCED RELIABILITY OF TRAIN B PUMPING FOR SECONDARY RECIRC	NORMAL POSITION. INCLUDES TRST SWITCHES

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR OPERATOR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION ENSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.03.03.2	G-50A	LSL/LSLE-3088 LSL/LSLE-3089 LSL/LSLE-3090	ON (LOW)	1/3 LOW RWST LEVEL INPUTS TRIPPED TO TRAIN B. TRAIN B TRIP LOGIC BECOMES 1/2 ON REMAINING INPUTS	ANNUNCIATION	REDUNDANT TRAIN	REDUCED REDUNDANCY AGAINST TRAIN B SI/PW PUMP TRIP	RELAYS ENERGIZED ON LOW RWST LEVEL
01.2.03.04.1	G-50A	RTI (FW) RTI (SI)	CONTACTS CLOSED (OFF)	FW OR SI PUMP TRIP AND INPUT DISABLED FOR TRAIN B INPUT TO LOW RWST LEVEL TRIP OF NOV-850A/B/C. LOGIC TO RTIA2, RTIB2, RTIC2 BECOMES 1/1 ON REMAINING RTI	PERIODIC TESTING	(SAME AS 1.2.3.2.2)	(SAME AS 1.2.3.2.2)	NORMAL POSITION
01.2.03.04.2	G-50A	RTI (FW) RTI (SI)	CONTACTS OPEN (ON)	TRAIN B LOW RWST LEVEL SIGNAL TO NOV-850A/B/C VIA RTIA2, RTIB2, RTIC2 AND TRIP OF AFFECTED PUMP	CONTROL ROOM INDICATION	INPUTS FROM REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BRCIRC	REDUCED REDUNDANCY AGAINST NOV-850A/B/C CLOSURE (1/1 ON TRAIN A INPUT TO EACH VALVE) FOR SI, NONE FOR SECONDARY BRCIRC	RELAY ENERGIZED ON 2/3 LOW RWST LEVEL WITH SIS/SISLOP IN RESPECTIVE PUMP CONTROL CIRCUIT
01.2.03.05.1	G-50A	RTIA2 RTIB2 RTIC2	OFF (LOW)	TRAIN B LOW RWST LEVEL SIGNAL TO ONE OF NOV-850A/B/C. NO EFFECT ON SI PUMP	PERIODIC TESTING	REDUNDANT VALVES FOR SI, NONE REQUIRED FOR SECONDARY BRCIRC	REDUCED REDUNDANCY AGAINST NOV-850A, B, OR C CLOSURE (1/1 ON TRAIN A INPUT) FOR SI, NONE FOR SECONDARY BRCIRC	INCLUDES TEST SWITCH BS-3850. RELAYS DE-ENERGIZE ON LO-LO RWST LEVEL WITH SIS/SISLOP
01.2.03.05.2	G-50A	RTIA2 RTIB2 RTIC2	ON (HIGH)	TRAIN B LOW RWST INPUT DISABLED TO ONE OF NOV-850A/B/C	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BRCIRC, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL	NONE FOR SI OR SECONDARY BRCIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION
01.2.03.06.1	G-50A	RS-3091 RS-3091A	CONTACTS CLOSED (OFF)	SI SEAL-IN TO TRAIN B SI AND PW PUMPS CANNOT BE RESET AFTER SEQ BLOCK/RESBT (ONE SWITCH)	PERIODIC TESTING	NONE REQUIRED FOR INJECTION OR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY BRCIRC	NONE FOR INJECTION OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, INOPERABILITY OF TRAIN B PUMPING FOR SECONDARY BRCIRC	NORMAL POSITION. BOTH SWITCHES MUST OPEN FOR RESET. FAILURE OF EITHER SWITCH PREVENTS RESTART OF PUMP AFTER LO-LO RWST LEVEL TRIP (POST-MSLB IN CONTAINMENT) FOR SECONDARY BRCIRC
01.2.03.06.2	G-50A	RS-3091 RS-3091A	CONTACTS OPEN (ON)	TRAIN B SI SEAL-IN REDUNDANCY FOR LOW RWST LEVEL TRIP REDUCED TO 1/1 ON REMAINING RESBT SWITCH	PERIODIC TESTING	(SAME AS 1.2.3.3.1)	(SAME AS 1.2.3.3.1)	
01.2.03.07.1	G-50A	SEQ 2 (37-1, 3)	CONTACTS OPEN (OFF)	TRAIN B SI PUMP FAILS TO START. NO EFFECT ON LOW RWST LEVEL TRIP AFTER START DUE TO SEAL-IN WITHIN PUMP CONTROL CIRCUIT	PERIODIC TESTING	(SAME AS 1.2.3.1.1)	(SAME AS 1.2.3.1.1)	NORMAL POSITION. FAILURE OF SI PUMP TO AUTO-START COULD RESULT IN CAVITATION FAILURE OF PW PUMP
01.2.03.07.2	G-50A	SEQ 2 (37-1, 3)	CONTACTS CLOSED (ON)	TRAIN B SI PUMP STARTS, OR CANNOT BE RESTARTED AFTER LOW RWST LEVEL TRIP	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED FOR SI OR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY BRCIRC	NONE FOR SI OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, INOPERABILITY OF TRAIN B PUMPING FOR SECONDARY BRCIRC	
01.2.03.08.1	G-50A	SEQ 2 (41-9, 11)	CONTACTS CLOSED (OFF)	TRAIN B SI PUMP OVERLOAD TRIP NOT DEPLETED UNTIL RS-5 CONTACTS OPEN UPON BV-851A NOT CLOSED	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY BRCIRC, NONE REQUIRED FOR LO-LO RWST LEVEL TRIP	REDUCED RELIABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BRCIRC	NORMAL POSITION

EMERGENCY COBB COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONOFFER UNIT 1
TABLE 1-1. SAFETY INJECTION / MAIN FW ISOLATION FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.03.08.2	G-50A	SBQ 2 (41-9, 11)	CONTACTS OPEN (ON)	TRAIN B SI PUMP OVERLOAD TRIP DEPRATED	PERIODIC TESTING	(SAME AS 1.2.3.8.1)	(SAME AS 1.2.3.8.1)	INCREASED RISK OF SI PUMP MOTOR DAMAGE DURING NORMAL SURVEILLANCE TESTING
01.2.03.09.1	G-50A	83-5 (RELAY)	CONTACTS CLOSED (OFF)	TRAIN B SI PUMP OVERLOAD TRIP NOT DEPRATED AFTER SBQ BLOCK/RSBT	PERIODIC TESTING	(SAME AS 1.2.3.8.1)	(SAME AS 1.2.3.8.1)	NORMAL POSITION. INTERLOCK FROM SUCTION VALVE HV-853A POSITION
01.2.03.09.2	G-50A	83-5 (RELAY)	CONTACTS OPEN (ON)	(SAME AS 1.2.3.8.2)	PERIODIC TESTING	(SAME AS 1.2.3.8.1)	(SAME AS 1.2.3.8.1)	(SAME AS 1.2.3.8.2)
01.2.03.10.1	G-50A	BUS 82C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B SI PUMP CANNOT BE STARTER OR TRIPPER	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC. REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC. REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	
01.2.04.01.1	HV-853A	VALVE/ACTUATOR	OPEN	CONDENSATE FLOW DIVERTED TO RWST VIA SI MINIFLOW IF PRIOR TO SIS/SISLOP. NO EFFECT AFTER SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC SURVEILLANCE	ADMINISTRATIVE CONTROLS ON RWST BORON CONCENTRATION	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	(INCLUDES SV-1, SV-2, SV-526. TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST
01.2.04.01.2	HV-853A	VALVE/ACTUATOR	CLOSED	TRAIN B SI PUMP DISCHARGE TO FW PUMP SUCTION BLOCKED	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	NORMAL POSITION (FW PUMP IN FW MODE)
01.2.04.02.1	HV-853A	83-1 (RELAY)	ON	NONE. CONTACTS JUMPED TO TRAIN B HEATER DRAIN PUMP (SAME AS 1.2.4.2.1)	PERIODIC TESTING	NONE REQUIRED	NONE	RELAY ENERGIZED BY HV-853A OPEN LIMIT SWITCHES
01.2.04.02.2	HV-853A	83-1 (RELAY)	OFF	SUCTION VALVE HV-853A CLOSED	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN B FW PUMP WILL TRIP 30 SEC AFTER SIS/SISLOP	NORMAL POSITION
01.2.04.03.1	HV-853A	83-2 (RELAY)	ON	SIGNAL WILL NOT CLEAR TO TRAIN B FW PUMP PROTECTIVE TRIP CIRCUIT AFTER SIS/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN B FW PUMP WILL TRIP 30 SEC AFTER SIS/SISLOP	RELAY ENERGIZED BY HV-853A CLOSED LIMIT SWITCHES
01.2.04.03.2	HV-853A	83-2 (RELAY)	OFF	SUCTION VALVE HV-853A CLOSED PROTECTIVE TRIP DISABLED FOR TRAIN B FW PUMP	PERIODIC TESTING	NONE REQUIRED	NONE	
01.2.04.04.1	HV-853A	83-3 (RELAY)	ON	NONE. CONTACTS JUMPED IN CONDENSATE PUMP CIRCUITS	NONE REQUIRED	NONE REQUIRED	NONE	RELAY ENERGIZED BY HV-853A OPEN LIMIT SWITCHES
01.2.04.04.2	HV-853A	83-3 (RELAY)	OFF	NONE. CONTACTS JUMPED IN CONDENSATE PUMP CIRCUITS	NONE REQUIRED	NONE REQUIRED	NONE	
01.2.04.05.1	HV-853A	83-5 (RELAY)	ON	TRAIN B SI/FW PUMP OVERLOAD TRIPS DEPRATED, FW PUMP MINIFLOW REALIGN TO RWST. NO EFFECT AFTER SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.2.4.1.1)	(SAME AS 1.2.4.1.1)	RELAY ENERGIZED BY HV-853A NOT CLOSED LIMIT SWITCHES
01.2.04.05.2	HV-853A	83-5 (RELAY)	OFF	TRAIN B FW PUMP MINIFLOW VALVE REALIGNMENT AND SI/FW PUMP OVERLOAD TRIP DEPRATED NOT SEALED IN, RESULTING IN REALIGNMENT OF MINIFLOW TO CONDENSER AFTER SBQ BLOCK/RSBT	PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW. BACKUP MANUAL MINIFLOW ISOLATION VALVES (FWS-472, 476) FOR RWST INVENTORY	*PARTIAL DIVERSION OF SI FLOW FROM TRAIN B AFTER SBQ BLOCK/RSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE. LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TRIMS
01.2.04.05.3	HV-853A	SBQ 2 (13-6, 8)	CONTACTS OPEN (OFF)	HV-853A FAILS TO OPEN (REMAINS CLOSED) ON SIS/SISLOP. NO EFFECT IF AFTER SIS/SISLOP, DUE TO SIGNAL SEAL-IN VIA 83-4 RELAY CONTACTS WITHIN VALVE CONTROL CIRCUIT	PERIODIC TESTING	(SAME AS 1.2.4.1.2)	(SAME AS 1.2.4.1.2)	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.04.06.2	HV-853A	8BQ 2 (19-G, 8)	CONTACTS CLOSED (ON)	(SAME AS 1.2.4.1.1)	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.2.4.1.1)	(SAME AS 1.2.4.1.1)	
01.2.04.07.1	HV-853A	125VDC BUS #2 (12-211)	VOLTS LOW	HV-853A FAILS TO OPEN (REMAINS CLOSED) ON SIS/SISLOP. RELAY 83-2 FAILS OFF, DISABLING TRAIN B FW PUMP SUCTION VALVE CLOSED PROTECTIVE TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BCCIRC	
01.2.04.08.1	HV-853A	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR SYSTEM RESET AFTER INJECTION TERMINATION	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-526. VALVE REQUIRED TO REMAIN OPEN FOR SI AND SECONDARY BCCIRC
01.2.05.01.1	HV-854A	VALVE/ACTUATOR	OPEN	TRAIN B FW PUMP SUCTION NOT ISOLATED FROM CONDENSATE AND HEATER DRAIN PUMPS ON SIS/SISLOP. VALVE POSITION INTERLOCK BLOCKS HV-854A OPENING	PERIODIC TESTING	REDUNDANT TRAIN FOR FLOW. CONDENSATE, HEATER DRAIN PUMP TRIPS AND DISCHARGE VALVE INTERLOCK PREVENT CONDENSATE INJECTION	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BCCIRC	NORMAL POSITION (FW PUMP IN FW MODE). INCLUDES SV-1, SV-2, SV-527
01.2.05.01.2	HV-854A	VALVE/ACTUATOR	CLOSED	LOSS OF CONDENSATE FLOW TO TRAIN B FW PUMP IF PRIOR TO SIS/SISLOP, INABILITY TO RESET TO FW ALIGNMENT FOLLOWING INJECTION IF AFTER SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BCCIRC IF FW PUMP FAILURE OCCURS	TRAIN B FW PUMP FAILURE COULD OCCUR DUE TO CAVITATION PRIOR TO SIS/SISLOP
01.2.05.02.1	HV-854A	Z3C-3851A1 Z3C-3851A3	CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR SEAL-IN OF VALVE CLOSE SIGNAL AFTER SBQ BLOCK/RESET (ONB LIMIT SWITCH). NO EFFECT ON SIS/SISLOP SIGNAL SEAL-IN OR CONDENSATE, HEATER DRAIN PUMP TRIPS	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. VALVE POSITION INTERLOCK FROM HV-854A. INTERLOCK BLOCKS MANUAL ACTUATION OPEN AFTER SBQ BLOCK/RESET AND RESET OF SIS/SISLOP SIGNAL SEAL-IN BY HV-854A HANDSWITCH
01.2.05.02.2	HV-854A	Z3C-3851A1 Z3C-3851A3	CONTACTS CLOSED (ON)	(SAME AS 1.2.5.1.2)	CONTROL ROOM INDICATION	(SAME AS 1.2.5.1.2)	(SAME AS 1.2.5.1.2)	
01.2.05.03.1	HV-854A	SV-2900	OFF (CLOSED)	LOSS OF INTER-DISC PRESSURE VENT/RELIEF FOR HV-854A. NO EFFECT ON HV-854A	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BCCIRC	INOPERABILITY OF TRAIN B PUMPING FOR SI, NONE FOR SECONDARY BCCIRC	NORMAL POSITION. INTER-DISC CAVITY VENT/RELIEF REQUIRED TO OPEN HV-854A FOR SI. HV-851B CLOSED IS NORMAL FOR SECONDARY BCCIRC
01.2.05.03.2	HV-854A	SV-2900	ON (OPEN)	HV-854A INTER-DISC CAVITY CONTINUOUSLY VENTED TO FW PUMP SID. NO EFFECT ON HV-854A OR HV-854A SI REALIGNMENT, BUT DISABLES CONTAINMENT ISOLATION FUNCTION OF HV-854A	PERIODIC TESTING	NONE REQUIRED	NONE	*CONTAINMENT ISOLATION FUNCTION EVALUATED IN BSP SPA. NOV-850A/B/C ARE REDUNDANT CONTAINMENT ISOLATION VALVES TO HV-854A/B AND SV-2900/3900, BUT PENETRATIONS AND VALVES NOT TYPICALLY TESTED PER 10CFR50 APPENDIX J
01.2.05.04.1	HV-854A	Z30-3851A2 Z30-3851A4	CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR HV-854A CLOSED INTERLOCK TO HV-851A CIRCUIT (ONB SWITCH). REMAINING SWITCH PROVIDES SIGNAL AS REQUIRED	PERIODIC TESTING	(SAME AS 1.2.5.3.1)	RELIABILITY REDUCED FOR TRAIN B SI PUMPING, NONE FOR SECONDARY BCCIRC	NORMAL POSITION. VALVE POSITION INTERLOCK TO HV-851A. CONTACTS CLOSED WHEN HV-854A CLOSED

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION EMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.05.01.2	HV-851A	ZSO-3854A2 ZSO-3854A1	CONTACTS CLOSED (ON)	HV-851A CLOSED INTERLOCK TO HV-851A DEPRATED. HV-851A WILL BEGIN OPENING CONCURRENTLY WITH HV-851 CLOSING	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED (MSLB ANALYSIS BOUNDS POTENTIAL CONDENSATE INJECTION)	INJECTION OF CONDENSATE FROM ONE TRAIN DURING PW PUMP REALIGNMENT	
01.2.05.05.1	HV-851A	SRQ 2 (18-10, 12)	CONTACTS OPEN (OFF)	HV-851A FAILS TO CLOSE (REMAINS OPEN) ON SIS/SISLOP. NO EFFECT IF AFTER SIS/SISLOP DUE TO SIGNAL SEAL-IN VALVE CIRCUIT	PERIODIC TESTING	(SAME AS 1.2.5.1.1)	(SAME AS 1.2.5.1.1)	NORMAL POSITION
01.2.05.05.2	HV-851A	SRQ 2 (18-10, 12)	CONTACTS CLOSED (ON)	(SAME AS 1.2.5.1.2)	PERIODIC TESTING	(SAME AS 1.2.5.1.2)	(SAME AS 1.2.5.1.2)	
01.2.05.06.1	HV-851A	125VDC BUS #2 (12-211)	VOLTS LOW	HV-851A FAILS TO CLOSE (REMAINS OPEN) ON SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR FLOW. CONDENSATE, HEATER DRAIN PUMP TRIPS AND DISCHARGE VALVE INTERLOCK PREVENT CONDENSATE INJECTION	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BCCIRC	
01.2.05.07.1	HV-851A	19A	PRESSURE LOW	19A UNAVAILABLE TO REPOSITION VALVE OPEN FOR SYSTEM RESET AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY 3V-527. VALVE REQUIRED TO CLOSE FOR SI AND SECONDARY BCCIRC
01.2.06.01.1	G-3A	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN B PW PUMP FLOW	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BCCIRC	INCLUDES LUBE OIL FAN COOLER B-17A. PUMP REQUIRED FOR SECONDARY BCCIRC UNTIL SI PUMP CAN DELIVER REQUIRED FLOW VIA IDLR/WINDMILLING PW PUMP
01.2.06.02.1	G-3A	BUS #2C (152-12C04)	OPEN	TRAIN B PW PUMP FAILS TO RESTART FOR SI (ON SIS/SISLOP) OR FOR SECONDARY BCCIRC (MANUALLY) OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BCCIRC	
01.2.06.02.2	G-3A	BUS #2C (152-12C04)	CLOSED	TRAIN B PW PUMP FAILS TO TRIP DURING SIS/SISLOP STARTING SEQUENCE OR ON LO-LO RWST LEVEL. MAINTAINS DIFFERENTIAL PRESSURE ON HV-851A VALVE DISC AND DEGRADES TRAIN B BUS VOLTAGES DURING LOAD SEQUENCE	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY BCCIRC, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BCCIRC, INCREASED RESPONSE TIME FOR TRAIN B MOTOR-OPERATED VALVES (NOV-850A, NOV-21), REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION. BREAKER TRIPPED AND RECLOSURE ON 11 SEC TIME DELAY FOLLOWING SIS/SISLOP. PUMP UNAVAILABLE FOR SECONDARY BCCIRC DUE TO CAVITATION FAILURE AFTER SI PUMP TRIP ON LO-LO RWST LEVEL
01.2.06.03.1	G-3A	LSL1-3088 LSL/LSL1-3089 LSL/LSL1-3090	OFF (HIGH)	1/3 LOW RWST LEVEL TRIP INPUTS DISABLED TO TRAIN B PW PUMP. TRAIN B PW PUMP TRIP LOGIC BECOMES 2/2 ON REMAINING INPUTS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. INTERLOCK FROM G-50A CONTROL CIRCUIT
01.2.06.03.2	G-3A	LSL1-3088 LSL/LSL1-3089 LSL/LSL1-3090	ON (LOW)	1/3 LOW RWST LEVEL INPUTS TRIPPED, TRAIN B PW PUMP TRIP LOGIC BECOMES 1/2 ON REMAINING INPUTS	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BCCIRC	REDUCED RELIABILITY OF TRAIN B PUMPING FOR SI, NONE FOR SECONDARY BCCIRC	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM OMOFBB UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FM ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
01.2.06.04.1 G-3A	RTX (FM)	OFF		TRAIN B FM PUMP TRIP ON LOW RWST LEVEL AND TRAIN B FM PUMP INPUT TO MOV-850A/B/C CLOSURE DISABLED	PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT INPUT FROM SI PUMP FOR MOV CLOSURE ON LO-LO RWST LEVEL	NONE FOR SI, REDUCED RELIABILITY OF AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION
01.2.06.04.2 G-3A	RTX (FM)	ON		TRAIN B FM PUMP TRIPS, CANNOT BE RESTARTED. TRAIN B LOW RWST LEVEL SIGNAL TO MOV-850A/B/C VIA RELAYS RTXR, RTXB, RTXC	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC PUMPING, INPUTS FROM REDUNDANT TRAIN TO PREVENT PREMATURE MOV-850A/B/C CLOSURE	(SAME AS 1.2.6.1.1)	
01.2.06.05.1 G-3A	HS-3091 HS-3091A	CONTACTS CLOSED (OFF)		SI/SISLOP SIGNAL SERIAL-IN TO TRAIN B SI/FM PUMPS CANNOT BE RESET AFTER SBQ BLOCK/RESET (ONN SWITCH)	PERIODIC TESTING	NONE REQUIRED FOR SI OR LO-LO RWST LEVEL TRIP, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, INOPERABILITY OF TRAIN B PUMPING FOR SECONDARY RECIRC	NORMAL POSITION. BOTH SWITCHES MUST OPEN FOR RESET. RESET REQUIRED TO PERMIT PUMP RESTART FOR SECONDARY RECIRC AFTER LO-LO RWST LEVEL TRIP
01.2.06.05.2 G-3A	HS-3091 HS-3091A	CONTACTS OPEN (ON)		TRAIN B SI/SISLOP SIGNAL SERIAL-IN REDUNDANCY FOR LOW RWST LEVEL TRIP REDUCED TO 1/1 ON REMAINING RESET SWITCH	PERIODIC TESTING	REDUNDANT INPUTS FROM SI PUMP FOR MOV CLOSURE ON LO-LO RWST LEVEL, NONE REQUIRED FOR SI AND SECONDARY RECIRC	REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, NONE FOR SI OR SECONDARY RECIRC	
01.2.06.06.1 G-3A	152-12C04 "b" CONTACT	OPEN		TRAIN B HEATER DRAIN PUMP DOES NOT AUTOMATICALLY TRIP ON FM PUMP TRIP. SI/SISLOP TRIP UNAPPECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. HEATER DRAIN PUMP TRIPS ON SEPARATE SBQ INPUT FOR SI, CAN ALSO BE TRIPPED MANUALLY FOR SECONDARY RECIRC
01.2.06.06.2 G-3A	152-12C04 "b" CONTACT	CLOSED		TRAIN B HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	(SAME AS 1.2.6.6.1)	(SAME AS 1.2.6.6.1)	
01.2.06.07.1 G-3A	83-2 (RELAY)	CONTACTS OPEN (OFF)		TRAIN B FM PUMP PROTECTIVE TRIP ON SUCTION VALVE HV-853A CLOSED DISABLED	PERIODIC TESTING	(SAME AS 1.2.6.6.1)	(SAME AS 1.2.6.6.1)	NORMAL POSITION
01.2.06.07.2 G-3A	83-2 (RELAY)	CONTACTS CLOSED (ON)		SUCTION VALVE HV-853A CLOSED SIGNAL WILL TRIP TRAIN B FM PUMP 30 SEC AFTER SI/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	INOPERABILITY OF TRAIN B PUMPING FOR SI, NONE FOR SECONDARY RECIRC	SI/SISLOP BLOCK/RESET WOULD OCCUR BEFORE PUMP RESTART FOR SECONDARY RECIRC
01.2.06.08.1 G-3A	83-5 (RELAY)	OFF		SI/SISLOP SERIAL-IN DISABLED TO TRAIN B FM PUMP SUCTION VALVE PROTECTIVE TRIP, OVERLOAD TRIP DEPRAT AND RWST MINIFLOW VALVE CV-875A. FM PUMP MINIFLOW VALVES WILL REALIGN TO CONDENSER AFTER SBQ BLOCK/RESET	PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW, BACKUP MANUAL MINIFLOW ISOLATION VALVES (PMS-472, 476) FOR RWST INVENTORY AND SECONDARY RECIRC	*PARTIAL DIVERSION OF TRAIN B SI FLOW AFTER SBQ BLOCK/RESET VIA MINIFLOW VALVE CV-36 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE. LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS
01.2.06.08.2 G-3A	83-5 (RELAY)	ON		SI/SISLOP SERIAL-IN SIGNAL TO TRAIN B FM PUMP MINIFLOW VALVE CV-875A AND OVERLOAD TRIP DEPRAT, CAUSING REALIGNMENT OF TRAIN B FM PUMP MINIFLOW TO RWST. NO EFFECT AFTER SI/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	ADMINISTRATIVE CONTROLS ON RWST BORON CONCENTRATION	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SI/SISLOP. NO EFFECT IF AFTER.	TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PHSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMBERRNT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.06.09.1 G-3A	CV-875A	OPRN	PARTIAL DIVERSION OF CONDENSATE FLOW FROM TRAIN B PW PUMP TO RWST IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	CONTROL ROOM INDICATION	(SAME AS 1.2.6.8.2)	*(SAME AS 1.2.6.8.2)		(INCLUDES SV-875A, LS-2 (ZSC-1875A))
01.2.06.09.2 G-3A	CV-875A	CLOSED	LOSS OF TRAIN B PW PUMP MINIFLOW PROTECTION FOLLOWING SIS/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC		NORMAL POSITION. MINIFLOW REQUIRED TO PREVENT PUMP FAILURE FOR SBLOCA AND NSLB
01.2.06.10.1 G-3A	CV-36	OPRN	DIVERSION OF TRAIN B PW PUMP MINIFLOW TO CONDENSER	PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW. BACKUP MANUAL MINIFLOW ISOLATION VALVES (PWS-172, 176) FOR RWST INVENTORY	*PARTIAL DIVERSION OF TRAIN B PW PUMP FLOW TO CONDENSER VIA MINIFLOW VALVE CV-36		*INCLUDES SV-17, 17A. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS
01.2.06.10.2 G-3A	CV-36	CLOSED	LOSS OF TRAIN B PW PUMP MINIFLOW PROTECTION DURING NORMAL OPERATION	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC		NORMAL POSITION AT POWER. VALVE OPENS PNEUMATICALLY ON LOW CONDENSATE FLOW (SG. FOLLOWING PW PUMP TRIP)
01.2.06.11.1 G-3A	SEQ 2 (19-9, 11)	CONTACTS OPEN (OFF)	TRAIN B PW PUMP FAILS TO TRIP ON SIS/SISLOP, MAINTAINING DIFFERENTIAL PRESSURE ON BV-851A VALVE DISC AND DEGRADING TRAIN B BUS VOLTAGES DURING LOAD SEQUENCE	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC, REDUNDANT INPUTS FROM SI PUMP FOR MOV CLOSURE ON LO-LO RWST LEVEL	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, INCREASED RESPONSE TIME OF TRAIN B MOTOR OPERATED VALVES (MOV-850A, MOV-21), REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL		NORMAL POSITION. PW PUMP TRIP REQUIRED FOR BV-851A/B REALIGNMENT. PUMP COULD BE UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURE AFTER SI PUMP TRIP ON LO-LO RWST LEVEL
01.2.06.11.2 G-3A	SEQ 2 (19-9, 11)	CONTACTS CLOSED (ON)	TRAIN B PW PUMP TRIPS, RESTARTS 11 SEC LATER. CANNOT BE RESTARTED AFTER LOW RWST LEVEL TRIP	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC, NONE REQUIRED FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, NONE FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL		FAILURE OCCURRING PRIOR TO SIS/SISLOP WOULD HAVE SAME EFFECT ON SI FUNCTION AS FAILURE TO TRIP
01.2.06.12.1 G-3A	SEQ 2 (42-1, 3)	CONTACTS CLOSED (OFF)	TRAIN B PW PUMP OVERLOAD TRIP DEPRAT DISABLED UNTIL HV-853A BEGINS TO OPEN	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B SI PUMPING		NORMAL POSITION
01.2.06.12.2 G-3A	SEQ 2 (42-1, 3)	CONTACTS OPEN (ON)	TRAIN B PW PUMP OVERLOAD TRIP OPERATED	PERIODIC TESTING	(SAME AS 1.2.6.12.1)	(SAME AS 1.2.6.12.1)		
01.2.06.13.1 G-3A	SEQ 2 (53-1, 3)	CONTACTS OPEN (OFF)	TRAIN B PW PUMP MINIFLOW DOES NOT ISOLATE TO CONDENSER ON SIS/SISLOP, PW PUMP PROTECTIVE TRIP ON SUCTION VALVE BV-853A CLOSED ALSO DISABLED	PERIODIC TESTING	(SAME AS 1.2.6.10.1)	*(SAME AS 1.2.6.10.1)		NORMAL POSITION
01.2.06.14.2 G-3A	SEQ 2 (53-1, 3)	CONTACTS CLOSED (ON)	TRIPS TRAIN B PW PUMP AFTER 30 SEC AND PROVIDES CLOSE PERMISSIVE TO TRAIN B PW PUMP MINIFLOW VALVE CV-36 IF PRIOR TO SIS/SISLOP. AFTER SIS/SISLOP, HV-853A OPENING WILL CLEAR PW PUMP PROTECTIVE TRIP SIGNAL	CONTROL ROOM INDICATION	NONE REQUIRED	NONE		TRAIN B VALVES WILL RESPOND NORMALLY AND PW PUMP WILL RESTART AS REQUIRED

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS QUOPER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCS	REMARKS
01.2.06.14.1 G-3A		SEQ 2 (38-9, 11)	CONTACTS OPEN (OFF)	TRAIN B PW PUMP MINIFLOW VALVES WILL NOT REALIGN TO BUST UNTIL HV-853A BEGINS TO OPEN	PERIODIC TESTING	REDUNDANT CONTACT FROM HV-853A AND REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	REDUCED RELIABILITY OF TRAIN B PUMPING FOR SI, NONE FOR SECONDARY RECIRC	NORMAL POSITION
01.2.06.14.2 G-3A		SEQ 2 (38-9, 11)	CONTACTS CLOSED (ON)	TRAIN B PW PUMP MINIFLOW VALVES REALIGN TO BUST	CONTROL ROOM INDICATION, PERIODIC TESTING	ADMINISTRATIVE CONTROLS ON BUST BORON CONCENTRATION	*REDUCTION IN BUST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE BUST
01.2.06.15.1 G-3A		BUS 02C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B PW PUMP CANNOT BE TRIPPED OR RESTARTED, AND ITS MINIFLOW REMAINS ALIGNED TO CONDENSER	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC PUMPING, BACKUP MANUAL MINIFLOW ISOLATION VALVES (PWS-472, 476) FOR BUST INVENTORY	*IMPROBABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN B FLOW TO CONDENSER VIA CV-36	*BUST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS
01.2.06.16.1 G-3A		MCC-2 (42-1282)	VOLTS LOW	LOSS OF TRAIN B PW PUMP LUBR OIL COOLER	CONTROL ROOM INDICATION	REDUNDANT TRAIN	IMPROBABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	LUBR OIL PUMP COOLER B-17A REQUIRED FOR EXTENDED PW PUMP OPERATION DURING SBLOCA OR HSLB INSIDE CONTAINMENT
01.2.06.17.1 G-3A		ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION PW PUMP MINIFLOW VALVES CV-36 AND CV-875A	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	NONE. TRAIN B PW PUMP MINIFLOW VALVES REPOSITION AS REQUIRED USING SAFETY RELATED BACK-UP NITROGEN	ISA IS A NON-SAFETY RELATED, NON-SEISMIC SYSTEM
01.2.06.18.1 G-3A		GNI	PRESSURE LOW	BACKUP NITROGEN UNAVAILABLE TO REPOSITION PW PUMP MINIFLOW VALVES CV-36 AND CV-875A	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC PUMPING, MANUAL BACKUP MINIFLOW ISOLATION VALVES (PWS-472, 476) FOR BUST INVENTORY	*IMPROBABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN B SI FLOW TO CONDENSER	*TRAIN B PW PUMP MAY FAIL DURING SBLOCA OR HSLB IF CV-875A CLOSED. BUST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE OPEN, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS
01.2.07.01.1 HV-851A		VALVE/ACTUATOR	OPEN	TRAIN B PW FLOW ALIGNED TO SI HEADER (IF PARTIALLY OPEN) OR SUCTION VALVE HV-851A CLOSURE (VIA INTERLOCK IF HV-851A FULLY OPEN) IF PRIOR TO SIS/SISLOP. NO EFFECT AFTER SIS/SISLOP, BUT CANNOT BE RECIRCLED FOR SECONDARY RECIRC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SI FLOW, REDUNDANT MOV-850A/B/C CLOSURE FOR SECONDARY RECIRC BOUNDARY. HSLB ANALYSIS BOUNDS POSSIBLE AGAINST INJECTION OF CONDENSATE TO RCS	IMPROBABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE TO RCS	TRAIN B PW PUMP FAILURE MAY OCCUR DUE TO CAVITATION IF INTERLOCK CLOSURE HV-851A PRIOR TO SIS/SISLOP
01.2.07.01.2 HV-851A		VALVE/ACTUATOR	CLOSED	TRAIN B PW PUMP SI FLOW PATH BLOCKED	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	IMPROBABILITY OF TRAIN B PUMPING FOR SI, NONE FOR SECONDARY RECIRC	NORMAL POSITION. FAILURE CAN RESULT FROM INADEQUATE ACTUATOR THRUST TO OVERCOME DRAG FORCES IF SV-2900/3900 FAILS TO VENT INTER-DISC CAVITY OR PW PUMP FAILS TO TRIP
01.2.07.02.1 HV-851A		Z30-3854A2 Z30-3854A4	CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR OPEN PERMISSIBLE TO HV-851A (ONE SWITCH). REMAINING SWITCH PROVIDES SIGNAL AS REQUIRED	PERIODIC TESTING	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	RELIABILITY REDUCED FOR TRAIN B SI PUMPING, NONE FOR SECONDARY RECIRC	NORMAL POSITION. INTERLOCK FROM HV-851A NOT CLOSED LIMIT SWITCHES

EMERGENCY COBB COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SIM ONOPER UNIT 1
 TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION ENRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECS	REMARKS
01-2.07.02.2	HV-851A	Z90-3851A2 Z90-3851A4	CONTACTS CLOSED (OH)	INTERLOCK FROM HV-851A DEPARTED, HV-851A WILL BEGIN OPENING CONCURRENTLY WITH HV-851A CLOSING	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED (JESL ANALYSIS BOUNDS POTENTIAL CONDENSATE INJECTION)		
01-2.07.03.1	HV-851A	Z90-3851A1 Z90-3851A3	CONTACTS OPEN (OFF)	REDUCED REDUNDANCY FOR CLOSE SIGNAL SERIAL-IN TO HV-851A AFTER 899 BLOC/RESET (ONE LIMIT SWITCH)	CONTROL ROOM INDICATION PERIODIC TESTING	BOUNDARY LIMIT SWITCH, CONDENSATE AND WATER DRAIN PUMP TRIPS	REDUCED REDUNDANCY AGAINST CONDENSATE INJECTION FROM TRAIN B PW PUMP	NORMAL POSITION
01-2.07.03.2	HV-851A	Z90-3851A1 Z90-3851A3	CONTACTS CLOSED (OH)	CLOSE INTERLOCK SIGNAL TO HV-851A, CAUSING LOSS OF CONDENSATE FLOW TO TRAIN B PW PUMP PRIOR TO SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	BOUNDARY TRAIN	IMPROBABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY BECIBC IF PW PUMP FAILS	TRAIN B PW PUMP FAILURE MAY RESULT FROM CAVITATION PRIOR TO SIS/SISLOP
01-2.07.04.1	HV-851A	899 Z (18-9, 11)	CONTACTS CLOSED (OH)	HV-851A WILL OPEN AS REQUIRED ON HV-851A CLOSED INTERLOCK SIGNAL. VALVE CANNOT BE RECLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION	PERIODIC TESTING	(SAME AS 1.2.1.1.2)	NONE FOR SI, REDUCED REDUNDANCY E.H.-850A/B/C PROVIDE REDUNDANT REDUNDANT NOV-850A/B/C CLOSURE AGAINST CONDENSATE INJECTION TO ISOLATION FOR SECONDARY BECIBC	
01-2.07.04.2	HV-851A	899 Z (18-9, 11)	CONTACTS OPEN (OFF)	(SAME AS 1.2.1.1.2)	PERIODIC TESTING	(SAME AS 1.2.1.1.2)	(SAME AS 1.2.1.1.2)	NORMAL POSITION
01-2.07.05.1	HV-851A	125VDC BUS 02 (12-21)	VOLTS LOW	TRAIN B PW PUMP SI FLOW PATH BLOCKED	CONTROL ROOM INDICATION	BOUNDARY TRAIN FOR SI, NONE REQUIRED FOR SECONDARY BECIBC	BOUNDARY TRAIN FOR SI, NONE FOR SECONDARY BECIBC	
01-2.07.06.1	HV-851A	15A	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	BACKUP NITROGEN	VALVE WILL REPOSITION AS AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-52A
01-2.07.07.1	HV-851A	GM1	PRESSURE LOW	BACKUP NITROGEN UNAVAILABLE TO PERIODIC SURVEILLANCE REPOSITION VALVE CLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	PERIODIC SURVEILLANCE	NON-SAFETY RELATED ISA SYSTEM CAN BE CREDITED FOR RELIABILITY FOR SECONDARY BECIBC ALIGNMENT	NON-SAFETY RELATED ISA SYSTEM CAN BE CREDITED FOR RELIABILITY FOR SECONDARY BECIBC ALIGNMENT	15-1-5
01-2.08.01.1	HV-852A	VALVE/ACTUATOR	OPEN	SI FLOW FROM BOTH TRAINS DIVERTED INTO NON-SEISMIC PORTION OF MAIN PW HEADER UNTIL BACKUP VALVES CLOSED. REQUIRED POSITION FOR SECONDARY RECIRCULATION	PERIODIC TESTING	REDUNDANT PW ISOLATION VALVES (SI DELIVER TIME INCREASED, SI RELIABILITY REDUCED) VIA PCV-456, 457, 458, CV-142, 143, 144, NOV-20, 21, 22 ASSURED IN LOCAL/SIB ANALYSIS. HEADERS. NONE FOR NON-SEISMIC HEADER	SI NORMAL POSITION. INCLUDES SV-1, SV-2, SV-525. BACKUP VALVES ARE SAFETY RELATED. SEISMIC CATEGORY A. VALVE OPEN NORMAL FOR SECONDARY BECIBC	
01-2.08.01.2	HV-852A	VALVE/ACTUATOR	CLOSED	VALVE CANNOT BE OPENED FOR SYSTEM RESET OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM INDICATION PERIODIC TESTING	NONE FOR SI, IMPROBABILITY OF TRAIN B PUMPING FOR SECONDARY BECIBC	NONE FOR SI, IMPROBABILITY OF TRAIN B PUMPING FOR SECONDARY BECIBC	
01-2.08.02.1	HV-852A	899 Z (18-2, 4)	CONTACTS OPEN (OFF)	(SAME AS 1.2.8.1.1)	PERIODIC TESTING	(SAME AS 1.2.8.1.1)	(SAME AS 1.2.8.1.1)	NORMAL POSITION
01-2.08.02.2	HV-852A	899 Z (18-2, 4)	CONTACTS CLOSED (OH)	(SAME AS 1.2.8.1.2)	PERIODIC TESTING	(SAME AS 1.2.8.1.2)	(SAME AS 1.2.8.1.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
01.2.09.01.1	125VDC BUS #2 (72-211)	125VDC BUS #2 (72-211)	VOLTS LOW	SI FLOW FROM ROTR TRAILS DIVERTED INTO NON-SIS/ISIC POSITION OF MAIN FW HEADER UNTIL BACKUP VALVES CLOSED. REQUIRED POSITION FOR SECONDARY RECIRCULATION IS UNAVAILABLE TO REPOSITION VALVE OPEN FOR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED.	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT FW ISOLATION VALVES PCV-156, 457, 458, CV-142, 143, 144, NOV-20, 21, 22 ASSURED IN LOCAL/BAKUP ANALYSIS NONE FOR NON-SIS/ISIC HEADER DURING SI. NONE REQUIRED FOR SI, IMPROBABILITY OF TRAIN & PUMPING FOR SECONDARY RECIRC. NON-SAFETY RELATED ISA SYSTEM CAN BE CREDITED FOR NSLS IN CONTAINMENT PER SEP SECTION 15.1.5. AIR-OPERATED HYDRAULIC PUMP IN VALVE ACTUATOR ISOLATED BY SV-525	SI VALVE OPEN NORMAL FOR SECONDARY RECIRC	
01.2.09.01.2	NOV-850A	VALVE/ACTUATOR	OPEN	NO EFFECT ON INJECTION. VALVE CANNOT BE CLOSED ON LOW BUST LEVEL TO TERMINATE INJECTION FLOW OR RESET-MANUALLY FOR SECONDARY RECIRC BOUNDARY INJECTION PATH BLOCKED TO RCS LOOP A.	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED FOR SI, REDUCED REDUNDANCY SECONDARY PUMP TRIPS FOR LO-LO FOR AUTO-TERMINATION OF SI ON BUST LEVEL, REDUNDANT VALVES LO-LO BUST LEVEL, AND FOR FOR SECONDARY RECIRC BOUNDARY SECONDARY RECIRC	NONE FOR SI, REDUCED REDUNDANCY SECONDARY PUMP TRIPS FOR LO-LO FOR AUTO-TERMINATION OF SI ON BUST LEVEL, AND FOR FOR SECONDARY RECIRC BOUNDARY SECONDARY RECIRC	
01.2.09.02.1	NOV-850A	RT1B1 RT1B2	CONTACTS CLOSED (OFF)	REDUCED REDUNDANCY AGAINST AUTO-CLOSURE OF NOV-850A ON LOW BUST LEVEL (ONE RELAY)	CONTROL ROOM ANNUNCIATION, INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS B AND C FOR SI, NONE REQUIRED FOR SECONDARY RECIRC OR LO-LO BUST LEVEL. REDUNDANT FLOW PATHS TO LOOPS B AND C FOR SI, NONE REQUIRED FOR LO-LO BUST LEVEL OR FOR SECONDARY RECIRC	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR NSLS (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). NONE FOR SECONDARY RECIRC OR AUTO-TERMINATION OF SI ON LO-LO BUST LEVEL. VALVE AUTO-CLOSE LOGIC RECORDS INJECTION PATH FOR SI, NONE FOR 1/1 ON REMAINING RELAY INPUT AUTO-TERMINATION OF SI ON LO-LO BUST LEVEL OR FOR SECONDARY RECIRC	NORMAL POSITION NOV-850C ASSURED COMMON-CAUSE FAILURE DURING NSLS OUTSIDE CONTAINMENT DUE TO UNQUALIFIED POWER SUPPLY IN TURBINE BUILDING
01.2.09.02.2	NOV-850A	RT1B1 RT1B2	CONTACTS OPEN (ON)	AUTO-CLOSURE OF NOV-850A ON LO-LO BUST LEVEL OPERATED	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY RECIRC, REDUCED REDUNDANCY FOR PUMP TRIPS FOR LO-LO BUST LEVEL (SAME AS 1.2.9.1.2)	NONE FOR SI OR SECONDARY RECIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO BUST LEVEL (SAME AS 1.2.9.1.2)	NORMAL POSITION
01.2.09.03.1	NOV-850A	SSQ 2 (45-1.3)	CONTACTS OPEN (OFF)	NOV-850A OPENS DURING NORMAL OPERATION. NO EFFECT ON INJECTION OR AUTO-CLOSURE ON LOW BUST LEVEL.	PERIODIC TESTING	NONE REQUIRED	NONE	FAILURE MAY RESULT IN INCREASED MAIN FW PUMP ACCELERATION TIME DURING LRI/LOCA, BUT BOTH TRAINS WOULD BE AVAILABLE WITH THIS FAILURE
01.2.09.03.2	NOV-850A	SSQ 2 (45-1.3)	CONTACTS CLOSED (ON)	INJECTION PATH NOT AUTOMATICALLY ALIGNED TO RCS LOOP A ON SIS/SIS/ISLOP	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS B AND C FOR SI, NONE REQUIRED FOR LO-LO BUST LEVEL OR FOR SECONDARY RECIRC	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR NSLS (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). NONE FOR AUTO-TERMINATION OF SI ON LO-LO BUST LEVEL OR FOR SECONDARY RECIRC	
01.2.09.04.1	125VDC BUS #2 (72-211)	125VDC BUS #2 (72-211)	VOLTS LOW		CONTROL ROOM INDICATION			

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.09.05.1	MOV-850A	BCC-2 (152-1274)	VOLTS LOW	VALVE WILL NOT OPEN ON SIS/SISLOP OR RECLOSE ON LOW RWST LEVEL	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS B AND C FOR SI, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL, REDUNDANT VALVES (BV-851A/B) FOR SECONDARY RECIRC BOUNDARY	SI FLOW REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR NSLB (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURES). REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL AND FOR SECONDARY RECIRC	
01.2.10.01.1 (NOT USED)								
01.2.11.01.1	G-1A, G-1B	BUS 82C (152-12C06) (152-12C08)	OPEN	1 OF 2 CONDENSATE PUMPS TRIPPED TO TRAIN B FW PUMP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	TRAIN B POWERED CONDENSATE PUMP WOULD BE TRIPPED ON SIS/SISLOP IF RUNNING NORMAL POSITION
01.2.11.01.2	G-1A, G-1B	BUS 82C (152-12C06) (152-12C08)	CLOSED	1 OF 2 CONDENSATE PUMPS CANNOT BE TRIPPED TO TRAIN B FW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE BV-851A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN B	
01.2.11.02.1	G-1A, G-1B	194-5 (RELAYS)	CONTACTS OPEN (OFF)	1 OF 2 TRAIN B CONDENSATE PUMPS WILL NOT TRIP ON BUS UNDERVOLTAGE. SIS/SISLOP TRIP FROM SBQ UNAFFECTED	PERIODIC TESTING	(SAME AS 1.2.11.1.2)	(SAME AS 1.2.11.1.2)	NORMAL POSITION
01.2.11.02.2	G-1A, G-1B	194-5 (RELAYS)	CONTACTS CLOSED (ON)	1 OF 2 TRAIN B CONDENSATE PUMPS TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.2.11.03.1	G-1A, G-1B	88Q 2 (20-5,7) (20-9,11)	CONTACTS OPEN (OFF)	TRAIN B CONDENSATE PUMPS WILL NOT TRIP ON SBQ SIGNAL. BUS UNDERVOLTAGE TRIP UNAFFECTED	PERIODIC TESTING	(SAME AS 1.2.11.1.2)	(SAME AS 1.2.11.1.2)	NORMAL POSITION
01.2.11.03.2	G-1A, G-1B	88Q 2 (20-5,7) (20-9,11)	CONTACTS CLOSED (ON)	1 OF 2 TRAIN B CONDENSATE PUMPS TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.2.11.04.1	G-1A, G-1B	BUS 82C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B CONDENSATE PUMPS WILL NOT TRIP ON SBQ OR BUS UNDERVOLTAGE SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE BV-851A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED RELIABILITY AGAINST INJECTION OF CONDENSATE BY TRAIN B	
01.2.12.01.1	G-36A	BUS 82C (152-12C09)	OPEN	HEATER DRAIN PUMP TRIPPED TO TRAIN B FW PUMP SUCTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	HEATER DRAIN PUMP TRIPPED ON SIS/SISLOP
01.2.12.01.2	G-36A	BUS 82C (152-12C09)	CLOSED	HEATER DRAIN PUMP CANNOT BE TRIPPED TO TRAIN B FW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW. CLOSURE OF SUCTION VALVE BV-851A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN B.	NORMAL POSITION
01.2.12.02.1	G-36A	152-12C04 "b" CONTACT	OPEN	HEATER DRAIN PUMP WILL NOT TRIP ON TRAIN B FW PUMP TRIP. SBQ TRIP UNAFFECTED	PERIODIC TESTING	(SAME AS 1.2.12.1.2)	(SAME AS 1.2.12.1.2)	NORMAL POSITION DURING POWER OPERATION
01.2.12.02.2	G-36A	152-12C04 "b" CONTACT	CLOSED	TRAIN B HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.2.12.03.1	G-36A	194-4 (RELAY)	CONTACTS OPEN (OFF)	TRAIN B HEATER DRAIN PUMP WILL NOT TRIP ON BUS UNDERVOLTAGE, SBQ AND FW PUMP TRIPS UNAFFECTED	PERIODIC TESTING	(SAME AS 1.2.12.1.2)	(SAME AS 1.2.12.1.2)	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR OPERATOR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION EMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.12.03.2	G-36A	194-4	CONTACTS CLOSED (ON)	TRAIN B HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.2.12.04.1	G-36A	SRQ 2 (19-1, 3)	CONTACTS OPEN (OFF)	TRAIN B HEATER DRAIN PUMP WILL NOT TRIP ON SRQ SIGNAL. TRIP ON PW PUMP TRIP UNEXPECTED	PERIODIC TESTING	(SAME AS 1.2.12.1.2)	(SAME AS 1.2.12.1.2)	NORMAL POSITION
01.2.12.04.2	G-36A	SRQ 2 (19-1, 3)	CONTACTS CLOSED (ON)	TRAIN B HEATER DRAIN PUMP TRIPPED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.2.12.05.1	G-36A	BUS 82C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B HEATER DRAIN PUMP WILL NOT TRIP ON SRQ OR PW PUMP TRIP SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW. CLOSURE OF SUCTION VALVE BY-851A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN B	
01.3.01.01.1		HANDUAL VALVES, TRAIN C FLOW						THERE ARE NO VALVES IN THIS CATEGORY
01.3.01.02.1		CHECK VALVES, TRAIN C FLOW	NONE (PASSIVE)		PERIODIC TESTING			INCLUDES SIS-004
01.3.02.01.1		HANDUAL VALVES, TRAIN C BOUNDARY						THERE ARE NO VALVES IN THIS CATEGORY
01.3.02.02.1		CHECK OR RELIEF VALVES, TRAIN C BOUNDARY						THERE ARE NO VALVES IN THIS CATEGORY
01.3.03.01.1	NOV-850C	VALVE/ACTUATOR	OPEN	NO EFFECT ON INJECTION. VALVE CANNOT BE CLOSED ON LOW RWST LEVEL TO TERMINATE INJECTION FLOW OR REMOTE-MANUALLY FOR SECONDARY RECIRC BOUNDARY	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL, REDUNDANT VALVES FOR SECONDARY RECIRC BOUNDARY	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, AND FOR SECONDARY RECIRC	POTENTIAL COMMON-CAUSE FAILURE DURING HSLB OUTSIDE CONTAINMENT HAS NO EFFECT, BECAUSE LO-LO RWST LEVEL WILL NOT OCCUR (SINCE NO CONTAINMENT SPRAY ACTUATION OCCURS) AND SECONDARY RECIRC IS ONLY USED FOR HSLB INSIDE CONTAINMENT
01.3.03.01.2	NOV-850C	VALVE/ACTUATOR	CLOSED	INJECTION PATH BLOCED TO RCS LOOP C	PERIODIC TESTING	REDUNDANT FLOW PATHS TO LOOPS A AND B FOR SI FLOW, NONE REQUIRED FOR SECONDARY RECIRC OR LO-LO RWST LEVEL	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING) AND 2/2 LOOPS FOR HSLB, NONE FOR SECONDARY RECIRC OR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	ASSUMED COMMON-CAUSE FAILURE DURING HSLB DUE TO NON-QUALIFIED POWER SUPPLY IN TURBINE BUILDING
01.3.03.02.1	NOV-850C	RTIC1 RTIC2	CONTACTS CLOSED (OFF)	REDUCED REDUNDANCY AGAINST AUTO-CLOSURE ON LO-LO RWST LEVEL (ONE RELAY)	CONTROL ROOM ANNUNCIATION, INDICATION	REDUNDANT FLOW PATHS TO LOOPS A AND B FOR SI FLOW, NONE REQUIRED FOR LO-LO RWST LEVEL OR FOR SECONDARY RECIRC	REDUCED RELIABILITY OF LOOP C INJECTION PATH FOR SI FLOW, NONE FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL OR FOR SECONDARY RECIRC	VALVE AUTO-CLOSE LOGIC BECOMES I/I ON REMAINING RELAY INPUT
01.3.03.02.2	NOV-850C	RTIC1 RTIC2	CONTACTS OPEN (ON)	AUTO-CLOSURE OF NOV-850C ON LO-LO RWST LEVEL DEBATED	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY RECIRC, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL	NONE FOR SI OR SECONDARY RECIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION
01.3.03.03.1	NOV-850C	SRQ 1 (21-5, 7)	CONTACTS OPEN (OFF)	LOSS OF TRAIN A SIS/SISLOP ACTUATION OF LOOP C INJECTION FLOW PATH	PERIODIC TESTING	REDUNDANT INPUT FROM TRAIN B (SRQ 2), REDUNDANT FLOW PATHS TO RCS LOOPS A AND B	REDUCED REDUNDANCY FOR SI FLOW THROUGH LOOP INJECTION PATH	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PH2A

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.3.03.03.2	MOV-850C	SBQ 1 (21-5, 7)	CONTACTS CLOSED (ON)	MOV-850C OPENS DURING NORMAL OPERATION. NO EFFECT ON INJECTION OR AUTO-CLOSURE ON LOW RWST LEVEL.	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	FAILURE MAY RESULT IN INCREASED MAIN PW PUMP ACCELERATION TIME DURING LBLOCA, BUT BOTH TRAINS OF SI FLOW WOULD BE AVAILABLE WITH THIS FAILURE NORMAL POSITION
01.3.03.04.1	MOV-850C	SBQ 2 (18-6, 8)	CONTACTS OPEN (OFF)	LOSS OF TRAIN B SIS/SISLOP ACTUATION OF LOOP C INJECTION FLOW PATH (SAME AS 1.3.3.2)	PERIODIC TESTING	REDUNDANT INPUT FROM TRAIN A (SBQ 1), REDUNDANT FLOW PATHS TO RCS LOOPS A AND B (SAME AS 1.3.3.2)	REDUCED REDUNDANCY FOR SI FLOW THROUGH LOOP C INJECTION PATH	
01.3.03.04.2	MOV-850C	SBQ 2 (18-6, 8)	CONTACTS CLOSED (ON)	(SAME AS 1.3.3.2)	CONTROL ROOM INDICATION	(SAME AS 1.3.3.2)	(SAME AS 1.3.3.2)	
01.3.03.05.1	MOV-850C	UPS	VOLTS LOW	IF PRIOR TO SIS/SISLOP, MOV-850C CANNOT BE OPENED. IF AFTER, MOV-850C CANNOT BE RECLOSED	CONTROL ROOM INDICATION	REDUNDANT PATHS TO LOOPS A AND B FOR SI FLOW, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL, REDUNDANT VALVES (MV-851A/B) FOR SECONDARY RECIRC BOUNDARY	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING) AND 2/2 FOR HSLB. REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL AND FOR SECONDARY RECIRC BOUNDARY	INCLUDES BATTERY, INVERTER TB-3
01.3.03.06.1	MOV-850C	HCC-3 (8-1391)	VOLTS LOW	CAUSES LOSS OF UPS AFTER >30 MINUTES	CONTROL ROOM INDICATION	REDUNDANT PATHS TO LOOPS A AND B FOR SI FLOW, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL, REDUNDANT VALVES (MV-851A/B) FOR SECONDARY RECIRC BOUNDARY	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING) AND 2/2 FOR HSLB. REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL AND FOR SECONDARY RECIRC BOUNDARY	FAILURE MAY OCCUR > 30 MINUTES PRIOR TO SIS/SISLOP
01.4.01.01.1	MANUAL VALVES, COMMON FLOW							THERE ARE NO VALVES IN THIS CATEGORY
01.4.01.02.1	CHECK VALVES, COMMON FLOW							THERE ARE NO VALVES IN THIS CATEGORY
01.4.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	PARTIAL DIVERSION OF SI FLOW FROM BOTH TRAINS TO OTHER SYSTEMS OR ATMOSPHERE	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR COMBINED SI FLOW RATE, NORMALLY CLOSED BACKUP VALVES AND/OR ADMINISTRATIVELY CONTROLLED VALVE LOCKING FOR RWST INVENTORY	PARTIAL DIVERSION OF 2 TRAIN SI FLOW, BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW, CV-36/37 FAILURE FOR RWST INVENTORY	SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
01.4.02.01.2	MANUAL VALVES, COMMON BOUNDARY		CLOSED	NO EFFECTS ON ECCS FUNCTIONS	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
01.4.02.02.1	CHECK AND RELIEF VALVES, COMMON BOUNDARY		NORMAL (PASSIVE)	PARTIAL DIVERSION OF BOTH TRAINS OF SI FLOW FROM LOOPS A, B, C TO HOLD-UP TANK	NONE	REDUNDANT TRAINS (COMBINED FLOW) FOR FLOW RATE, NONE FOR INVENTORY	INCRB FOR SI FLOW RATE. HOWEVER, LOSS OF INVENTORY NOT INCLUDED IN RWST CALCULATION	SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. INCLUDES SIS-385 AND RV-868. SIS-385 IS A SPRING CHECK VALVE
01.4.03.01.1	MOV-20	VALVE/ACTUATOR	OPEN	PW BLOCK VALVE TO S/G B CANNOT BE CLOSED	PERIODIC TESTING	REDUNDANT ISOLATION VALVES (PCV-457 OR MV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G B FOR SI AND SECONDARY RECIRC	NORMAL POSITION DURING POWER OPERATION. MOV-20 OR PCV-457 CLOSED FOR SECONDARY RECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-144
01.4.03.01.2	MOV-20	VALVE/ACTUATOR	CLOSED	MAIN PW BLOCKED TO S/G B, BYPASS PATH UNAPPROVED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE CLOSED ON SIS/SISLOP

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION PMSA

ITSN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
01.4.01.02.1 NOV-20	SRQ 1 (42-5, 7)		CONTACTS OPEN (OFF)	PW BLOCK VALVE TO S/G B WILL NOT CLOSE ON SIS/SISLOP	PERIODIC TESTING	(SAME AS 1.4.3.1.1)	(SAME AS 1.4.3.1.1)	VALVE CAN BE MANUALLY CLOSED FOR SECONDARY BECIRC
01.4.01.02.2 NOV-20	SRQ 1 (42-5, 7)		CONTACTS CLOSED (ON)	(SAME AS 1.4.3.1.2)	CONTROL ROOM INDICATION	(SAME AS 1.4.3.1.2)	(SAME AS 1.4.3.1.2)	
01.4.03.03.1 NOV-20	NCC-1 (42-1197)		VOLTS LOW	PW BLOCK VALVE TO S/G B CANNOT BE CLOSED EXCEPT LOCAL-MANUALLY	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES (PCV-457 OR NV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G B FOR SI AND SECONDARY BECIRC	NOV-20 OR PCV-457 CLOSED FOR SECONDARY BECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-144. VALVE LOCATED IN TURBINE BUILDING AND ACCESSIBLE FOR LOCAL-MANUAL CONTROL IF NEEDED DURING NSLB INSIDE CONTAINMENT
01.4.04.01.1 NOV-21	VALVE/ACTUATOR		OPEN	PW BLOCK VALVE TO S/G A CANNOT BE CLOSED	PERIODIC TESTING	REDUNDANT ISOLATION VALVES (PCV-456 OR NV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G A FOR SI AND SECONDARY BECIRC	NORMAL POSITION DURING POWER OPERATION. NOV-21 OR PCV-456 CLOSED FOR SECONDARY BECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-142
01.4.04.01.2 NOV-21	VALVE/ACTUATOR		CLOSED	MAIN PW BLOCED TO S/G A, BYPASS PATH UNAFFECTED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE CLOSED ON SIS/SISLOP
01.4.04.02.1 NOV-21	SRQ 2 (42-5, 7)		CONTACTS OPEN (OFF)	PW BLOCK VALVE TO S/G A WILL NOT CLOSE ON SIS/SISLOP	PERIODIC TESTING	(SAME AS 1.4.4.1.1)	(SAME AS 1.4.4.1.1)	VALVE CAN BE MANUALLY CLOSED FOR SECONDARY BECIRC
01.4.04.02.2 NOV-21	SRQ 2 (42-5, 7)		CONTACTS CLOSED (ON)	(SAME AS 1.4.4.1.2)	CONTROL ROOM INDICATION	(SAME AS 1.4.4.1.2)	(SAME AS 1.4.4.1.2)	
01.4.04.03.1 NOV-21	NCC-2 (42-1242)		VOLTS LOW	PW BLOCK VALVE TO S/G A CANNOT BE CLOSED EXCEPT LOCAL-MANUALLY	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES (PCV-456 OR NV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G A FOR SI AND SECONDARY BECIRC	NOV-21 OR PCV-456 CLOSED FOR SECONDARY BECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-142. VALVE LOCATED IN TURBINE BUILDING AND ACCESSIBLE FOR LOCAL-MANUAL CONTROL DURING NSLB INSIDE CONTAINMENT
01.4.05.01.1 NOV-22	VALVE/ACTUATOR		OPEN	PW BLOCK VALVE TO S/G C CANNOT BE CLOSED	PERIODIC TESTING	REDUNDANT ISOLATION VALVES (PCV-458 OR NV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G C FOR SI AND SECONDARY BECIRC	NORMAL POSITION DURING POWER OPERATION. NOV-22 OR PCV-458 CLOSED FOR SECONDARY BECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-143
01.4.05.01.2 NOV-22	VALVE/ACTUATOR		CLOSED	MAIN PW BLOCED TO S/G C, BYPASS PATH UNAFFECTED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE CLOSED ON SIS/SISLOP
01.4.05.02.1 NOV-22	SRQ 1 (58-1, 3)		CONTACTS OPEN (OFF)	PW BLOCK VALVE TO S/G C WILL NOT CLOSE ON SIS/SISLOP	PERIODIC TESTING	(SAME AS 1.4.5.1.1)	(SAME AS 1.4.5.1.1)	VALVE CAN BE MANUALLY CLOSED FOR SECONDARY BECIRC
01.4.05.02.2 NOV-22	SRQ 1 (58-1, 3)		CONTACTS CLOSED (ON)	(SAME AS 1.4.5.1.2)	CONTROL ROOM INDICATION	(SAME AS 1.4.5.1.2)	(SAME AS 1.4.5.1.2)	
01.4.05.03.1 NOV-22	NCC-1 (42-1183)		VOLTS LOW	PW BLOCK VALVE TO S/G C CANNOT BE CLOSED EXCEPT LOCAL-MANUALLY	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES (PCV-458 OR NV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G C FOR SI AND SECONDARY BECIRC	NOV-22 OR PCV-458 CLOSED FOR SECONDARY BECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-143. VALVE LOCATED IN TURBINE BUILDING AND ACCESSIBLE FOR LOCAL-MANUAL CONTROL DURING NSLB INSIDE CONTAINMENT

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	VALVE/ACTUATOR	OPERATION	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.06.01.1	PCV-456		VALVE/ACTUATOR	OPEN		MAIN PW CONTROL VALVE TO S/G A PERIODIC TESTING CANNOT BE CLOSED	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES (TRV-21 OR RV-82A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G A FOR SI AND SECONDARY RECIRC	NORMAL POSITION DURING POWER OPERATION. INCLUDES SV-456, SV-2156 AND BACKUP NITROGEN (GNI) SUPPLY. NON-21 OR PCV-456 CLOSED FOR SECONDARY RECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-142
01.1.06.01.2	PCV-456		VALVE/ACTUATOR	CLOSED		MAIN PW BLOTTED TO S/G A, BYPASS PATH UNAFFECTED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	"VALVE CLOSED ON SIS/SISLOP"
01.1.06.02.1	CV-142		VALVE/ACTUATOR	OPEN		MAIN PW BYPASS VALVE TO S/G A CANNOT BE CLOSED OR THROTTLED	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT ISOLATION VALVES (RV-452A/B) FOR SI, REDUNDANT MANUAL BLOCK VALVE AND REDUNDANT S/Gs FOR SECONDARY RECIRC	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G A FOR SI, LOSS OF SECONDARY RECIRC FLOW	NORMAL POSITION DURING STARTUP/SHUTDOWN
01.1.06.02.2	CV-142		VALVE/ACTUATOR	CLOSED		MAIN PW BYPASS ISOLATED TO S/G A, MAIN FLOW PATH UNAFFECTED	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A	NORMAL POSITION.
01.1.06.03.1	CV-142	SV-143		OFF (OPEN)		MAIN PW BYPASS VALVE TO S/G A WILL NOT CLOSE ON TRAIN A SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT SOLENOID (SV-3142)	REDUCED REDUNDANCY FOR ISOLATION OF MAIN PW BYPASS PATH TO S/G A	
01.1.06.03.2	CV-142	SV-143		ON (CLOSED)		MAIN PW BYPASS VALVE TO S/G A WILL NOT CLOSE ON TRAIN B SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.1.6.2.2)	(SAME AS 1.1.6.2.2)	
01.1.06.04.1	CV-142	SV-3142		OFF (OPEN)		MAIN PW BYPASS VALVE TO S/G A WILL NOT CLOSE ON TRAIN B SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT SOLENOID (SV-143)	REDUCED REDUNDANCY FOR ISOLATION TO S/G A	NORMAL POSITION
01.1.06.04.2	CV-142	SV-3142		ON (CLOSED)		MAIN PW BYPASS VALVE TO S/G A WILL NOT CLOSE ON TRAIN B SIS/SISLOP	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.1.6.2.2)	(SAME AS 1.1.6.2.2)	
01.1.06.05.1	CV-142	LC-453B-12 (RELAT)		CONTACTS OPEN (OFF)		S/G A OVERFILL PROTECTION SIGNAL DISABLED TO MAIN PW FLOW CONTROL VALVE (PCV-456) AND BYPASS (CV-142, VIA SV-2156)	CONTROL ROOM INDICATION PERIODIC TESTING	NONE REQUIRED FOR SI AND SECONDARY RECIRC	NONE FOR SI OR SECONDARY RECIRC	NORMAL POSITION. CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 MODIFICATIONS. BOUNDS LT-453 LOOP FAILURE LOW
01.1.06.05.2	CV-142	LC-453B-12 (RELAT)		CONTACTS CLOSED (ON)		S/G A OVERFILL PROTECTION SIGNAL CLOSING PCV-456 AND CV-142	PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. BOUNDS LT-453 LOOP FAILURE HIGH
01.1.06.05.3	CV-142	82C BUS #1 (18-1181)		VOLTS LOW		S/G A OVERFILL PROTECTION SIGNAL CLOSING PCV-456 AND CV-142	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. LT-453 LOOP FAILS HIGH ON LOSS OF POWER

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRS UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMSA

ITSM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.06.05.4	PCV-456 CV-142	VITAL BUS #1 (B-1105V)	VOLTS LOW	S/G A OVERFILL PROTECTION SIGNAL DISABLED TO PCV-456 AND CV-142	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	RELAY IS ENERGIZE TO ACTUATE AND FAILS OFF ON LOSS OF VITAL BUS POWER, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. ANNUNCIATION OCCURS ON MISMATCH CHANNEL TRIP
01.4.06.05.5	PCV-456 CV-142	LT-453 LOOP	BQ	S/G A OVERFILL PROTECTION SIGNAL CLOSURE PCV-456 AND CV-142	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-454 AND LT-455 LOOPS	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-454 AND LT-455	NONE-BQ S/G NR LEVEL ENTERS ASSUMED COMMON-CAUSE FAILURES DURING NSLB INSIDE CONTAINMENT. UPSCALD FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS
01.4.07.01.1	PCV-457	VALVE/ACTUATOR	OPEN	MAIN FW CONTROL VALVE TO S/G B CANNOT BE CLOSED	PERIODIC TESTING	REDUNDANT ISOLATION VALVES (NOV-20 OR NV-452A/B)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION TO S/G B FOR SI AND SECONDARY RECIRC	NORMAL POSITION DURING POWER OPERATION. INCLUDES SV-457, SV-3457 AND BACKUP NITROGEN (GN) SUPPLY. NOV-20 OR PCV-457 CLOSED FOR SECONDARY RECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-144
01.4.07.01.2	PCV-457	VALVE/ACTUATOR	CLOSED	MAIN FW BLOCKED TO S/G B, BYPASS PATH UNAFFECTED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE CLOSED ON SIS/SISLOP
01.4.07.02.1	CV-144	VALVE/ACTUATOR	OPEN	MAIN FW BYPASS VALVE TO S/G B CANNOT BE CLOSED OR THROTTLED	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT ISOLATION VALVES (NV-452A/B) FOR SI, REDUNDANT MANUAL BLOCK VALVE AND REDUNDANT S/Gs FOR SECONDARY RECIRC	REDUCED REDUNDANCY FOR MAIN FW ISOLATION TO S/G B FOR SI, LOSS OF SECONDARY RECIRC FLOW CONTROL TO S/G B	NORMAL POSITION DURING STARTUP/SHUTDOWN
01.4.07.02.2	CV-144	VALVE/ACTUATOR	CLOSED	MAIN FW BYPASS ISOLATED TO S/G B, MAIN FLOW PATH UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G B	
01.4.07.03.1	CV-144	SV-151	OFF (OPEN)	MAIN FW BYPASS VALVE TO S/G B WILL NOT CLOSE ON TRIM B SIS/SISLOP	PERIODIC TESTING	REDUNDANT SOLENOID (SV-2144)	REDUCED REDUNDANCY FOR ISOLATION OF MAIN FW BYPASS PATH TO S/G B	NORMAL POSITION
01.4.07.03.2	CV-144	SV-151	ON (CLOSED)	(SAME AS 1.4.7.2.2)	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.4.7.2.2)	(SAME AS 1.4.7.2.2)	
01.4.07.04.1	CV-144	SV-2144	OFF (OPEN)	MAIN FW BYPASS VALVE TO S/G B WILL NOT CLOSE ON TRIM A SIS/SISLOP	PERIODIC TESTING	REDUNDANT SOLENOID (SV-151)	REDUCED REDUNDANCY FOR MAIN FW BYPASS ISOLATION TO S/G B	NORMAL POSITION
01.4.07.04.2	CV-144	SV-2144	ON (CLOSED)	(SAME AS 1.4.7.2.2)	CONTROL ROOM INDICATION PERIODIC TESTING	(SAME AS 1.4.7.2.2)	(SAME AS 1.4.7.2.2)	
01.4.07.05.1	PCV-457 CV-144	LC-454B-12G (RELAY)	CONTACTS OPEN (OFF)	S/G B OVERFILL PROTECTION SIGNAL DISABLED TO MAIN FW FLOW CONTROL VALVE (PCV-457) AND BYPASS (CV-144, VIA SV-151)	PERIODIC TESTING	NONE REQUIRED FOR SI AND SECONDARY RECIRC	NONE FOR SI OR SECONDARY RECIRC	NORMAL POSITION. CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. 9 UNCS LT-454 LOOP FAILURE LMA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOFFS UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
01.4.07.05.2	PCV-457 CV-144	LC-454B-12G (RBLAT)	CONTACTS CLOSED (ON)	S/G B OVERFILL PROTECTION SIGNAL CLOSBS PCV-457 AND CV-144	PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RBCIRC	NONE FOR SI, LOSS OF SECONDARY RBCIRC TO S/G B	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. BOUNDS LT-454 LOOP FAILURE HIGH
01.4.07.05.3	PCV-457 CV-144	B&G BUS #2 (B-12R1)	VOLTS LOW	S/G B OVERFILL PROTECTION SIGNAL CLOSBS PCV-457 AND CV-144	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RBCIRC	NONE FOR SI, LOSS OF SECONDARY RBCIRC TO S/G B	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. LT-454 LOOP FAILS HIGH ON LOSS OF POWER
01.4.07.05.4	PCV-457 CV-144	VITAL BUS #2 (B-1205V)	VOLTS LOW	S/G B OVERFILL PROTECTION SIGNAL DISABLED TO PCV-457 AND CV-144	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	RELAY IS ENERGIZED TO ACTUATE AND FAILS OFF ON LOSS OF VITAL BUS POWER, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. ANNUNCIATION OCCURS ON MISMATCH CHANNEL TRIP
01.4.07.05.5	PCV-457 CV-144	LT-454 LOOP	BQ	S/G B OVERFILL PROTECTION SIGNAL CLOSBS PCV-457 AND CV-144	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY RBCIRC WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-455 LOOPS	NONE FOR SI, LOSS OF SECONDARY RBCIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-455	NONE-BQ S/G NR LEVEL INTBS ASSUMED COMMON-CAUSE FAILURES DURING MSLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS
01.4.08.01.1	PCV-458	VALVE/ACTUATOR	OPRN	MAIN PW CONTROL VALVE TO S/G C CANNOT BE CLOSED	PERIODIC TESTING	REDUNDANT ISOLATION VALVES (HV-22 OR HV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G C FOR SI AND SECONDARY RBCIRC	NORMAL POSITION DURING POWER OPERATION. INCLUDES SV-458, SV-3458 AND BACKUP NITROGEN (GN1) SUPPLY. HV-22 OR PCV-458 CLOSED FOR SECONDARY RBCIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-143
01.4.08.01.2	PCV-458	VALVE/ACTUATOR	CLOSED	MAIN PW BLOCKED TO S/G C, BYPASS PATH UNAFFECTED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE CLOSED ON SIS/SI3/LOP
01.4.08.02.1	CV-143	VALVE/ACTUATOR	OPRN	MAIN PW BYPASS VALVE TO S/G C CANNOT BE CLOSED OR THROTTLED	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT ISOLATION VALVES (HV-852A/B) FOR SI, REDUNDANT MANUAL BLOCK VALVE AND REDUNDANT S/Gs FOR SECONDARY RBCIRC	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G C FOR SI, LOSS OF SECONDARY RBCIRC FLOW CONTROL TO S/G C	NORMAL POSITION DURING STARTUP/SHUTDOWN

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS DMOFBE UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.08.02.2	CV-143	VALVE/ACTUATOR	CLOSED	MAIN FW BYPASS ISOLATED TO S/G C, MAIN FLOW PATH UNAPPECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY BCCIRC	NONE FOR SI, LOSS OF SECONDARY BCCIRC TO S/G C	
01.4.08.03.1	CV-143	SV-150	OFF (OPEN)	MAIN FW BYPASS VALVE TO S/G C WILL NOT CLOSE ON TRAM B SIS/SISLOP	PERIODIC TESTING	REDUNDANT SOLENOID (SV-2143)	REDUCED REDUNDANCY FOR ISOLATION OF MAIN FW BYPASS PATH TO S/G C	NORMAL POSITION
01.4.08.03.2	CV-143	SV-150	ON (CLOSED)	(SAME AS 1.4.0.2.2)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 1.4.0.2.2)	(SAME AS 1.4.0.2.2)	
01.4.08.04.1	CV-143	SV-2143	OFF (OPEN)	MAIN FW BYPASS VALVE TO S/G C WILL NOT CLOSE ON TRAM A SIS/SISLOP	PERIODIC TESTING	REDUNDANT SOLENOID (SV-150)	REDUCED REDUNDANCY FOR MAIN FW BYPASS ISOLATION TO S/G C	NORMAL POSITION
01.4.08.04.2	CV-143	SV-2143	ON (CLOSED)	(SAME AS 1.4.0.2.2)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 1.4.0.2.2)	(SAME AS 1.4.0.2.2)	
01.4.08.05.1	PCV-458 CV-143	LC-455B-12G (RBLAT)	CONTACTS OPEN (OFF)	S/G C OVERFILL PROTECTION SIGNAL DISABLED TO MAIN FW FLOW CONTROL VALVE (PCV-458) AND BYPASS (CV-143), VIA SV-150	PERIODIC TESTING	NONE REQUIRED FOR SI AND SECONDARY BCCIRC	NONE FOR SI OR SECONDARY BCCIRC	NORMAL POSITION. CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. BOUNDS LT-455 LOOP FAILURE LOW
01.4.08.05.2	PCV-458 CV-143	LC-455B-12G (RBLAT)	CONTACTS CLOSED (ON)	S/G C OVERFILL PROTECTION SIGNAL CLOSSES PCV-458 AND CV-143	PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY BCCIRC	NONE FOR SI, LOSS OF SECONDARY BCCIRC TO S/G C	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. BOUNDS LT-455 LOOP FAILURE HIGH
01.4.08.05.3	PCV-458 CV-143	RBC BUS #3 (B-1321)	VOLTS LOW	S/G C OVERFILL PROTECTION SIGNAL CLOSSES PCV-458 AND CV-143	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY BCCIRC	NONE FOR SI, LOSS OF SECONDARY BCCIRC TO S/G C	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. LT-455 LOOP FAILS HIGH ON LOSS OF POWER
01.4.08.05.4	PCV-458 CV-143	VITAL BUS #3 (B-1305V)	VOLTS LOW	S/G C OVERFILL PROTECTION SIGNAL DISABLED TO PCV-458 AND CV-143	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	RBLAT IS ENERGIZE TO ACTUATE AND FAILS OFF ON LOSS OF VITAL BUS POWER, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. ANNUNCIATION OCCURS ON MISMATCH CHANNEL TRIP
01.4.08.05.5	PCV-458 CV-143	LT-455 LOOP	BQ	S/G C OVERFILL PROTECTION SIGNAL CLOSSES PCV-458 AND CV-143	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY BCCIRC WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-454 LOOPS	NONE FOR SI, LOSS OF SECONDARY BCCIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-454	NONE-BQ S/G NR LEVEL INTRUS ASSUMED COMMON-CAUSE FAILURES DURING NSLS INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-453B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS.

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRB UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION PHAS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.09.01.1	PCV-456 CV-142,143,144	SEQ 1 (16-9, 11)	CONTACTS OPEN (OFF)	MAIN FW CONTROL VALVE TO S/G A AND BYPASS VALVES TO S/G A, B, C WILL NOT CLOSE ON TRAIN A SIS/SISLOP	PERIODIC TESTING	REDUNDANT ISOLATION VALVE FOR PCV (NOV-21), REDUNDANT SOLENOIDS FOR BYPASS VALVES (SV-2142, SV-150, SV-151)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION	NORMAL POSITION. INCLUDES RELAY SQ11 IN SOLENOID VALVE CONTROL CIRCUITS. VALVES CAN BE MANUALLY CONTROLLED FOR SECONDARY RECIRC
01.4.09.01.2	PCV-456 CV-142,143,144	SEQ 1 (16-9, 11)	CONTACTS CLOSED (ON)	MAIN FW BLOCKED TO S/G A AND BYPASS PATH BLOCKED TO S/G A, B, C	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C	*LOW PERD FLOW WILL BE INDICATED. EVALUATION OF MANUAL BYPASS PATH OR LEAD LIFTING REQUIRED TO MITIGATE EFFECTS ON SECONDARY RECIRCULATION
01.4.09.02.1	PCV-457,458 CV-142,143,144	SEQ 2 (17-1, 3)	CONTACTS OPEN (OFF)	MAIN FW CONTROL VALVES TO S/G B, C AND BYPASS VALVES TO S/G A, B, C WILL NOT CLOSE ON TRAIN B SIS/SISLOP	PERIODIC TESTING	REDUNDANT ISOLATION VALVES FOR PCVS (NOV-20, NOV-22), REDUNDANT SOLENOIDS FOR BYPASS VALVES (SV-149, SV-2143, SV-2144)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION	NORMAL POSITION. INCLUDES RELAY SQ12 IN SOLENOID VALVE CONTROL CIRCUITS. VALVES CAN BE CONTROLLED MANUALLY FOR SECONDARY RECIRC
01.4.09.02.2	PCV-457,458 CV-142,143,144	SEQ 2 (17-1, 3)	CONTACTS CLOSED (ON)	MAIN FW BLOCKED TO S/G B, C AND BYPASS PATH BLOCKED TO S/G A, B, C	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C	*LOW PERD FLOW WILL BE INDICATED. EVALUATION OF MANUAL BYPASS PATH OR LEAD LIFTING REQUIRED TO MITIGATE EFFECTS ON SECONDARY RECIRCULATION
01.4.09.03.1	PCV-456 CV-142,143,144	125VDC BUS #1 (72-130)	VOLTS LOW	MAIN FW CONTROL VALVE TO S/G A AND BYPASS VALVES TO S/G A, B, C WILL NOT CLOSE ON TRAIN A SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVE FOR PCV (NOV-21), REDUNDANT SOLENOIDS FOR BYPASS VALVES (SV-2142, SV-150, SV-151)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION	VALVES CAN BE MANUALLY CONTROLLED FOR SECONDARY RECIRC
01.4.09.04.1	PCV-457,458 CV-142,143,144	125VDC BUS #2 (72-211)	VOLTS LOW	MAIN FW CONTROL VALVES TO S/G B, C AND BYPASS VALVES TO S/G A, B, C WILL NOT CLOSE ON TRAIN B SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES FOR PCVS (NOV-20, NOV-22), REDUNDANT SOLENOIDS FOR BYPASS VALVES (SV-149, SV-2143, SV-2144)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION	VALVES CAN BE MANUALLY CONTROLLED FOR SECONDARY RECIRC
01.4.09.05.1	PCV-456,457,458 CV-142,143,144	APWAS-A	TRIPPED (CONTACTS CLOSED)	HPW CHECK VALVE BACKUP MODE IS ARMED FOR S/G A/B/C. PCVs AND CVs WILL CLOSE VIA RESPECTIVE SOLENOIDS IF TURBINE IS TRIPPED (TT12 CONTACTS CLOSED) AND BOTH HPW PUMPS ARE TRIPPED ("b" CONTACTS CLOSED)	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER HPW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR HPW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY RECIRC
01.4.09.05.2	PCV-456,457,458 CV-142,143,144	APWAS-A	UNTRIPPED (CONTACTS OPEN)	HPW CHECK VALVE BACKUP MODE DISABLED FOR S/G A/B/C	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY RECIRC	NONE FOR SI AND SECONDARY RECIRC	OUTPUT/ISOLATION RELAYS ARE DE-EMERGIZE TO ACTUATE. UNTRIPPED STATE IS WITH RELAYS IN EMERGIZED POSITION
01.4.09.06.1	PCV-456,457,458 CV-142,143,144	APWAS-B	TRIPPED (CONTACTS CLOSED)	HPW CHECK VALVE BACKUP MODE IS ARMED FOR S/G A/B/C. PCVs AND CVs WILL CLOSE VIA RESPECTIVE SOLENOIDS IF TURBINE IS TRIPPED (TT12 CONTACTS CLOSED) AND BOTH HPW PUMPS ARE TRIPPED ("b" CONTACTS CLOSED)	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER HPW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR HPW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY RECIRC

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
01.4.09.06.2	PCV-456,457,458 CV-142,143,144	AFWAS-B	UNTRIPPED (CONTACTS OPEN)	NFW CHECK VALVE BACKUP MODE DISABLED FOR S/G A/B/C	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BECIRC	NONE FOR SI AND SECONDARY BECIRC	OUTPUT/ISOLATION RELAYS ARE OR-EMERGIZR TO ACTUATE. UNTRIPPED STATE IS WITH RELAYS IN EMERGIZED POSITION
01.4.09.07.1	PCV-456,457,458 CV-142,143,144	152-11C04 ("b" CONTACT) 152-12C04 ("b" CONTACT)	CONTACT CLOSED	NFW CHECK VALVE BACKUP MODE WILL BE ARMED FOR S/G A/B/C AND PCV _s /CV _s WILL CLOSE VIA RESPECTIVE SOLENOIDS IF TURBINE IS TRIPPED (TT12 CONTACTS CLOSED), EITHER TRAIN OF APWAS ACTUATES (CONTACTS CLOSED) AND REMAINING NFW PUMP TRIPS ("b" CONTACT CLOSURE)	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BECIRC	NONE FOR SI AND SECONDARY BECIRC	*SECONDARY BECIRC UNAFFECTED BECAUSE S/G LEVEL RESTORED TO 70% BY APW FLOW PER BOI, PRIOR TO INITIATING SECONDARY BECIRC FLOW. RESET OF APWAS (WITH LEVEL > 5X) DISARMS CHECK VALVE BACKUP MODE FOR PCV _s AND CV _s . BOI VERIFICATION REQUIRED
01.4.09.07.2	PCV-456,457,458 CV-142,143,144	152-11C04 ("b" CONTACT) 152-12C04 ("b" CONTACT)	CONTACT OPEN	NFW CHECK VALVE BACKUP MODE DISABLED FOR S/G A/B/C	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BECIRC	NONE FOR SI AND SECONDARY BECIRC	
01.4.09.08.1	PCV-456,457,458 CV-142,143,144	TT12, TT12-150 TT13-150 (RELAYS)	CONTACTS OPEN (OFF)	NFW CHECK VALVE BACKUP MODE DISABLED FOR RESPECTIVE PCV/CV SOLENOID VALVE CIRCUITS (TT12: PCV-456, CV-142/143/144 TRAIN A SV _s , TT12-150: PCV-457/458, CV-143/144 TRAIN B SV _s , TT13-150: CV-142 TRAIN B SV)	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BECIRC	NONE FOR SI AND SECONDARY BECIRC	OUTPUT/ISOLATION RELAYS ARE EMERGIZR TO ACTUATE
01.4.09.08.2	PCV-456,457,458 CV-142,143,144	TT12, TT12-150 TT13-150 (RELAYS)	CONTACTS CLOSED (ON)	NFW CHECK VALVE BACKUP MODE ARMED FOR S/G A/B/C. PCV _s AND CV _s WILL CLOSE VIA RESPECTIVE SOLENOID VALVES IF EITHER TRAIN OF APWAS IS ACTUATED (RELAY CONTACTS CLOSED) AND BOTH NFW PUMPS ARE TRIPPED ("b" CONTACTS CLOSED)	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BECIRC	NONE FOR SI AND SECONDARY BECIRC	*SECONDARY BECIRC UNAFFECTED BECAUSE S/G LEVEL RESTORED TO 70% BY APW FLOW PER BOI, PRIOR TO INITIATING SECONDARY BECIRC FLOW. RESET OF APWAS (WITH LEVEL > 5X) DISARMS CHECK VALVE BACKUP MODE FOR PCV _s AND CV _s . BOI VERIFICATION REQUIRED
01.4.09.09.1	PCV-456,457,458 CV-142,143,144	VITAL BUS #1 (8-1414V)	VOLTS LOW	NFW CHECK VALVE BACKUP MODE DISABLED FOR RESPECTIVE PCV/CV SOLENOID VALVE CIRCUITS (TT12: PCV-456, CV-142/143/144 TRAIN A SV _s , TT12-150: PCV-457/458, CV-143/144 TRAIN B SV _s , TT13-150: CV-142 TRAIN B SV)	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY BECIRC	NONE FOR SI AND SECONDARY BECIRC	OUTPUT/ISOLATION RELAYS ARE EMERGIZR TO ACTUATE
01.4.09.10.1	PCV-456,457,458 CV-142,143,144	VITAL BUS #3A (8-3315V)	VOLTS LOW	NFW CHECK VALVE BACKUP MODE IS ARMED FOR S/G A/B/C. PCV _s AND CV _s WILL CLOSE VIA RESPECTIVE SOLENOIDS IF TURBINE IS TRIPPED (TT12 CONTACTS CLOSED) AND BOTH NFW PUMPS ARE TRIPPED ("b" CONTACTS CLOSED)	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, NONE FOR SECONDARY BECIRC	*NONE FOR SI, LOSS OF SECONDARY BECIRC TO S/G A/B/C AFTER NFW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR NFW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY BECIRC. ANNUNCIATION OCCURS FROM APWAS-A ACTUATION OR TROUBLE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB CHOPPER UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
01.4.09.11.1	PCV-456,457,458 CV-142,143,144	VITAL BUS BS (B-2901V)	VOLTS LOW	NEW CHECK VALVE BACKUP MODE IS ARMED FOR S/G A/B/C. PCVs AND CVs WILL CLOSE VIA RESPECTIVE SOLENOIDS IF TURBINE IS TRIPPED (TYPE CONTACTS CLOSED) AND BOTH NEW PUMPS ARE TRIPPED ("A" CONTACTS CLOSED).	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, NONE FOR SECONDARY BECIRC	NONE FOR SI, LOSS OF SECONDARY BECIRC TO S/G A/B/C AFTER NEW PUMPS TRIPPED	EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR NEW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY BECIRC. ANNUNCIATION OCCURS ON APVAS-B ACTUATION OR TROUBLE TRACH PCV HAS SEPARATE BACKUP N2 (GNI) SUPPLY FOR CLOSURE. COMMON-CAUSE FAILURE NOT POSTULATED DURING SECONDARY BECIRC, BUT SINGLE FAILURE OF ISA-950 COULD ISOLATE ISA TO CVs. EVALUATION OF MANUAL BYPASS PATHS REQD FOR MITIGATING EFFECTS ON SECONDARY BECIRC
01.4.09.12.1	PCV-456,457,458 CV-142,143,144	ISA	PRESSURE LOW	MAIN FW CONTROL VALVES FAIL OPEN, BYPASS VALVES FAIL CLOSED TO S/G A, B, C	CONTROL ROOM ANNUNCIATION	NONE REQUIRED FOR BYPASS VALVES, BACKUP NITROGEN FOR CONTROL VALVES FOR SI. NONE FOR SECONDARY BECIRC	NONE FOR SI (ISA NOT CREDITED FOR PCV CLOSURE), LOSS OF SECONDARY BECIRC TO S/G A/B/C	TRACH PCV HAS SEPARATE BACKUP N2 (GNI) SUPPLY FOR CLOSURE. COMMON-CAUSE FAILURE NOT POSTULATED DURING SECONDARY BECIRC, BUT SINGLE FAILURE OF ISA-950 COULD ISOLATE ISA TO CVs. EVALUATION OF MANUAL BYPASS PATHS REQD FOR MITIGATING EFFECTS ON SECONDARY BECIRC
01.4.10.01.1	NOV-1204	VALVE/ACTUATOR	OPEN	POTENTIAL PARTIAL DIVERSION OF BOTH TRAINS OF SI FLOW TO APW SYSTEM (G-109 OFF) OR INJECTION OF APW INTO MAIN FW HEADER (G-109 ON)	CONTROL ROOM INDICATION, ANNUNCIATION	APW LOGIC, VALVES APW-304 AND NOV-1202 PREVENT SI DIVERSION. HV-852A/B PREVENT INJECTION OF CONDENSATE TO RCS	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION AND INJECTION OF CONDENSATE TO RCS	*CROSS-TIE VALVE FROM APW PUMP G-109 TO MAIN FW HEADER. ACCEPTABILITY REQUIRES: 1) APW LOGIC TO PREVENT TRAIN A START UNLESS TRAIN B FAILED, 2) DUAL FAILURE OF NOV-1204 OPEN PLUS APW TRAIN B IS OUTSIDE DESIGN BASIS. APW CHECK VALVE NOT SEAT LEAK TESTED
01.4.10.01.2	NOV-1204	VALVE/ACTUATOR	CLOSED		PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION DURING POWER OPERATION. MAY BE OPEN DURING STARTUP UNDER ADMINISTRATIVE CONTROL. VALVE CLOSURE AUTOMATICALLY ON SIS/SISLOP AND APVAS-A
01.4.10.02.1	NOV-1204	SRQ 1 (49-1,3)	CONTACTS OPEN (OFF)	NOV-1204 WILL NOT CLOSE ON SIS/SISLOP	PERIODIC TESTING	(SAME AS 1.4.10.1.1)	(SAME AS 1.4.10.1.1)	(SAME AS 1.4.10.1.1). NORMAL POSITION
01.4.10.02.2	NOV-1204	SRQ 1 (49-1,3)	CONTACTS CLOSED (ON)	NOV-1204 CLOSURE. CANNOT BE REOPENED	PERIODIC TESTING	(SAME AS 1.4.10.1.2)	(SAME AS 1.4.10.1.2)	
01.4.10.04.1	NOV-1204	BCC-1 (42-112?)	VOLTS LOW	POTENTIAL PARTIAL DIVERSION OF BOTH TRAINS OF SI FLOW TO APW SYSTEM (G-109 OFF) OR INJECTION OF APW INTO MAIN FW HEADER (G-109 ON)	CONTROL ROOM INDICATION, ANNUNCIATION	APW LOGIC, VALVES APW-304 AND NOV-1202 PREVENT SI DIVERSION. HV-852A/B PREVENT INJECTION OF CONDENSATE TO RCS	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION AND INJECTION OF CONDENSATE TO RCS	*CROSS-TIE FROM APW PUMP G-109 TO MAIN FW HEADER. ACCEPTABILITY REQUIRES: 1) APW LOGIC TO PREVENT TRAIN A START UNLESS TRAIN B FAILED AND 2) DUAL FAILURE OF NOV-1204 OPEN PLUS APW TRAIN B IS OUTSIDE DESIGN BASIS. APW CHECK VALVE NOT SEAT LEAK TESTED
01.4.11.01.1	SV-102A SV-102C	SOLENOID VALVES	OPEN	SI LOOP B OR C VENT WILL NOT ISOLATE ON TRAIN B CTS (ONB VALVE)	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVES (SV-102B, SV-102D)	REDUCED REDUNDANCY FOR SI LOOP B, C BOUNDARY ISOLATION	MAY BE OPENED FOR PERIODIC SURVEILLANCE. CTS ACTUATED ON RESPECTIVE SEQUENCES AS WELL AS ON HIGH CONTAINMENT PRESSURE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONOPRR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMEA

ITEM #	SERVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.11.01.2	SV-702A SV-702C	SOLENOID VALVES	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
01.4.11.02.1	SV-702A SV-702C	D10, D10-1 (RRLATS)	CONTACTS CLOSED (ON)	SI LOOP B AND C VENTS WILL NOT ISOLATE ON TRAIN B CIS	PERIODIC TESTING	(SAME AS 1.4.11.1.1)	(SAME AS 1.4.11.1.1)	NORMAL POSITION FOR D10. RELAY CONTACTS WIRED IN PARALLEL
01.4.11.02.2	SV-702A SV-702C	D10, D10-1 (RRLATS)	CONTACTS OPEN (OFF)	TRAIN B SI LOOP B AND C VENT ISOLATION VALVES WILL CLOSE	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION FOR D10-1. RELAY CONTACTS WIRED IN PARALLEL. D10 IS CIS RELAY, D10-1 IS CIS OVERRIDE RELAY
01.4.11.03.1	SV-702A SV-702C	CIS-B (PC-1121-1)	ON (NO CIS)	(SAME AS 1.4.11.2.1)	PERIODIC TESTING	(SAME AS 1.4.11.1.1)	(SAME AS 1.4.11.1.1)	NORMAL POSITION. OUTPUT IS DE-ENERGIZE TO ACTUATE
01.4.11.03.2	SV-702A SV-702C	CIS-B (PC-1121-1)	OFF (CIS)	(SAME AS 1.4.11.2.2)	CONTROL ROOM ANNUNCIATION	(SAME AS 1.4.11.1.2)	(SAME AS 1.4.11.1.2)	
01.4.11.04.1	SV-702A SV-702C	SBQ 2 (20-1, 2, 3, 4)	CONTACTS CLOSED (ON)	CIS TRAIN B ACTUATED TO SI LOOP B, C VENT ISOLATION VALVES	PERIODIC TESTING	(SAME AS 1.4.11.1.2)	(SAME AS 1.4.11.1.2)	
01.4.11.04.2	SV-702A SV-702C	SBQ 2 (20-1, 2, 3, 4)	CONTACTS OPEN (OFF)	CIS TRAIN B WILL NOT ACTUATE ON LOW PRESSURIZER PRESSURE (EG. NSLB OUTSIDE CONTAINMENT)	PERIODIC TESTING	(SAME AS 1.4.11.1.1)	(SAME AS 1.4.11.1.1)	NORMAL POSITION
01.4.11.05.1	SV-702A SV-702C	VITAL BUS #6 (8-3002V)	VOLTS LOW	TRAIN B SI LOOP B AND C VENT ISOLATION VALVES CLOSE IRRESPECTIVE OF CIS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.11.06.1	SV-702A SV-702C	125VDC BUS #2 (72-221)	VOLTS LOW	CIS TRAIN B ACTUATED TO SI LOOP B AND C VENT ISOLATION VALVES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.12.01.1	SV-702B SV-702D	SOLENOID VALVES	OPEN	SI LOOP B OR C VENT WILL NOT ISOLATE ON TRAIN A CIS (ONE VALVE)	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVES (SV-702A, SV-702C)	REDUCE REDUNDANCY FOR SI LOOP B, C BOUNDARY ISOLATION	MAY BE OPENED FOR PERIODIC SURVEILLANCE. CIS ACTUATED ON RESPECTIVE SEQUENCES AS WELL AS ON HIGH CONTAINMENT PRESSURE
01.4.12.01.2	SV-702B SV-702D	SOLENOID VALVES	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
01.4.12.02.1	SV-702B SV-702D	D10, D10-1 (RRLATS)	CONTACTS CLOSED (ON)	SI LOOP B AND C VENTS WILL NOT ISOLATE ON TRAIN A CIS	PERIODIC TESTING	(SAME AS 1.4.12.1.1)	(SAME AS 1.4.12.1.1)	NORMAL POSITION FOR D10. RELAY CONTACTS WIRED IN PARALLEL
01.4.12.02.2	SV-702B SV-702D	D10, D10-1 (RRLATS)	CONTACTS OPEN (OFF)	TRAIN A SI LOOP B AND C VENT ISOLATION VALVES WILL CLOSE	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION FOR D10-1. RELAY CONTACTS WIRED IN PARALLEL. D10 IS CIS RELAY, D10-1 IS CIS OVERRIDE RELAY
01.4.12.03.1	SV-702B SV-702D	CIS-A (PC-1120-1)	ON (NO CIS)	(SAME AS 1.4.12.2.1)	PERIODIC TESTING	(SAME AS 1.4.12.1.1)	(SAME AS 1.4.12.1.1)	NORMAL POSITION. OUTPUT IS DE-ENERGIZE TO ACTUATE
01.4.12.03.2	SV-702B SV-702D	CIS-A (PC-1120-1)	OFF (CIS)	(SAME AS 1.4.12.2.2)	CONTROL ROOM ANNUNCIATION	(SAME AS 1.4.12.1.2)	(SAME AS 1.4.12.1.2)	
01.4.12.04.1	SV-702B SV-702D	SBQ 1 (20-1, 2, 3, 4)	CONTACTS CLOSED (ON)	CIS TRAIN A ACTUATED TO SI LOOP B, C VENT ISOLATION VALVES	PERIODIC TESTING	(SAME AS 1.4.12.1.2)	(SAME AS 1.4.12.1.2)	
01.4.12.04.2	SV-702B SV-702D	SBQ 1 (20-1, 2, 3, 4)	CONTACTS OPEN (OFF)	CIS TRAIN A WILL NOT ACTUATE ON LOW PRESSURIZER PRESSURE (EG. NSLB OUTSIDE CONTAINMENT)	PERIODIC TESTING	(SAME AS 1.4.12.1.1)	(SAME AS 1.4.12.1.1)	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.12.05.1	SV-702B SV-702D	VITAL BUS #1 (6-1112W)	VOLTS LOW	TRAIN A SI LOOP B AND C VENT ISOLATION VALVES CLOSE IRRESPECTIVE OF CIS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.12.06.1	SV-702B SV-702D	125VDC BUS #1 (72-123)	VOLTS LOW	CIS TRAIN A ACTUATED TO SI LOOP B AND C VENT ISOLATION VALVES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.13.01.1	NOV-356	VALVE/ACTUATOR	OPEN	PARTIAL DIVERSION OF LOOP A SI FLOW TO OTHER LOOPS VIA SERIAL INJECTION/COLD LRG RECIRCULATION DISCHARGE PIPING	CONTROL ROOM INDICATION	NONE REQUIRED	SI DELIVERY TO CORE IMPROVED	FLOW DISTRIBUTION BOUNDED BY THREE HEADER VALVE OPEN CASE (2/3 LOOPS FOR LOCA, 3/3 LOOPS FOR NSLB) VS. DESIGN BASIS CASE (1/2 LOOPS FOR LOCA, 2/2 LOOPS FOR NSLB)
01.4.13.01.2	NOV-356	VALVE/ACTUATOR	CLOSED	NO EFFECT ON INJECTION	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. IMPACT ON COLD LRG RECIRCULATION ADDRESSED IN SECTION 2
01.4.13.02.1	NOV-356	HCC-1 (42-1154)	VOLTS LOW	NO EFFECT ON INJECTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	IMPACT ON COLD LRG RECIRC ADDRESSED IN SECTION 2
01.4.14.01.1	NOV-357	VALVE/ACTUATOR	OPEN	PARTIAL DIVERSION OF LOOP B SI FLOW TO OTHER LOOPS VIA SERIAL INJECTION/COLD LRG RECIRCULATION DISCHARGE PIPING	CONTROL ROOM INDICATION	NONE REQUIRED	SI DELIVERY TO CORE IMPROVED	FLOW DISTRIBUTION BOUNDED BY THREE HEADER VALVE OPEN CASE (2/3 LOOPS FOR LOCA, 3/3 LOOPS FOR NSLB) VS. DESIGN BASIS CASE (1/2 LOOPS FOR LOCA, 2/2 LOOPS FOR NSLB)
01.4.14.01.2	NOV-357	VALVE/ACTUATOR	CLOSED	NO EFFECT ON INJECTION	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. IMPACT ON COLD LRG RECIRCULATION ADDRESSED IN SECTION 2
01.4.14.02.1	NOV-357	HCC-2 (42-1243)	VOLTS LOW	NO EFFECT ON INJECTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	IMPACT ON COLD LRG RECIRCULATION ADDRESSED IN SECTION 2
01.4.15.01.1	NOV-358	VALVE/ACTUATOR	OPEN	PARTIAL DIVERSION OF LOOP C SI FLOW TO OTHER LOOPS VIA SERIAL INJECTION/COLD LRG RECIRCULATION DISCHARGE PIPING	CONTROL ROOM INDICATION	NONE REQUIRED	SI DELIVERY TO CORE IMPROVED	FLOW DISTRIBUTION BOUNDED BY THREE HEADER VALVE OPEN CASE (2/3 LOOPS FOR LOCA, 3/3 LOOPS FOR NSLB) VS. DESIGN BASIS CASE (1/2 LOOPS FOR LOCA, 2/2 LOOPS FOR NSLB)
01.4.15.01.2	NOV-358	VALVE/ACTUATOR	CLOSED	NO EFFECT ON INJECTION	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. IMPACT ON COLD LRG RECIRCULATION ADDRESSED IN SECTION 2
01.4.15.02.1	NOV-358	UPS	VOLTS LOW	NO EFFECT ON INJECTION	PERIODIC TESTING	NONE REQUIRED	NONE	UPS COMMON TO NOV-850C. IMPACT ON COLD LRG RECIRCULATION ADDRESSED IN SECTION 2
01.4.15.03.1	NOV-358	HCC-3 (42-1385)	VOLTS LOW	CAUSES LOSS OF UPS AFTER 130 MINUTES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	IMPACT ON COLD LRG RECIRCULATION ADDRESSED IN SECTION 2
01.4.16.01.1	CV-202	VALVE/ACTUATOR	OPEN	LBTDOWN NOT AUTOMATICALLY ISOLATED ON SIS/SISLOP. DIVERSION FLOW FROM RCS LOOP A LIMITED TO 90 GPM BY FLOW ORIFICES. FLOW TO PRESSURIZER HEATER TANK FOLLOWING REMOTE MANUAL LBTDOWN ISOLATION VIA CONTAINMENT VALVES	PERIODIC TESTING	REDUNDANT TRAIN FOR COMBINED SI FLOW RATE, LBTDOWN CONTAINMENT ISOLATION VALVES AND LIMITED NSLB/TANK CAPACITY FOR RWST INVENTORY	*PARTIAL DIVERSION OF 2 TRAIN SI FLOW, BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW. CV/35/27 FAILURE FOR RWST INVENTORY	*INCLUDES BY-1202. B01 88V REQUIRED TO SPECIFY CLOSING CV-525 AND CV-526 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC SET REQUIRED TO ADDRESS UNDESIRABLE FLOW FROM SIS TO RWST VIA B. 1.2

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ONOPRR UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.16.01.2	CV-202	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
01.4.16.02.1	CV-203	VALVE/ACTUATOR	OPEN	(SAME AS 1.4.16.1.1)	PERIODIC TESTING	(SAME AS 1.4.16.1.1)	*(SAME AS 1.4.16.1.1)	*NORMAL POSITION. INCLUDES HY-1203. BOI REV REQUIRED TO SPECIFY CLOSING CV-525 AND CV-526 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC REV REQUIRED TO ADDRESS UNISOLABLE FLOW FROM RCS TO PRT VIA RV-206
01.4.16.02.2	CV-201	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	*INCLUDES HY-1204. BOI REV REQUIRED TO SPECIFY CLOSING CV-525 AND CV-526 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC REV REQUIRED TO ADDRESS UNISOLABLE FLOW FROM RCS TO PRT VIA RV-206
01.4.16.03.1	CV-204	VALVE/ACTUATOR	OPEN	(SAME AS 1.4.16.1.1)	PERIODIC TESTING	(SAME AS 1.4.16.1.1)	*(SAME AS 1.4.16.1.1)	*INCLUDES HY-1204. BOI REV REQUIRED TO SPECIFY CLOSING CV-525 AND CV-526 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC REV REQUIRED TO ADDRESS UNISOLABLE FLOW FROM RCS TO PRT VIA RV-206
01.4.16.03.2	CV-204	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
01.4.16.04.1	CV-287	VALVE/ACTUATOR	OPEN	EXCESS LBTDOWN NOT AUTOMATICALLY ISOLATED ON SIS/SISLOP. DIVERSION FLOW FROM RCS LOOP A TO LBTDOWN. RCS DRAIN TANK OR SEAL WATER RETURN. (FLOW LIMITED TO LESS THAN 90 GPM BY LINE LOSSES)	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR COMBINED SI FLOW RATE, BACKUP BROTHER-MANUAL FAIL-CLOSED ISOLATION VALVE (ICV-1117) FOR CV-16/37 FAILURE FOR RWST INVENTORY	*PARTIAL DIVERSION OF 2 TRAIN SI FLOW BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW RATE, RWST INVENTORY	INCLUDES HY-1237. MAY BE OPEN DURING STARTUP. BOI REV REQUIRED TO SPECIFY CLOSING ICV-1117 UPON SIS/SISLOP IF EXCESS LBTDOWN IS IN SERVICE
01.4.16.04.2	CV-287	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION DURING POWER OPERATION
01.4.16.05.1	CV-202, 203, 204, 287	SRQ 1 (50-1, 3)	CONTACTS OPEN (OFF)	LBTDOWN, EXCESS LBTDOWN WILL NOT ISOLATE ON TRAIN A SIS/SISLOP	PERIODIC TESTING	REDUNDANT INPUT FROM TRAIN B SRQ	REDUCED REDUNDANCY AGAINST SI DIVERSION FROM LOOP A	
01.4.16.05.2	CV-202, 203, 204, 287	SRQ 1 (50-1, 3)	CONTACTS CLOSED (ON)	LBTDOWN, EXCESS LBTDOWN ISOLATED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.16.06.1	CV-202, 203, 204, 287	SRQ 2 (50-1, 3)	CONTACTS OPEN (OFF)	LBTDOWN, EXCESS LBTDOWN WILL NOT ISOLATE ON TRAIN B SIS/SISLOP	PERIODIC TESTING	REDUNDANT INPUT FROM TRAIN A SEQUENCER	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION FROM LOOP A	
01.4.16.06.2	CV-202, 203, 204, 287	SRQ 2 (50-1, 3)	CONTACTS CLOSED (ON)	LBTDOWN, EXCESS LBTDOWN ISOLATED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.16.07.1	CV-202, 203, 204 83-10 (RELAY)	83-10	ON	AUTO-CLOSE SIGNAL TO CV-202/203, DE-ENERGIZING RESPECTIVE SOLENOID PILOTS FY1202/1203 AND CLOSING VALVES	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SRQ #2 SIS/SISLOP. FAILURE PREVENTS RE-OPENING CV-202/203 TO RE-ESTABLISH LBTDOWN. PARALLEL VALVE CV-204 UNAPFFECTED
01.4.16.07.2	CV-202, 203, 204 83-19 (RELAY)	83-19	OFF	SRQ #2 AUTO-CLOSE SIGNAL DISABLED TO CV-202/203. REDUNDANT SIGNAL FROM SRQ #1 VIA RELAY 83-12 UNAPFFECTED	PERIODIC TESTING	REDUNDANT SIGNAL FROM SRQ #1	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LBTDOWN	POSITION OF RELAY DURING NORMAL OPERATION. PARALLEL VALVE CV-204 AUTO-CLOSE SIGNALS FROM SRQ #1 AND #2 VIA RELAYS 83-11 AND 83-13 UNAPFFECTED

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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.16.08.1	CV-202, 203, 204	83-11 (RELAY)	ON	CONTACTS CLOSE TO PROVIDE SEQ #2 SEAL-IN SIGNAL TO RELAYS 83-10 AND 83-11, RESULTING IN AUTO-CLOSE SIGNAL TO CV-202/203/204 WHICH DE-ENERGIZES RESPECTIVE SOLENOID PILOTS PT1202/1203/1204 AND CLOSURE VALVES	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SEQ #2 SIS/SISLOP. FAILURE PREVENTS RE-OPENING VALVES TO RE-ESTABLISH LRTDOWN IF DESIRED
01.4.16.08.2	CV-202, 203, 204	83-11 (RELAY)	OFF	SEQ #2 SEAL-IN FOR CV-202/203/204 AND AUTO-CLOSE SIGNAL TO CV-204 DISABLED. REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #1 VIA RELAYS 83-12 AND 83-13 UNAPPECTED	PERIODIC TESTING	REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #1	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LRTDOWN	POSITION OF RELAY DURING NORMAL OPERATION
01.4.16.09.1	CV-202, 203, 204	83-12 (RELAY)	ON	AUTO-CLOSE SIGNAL TO CV-202 AND CV-203 WHICH DE-ENERGIZES SOLENOID PILOTS PT1202 AND PT-1203, CLOSING VALVES	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SEQ #1 SIS/SISLOP. FAILURE PREVENTS RE-OPENING CV-202 AND CV-203 TO RE-ESTABLISH LRTDOWN. PARALLEL VALVE CV-204 UNAPPECTED
01.4.16.09.2	CV-202, 203, 204	83-12 (RELAY)	OFF	SEQ #1 AUTO-CLOSE SIGNAL DISABLED TO CV-202/203. REDUNDANT SIGNAL FROM SEQ #2 VIA RELAY 83-10 UNAPPECTED	PERIODIC TESTING	REDUNDANT SIGNAL FROM SEQ #2	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LRTDOWN	POSITION OF RELAY DURING NORMAL OPERATION. PARALLEL VALVE CV-204 AUTO-CLOSE SIGNALS FROM SEQ #1 AND #2 VIA RELAYS 83-11 AND 83-13 UNAPPECTED
01.4.16.10.1	CV-202, 203, 204	83-13 (RELAY)	ON	CONTACTS CLOSE TO PROVIDE SEQ #1 SEAL-IN SIGNAL TO RELAYS 83-12 AND 83-13, RESULTING IN AUTO-CLOSE SIGNAL TO CV-202/203/204 WHICH DE-ENERGIZES RESPECTIVE SOLENOID PILOTS PT1202/1203/1204, CLOSING VALVES	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SEQ #1 SIS/SISLOP. FAILURE PREVENTS RE-OPENING VALVES TO RE-ESTABLISH LRTDOWN IF DESIRED
01.4.16.10.2	CV-202, 203, 204	83-13 (RELAY)	OFF	SEQ #1 SEAL-IN FOR CV-202/203/204 AND AUTO-CLOSE SIGNAL TO CV-204 DISABLED. REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #2 VIA RELAYS 83-10 AND 83-11 UNAPPECTED	PERIODIC TESTING	REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #2	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LRTDOWN	POSITION OF RELAY DURING NORMAL OPERATION
01.4.16.11.1	CV-202, 203, 204, 207	UTILITY BUS (8-1518)	VOLTS LOW	SOLENOID VALVES FOR CV-202, 203, 204, 207 AND SEQ RELAYS 83-10, 83-12 DE-ENERGIZE, ISOLATING LRTDOWN AND REC335 LRTDOWN	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFR UNIT 1
 TABLE 1-1: SAFETY INJECTION / MAIN PW ISOLATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCS	REMARKS
01.4.17.01.1	NOV-833	VALVE/ACTUATOR	OPEN	1 OF 2 SBIBS VALVES OPENED FROM LOOP A COLD LRG BOUNDARY	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT VALVE NOV-834	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION FROM LOOP A	
01.4.17.01.2	NOV-833	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
01.4.17.02.1	NOV-833	MCC-1 (42-1170)	VOLTS LOW	NO EFFECT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.18.01.1	NOV-834	VALVE/ACTUATOR	OPEN	1 OF 2 SBIBS VALVES OPENED FROM LOOP A COLD LRG BOUNDARY	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT VALVE NOV-833	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION FROM LOOP A	
01.4.18.01.2	NOV-834	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
01.4.18.02.1	NOV-834	PC-425E	OPEN	NOV-834 OPENING BLOCKED	PERIODIC TESTING	(SAME AS 1.4.18.1.2)	(SAME AS 1.4.18.1.2)	NORMAL POSITION. PRESSURIZER PRESSURE INTERLOCK
01.4.18.02.2	NOV-834	PC-425E	CLOSED	NOV-834 OPENING NOT BLOCKED	CONTROL ROOM INDICATION	REDUNDANT VALVE (NOV-833)	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION FROM LOOP A	
01.4.18.03.1	NOV-834	MCC-2 (42-1272)	VOLTS LOW	NO EFFECT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.19.01.1	CV-955	VALVE/ACTUATOR	OPEN	LOOP B RCS SAMPLE FLOW NOT ISOLATED INSIDE CONTAINMENT. OUTSIDE CONTAINMENT VALVE SV-3302 UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT VALVE (SV-3302)	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION FROM LOOP B	NORMAL POSITION. INCLUDES SV-955
01.4.19.01.2	CV-955	VALVE/ACTUATOR	CLOSED	LOOP B RCS SAMPLE FLOW ISOLATED	PERIODIC TESTING	NONE REQUIRED	NONE	
01.4.19.02.1	CV-956	VALVE/ACTUATOR	OPEN	LOOP C RCS SAMPLE FLOW NOT ISOLATED INSIDE CONTAINMENT. OUTSIDE CONTAINMENT VALVE SV-3302 UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT VALVE (SV-3302)	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION FROM LOOP C	NORMAL POSITION. INCLUDES SV-956
01.4.19.02.2	CV-956	VALVE/ACTUATOR	CLOSED	LOOP C RCS SAMPLE FLOW ISOLATED	PERIODIC TESTING	NONE REQUIRED	NONE	
01.4.19.03.1	CV-955 CV-956	VITAL BUS 83A (8-3314V)	VOLTS LOW	LOOP B, C RCS SAMPLE FLOW ISOLATED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE SAFETY FUNCTION IS TO FAIL CLOSED
01.4.20.01.1	SV-3302	VALVE	OPEN	LOOP B, C RCS SAMPLE FLOW NOT ISOLATED ON TRAIN B CIS	PERIODIC TESTING	EMERGENCY-MANUAL, FAIL CLOSED BACKUP ISOLATION VALVES (SV-955, SV-956)	PARTIAL DIVERSION OF 2-TRAIN SI FLOW, BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW. CV-36/37 FAILURE FOR RWST INVENTORY	NORMAL POSITION
01.4.20.01.2	SV-3302	VALVE	CLOSED	LOOP B, C RCS SAMPLE FLOW ISOLATED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.20.02.1	SV-3302	D13, D13-1 (RBLAYS)	ON (NO CIS)	(SAME AS 1.4.20.1.1)	PERIODIC TESTING	(SAME AS 1.4.20.1.1)	(SAME AS 1.4.20.1.1)	NORMAL POSITION FOR D13. RELAY CONTACTS WIRED IN PARALLEL
01.4.20.02.2	SV-3302	D13, D13-1 (RBLAYS)	OFF (CIS)	LOOP B, C RCS SAMPLE FLOW ISOLATED (SV-3302 OR-EMERGIZED)	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION FOR D13-1. RELAY CONTACTS WIRED IN PARALLEL. D13 IS CIS RELAY, D13-1 IS CIS OVERRIDE RELAY
01.4.20.03.1	SV-3302	CIS-B (PC-1121-1)	ON (NO CIS)	(SAME AS 1.4.20.1.1)	PERIODIC TESTING	(SAME AS 1.4.20.1.1)	(SAME AS 1.4.20.1.1)	NORMAL POSITION. OUTPUT IS DB-EMERGIZB TO ACTUATOR
01.4.20.03.2	SV-3302	CIS-B (PC-1121-1)	OFF (CIS)	(SAME AS 1.4.20.2.2)	PERIODIC TESTING	(SAME AS 1.4.20.2.2)	(SAME AS 1.4.20.2.2)	
01.4.20.04.1	SV-3302	SRQ 2 (20-1, 2, 3, 4)	CONTACTS CLOSED (ON)	CIS TRAIN B ACTUATED TO SV-3302	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 1.4.20.1.2)	(SAME AS 1.4.20.1.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONOPFB UNIT 1
TABLE 1-1: SAFETY INJECTION / MAIN FW ISOLATION EMSA

ITER #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.20.04.2	SV-330Z	SRV 2	CONTACTS OPEN (20-1, 2, 3, 4) (OFF)	CIS TRAIN B WILL NOT ACTIVATE ON LOW PRESSURIZER PRESSURE (EG. NSLB OUTSIDE CONTAINMENT)	PERIODIC TESTING	(SAME AS 1.4.20.1.1)	(SAME AS 1.4.20.1.1)	NORMAL POSITION
01.4.20.05.1	SV-330Z	125VDC BUS #2 (12-221)	VOLTS LOW	SV-330Z FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	

. TABLE 1-2: SAFETY INJECTION BOUNDARY VALVE ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM QUOFFER UNIT 1
 BOUNDARY VALVE ANALYSIS

--- SAFETY RELATED BOUNDARY ---				--- SAFETY RELATED BACKUP ---		--- NON-SAFETY RELATED BACKUP ---		REMARKS
ITRM #	TAG #	MC/AUTO?	LOCKED?	TAG #	MC/AUTO?	TAG #	MC/AUTO?	
01.1.01	SIS-305	CLOSED	NO	NONE				* G-50B SUCTION DRAIN TO AUX BLDG SUMP
01.1.02	SIS-307	CLOSED	NO	NONE				* G-50B CASING VENT
01.1.03	SIS-309	CLOSED	NO	NONE				* G-50B DISCHARGE HEADER DRAIN
01.1.04	SIS-311	CLOSED	NO	NONE				* G-50B DISCHARGE HEADER PRESSURE INSTRUMENT TEST CONNECTION
01.1.05	SIS-317	CLOSED	NO	NONE		SIS-329	CLOSED	* G-50B DISCHARGE HEADER DRAIN
01.1.06	SIS-315	CLOSED	NO	NONE		NONE		* G-50B DISCHARGE HEADER DRAIN
01.1.07	SIS-321	CLOSED	NO	NONE		NONE		* HV-853B INTER-DISC DRAIN
01.1.08	SIS-325	CLOSED	NO	NONE		NONE		* HV-853B INTER-DISC DRAIN
01.1.09	HV-851B	AUTO		NONE		CONDENSATE AND HEATER DRAIN SYSTEM		* G-3B CONDENSATE SUCTION ISOLATION
01.1.10	PWS-565	CLOSED	NO	NONE		NONE		* G-3B CASING VENT
01.1.11	PWS-575	CLOSED	NO	NONE		NONE		* G-3B MINIFLOW HEADER VENT
01.1.12	PWS-569	CLOSED	NO	NONE		NONE		* G-3B MINIFLOW HEADER VENT
01.1.13	PWS-543	CLOSED	NO	NONE		NONE		* G-3B MINIFLOW HEADER DRAIN
01.1.14	CV-37	AUTO		PWS-473	OPEN	PWS-477, 537	OPEN	* G-3B CONDENSER MINIFLOW ISOLATION. DOWNSTREAM DRAIN PWS-537 NORMALLY CLOSED CV-37 BYPASS
01.1.15	PWS-475	CLOSED	YES	NONE		NONE		* G-3B DISCHARGE HEADER VENT
01.1.16	PWS-455	CLOSED	NO	NONE		NONE		* G-3B DISCHARGE HEADER VENT
01.1.17	HV-852B	AUTO		CV-142/3/4, PCV-456/7/8, MOV-20/21/22, MOV-1204, APV-343, 346, 388, PWS-373, 412	AUTO	PWS-449, 453, 347, 411, 457, 467, 583, 536, 546, 496, 488, 392, 390, 444, 538, 540, 542, 572, BV-47, 46	CLOSED	* G-3B FRESHWATER DISCHARGE ISOLATION
01.1.18	SIS-335	CLOSED	NO	NONE		NONE		* HV-851B INTER-DISC DRAIN
01.1.19	SIS-337	CLOSED	NO	NONE		NONE		* HV-851B INTER-DISC DRAIN
01.2.01	SIS-306	CLOSED	NO	NONE		NONE		* G-50A SUCTION DRAIN TO AUX BLDG SUMP
01.2.02	SIS-308	CLOSED	NO	NONE		NONE		* G-50A CASING VENT
01.2.03	SIS-310	CLOSED	NO	NONE		NONE		* G-50A DISCHARGE HEADER DRAIN
01.2.04	SIS-314	CLOSED	NO	NONE		NONE		* G-50A DISCHARGE HEADER PRESSURE INSTRUMENT TEST CONNECTION
01.2.05	SIS-318	CLOSED	NO	NONE		SIS-316	CLOSED	* G-50A DISCHARGE HEADER DRAIN
01.2.06	SIS-330	CLOSED	NO	NONE		NONE		* G-50A DISCHARGE HEADER DRAIN
01.2.07	SIS-322	CLOSED	NO	NONE		NONE		* HV-853A INTER-DISC DRAIN
01.2.08	SIS-326	CLOSED	NO	NONE		NONE		* HV-853A INTER-DISC DRAIN
01.2.09	HV-854A	AUTO		NONE		CONDENSATE AND HEATER DRAIN SYSTEM		* G-3A CONDENSATE SUCTION ISOLATION
01.2.10	PWS-510	CLOSED	NO	NONE		NONE		* G-3A CASING VENT
01.2.11	PWS-468	CLOSED	NO	NONE		NONE		* G-3A MINIFLOW HEADER VENT
01.2.12	PWS-470	CLOSED	NO	NONE		NONE		* G-3A MINIFLOW HEADER VENT
01.2.13	PWS-568	CLOSED	NO	NONE		NONE		* G-3A MINIFLOW HEADER DRAIN
01.2.14	CV-36	AUTO		PWS-472	OPEN	PWS-476, 506	OPEN	* G-3A CONDENSER MINIFLOW ISOLATION. DOWNSTREAM DRAIN PWS-506 NORMALLY CLOSED CV-36 BYPASS
01.2.15	PWS-474	CLOSED	YES	NONE		NONE		* G-3A SUCTION HEADER DRAIN
01.2.16	PWS-564	CLOSED	NO	NONE		NONE		* G-3A SUCTION HEADER DRAIN
01.2.17	HV-852A	AUTO		CV-142/3/4, PCV-456/7/8, MOV-20/21/22, MOV-1204, APV-343, 346, 388, PWS-373, 412	AUTO	PWS-449, 453, 347, 411, 457, 467, 583, 536, 546, 496, 488, 392, 390, 444, 538, 540, 542, 572, BV-47, 46	CLOSED	* G-3A FRESHWATER DISCHARGE ISOLATION
01.2.18	SIS-336	CLOSED	NO	NONE		NONE		* HV-851A INTER-DISC DRAIN
01.2.19	SIS-338	CLOSED	NO	NONE		NONE		* HV-851A INTER-DISC DRAIN

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS QUOPRE UNIT 1
BOUNDARY VALVE ANALYSIS

SAFETY RELATED BOUNDARY					NON-SAFETY RELATED BACKUP					REMARKS
ITEM #	TAG #	MC/AUTO?	LOCATED?	TAG #	MC/AUTO?	TAG #	MC/AUTO?	TAG #	MC/AUTO?	
01.3.01 (NOT USED)										<ul style="list-style-type: none"> THERE ARE NO BOUNDARY VALVES UNIQUE TO THE TRAIN "C" INJECTION PATH VIA NOV-850C. NOV-358 IS ADDRESSED AS PART OF THE COMMON BOUNDARY IN SECTION 1.4 OF THIS TABLE
01.4.01	RCS-019	CLOSED	NO	NONE		RCS-021	CLOSED			<ul style="list-style-type: none"> LOOP A COLD LBG (DISCHARGE) DRAIN TO RCDT
01.4.02	RCS-014	CLOSED	NO	NONE		RCS-028	CLOSED			<ul style="list-style-type: none"> LOOP B COLD LBG (DISCHARGE) DRAIN TO RCDT
01.4.03	RCS-048	CLOSED	NO	NONE		RCS-050	CLOSED			<ul style="list-style-type: none"> LOOP C COLD LBG (DISCHARGE) DRAIN TO RCDT
01.4.04	RCS-065	CLOSED	NO	NONE		RCS-064	CLOSED			<ul style="list-style-type: none"> LETDOWN LINE DRAIN TO RCDT PUMP SUCTION
01.4.05	SIS-319	CLOSED	NO	NONE		NONE				<ul style="list-style-type: none"> G-3A BYPASS. THROTTLED OPEN FOR TECH SPEC SURVEILLANCE OF SI HEADER BORON CONCENTRATION. FAILURE OPEN WOULD DIVERT SI FLOW FROM BOTH TRAINS AND DISABLE OUTSIDE CONTAINMENT ISOLATION FOR SI HEADER
01.4.06	SIS-320	CLOSED	NO	NONE		NONE				<ul style="list-style-type: none"> G-3A BYPASS. THROTTLED OPEN FOR TECH SPEC SURVEILLANCE OF SI HEADER BORON CONCENTRATION. FAILURE OPEN WOULD DIVERT SI FLOW FROM BOTH TRAINS AND DISABLE OUTSIDE CONTAINMENT ISOLATION FOR SI HEADER
01.4.07	SIS-340	CLOSED	NO	NONE		CAP				<ul style="list-style-type: none"> SIS HEADER DRAIN DOWNSTREAM OF HV-851A
01.4.08	SIS-342	CLOSED	NO	NONE		NONE				<ul style="list-style-type: none"> SIS HEADER SAMPLER DOWNSTREAM OF HV-851A
01.4.09	SIS-344	CLOSED	NO	NONE		NONE				<ul style="list-style-type: none"> SIS HEADER VENT DOWNSTREAM OF HV-851A
01.4.10	SIS-341	CLOSED	NO	NONE		NONE				<ul style="list-style-type: none"> SIS HEADER SAMPLER DOWNSTREAM OF HV-851B
01.4.11	SIS-343	CLOSED	NO	NONE		SIS-345, 347	CLOSED			<ul style="list-style-type: none"> SIS HEADER VENT DOWNSTREAM OF HV-851B
01.4.12	SIS-363	CLOSED	NO	NONE		NONE				<ul style="list-style-type: none"> SIS HEADER VENT, MAIN SI HEADER
01.4.13	SIS-361	CLOSED	NO	NONE		NONE				<ul style="list-style-type: none"> SIS HEADER VENT, LOOP A SI PATH
01.4.14	HV-868	RELIEF		NONE		NONE				<ul style="list-style-type: none"> SIS HEADER RELIEF TO RWL HOLDUP TANK. NORMAL SETTING RANGE RESULTS IN SI DIVERSION DURING SBLOCA OR NSLB. SETPOINT VERIFIED AS PART OF ASMR SECTION II TEST PROGRAM
01.4.15	SIS-390	CLOSED	YES							<ul style="list-style-type: none"> SIS HEADER PURGE TO RWL HOLDUP TANK
01.4.16	SIS-386	CHECK		NONE		SIS-387	OPEN			<ul style="list-style-type: none"> SPRING-LOADED CHECK VALVE RELIEVES SIS HEADER TO RWL HOLDUP TANK. NORMAL SETTING RANGE RESULTS IN SI DIVERSION DURING SBLOCA OR NSLB. VALVE IS NOT INCLUDED IN ASMR SECTION II TEST PROGRAM
01.4.17	SIS-385	CLOSED	YES							<ul style="list-style-type: none"> SIS HEADER PURGE TO BUST. TECH SPEC ACTION STATEMENT ENTERED WHEN VALVE THROTTLED OPEN FOR SURVEILLANCE OF SI HEADER BORON CONCENTRATION
01.4.18	SIS-388	CLOSED	NO	NONE		UNKNOWN NEEDLE (SAMPLE VALVE)	CLOSED			<ul style="list-style-type: none"> SIS HEADER PURGE LINE PRESSURE INSTRUMENT ISOLATION
01.4.19	SIS-408	CLOSED	NO	NONE		GMI-1115	CLOSED			<ul style="list-style-type: none"> LOOP C SI HEADER NITROGEN TEST CONNECTION
01.4.20	SIS-410	CLOSED	NO	NONE		GMI-1116	CLOSED			<ul style="list-style-type: none"> LOOP B SI HEADER NITROGEN TEST CONNECTION
01.4.21	SV-702D	AUTO		SV-702C, SIS-405						<ul style="list-style-type: none"> LOOP B SI HEADER SAMPLE LINE CONTAINMENT ISOLATION
01.4.22	SV-702B	AUTO		SV-702A, SIS-406						<ul style="list-style-type: none"> LOOP C SI HEADER SAMPLE LINE CONTAINMENT ISOLATION
01.4.23	NOV-356	CLOSED	NO	VCC-305, 306						<ul style="list-style-type: none"> LOOP A CLR ISOLATION. VALVE NOT OPENED UNTIL CHARGING PUMP(S) RUNNING
01.4.24	NOV-357	CLOSED	NO	VCC-305, 306						<ul style="list-style-type: none"> LOOP B CLR ISOLATION. VALVE NOT OPENED UNTIL CHARGING PUMP(S) RUNNING

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
S&M OPERATOR UNIT 1
BOUNDARY VALVE ANALYSIS

SAFETY RELATED BOUNDARY				SAFETY RELATED BACKUP		NON-SAFETY RELATED BACKUP				REMARKS
ITEM #	TAG #	MC/AUTO?	LOCKED?	TAG #	MC/AUTO?	TAG #	MC/AUTO?	TAG #	MC/AUTO?	
01.4.25	MOV-158	CLOSED	NO	VCC-305, 306	CHECK					LOOP C CLR ISOLATION. VALVE NOT OPENED UNTIL CHARGING PUMP(S) RUNNING
01.4.26	CRS-360	OPEN		NONE		CRS-313, 361, 362, 371/372, 315, 376, 380, 383, 388, 389	CLOSED			RWST FILTER PUMP SUCTION. VALVE IS BR/WSR SEISMIC BOUNDARY AND MUST BE CLOSED DURING NORMAL OPERATION TO MEET SRP TOPIC III-6 COMMITMENTS. TECH SPIC ACTION ENTRY FOR INOPERABLE RWST REQUIRED WITH VALVE OPEN. CRS-318 IS BOUNDARY FROM WSR BACK TO SR PIPING
01.4.27	CRS-338	CLOSED	YES							REFUELING WATER PUMP BYPASS TO RWST. OPENED/THROTTLED FOR SECONDARY RECIRCULATION
01.4.28	CRS-391	CLOSED	NO	SPP-328	CLOSED	RWL-540				RWL ION EXCHANGER CONNECTION TO RWST
01.4.29	CRS-308	CLOSED	NO	NONE		NONE				C-8A DEDICATED SAFE SHUTDOWN MINIFLOW DRAIN
01.4.30	CRS-344	CLOSED	NO	NONE		CRS-318, VCC-384, 396, 398, 400, 402, 404	CLOSED			C-8A DEDICATED SAFE SHUTDOWN MINIFLOW TO RWST
01.4.31	CRS-438	CLOSED	NO	CAP						RWST LEVEL INSTRUMENT NOZZLE DRAIN
01.4.32	UNKNOWN	CLOSED	NO	NONE		NONE				RWST LEVEL INSTRUMENT (LS-63) DRAIN
01.4.33	UNKNOWN	CLOSED	NO	NONE		NONE				RWST LEVEL INSTRUMENT (LT-950) DRAIN
01.4.34	UNKNOWN	CLOSED	NO	NONE		NONE				RWST LEVEL INSTRUMENT (LT-3020) DRAIN
01.4.35	UNKNOWN	CLOSED	NO	NONE		NONE				RWST LEVEL INSTRUMENT (LS-30) DRAIN
01.4.36	LDS-805	CLOSED	NO	NONE		LDS-805	CLOSED			LBDOWN LINE DRAIN UPSTREAM OF REGENERATIVE BE
01.4.37	LDS-802	CLOSED	NO	NONE		BLIND FLANGE				LBDOWN LINE DRAIN DOWNSTREAM OF REGENERATIVE BE
01.4.38	CV-202	AUTO		CV-525 OR CV-526/LDS-312	OPEN					RCS LBDOWN ISOLATION. VALVE FAILURE OR LEAKAGE RESULTS IN SI DIVERSION, AND BACKUP VALVES NOT ADDRESSED IN ROI. HOWEVER, EVEN IF INCLUDED IN ROI, DIVERSION WOULD STILL OCCUR FOR SBLOCA AND HSLB VIA RV-206 TO PRT
01.4.39	CV-203	AUTO		CV-525 OR CV-526/LDS-312	OPEN					RCS LBDOWN ISOLATION. VALVE FAILURE OR LEAKAGE RESULTS IN SI DIVERSION, AND BACKUP VALVES NOT ADDRESSED IN ROI. HOWEVER, EVEN IF INCLUDED IN ROI, DIVERSION WOULD STILL OCCUR FOR SBLOCA AND HSLB VIA RV-206 TO PRT
01.4.40	CV-204	AUTO		CV-525 OR CV-526/LDS-312	OPEN					RCS LBDOWN ISOLATION. VALVE FAILURE OR LEAKAGE RESULTS IN SI DIVERSION, AND BACKUP VALVES NOT ADDRESSED IN ROI. HOWEVER, EVEN IF INCLUDED IN ROI, DIVERSION WOULD STILL OCCUR FOR SBLOCA AND HSLB VIA RV-206 TO PRT
01.4.41	CV-287	AUTO		LDS-010, HCV-1117	CLOSED					RCS EXCESS LBDOWN ISOLATION
01.4.42	PWS-567	CLOSED	NO	NONE		NONE				MFW PUMP RWST MINIFLOW DRAIN DOWNSTREAM OF CV-875B
01.4.43	PWS-554	CLOSED	NO	NONE		NONE				MFW PUMP RWST MINIFLOW DRAIN DOWNSTREAM OF CV-875A
01.4.44	PWS-544	CLOSED	NO	NONE		NONE				MFA PUMP RWST MINIFLOW DRAIN IN COMMON RETURN TO RWST

SECTION 2: COLD LEG RECIRCULATION

COLD LEG RECIRCULATION NOTES

1. Item numbers in this section have been assigned as follows:
 - 02.1: Train A CLR pumping and filter bypass, CLR flow path to RCS Loop A and boundary devices
 - 02.2: Train B CLR pumping and filter bypass, CLR flow path to RCS Loop B and boundary devices
 - 02.3: CLR flow path to RCS Loop C and boundary devices
 - 02.4: Common flow path and boundary devices.
2. Table 2-1 is the Failure Modes and Effects Analysis (FMEA) for the CLR function. Table 2-2 is the associated boundary valve analysis.
3. The boundary valve analysis for those portions of the Containment Recirculation and Spray system associated only containment spray is contained in Table 5-2.
4. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.
5. Potential single failure susceptibilities in the Boundary Valve Analysis table are flagged with "*" in the unlabelled field adjacent to REMARKS. Items flagged with "#" in the unlabelled field adjacent to REMARKS are acceptable from a single failure standpoint subject to credit for SEP Topic III-6 seismic boundary criteria.

COLD LEG RECIRCULATION REFERENCES

Piping and Instrumentation Diagrams

5178100	Reactor Coolant System
5178110	RCP Seal Water System (Sh 1)
5178111	RCP Seal Water System (Sh 2)
5178115	Safety Injection System
5178120	Containment Spray and Recirculation System (Sh 1)
5178121	Containment Spray and Recirculation System (Sh 2)
5178135	Volume Control and Charging System (Sh 1)
5178136	Volume Control and Charging System (Sh 2)
5178140	Letdown Demineralizer System
5178145	Boric Acid System
5178150	Reactor Cycle Sampling System
5178403	Gaseous Nitrogen System (Sh 4)
5178404	Gaseous Nitrogen System (Sh 5)
5178443	Instrument and Service Air System (Sh 4)
5178447	Instrument and Service Air System (Sh 8)
5178449	Instrument and Service Air System (Sh 10)
5178950	Post-Accident Sampling System (Sh 1)

Elementary Diagrams

N1542 Sh 1	Recirculation Pumps
N1546 Sh 13	Station Loss of Voltage Auto-Transfer
63719	FY-1112, FY-1115A/B/C/D/E/F (Sh 6)
64374	MOV-883
455369	MOV-1100B
455371	MOV-866A/B, MOV-18/19, MOV-356/357/358
455432	HCV-427A/B/C
455437	CV-410/411
455448	CV-304/305
455510	MG-8AF/BF (Charging Pump Lube Oil Cooler Fans)
455875	CV-406A/B
456246	FCV-1115D/E/F (Train B)
5150626	Charging Pumps
5150885	480 V Bus #1/2/3 Undervoltage
5151028	MOV-1100C
5167841	CV-2145
5202909	MOV-1100D

Other Drawings

63714 Sh 1	Loop: PT-425
64383	One-Line: CSAS Inverter (Train B)
451410	Loop: Recirculation/SI Flow
457257	Loop: LT-1100
5112418	Schematic: Auxiliary Relay Rack R12 (Rear)

Procedures

SO1-1.0-10	Reactor Trip or Safety Injection
SO1-1.0-12	SI Termination
SO1-1.0-20	Loss of Reactor Coolant
SO1-1.0-23	Transfer to Cold Leg Injection and Recirculation
SO1-4-39	Safety Injection Alignment
SO1-12.3-7	Monthly Sequencer Testing

SO1-14-40 Control of Locked Valves

Other Documents

SD-SO1-580 System Description: Safety Injection, Recirculation and Containment Spray Systems
SD-SO1-590 System Description: Safeguard Load Sequencing System
M89048 Response to Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety Related Systems", dated July 5, 1989

TABLE 2-1: COLD LEG RECIRCULATION FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN MARGUERITE UNIT 1
 TABLE 2-1: CORE LSI REGULATION PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON SCSS	REMARKS
02.1.01.01.1	MANUAL VALVES, TRAIN A FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	INCLUDES: VCC-202, -203, -229 AND -337
02.1.01.01.2	MANUAL VALVES, TRAIN A FLOW		CLOSED	TRAIN A CHARGING PUMP SUCTION, DISCHARGE OR MINIFLOW ISOLATED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	LOSS OF TRAIN A CHARGING PUMP CAPABILITY FOR CLB, HLR	
02.1.01.02.1	CHECK VALVES, TRAIN A FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES: CBS-000, VCC-305, -331
02.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	DIVERSION OF TRAIN A PUMP FLOW AND, FOR OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS, LOSS OF BCCIRC/RWST INVENTORY	PERIODIC SURVEILLANCE	SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	*POTENTIAL LOSS OF BOTH TRAINS OF CLB, HLR AND SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
02.1.02.01.2	MANUAL VALVES, TRAIN A BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
02.1.02.02.1	CHECK OR BELIEF VALVES, TRAIN A BOUNDARY		NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
02.1.03.01.1	G-45A	PUMP/MOTOR	LOW FLOW	REDUCED BCCIRC PUMP OUTPUT TO REFUELING WATER AND CHARGING PUMPS. NO EFFECT ON INJECTION	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A BCCIRC PUMPING	*PUMP 1ST DRY BUMP AND REFUELING INTERVAL MINIFLOW TESTS INADEQUATE TO VERIFY PERFORMANCE RELATIVE TO MINIMAL SYSTEM MARGINS. TECH SPEC MUST ALSO BE REVISED TO REQUIRE OPERABILITY OF BOTH BCCIRC PUMPS
02.1.03.02.1	G-45A	8MGR #1 (52-1107)	OPEN	TRAIN A BCCIRC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 2.1.3.1.1)	(SAME AS 2.1.3.1.1)	NORMAL POSITION
02.1.03.02.2	G-45A	8MGR #1 (52-1107)	CLOSED	TRAIN A BCCIRC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING OR (IF PRIOR TO SUBMERGENCE) PUMP DAMAGE	CONTROL ROOM INDICATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN A BCCIRC PUMP OR ELECTRICAL POWER	PUMP NORMALLY DRY
02.1.03.03.1	G-45A	27-112 (UV RELAY)	TRIPPED	BUS UV TRIP SEAL-IN TO TRAIN A BCCIRC PUMP. TRIPS PUMP IF RUNNING, BLOCKS START IF NOT	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A BCCIRC PUMPING	
02.1.03.03.2	G-45A	27-112 (UV RELAY)	UNTRIPPED	BUS UV TRIP DEPRATED TO TRAIN A BCCIRC PUMP, CAUSING OUT OF SEQUENCE BUS LOADING IF PUMP ON AT TIME OF SIS/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER	NORMAL POSITION
02.1.03.04.1	G-45A	LSI (SUMP LVL RELAT)	CONTACTS OPEN	SERVICE WATER COOLING DISABLED TO TRAIN A BCCIRC PUMP FOR NORMAL TESTING. NOT REQUIRED WHEN SUBMERGED POST-ACCIDENT	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A BCCIRC PUMPING	
02.1.03.04.2	G-45A	LSI (SUMP LVL RELAT)	CONTACTS CLOSED	SERVICE WATER COOLING AND UNQUALIFIED SV (PV-2077) ISOLATED AFTER PUMP START	PERIODIC TESTING	ISOLATION PUSRS PRESENT (B)(2) INTERACTION WITH PUMP CONTROLS	REDUCED RELIABILITY OF TRAIN A BCCIRC PUMPING	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOFFER UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON SCS	REMARKS
02.1.03.05.1	G-45A	RV-2017	BA	LOSS OF SERVICE WATER COOLING TO TRAIN A RECIRC PUMP, PUSHES BLOW TO PROTECT PUMP CONTROLS	PERIODIC TESTING	ISOLATION FUSES PREVENT (B1) (2) INTERACTION WITH PUMP CONTROLS	REDUCED RELIABILITY OF TRAIN A RECIRC PUMPING	
02.1.03.06.1	G-45A	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	TRAIN A RECIRC PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN A RECIRC PUMPING	
02.1.04.01.1	MOV-866A	VALVE/ACTUATOR	OPEN	LOSS OF INJECTION MODE CHARGING AND REFUELING WATER PUMP SUCTION DUE TO GAS BINDING OF COMMON PIPING BY CONTAINMENT PRESSURE	CONTROL ROOM INDICATION	NONE FOR INJECTION, CHECK VALVE PREVENTS BACKFLOW	LOSS OF INJECTION MODE AND POTENTIAL LOSS OF RECIRC MODE CHARGING DUE TO GAS BINDING OF COMMON SUCTION PIPING	LINE LOCK OUT OF MOV-866A AND NOV-866B REQUIRED PER NBC BRANCH TECHNICAL POSITION ICSS-18
02.1.04.01.2	MOV-866A	VALVE/ACTUATOR	CLOSED	TRAIN A RECIRC PUMP CANNOT BE ALIGNED	PERIODIC TESTING	REDUNDANT TRAIN	IMOPERABILITY OF TRAIN A RECIRC PUMPING CAPABILITY	NORMAL POSITION
02.1.04.02.1	MOV-866A	MCC-1 (42-1182)	VOLTS LOW	TRAIN A RECIRC PUMP CANNOT BE ALIGNED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	IMOPERABILITY OF TRAIN A RECIRC PUMPING CAPABILITY	
02.1.05.01.1	MOV-1100B	VALVE/ACTUATOR	OPEN	NOT ALIGNED TO CHARGING PUMP SUCTION. NORMAL FOR INJECTION. CLR AND HLR. SEAL RETURN TO VCT ISOLATED VIA INTERLOCK TO CV-410 AND CV-411	CONTROL ROOM INDICATION	CHECK VALVE (VSC-388) PREVENTS BACKFLOW DURING NORMAL OPS. MANUAL VALVE (CR3-316 OR -425) FOR SECONDARY RECIRC. NONE REQUIRED FOR CLR AND HLR	NONE FOR INJECTION, CLR OR HLR. LOSS OF REMOTE-MANUAL CHARGING SUCTION ISOLATION FOR SECONDARY RECIRC	
02.1.05.01.2	MOV-1100B	VALVE/ACTUATOR	CLOSED	1 OF 2 SUCTION VALVES FAILS TO OPEN FOR INJECTION, CLR AND HLR. NORMAL FOR SECONDARY RECIRC	PERIODIC TESTING	REDUNDANT VALVE FOR INJECTION, CLR AND HLR. NONE REQUIRED FOR SECONDARY RECIRC	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	NORMAL POSITION
02.1.05.02.1	MOV-1100B	LC-1100B1	HIGH LEVEL	MOV-1100B WILL NOT AUTO-OPEN ON LOW VCT LEVEL DURING NORMAL OPS. NO EFFECT ON SBQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	REDUNDANT VALVE FOR NORMAL OPS. NONE REQUIRED FOR INJECTION OR RECIRC	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT DURING NORMAL OPS. NONE FOR INJECTION OR FOR RECIRCULATION (IF VALVE IN MANUAL MODE PRIOR TO SEQ 1 BLOCK/RESSET)	
02.1.05.02.2	MOV-1100B	LC-1100B1	LOW LEVEL	MOV-1100B WILL AUTO-OPEN (AND NOT AUTO-CLOSE ON HIGH VCT LEVEL) DURING NORMAL OPS. NO EFFECT ON SBQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION OR RECIRC	NONE IF VALVE PLACED IN MANUAL PRIOR TO SEQ 1 BLOCK/RESSET	
02.1.05.03.1	MOV-1100B (MOV-1100C)	LS-9	CONTACTS OPEN	MOV-1100B WILL NOT AUTO-CLOSE ON HIGH VCT LEVEL DURING NORMAL OPS. NO EFFECT ON SBQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	NONE REQUIRED FOR INJECTION OR RECIRC		
02.1.05.03.2	MOV-1100B (MOV-1100C)	LS-9	CONTACTS CLOSED	MOV-1100B WILL AUTO-CLOSE ON HIGH VCT LEVEL BEFORE MOV-1100C IS FULLY OPEN, INCREASING POTENTIAL FOR LOSS OF SUCTION TO CHARGING PUMPS. NO EFFECT ON SBQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	REDUNDANT CONTACTS FROM LC-1100B1	REDUCED RELIABILITY FOR BOTH CHARGING PUMPS DURING NORMAL OPERATION	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR OWNER UNIT 1
TABLE 2-1: COLD LZG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
02.1.05.04.1	MOV-1100B	SBQ 1 (39-1, 3)	OFF (OPEN)	MOV-1100B WILL NOT OPEN ON SIS/SISLOP. AUTO-LEVEL AND MANUAL OPERATION UNAPPECTED	PERIODIC TESTING	REDUNDANT VALVES FOR INJECTION, NONE REQUIRED FOR RECIRC	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	VALVE REMOTE-MANUALLY OPENED PER PROCEDURE IF AUTO-OPEN FAILS
02.1.05.04.2	MOV-1100B	SBQ 1 (39-1, 3)	ON (CLOSED)	MOV-1100C AND MOV-1100C REALIGN FOR RWST SUCTION TO CHARGING PUMPS, CV-410 AND CV-411 CLOSE	CONTROL ROOM INDICATION	NONE REQUIRED FOR INJECTION, CLR OR HLR. REDUNDANT MANUAL VALVES FOR SECONDARY RECIRC	NONE FOR INJECTION, CLR OR HLR. LOSS OF REMOTE-MANUAL CHARGING SUCTION REALIGNMENT FOR SECONDARY RECIRC	
02.1.05.05.1	MOV-1100B	SIX (RBLAT)	OFF	MOV-1100C WILL NOT CLOSE ON SBQ 1 SIS/SISLOP. NO EFFECT ON MOV-1100B OR D ACTUATION	PERIODIC TESTING	REDUNDANT MOV-1100C INPUT FROM MOV-1100B (SBQ 2/SIX) FOR INJECTION, NONE REQUIRED FOR RECIRC	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT (VCT ISOLATION)	NORMAL POSITION
02.1.05.05.2	MOV-1100B	SIX (RBLAT)	ON	SBQ AUTO-CLOSE SIGNAL TO MOV-1100C, CAUSING VALVE TO CLOSE AS SOON AS LIMIT SWITCH INTERLOCK SATISFIED BY MOV-1100B OR D OPEN. NO EFFECT ON MOV-1100B OR D	PERIODIC TESTING	NONE REQUIRED	NONE. VALVES RESPOND NORMALLY TO SBQ INITIATION AND RESET	
02.1.05.06.1	MOV-1100B	LS-5	CONTACTS OPEN	MOV-1100B NOT-CLOSED SIGNAL ISOLATES SEAL WATER RETURN TO VCT VIA CV-410. NO EFFECT ON MOV-1100B OPERATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. DUE TO NORMAL PATH TO SUCTION RETURN	
02.1.05.06.2	MOV-1100B	LS-5	CONTACTS CLOSED	LOSS OF MOV-1100B INTERLOCK TO CV-410	PERIODIC TESTING	REDUNDANT VALVE	REDUCED REDUNDANCY FOR SEAL WATER RETURN ISOLATION TO VCT	
02.1.05.07.1	MOV-1100B	LS-6	CONTACTS OPEN	MOV-1100B NOT CLOSED SIGNAL ISOLATES SEAL WATER RETURN TO VCT VIA CV-411. NO EFFECT ON MOV-1100B OPERATION	(SAME AS 2.1.5.6.1)	(SAME AS 2.1.5.6.1)	(SAME AS 2.1.5.6.1)	
02.1.05.07.2	MOV-1100B	LS-6	CONTACTS CLOSED	LOSS OF MOV-1100B INTERLOCK TO CV-411	(SAME AS 2.1.5.6.2)	(SAME AS 2.1.5.6.2)	(SAME AS 2.1.5.6.2)	
02.1.05.08.1	MOV-1100B	LS-9	CONTACTS CLOSED	VALVE OPEN SIGNAL TO MOV-1100C WILL PERMIT MOV-1100C TO AUTO-CLOSE ON LOW VCT LEVEL OR SBQ SIGNAL (VIA SIX RBLAT) BEFORE MOV-1100B OR D FULL OPEN, INCREASING POTENTIAL FOR LOSS OF SUCTION TO CHARGING PUMPS. NO EFFECT ON MOV-1100B OPERATION	PERIODIC TESTING	REDUNDANT CONTACTS FROM LC-1100B AND SIX RBLAYS	REDUCED RELIABILITY FOR BOTH CHARGING PUMPS DURING NORMAL OPERATION	
02.1.05.08.2	MOV-1100B	LS-9	CONTACTS OPEN	LOSS OF 1 OF 2 VALVE OPEN SIGNALS TO MOV-1100C SBQ AND VCT LEVEL AUTO-CLOSE CBTS	PERIODIC TESTING	REDUNDANT CONTACTS FROM MOV-1100B	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	
02.1.05.09.1	MOV-1100B	LS-10	CONTACTS CLOSED	VALVE OPEN SIGNAL TO MOV-1100C WILL PERMIT MOV-1100C TO AUTO-OPEN ON HIGH VCT LEVEL WITH NO SBQ SIGNAL	PERIODIC TESTING	NONE REQUIRED	NONE FOR INJECTION OR HLR	MOV-1100C PLACED IN MANUAL PRIOR TO SBQ BLOCK/RESET) CLR, HLR
02.1.05.09.2	MOV-1100B	LS-10	CONTACTS OPEN	LOSS OF 1 OF 2 VALVE OPEN SIGNALS TO MOV-1100C AUTO-OPEN ON VCT LEVEL	PERIODIC TESTING	NONE REQUIRED	NONE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFR UNIT 1
TABLE 2-1: COLD LBC RECIRCULATION FNSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.1.05.10.1	NOV-1100B	NCC-1 (42-1147)	VOLTS LOW	NOV-1100B CANNOT BE OPENED REMOTE-MANUALLY OR VIA SIS/SISLOP FOR INJECTION, CLR AND HLR. OR CANNOT BE RE-CLOSED REMOTE-MANUALLY FOR SECONDARY RECIRC	CONTROL ROOM INDICATION	REDUNDANT VALVE/TRAIN	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	
02.1.06.01.1	G-8B	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN A CHARGING PUMP FLOW. RESULTS IN AUTO-START SIGNAL TO REDUNDANT PUMP G-8A ON LOW DISCHARGE PRESSURE (PIC-11111) DURING NORMAL OPS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING	REDUNDANT PUMP/TRAIN	IMPERABILITY OF TRAIN A PUMPING FOR CLR AND HLR PRIMARY PATH	INCLUDES AUT L.G. PUMP AND FAN COOLER. CHARGING FLOW NOT CREDITED FOR INJECTION
02.1.06.02.1	G-8B	BUS SIC (152-11C07)	OPEN	TRAIN A CHARGING PUMP TRIPS, OR FAILS TO START ON SIS/SISLOP IF SELECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP/TRAIN	IMPERABILITY OF TRAIN A PUMPING FOR CLR AND HLR PRIMARY PATH	
02.1.06.02.2	G-8B	BUS SIC (152-11C07)	CLOSED	TRAIN A PUMP STARTS OR FAILS TO TRIP ON SIS/SISLOP IF SELECTED. NOV-1100C UNAPFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NOV-1100C CLOSURES AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	ADMINISTRATIVELY CONTROLLED SELECTOR SWITCHES ALIGN NOV-1100C POWER TO SAME TRAIN AS CHARGING PUMP SELECTED TO START, WITH OTHER TRAIN CHARGING PUMP TRIPPED AND LOCKED OUT ON SIS/SISLOP
02.1.06.03.1	G-8B	162 TDC (152-12C07)	ON (CONTACTS CLOSED)	TRAIN A CHARGING PUMP AUTO-START ENABLED ON LOW DISCHARGE HEADER PRESSURE WITH G8A OPP. NO EFFECT ON SBQ ACTUATION BUT PUMP MAY START ON SBQ BLOCK/BSBT WITH PIC-11111 BQ FAILURE	PERIODIC TESTING	(SAME AS 2.1.6.2.2)	(SAME AS 2.1.6.2.2)	
02.1.06.03.2	G-8B	162 TDC (152-12C07)	OFF (CONTACTS OPEN)	TRAIN A CHARGING PUMP AUTO-START ON LOW DISCHARGE HEADER PRESSURE DISABLED. NO EFFECT ON SBQ ACTUATION	PERIODIC TESTING	NONE REQUIRED	NONE	
02.1.06.04.1	G-8B	186 (152-12C07)	ON (CONTACTS CLOSED)	TRAIN A CHARGING PUMP AUTO-STARTS, CANNOT BE MANUALLY TRIPPED AFTER PUMP LOCKOUT BSBT. NO EFFECT ON SBQ ACTUATION	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	RELAY 74-1 SEALS IN TR RELAY IN DR-SELECTED PUMP AFTER SBQ BLOCK/BSBT
02.1.06.04.2	G-8B	186 (152-12C07)	OFF (CONTACTS OPEN)	TRAIN A CHARGING PUMP AUTO-START ON TRAIN B PUMP ELECTRICAL FAULT DISABLED. NO EFFECT ON SBQ ACTUATION	(SAME AS 2.1.6.3.2)	(SAME AS 2.1.6.3.2)	(SAME AS 2.1.6.3.2)	
02.1.06.05.1	G-8B	(NOT USED)	ON (CONTACTS CLOSED)	TRAIN A CHARGING PUMP (AND OTHER TRAIN A HV LOADS) TRIP AFTER 11.5 SEC, CANNOT BE RESTARTED (RELAY DOES NOT BSBT), OR RESTART DELAYED BY 35 SEC (RELAY RESETS)	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	IMPERABILITY OF TRAIN A PUMPING FOR CLR AND HLR PRIMARY FLOW PATH	UV RELAY TRIP DOES NOT OCCUR DURING SISLOP TP DG RE-BUSING BUS WITHIN 10 SEC SAFETY ANALYSIS LIMITS
02.1.06.06.1	G-8B	194-1 (RBLAT)	ON (CONTACTS CLOSED)	TRAIN A CHARGING PUMP (AND OTHER TRAIN A HV LOADS) TRIP AFTER 11.5 SEC, CANNOT BE RESTARTED (RELAY DOES NOT BSBT), OR RESTART DELAYED BY 35 SEC (RELAY RESETS)	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	IMPERABILITY OF TRAIN A PUMPING FOR CLR AND HLR PRIMARY FLOW PATH	UV RELAY TRIP DOES NOT OCCUR DURING SISLOP TP DG RE-BUSING BUS WITHIN 10 SEC SAFETY ANALYSIS LIMITS

REACTOR CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONOFFER UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
02.1.06.06.2 G-8B		194-1 (RELAY)	OFF (CONTACTS OPEN)	TRAIN A CHARGING PUMP (AND OTHER TRAIN A 4 KV LOADS) WILL NOT TRIP ON BUS UNDERVOLTAGE DURING NORMAL OPERATION. NO EFFECT ON SBQ ACTUATION OR LOAD SEQUENCING DUE TO SEPARATE SISLOP TRIP SIGNAL TO 4 KV LOADS.	PERIODIC TESTING	NONE REQUIRED	NONE	
02.1.06.07.1 G-8B		SS-1 (SEL. SWITCH)	BUS 81C (CONTACTS OPEN)	TRAIN A CHARGING PUMP WILL NOT TRIP ON SIS/SISLOP. NORMAL FOR TRAIN A CHARGING PUMP/NOV-1100C SELECTION. NO EFFECT ON TRAIN B PUMP OR NOV-1100C SBQ ACTUATION	PERIODIC SURVEILLANCE AND TESTING	NOV-1100C CLOSERS AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	
02.1.06.07.2 G-8B		SS-1 (SEL. SWITCH)	BUS 82C (CONTACTS CLOSED)	TRAIN A CHARGING PUMP WILL TRIP ON SIS/SISLOP. NORMAL FOR TRAIN B CHARGING PUMP/NOV-1100C SELECTION. NO EFFECT ON TRAIN B PUMP OR NOV-1100C SBQ ACTUATION	PERIODIC SURVEILLANCE AND TESTING	NONE REQUIRED FOR INJECTION, MANUAL CONTROL AFTER SBQ BLOCK/RESET FOR CLR AND NLR	LOSS OF AUTOMATIC INJECTION MODE CHARGING CAPABILITY IF TRAIN A PRESSELECTED ON SS (NOV-1100C) AND SS-2 (G-8A)	CHARGING NOT CREDITED DURING INJECTION. SELECTOR SWITCH POSITIONS ADMINISTRATIVELY CONTROLLED
02.1.06.08.1 G-8B		SBQ 1 (28-1, 3)	OFF (CONTACTS OPEN)	TRAIN A CHARGING PUMP WILL NOT TRIP ON SIS/SISLOP	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, MANUAL CONTROL AFTER SBQ BLOCK/RESET FOR CLR AND NLR	LOSS OF AUTOMATIC INJECTION MODE CHARGING CAPABILITY IF TRAIN A SELECTED ON SS (NOV-1100C) AND SS-2 (G-8A)	CHARGING NOT CREDITED DURING INJECTION
02.1.06.08.2 G-8B		SBQ 1 (28-1, 3)	ON (CONTACTS CLOSED)	TRAIN A CHARGING PUMP START SIGNAL. MAY CAUSE OUT-OF-SEQUENCE PUMP LOADING ON SISLOP IF TRAIN A SELECTED. TRIP ON SIS/SISLOP VIA SEPARATE SBQ CONTACTS AND SS-1 (IF TRAIN B SELECTED) NOT AFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP WITH TRAIN A SELECTED, NONE REQUIRED FOR SIS OR TRAIN B SELECTION	IMPOSSIBILITY OF TRAIN A FOR SISLOP. NO EFFECT IF SIS OR TRAIN B SELECTED	
02.1.06.09.1 G-8B		SBQ 1 (28-9, 11)	OFF (CONTACTS OPEN)	TRAIN A CHARGING PUMP WILL NOT TRIP ON SIS/SISLOP. NORMAL FOR TRAIN A CHARGING PUMP/NOV-1100C SELECTION. NO EFFECT ON TRAIN B PUMP OR NOV-1100C SBQ ACTUATION	PERIODIC SURVEILLANCE AND TESTING	NOV-1100C CLOSERS AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	
02.1.06.09.2 G-8B		SBQ 1 (28-9, 11)	ON (CONTACTS CLOSED)	TRAIN A CHARGING PUMP WILL TRIP IF TRAIN B SELECTED ON SS-1. NO EFFECT ON TRAIN B PUMP OR NOV-1100C SBQ ACTUATION	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION, REDUNDANT PUMP FOR CLR AND NLR	(SAME AS 2.1.6.1.2)	
02.1.06.10.1 G-8B		162 TDC (152-11C07)	ON	TRAIN B CHARGING PUMP AUTO-START ENABLED ON LOW DISCHARGE HEADS PRESSURE WITH G-8B OFF. NO EFFECT ON SBQ ACTUATION OF EITHER PUMP, BUT G-8A MAY START ON SBQ BLOCK/RESET WITH PIC-1111 E.	PERIODIC TESTING	NOV-1100C CLOSERS AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 2-1: COLD LRG RECIRCULATION PHEA

ITSM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCS	RSNARES
02.1.06.10.2 G-89	162 TDC (152-11C07)		OFF	TRAIN B CHARGING PUMP AUTO-START DISABLED ON LOW DISCHARGE HEADER PRESSURE. NO EFFECT ON SRQ ACTUATION OF EITHER PUMP.	PERIODIC TESTING	NONE REQUIRED	NONE	
02.1.06.11.1 G-88	186 (152-11C07)		ON	TRAIN A CHARGING PUMP LOCKED OUT, TRAIN B PUMP AUTO-STARTS AND CANNOT BE TRIPPED AFTER SRQ BLOCK RESET	CONTROL ROOM INDICATION	REDUNDANT TRAIN	LOSS OF TRAIN A CHARGING PUMP CAPABILITY FOR INJECTION, CLR AND HLR	
02.1.06.11.2 G-88	186 (152-11C07)		OFF	TRAIN A PROTECTION DISABLED FOR G-88 FAULTS	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY FOR TRAIN A ELECTRICAL SYSTEM	
02.1.06.12.1 G-88	MCC-1 (42-1129)		VOLTS LOW	TRAIN A MOTOR-DRIVEN LUBE OIL PUMP WILL NOT START ON LOW BEARING PRESSURE WITH PUMP RUNNING	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BOUNDS BY FAILURE OF LUBE OIL PUMP MOTOR. MOTOR-DRIVEN LUBE OIL PUMP NOT CREDITED IN LIBR OF SHAFT-DRIVEN PUMP
02.1.06.13.1 G-88	MCC-1 (42-1135)		VOLTS LOW	TRAIN A LUBE OIL FAN COOLER WILL NOT START ON DISLOP WITH PUMP RUNNING	PERIODIC TESTING	NONE REQUIRED	NONE	BOUNDS BY FAILURE OF FAN MOTOR. LUBE OIL FAN COOLER NOT CREDITED IN LIBR OF SHAFT-DRIVEN PUMP
02.1.06.14.1 G-88	BUS #1C 125VDC CONTROL POWER		VOLTS LOW	TRAIN A CHARGING PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CHARGING PUMP FOR INJECTION, CLR AND HLR	
02.1.06.15.1 G-88	(NOT USED)							
02.1.07.01.1 NOV-19	VALVE/ACTUATOR		OPEN	1 OF 2 FILTER BYPASS PATHS ALIGNED FOR CLR	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	
02.1.07.01.2 NOV-19	VALVE/ACTUATOR		CLOSED	1 OF 2 FILTER BYPASS PATHS DISABLED FOR CLR	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE (NOV-18)	REDUCED REDUNDANCY FOR CLR DISCHARGE FLOW PATH	
02.1.07.02.1 NOV-19	MCC-1 (42-1146)		VOLTS LOW	NOV-19 FAILS AS-IS	CONTROL ROOM INDICATION	REDUNDANT VALVE (NOV-18)	REDUCED REDUNDANCY FOR CLR DISCHARGE FLOW PATH IF FAILURE PRIOR TO REALIGNMENT	
02.1.08.01.1 NOV-356	VALVE/ACTUATOR		OPEN	1 OF 3 CLR PATHS ALIGNED TO RCS, CANNOT BE RECLOSED TO ISOLATE PCV-1115A/D IF REQUIRED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CLR ALIGNMENT	NONE FOR CLR ALIGNMENT	*NOT ACCEPTABLE FOR INJECTION WITH CONCURRENT FAILURE OF CHARGING (EG. DUE TO NOV-1100C). TECH SPRC ACTION ENTRY REQUIRED WITH VALVE OPEN DURING NORMAL OPERATION
02.1.08.01.2 NOV-356	VALVE/ACTUATOR		CLOSED	1 OF 3 CLR PATHS TO RCS LOOPS DISABLED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT FLOW PATHS TO RCS LOOPS B AND C	LOSS OF RCS LOOP A CLR FLOW PATH	FLOW VIA SHAL INJECTION TO ECP IN AFFECTED LOOP NOT CREDITED
02.1.08.02.1 NOV-356	MCC-1 (42-1158)		VOLTS LOW	NOV-356 CANNOT BE REPOSITIONED, RESULTING IN POTENTIAL LOSS OF 1 OF 3 CLR PATHS (IF CLOSED) OR INABILITY TO ISOLATE PCV-1115A/D (IF OPEN)	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS B AND C FOR CLR	POTENTIAL LOSS OF CLR FLOW PATH TO RCS LOOP A	
02.2.01.01.1	MANUAL VALVES, TRAIN B FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	INCLUDES: CRS-009, VCC-308, -332

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONEOFFER UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.2.01.01.2	MANUAL VALVES, TRAIN B FLOW		CLOSED	TRAIN B CHARGING PUMP SUCTION, DISCHARGE OR MINIFLOW ISOLATED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	LOSS OF TRAIN B CHARGING PUMP CAPABILITY FOR CLR AND HLR	
02.2.01.02.1	CHECK VALVES, TRAIN B FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES: CRS-009, VCC-308, -332
02.2.02.01.1	MANUAL BOUNDARY VALVES, TRAIN B		OPEN	DIVERSION OF TRAIN B PUMP FLOW AND, FOR VALVES OUTSIDE CONTAINMENT WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS, LOSS OF RECIRC/RNST INVENTORY	PERIODIC SURVEILLANCE	SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	POTENTIAL LOSS OF BOTH TRAINS OF CLR, HLR AND SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
02.2.02.01.2	MANUAL BOUNDARY VALVES, TRAIN B		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
02.2.02.02.1	CHECK OR RELIEF VALVES, TRAIN B BOUNDARY		NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
02.2.03.01.1	G-45B	PUMP/MOTOR	LOW FLOW	REDUCED RECIRC PUMP OUTPUT TO REFUELING WATER AND CHARGING PUMPS. NO EFFECT ON INJECTION	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B RECIRC PUMPING	*PUMP 1ST DRY RUMP AND REFUELING INTERVAL MINIFLOW TESTS INADEQUATE TO VERIFY PERFORMANCE RELATIVE TO MINIMAL SYSTEM MARGINS. TRCH SPEC MUST ALSO BE REVISED TO REQUIRE OPERABILITY OF BOTH PUMPS
02.2.03.02.1	G-45B	SWGR #2 (52-1207)	OPEN	TRAIN B RECIRC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B RECIRC PUMPING	NORMAL POSITION
02.2.03.02.2	G-45B	SWGR #2 (52-1207)	CLOSED	TRAIN B RECIRC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING OR (IF PRIOR TO SUBMERGENCE) PUMP DAMAGE	CONTROL ROOM INDICATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN B RECIRC PUMP OR ELECTRICAL POWER	PUMP NORMALLY DRY
02.2.03.03.1	G-45B	Z1-1E2 (UV RELAY)	TRIPPED	BUS UV TRIP SEAL-IN TO TRAIN B RECIRC PUMP. TRIPS PUMP IF BURNING, BLOCKS START IF NOT	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B RECIRC PUMPING	
02.2.03.03.2	G-45B	Z1-1E2 (UV RELAY)	UNTRIPPED	BUS UV TRIP DEFRATED TO TRAIN B RECIRC PUMP, CAUSING OUT OF SEQUENCE BUS LOADING IF PUMP ON AT TIME OF SIS/SISLOP	PERIODIC TESTING	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER	NORMAL POSITION
02.2.03.04.1	G-45B	LSI (SUMP LVL RELAY)	CONTACTS OPEN	SERVICE WATER COOLING DISABLED TO TRAIN B RECIRC PUMP FOR NORMAL TESTING. NOT REQUIRED WHEN SUBMERGED POST-ACCIDENT	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B RECIRC PUMPING	
02.2.03.04.2	G-45B	LSI (SUMP LVL RELAY)	CONTACTS CLOSED	SERVICE WATER COOLING AND UNQUALIFIED SV (PV-3077) ISOLATED AFTER PUMP START	PERIODIC TESTING	ISOLATION FUSES PREVENT (B)(2) REDUCED RELIABILITY OF TRAIN B INTERACTION WITH PUMP CONTROLS RECIRC PUMPING		NORMAL POSITION
02.2.03.05.1	G-45B	PV-3077	EQ	LOSS OF SERVICE WATER COOLING TO TRAIN B RECIRC PUMP, FUSES BLEW TO PROTECT PUMP CONTROLS	PERIODIC TESTING	ISOLATION FUSES PREVENT (B)(2) REDUCED RELIABILITY OF TRAIN B INTERACTION WITH PUMP CONTROLS RECIRC PUMPING		

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFR UNIT 1
 TABLE 2-1: COLD LBC RECIRCULATION PNEA

ITRM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCOS	REMARKS
02.2.03.06.1	G-458	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	TRAIN B RECIRC PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN B RECIRC PUMPING	
02.2.04.01.1	NOV-8668	VALVE/ACTUATOR	OPEN	LOSS OF INJECTION MODE CHARGING AND REBULLING WATER PUMP SUCTION DUE TO GAS BINDING OF COMMON PIPING BY CONTAINMENT PRESSURE	CONTROL ROOM INDICATION	NONE FOR INJECTION, CHECK VALVE PREVENTS BACKFLOW	LOSS OF INJECTION MODE CONTAINMENT SPRAY AND CHARGING AND POTENTIAL LOSS OF RECIRC MODE CHARGING DUE TO GAS BINDING OF COMMON SUCTION PIPING	POWER LOCK OUT OF NOV-8668 AND NOV-8668 REQUIRED PER NBC BRANCH TECHNICAL POSITION ICSB-18
02.2.04.01.2	NOV-8668	VALVE/ACTUATOR	CLOSED	TRAIN B RECIRC PUMP CANNOT BE ALIGNED	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B RECIRC PUMPING CAPABILITY	NORMAL POSITION
02.2.04.02.1	NOV-8668	MCC-2 (42-1270)	VOLTS LOW	TRAIN B RECIRC PUMP CANNOT BE ALIGNED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B RECIRC PUMPING CAPABILITY	
02.2.05.01.1	NOV-1100D	VALVE/ACTUATOR	OPEN	MUST ALIGN TO CHARGING PUMP SUCTION. NORMAL FOR INJECTION, CLR AND HLR. SEAL RETURN TO VCT ISOLATED VIA INTERLOCK TO CV-410 AND CV-411	CONTROL ROOM INDICATION	CHECK VALVE (VCC-306) PREVENTS BACKFLOW DURING NORMAL OPS, MANUAL VALVE (CRS-316 OR -425) FOR SECONDARY RECIRC, NONE REQUIRED FOR CLR AND HLR	LOSS OF REMOTE-MANUAL CHARGING SUCTION ISOLATION FOR SECONDARY RECIRC	
02.2.05.01.2	NOV-1100D	VALVE/ACTUATOR	CLOSED	1 OF 2 SUCTION VALVES FAILS TO OPEN FOR INJECTION, CLR AND HLR. NORMAL FOR SECONDARY RECIRC	PERIODIC TESTING	REDUNDANT VALVE FOR INJECTION, CLR AND HLR. NONE REQUIRED FOR SECONDARY RECIRC	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	NORMAL POSITION
02.2.05.02.1	NOV-1100D	LC-1100BX	HIGH LEVEL	NOV-1100D WILL NOT AUTO-OPEN ON LOW VCT LEVEL DURING NORMAL OPS. NO EFFECT ON SEQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	REDUNDANT VALVE FOR NORMAL OPS. NONE REQUIRED FOR INJECTION OR RECIRC	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT DURING NORMAL OPS. NONE FOR INJECTION OR FOR RECIRCULATION (IF VALVE IN MANUAL MODE PRIOR TO SEQ 2 BLOCK/RESET)	
02.2.05.02.2	NOV-1100D	LC-1100BX	LOW LEVEL	NOV-1100D WILL AUTO-OPEN (AND NOT AUTO-CLOSE ON HIGH VCT LEVEL) DURING NORMAL OPS. NO EFFECT ON SEQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION OR RECIRC	NONE (IF VALVE PLACED IN MANUAL PRIOR TO SEQ 2 BLOCK/RESET)	
02.2.05.03.1	NOV-1100D	LS-10 (NOV-1100C)	CONTACTS OPEN	NOV-1100D WILL NOT AUTO-CLOSE ON HIGH VCT LEVEL DURING NORMAL OPS. NO EFFECT ON SEQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	NONE REQUIRED FOR INJECTION OR NONE RECIRC		
02.2.05.03.2	NOV-1100D	LS-10 (NOV-1100C)	CONTACTS CLOSED	NOV-1100D WILL AUTO-CLOSE ON HIGH VCT LEVEL BEFORE NOV-1100C IS FULLY OPEN, INCREASING POTENTIAL FOR LOSS OF SUCTION TO CHARGING PUMPS. NO EFFECT ON SEQ ACTUATION OR (IF IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	REDUNDANT CONTACTS FROM LC-1100BX	REDUCED RELIABILITY FOR BOTH CHARGING PUMPS DURING NORMAL OPERATION	
02.2.05.04.1	NOV-1100D	SBQ 2 (39-1, 3)	OFF (OPBN)	NOV-1100D WILL NOT OPEN ON SIS/SISLOP. AUTO-LEVEL AND MANUAL OPERATION UNAFFECTED	PERIODIC TESTING	REDUNDANT VALVES FOR INJECTION, NONE REQUIRED FOR RECIRC	REDUCED REDUNDANCY FOR CHARGING VALVE REMOTE-MANUALLY OPENED PUMP SUCTION REALIGNMENT	PER PROCEDURES IF AUTO-OPEN FAILS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURES ANALYSIS
 SAN ONCPRE UNIT 1
 TABLE 2-1: COLD LEG RECIRCULATION PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.2.05.01.2	NOV-11000	SRQ 2 (39-1, 3)	ON (CLOSED)	NOV-11000 AND NOV-1100C REALIGN FOR RMST SUCTION TO CHARGING PUMPS, CV-410 AND CV-311 CLOSE	CONTROL ROOM INDICATION	NONE REQUIRED FOR INJECTION, CLR OR HLR. REDUNDANT MANUAL VALVES FOR SECONDARY RECIRC	NONE FOR INJECTION, CLR OR HLR. LOSS OF REMOTE-MANUAL CHARGING SUCTION REALIGNMENT FOR SECONDARY RECIRC.	
02.2.05.05.1	NOV-11000	SIX (RELAY)	OFF	NOV-1100C WILL NOT CLOSE ON SRQ 2 SIS/SISLOP. NO EFFECT ON NOV-1100B OR D ACTUATION	PERIODIC TESTING	REDUNDANT NOV-1100C INPUT FROM NOV-1100B (SRQ 1) FOR INJECTION, NONE REQUIRED FOR RECIRC	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT (VCT ISOLATION)	NORMAL POSITION
02.2.05.05.2	NOV-11000	SIX (RELAY)	ON	SRQ AUTO-CLOSE SIGNAL TO NOV-1100C, CAUSING VALVE TO CLOSE AS SOON AS LIMIT-SWITCH INTERLOCK SATISFIED BY NOV-1100B OR D. NO EFFECT ON NOV-1100B OR D	PERIODIC TESTING	NONE REQUIRED	NONE. VALVES RESPOND NORMALLY TO SRQ INITIATION AND RESET	
02.2.05.06.1	NOV-11000	LS-5	CONTACTS OPEN	NOV-11000 NOT CLOSED SIGNAL ISOLATES SEAL WATER RETURN TO VCT VIA CV-410. NO EFFECT ON NOV-11000 OPERATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE, DUE TO NORMAL PATH TO SUCTION RETURN	
02.2.05.06.2	NOV-11000	LS-5	CONTACTS CLOSED	LOSS OF NOV-11000 INTERLOCK TO CV-410	PERIODIC TESTING	REDUNDANT VALVE	REDUCED REDUNDANCY FOR SEAL WATER RETURN ISOLATION TO VCT	
02.2.05.07.1	NOV-11000	LS-6	CONTACTS OPEN	NOV-11000 NOT CLOSED SIGNAL ISOLATES SEAL WATER RETURN TO VCT VIA CV-411. NO EFFECT ON NOV-11000 OPERATION	(SAME AS 2.2.5.6.1)	(SAME AS 2.2.5.6.1)	(SAME AS 2.2.5.6.1)	
02.2.05.07.2	NOV-11000	LS-6	CONTACTS CLOSED	LOSS OF NOV-11000 INTERLOCK TO CV-411	(SAME AS 2.2.5.6.2)	(SAME AS 2.2.5.6.2)	(SAME AS 2.2.5.6.2)	
02.2.05.08.1	NOV-11000	LS-9	CONTACTS CLOSED	VALVE OPEN SIGNAL TO NOV-1100C WILL PERMIT NOV-1100C TO AUTO-CLOSE ON LOW VCT LEVEL OR SRQ SIGNAL (VIA SIX RELAY) BEFORE NOV-1100B OR D FULL OPEN, INCREASING POTENTIAL FOR LOSS OF SUCTION TO CHARGING PUMPS. NO EFFECT ON NOV-11000 OPERATION	PERIODIC TESTING	REDUNDANT CONTACTS FROM LC-1100B AND SIX RELAYS	REDUCED RELIABILITY FOR BOTH CHARGING PUMPS DURING NORMAL OPERATION	
02.2.05.08.2	NOV-11000	LS-9	CONTACTS OPEN	LOSS OF 1 OF 2 VALVE OPEN SIGNALS TO NOV-1100C SRQ AND VCT LEVEL AUTO-CLOSE CTR	PERIODIC TESTING	REDUNDANT CONTACTS FROM NOV-1100B	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	
02.2.05.09.1	NOV-11000	LS-10	CONTACTS CLOSED	VALVE OPEN SIGNAL TO NOV-1100C WILL PERMIT NOV-1100C TO AUTO-OPEN ON HIGH VCT LEVEL WITH NO SRQ SIGNAL	PERIODIC TESTING	NONE REQUIRED	NONE FOR INJECTION OR (IF NOV-1100C PLACED IN MANUAL PRIOR TO SRQ BLOCK/RESET) CLR, HLR	
02.2.05.09.2	NOV-11000	LS-10	CONTACTS OPEN	LOSS OF 1 OF 2 VALVE OPEN SIGNALS TO NOV-1100C AUTO-OPEN ON VCT LEVEL	PERIODIC TESTING	NONE REQUIRED	NONE	
02.2.05.10.1	NOV-11000	MCC-2 (42-1249)	VOLTS LOW	NOV-11000 CANNOT BE OPENED REMOTE-MANUALLY OR VIA SIS/SISLOP FOR INJECTION, CLR AND HLR, OR CANNOT BE RE-CLOSED REMOTE-MANUALLY FOR SECONDARY RECIRC	CONTROL ROOM INDICATION	REDUNDANT VALVE/TRAIN	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 2-1: COLD LRG RECIRCULATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.2.06.01.1 G-8A		PUMP/MOTOR	LOW FLOW	REDUCED TRAIN B CHARGING PUMP FLOW. RESULTS IN AUTO-START SIGNAL TO REDUNDANT PUMP G-8B OR LOW HEADER PRESSURE (PIC-1111B) DURING NORMAL OPS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING	REDUNDANT PUMP/TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR CLR AND HLR PRIMARY PATH	INCLUDES AVE L.O. PUMP AND FAN COOLING. CHARGING FLOW NOT CREDITED FOR INJECTION
02.2.06.02.1 G-8A		BUS #2C (152-12C07)	OPEN	TRAIN B CHARGING PUMP TRIPS, OR FAILS TO START ON SIS/SISLOP IF SELECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP/TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR CLR AND HLR PRIMARY PATH	
02.2.06.02.2 G-8A		BUS #2C (152-12C07)	CLOSED	TRAIN B PUMP STARTS OR FAILS TO TRIP ON SIS/SISLOP IF SELECTED. NOV-1100C UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NOV-1100C CLOSERS AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	ADMINISTRATIVELY CONTROLLED SELECTOR SWITCHES ALIGN NOV-1100C POWER TO SAME TRAIN AS CHARGING PUMP SELECTED TO START, WITH OTHER TRAIN CHARGING PUMP TRIPPED AND LOCKED OUT ON SIS/SISLOP
02.2.06.03.1 G-8A		16Z YDC (152-11C07)	ON (CONTACTS CLOSED)	TRAIN B CHARGING PUMP AUTO-START ENABLED ON LOW DISCHARGE HEADER PRESSURE WITH GSB OFF. NO EFFECT ON SEQ ACTUATION BUT PUMP MAY START ON SEQ BLOCK/RSBT WITH PIC-1111 EQ FAILURE	PERIODIC TESTING	(SAME AS 2.2.6.2.2)	(SAME AS 2.2.6.2.2)	
02.2.06.03.2 G-8A		16Z YDC (152-11C07)	OFF (CONTACTS OPEN)	TRAIN B CHARGING PUMP AUTO-START ON LOW DISCHARGE HEADER PRESSURE DISABLED. NO EFFECT ON SEQ ACTUATION	PERIODIC TESTING	NONE REQUIRED	NONE	
02.2.06.04.1 G-8A		186 (152-11C07)	ON (CONTACTS CLOSED)	TRAIN B CHARGING PUMP AUTO-STARTS, CANNOT BE MANUALLY TRIPPED AFTER PUMP LOCK-OUT RSBT. NO EFFECT ON SEQ ACTUATION	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	RELAY 74-1 SENDS IN TR SIGNAL TO DE-SELECTED PUMP AFTER SEQ BLOCK/RSBT
02.2.06.04.2 G-8A		186 (152-11C07)	OFF (CONTACTS OPEN)	TRAIN B CHARGING PUMP AUTO-START ON TRAIN A PUMP ELECTRICAL FAULT DISABLED. NO EFFECT ON SEQ ACTUATION	(SAME AS 2.2.6.3.2)	(SAME AS 2.2.6.3.2)	(SAME AS 2.2.6.3.2)	
02.2.06.05.1 G-8A		LC-11008E	HIGH	LO-LO-LO VCT LEVEL TRIP OF TRAIN B CHARGING PUMP DISABLED	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, CLR OR HLR	NONE	LO-LO-LO TRIP CREDITED FOR APPENDIX B PNEA SCENARIOS
02.2.06.05.2 G-8A		LC-11008E	LOW	LO-LO-LO VCT LEVEL TRIP OF TRAIN B CHARGING PUMP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR INJECTION, OVERRIDE SWITCH FOR RECIRC	INOPERABILITY OF TRAIN B CHARGING PUMP FOR INJECTION, NONE FOR RECIRC WITH CREDIT FOR MANUAL OPERATION OF OVERRIDE SWITCH	
02.2.06.05.3 G-8A		LC-11003I	EQ	LO-LO-LO VCT LEVEL TRIP OF TRAIN B CHARGING PUMP	CONTROL ROOM INDICATION	OVERRIDE SWITCH	INOPERABILITY OF TRAIN B CHARGING PUMP DURING INJECTION, NONE FOR RECIRC WITH CREDIT FOR MANUAL OPERATION OF OVERRIDE	OVERRIDE REQUIRED IF TRAIN A CHARGING PUMP DURING INJECTION, IS SINGLE FAILURE CONCURRENT WITH THIS COMMON-CAUSE FAILURE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 2-1: COLD LBC RECIRCULATION FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
02.2.06.06.1 G-8A	194-5 (RELAY)		ON (CONTACTS CLOSED)	TRAIN B CHARGING PUMP (AND OTHER TRAIN B 4 KV LOADS) TRIP AFTER 11.5 SRC, CANNOT BE RESTARTED (RELAY DOES NOT RESET), OR RESTART DELAYED BY 35 SRC (RELAY RESETS)	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	IMPROBABILITY OF TRAIN B PUMPING FOR CLR AND HLR PRIMARY FLOW PATH	BY RELAY TRIP DOES NOT OCCUR DURING SISLOP IF DG RE-ENERGIZES BUS WITHIN 10 SRC SAFETY ANALYSIS LIMITS
02.2.06.06.2 G-8A	194-5 (RELAY)		OFF (CONTACTS OPEN)	TRAIN B CHARGING PUMP (AND OTHER TRAIN B 4 KV LOADS) WILL NOT TRIP ON BUS UNDERVOLTAGE DURING NORMAL OPERATION. NO EFFECT ON SEQ ACTUATION OR LOAD SEQUENCING DUE TO SEPARATE SISLOP TRIP SIGNAL TO 4 KV LOADS.	PERIODIC TESTING	NONE REQUIRED	NONE	
02.2.06.07.1 G-8A	89-2 (REL. SWITCH)		BUS #2C (CONTACTS OPEN)	TRAIN B CHARGING PUMP WILL NOT TRIP ON SIS/SISLOP. NORMAL FOR TRAIN B CHARGING PUMP/NOV-1100C SELECTION. NO EFFECT ON TRAIN A PUMP OR NOV-1100C SEQ ACTUATION	PERIODIC SURVEILLANCE AND	NOV-1100C CLOSURE AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	
02.2.06.07.2 G-8A	89-2 (REL. SWITCH)		BUS #1C (CONTACTS CLOSED)	TRAIN B CHARGING PUMP WILL NOT TRIP ON SIS/SISLOP. NORMAL FOR TRAIN A CHARGING PUMP/NOV-1100C SELECTION. NO EFFECT ON TRAIN A PUMP OR NOV-1100C SEQ ACTUATION	PERIODIC SURVEILLANCE AND	NONE REQUIRED FOR INJECTION, MANUAL CONTROL AFTER SEQ BLOCK/RESET FOR CLR AND HLR	LOSS OF AUTOMATIC INJECTION MODE CHARGING CAPABILITY IF TRAIN B PRESELECTED ON SS (NOV-1100C) AND SS-1 (G-8B)	CHARGING NOT CREDITED DURING INJECTION. SELECTOR SWITCH POSITIONS ADMINISTRATIVELY CONTROLLED
02.2.06.08.1 G-8A	89Q 2 (28-1, 3)		OFF (CONTACTS OPEN)	TRAIN B CHARGING PUMP WILL NOT START ON SIS/SISLOP	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, MANUAL CONTROL AFTER SEQ BLOCK/RESET FOR CLR AND HLR	LOSS OF AUTOMATIC INJECTION MODE CHARGING CAPABILITY IF TRAIN B SELECTED ON SS (NOV-1100C) AND SS-1 (G-8B)	CHARGING NOT CREDITED DURING INJECTION
02.2.06.08.2 G-8A	89Q 2 (28-1, 3)		ON (CONTACTS CLOSED)	TRAIN B CHARGING PUMP START SIGNAL MAY CAUSE OUT-OF-SEQUENCE PUMP LOADING ON SISLOP IF TRAIN B SELECTED. TRIP ON SIS/SISLOP VIA SEPARATE SEQ CONTACTS AND SS-2 (IF TRAIN A SELECTED) NOT AFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP WITH TRAIN B SELECTED, NONE REQUIRED FOR SIS OR TRAIN A SELECTION	IMPROBABILITY OF TRAIN B FOR SISLOP. NO EFFECT IF SIS OR TRAIN A SELECTED	
02.2.06.09.1 G-8A	89Q 2 (29-1, 3)		OFF (CONTACTS OPEN)	TRAIN B CHARGING PUMP WILL NOT TRIP ON SIS/SISLOP. NORMAL FOR TRAIN B CHARGING PUMP/NOV-1100C SELECTION. NO EFFECT ON TRAIN A PUMP OR NOV-1100C SEQ ACTUATION	PERIODIC SURVEILLANCE AND	NOV-1100C CLOSURE AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	
02.2.06.09.2 G-8A	89Q 2 (29-1, 3)		ON (CONTACTS CLOSED)	TRAIN B CHARGING PUMP WILL TRIP IF TRAIN A SELECTED ON SS-2. NO EFFECT ON TRAIN A PUMP OR NOV-1100C SEQ ACTUATION	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION, REDUNDANT PUMP FOR CLR AND HLR	LOSS OF AUTOMATIC INJECTION MODE CHARGING CAPABILITY IF TRAIN B PRESELECTED ON SS (NOV-1100C) AND SS-1 (G-8B)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR OPERATOR UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCS	REMARKS
02.2.06.10.1	G-BA	162 TDC (152-12C07)	ON	TRAIN A CHARGING PUMP AUTO-START ENABLED ON LOW DISCHARGE HEADER PRESSURE WITH G-BA OFF. NO EFFECT ON SBQ ACTUATION OF EITHER PUMP, BUT G-BB MAY START ON SBQ BLOCK/RESET WITH PIC-1111 EQ FAILURE	PERIODIC TESTING	NOV-1100C CLOSURE AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	
02.2.06.10.2	G-BA	162 TDC (152-12C07)	OFF	TRAIN A CHARGING PUMP AUTO-START DISABLED ON LOW DISCHARGE HEADER PRESSURE. NO EFFECT ON SBQ ACTUATION OF EITHER PUMP.	PERIODIC TESTING	NONE REQUIRED	NONE	
02.2.06.11.1	G-BA	186 (152-12C07)	ON	TRAIN B CHARGING PUMP LOCKED OUT, TRAIN A PUMP AUTO-STARTS AND CANNOT BE TRIPPED AFTER SBQ BLOCK RESET	CONTROL ROOM INDICATION	REDUNDANT TRAIN	LOSS OF TRAIN B CHARGING PUMP CAPABILITY FOR INJECTION, CLR AND HLR	
02.2.06.11.2	G-BA	186 (152-12C07)	OFF	TRAIN B PROTECTION DISABLED FOR G-BA FAULTS	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY FOR TRAIN B ELECTRICAL SYSTEM	
02.2.06.12.1	G-BA	HCC-2A (42-12A16)	VOLTS LOW	TRAIN B MOTOR-DRIVEN LUBE OIL PUMP WILL NOT START ON LOW BEARING PRESSURE WITH PUMP RUNNING	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BOUNDS EQ FAILURE OF LUBE OIL PUMP MOTOR. MOTOR-DRIVEN LUBE OIL PUMP NOT CREDITED IN LIBR OF SHAFT-DRIVEN PUMP
02.2.06.13.1	G-BA	HCC-2A (42-12A16)	VOLTS LOW	TRAIN B LUBE OIL FAN COOLER WILL NOT START ON DISLOP WITH PUMP RUNNING	PERIODIC TESTING	NONE REQUIRED	NONE	BOUNDS EQ FAILURE OF FAN MOTOR. LUBE OIL FAN COOLER NOT CREDITED IN LIBR OF SHAFT-DRIVEN PUMP
02.2.06.14.1	G-BA	BUS 82C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B CHARGING PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CHARGING PUMP FOR INJECTION, CLR AND HLR	
02.2.06.15.1	G-BA	4KV XFER SWITCH (A4S1)	OPEN OR DSD	TRAIN B CHARGING PUMP WILL NOT START ON DIS/SLDOP	PERIODIC SURVEILLANCE	(SAME AS 2.1.6.1.4.1)	(SAME AS 2.1.6.1.4.1)	
02.2.07.01.1	NOV-18	VALVE/ACTUATOR	OPEN	1 OF 2 FILTER BYPASS PATHS ALIGND FOR CLR	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	
02.2.07.01.2	NOV-18	VALVE/ACTUATOR	CLOSED	1 OF 2 FILTER BYPASS PATHS DISABLED FOR CLR	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE (NOV-19)	REDUCED REDUNDANCY FOR CLR DISCHARGE FLOW PATH	
02.2.07.02.1	NOV-18	HCC-2 (42-1294)	VOLTS LOW	NOV-18 FAILS AS-IS	CONTROL ROOM INDICATION	REDUNDANT VALVE (NOV-19)	REDUCED REDUNDANCY FOR COLD LEG RECIRCULATION DISCHARGE FLOW PATH IF FAILURE PRIOR TO REALIGNMENT	
02.2.06.01.1	NOV-357	VALVE/ACTUATOR	OPEN	1 OF 3 CLR PATHS ALIGND TO RCS, CANNOT BE RECLOSED TO ISOLATE PCV-1115B/E IF REQUIRED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CLR ALIGNMENT	NONE FOR CLR ALIGNMENT	*NOT ACCEPTABLE FOR INJECTION WITH CONCURRENT FAILURE OF CHARGING (EG. DUE TO NOV-1100C). TRCH SPEC ACTION ENTRY REQUIRED WITH VALVE OPEN DURING NORMAL OPERATION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPFB UNIT 1
TABLE 2-1: COLD LBC RECIRCULATION PBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
02.2.02.01.2	NOV-357	VALVE/ACTUATOR	CLOSED	1 OF 3 CLR PATHS TO RCS LOOPS DISABLED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT FLOW PATHS TO RCS LOOPS A AND C	LOSS OF RCS LOOP B CLR FLOW PATH	FLOW VIA SBAL INJECTION TO RCP IN AFFECTED LOOP NOT CREDITED
02.2.08.02.1	NOV-357	BCC-2 (42-1243)	VOLTS LOW	NOV-357 CANNOT BE REPOSITIONED, RESULTING IN POTENTIAL LOSS OF 1 OF 3 CLR PATHS (IF CLOSED) OR INABILITY TO ISOLATE PCV-1115B/E (IF OPEN)	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND C FOR CLR	POTENTIAL LOSS OF CLR FLOW PATH TO RCS LOOP B	
02.3.01.01.1	NOV-358	VALVE/ACTUATOR	OPEN	1 OF 3 CLR PATHS ALIGNED TO RCS, CANNOT BE RECLOSED TO ISOLATE PCV-1115C/F IF REQUIRED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CLR ALIGNMENT	NONE FOR CLR ALIGNMENT	*NOT ACCEPTABLE FOR INJECTION WITH CONCURRENT FAILURE OF CHARGING (EC) DUE TO NOV-1100C). T8CY SPEC ACTION ENTRY REQUIRED WITH VALVE OPEN DURING NORMAL OPERATION
02.3.01.01.2	NOV-358	VALVE/ACTUATOR	CLOSED	1 OF 3 CLR PATHS TO RCS LOOPS DISABLED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT FLOW PATHS TO RCS LOOPS A AND B	LOSS OF RCS LOOP C CLR FLOW PATH	FLOW VIA SBAL INJECTION TO RCP IN AFFECTED LOOP NOT CREDITED
02.3.01.02.1	NOV-358	UPS	VOLTS LOW	NOV-358 CANNOT BE REPOSITIONED, RESULTING IN POTENTIAL LOSS OF 1 OF 3 CLR PATHS (IF CLOSED) OR INABILITY TO ISOLATE PCV-1115C/F (IF OPEN)	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND B FOR CLR	POTENTIAL LOSS OF CLR FLOW PATH TO RCS LOOP C	
02.3.01.03.1	NOV-358	BCC-3 (8-1391)	VOLTS LOW	CAUSES LOSS OF UPS AFTER 130 MIN. NOV-358 CANNOT BE REPOSITIONED, RESULTING IN POTENTIAL LOSS OF 1 OF 3 CLR PATHS (IF CLOSED) OR INABILITY TO ISOLATE PCV-1115C/F (IF OPEN)	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND B FOR CLR	POTENTIAL LOSS OF CLR FLOW PATH TO RCS LOOP C	
02.4.01.01.1	MANUAL VALVES, COMMON FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	INCLUDES: CCS-316, -425, VCC-343, -344, RCP-315, -316, -317, -318, -360, -362
02.4.01.01.2	MANUAL VALVES, COMMON FLOW		CLOSED	ISOLATION OF MINIFLOW FOR BOTH CHARGING PUMPS, OR LOW FLOW CLR CONTROL (PCV-1115A, B OR C)	PERIODIC SURVEILLANCE	NONE	*LOSS OF CHARGING PUMP CAPABILITY FOR CLR AND HLR	VCC-343 AND -344 MUST BE LOCKED OPEN
02.4.01.02.1	CHARGE VALVES, COMMON FLOW		NONE (PASSIVE)		PERIODIC SURVEILLANCE			INCLUDES: VCC-188
02.4.01.03.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	DIVERSION OF BOTH TRAINS OF PUMP FLOW AND, FOR OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS, LOSS OF RECIRC/RVST INVENTORY	PERIODIC SURVEILLANCE	SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	*POTENTIAL LOSS OF BOTH TRAINS OF CLR, HLR AND SPRAY DUE TO UNSOLUBLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	*SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. RECIRC BOUNDARY VALVES NOT SEAT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
02.4.01.03.2	MANUAL VALVES, COMMON BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SIS NUMBER UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.01.04.1	CECSE AND RELIEF VALVES, COMMON BOUNDARY		NORMAL (PASSIVE)	PARTIAL DIVERSION OF CHARGING PUMP AND CLR FLOW TO VCT AND BCOY VIA RV-289 AND RV-2004	PERIODIC SURVEILLANCE	REDUNDANT TRAINS FOR FLOW RATE, NONE FOR INVENTORY	LOSS OF INVENTORY NOT INCLUDED IN RWST CALCULATION	*SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. RECIRC BOUNDARY VALVES NOT SHUT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
02.4.02.01.1	NOV-883	VALVE/ACTUATOR	OPEN	NORMAL FOR INJECTION. LOSS OF REMOTE-MANUAL BOUNDARY ISOLATION FOR RECIRCULATION	PERIODIC TESTING	REDUNDANT CHECK VALVE (CRS-301)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*REDUNDANT CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
02.4.02.01.2	NOV-883	VALVE/ACTUATOR	CLOSED	NORMAL FOR RECIRC. LOSS OF INJECTION MODE SUCTION TO BOTH REPULPING WATER PUMPS AND CHARGING PUMPS	CONTROL ROOM INDICATION	POWER LOCK OUT BY REDUNDANT CONTROL SWITCHES AND CONTACTORS PER WRC BRANCH TECHNICAL POSITION (CSB-18)	NOT APPLICABLE. FAILURE PRECLUDED BY POWER LOCK-OUT	
02.4.02.02.1	NOV-883	RMS-2054	CONTACTS OPEN	NOV-883 CONTROL CIRCUIT DISABLED, CAUSING LOSS OF REMOTE-MANUAL BOUNDARY ISOLATION CAPABILITY FOR RECIRCULATION	PERIODIC TESTING	(SAME AS 2.4.2.1.1)	(SAME AS 2.4.2.1.1)	*(SAME AS 2.4.2.1.1)
02.4.02.02.2	NOV-883	RMS-2054	CONTACTS CLOSED	NOV-883 CONTROL CIRCUIT, INCLUDING RMS-2047, ENABLED VALVE ACTUATOR RECEIVES OPEN SIGNAL AS SOON AS CONTROL CIRCUIT ENABLED BY RMS-2054, CANNOT BE CLOSED	CONTROL ROOM INDICATION	REDUNDANT SWITCH RMS-2047	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	
02.4.02.03.1	NOV-883	RMS-2291	OPEN (CONTACTS B/C CLOSED)	REMOTE-MANUALLY FOR RECIRC BOUNDARY ISOLATION	PERIODIC TESTING	(SAME AS 2.4.2.1.1)	(SAME AS 2.4.2.1.1)	*(SAME AS 2.4.2.1.1)
02.4.02.03.2	NOV-883	RMS-2047	CLOSED (CONTACTS B/P CLOSED)	VALVE ACTUATOR RECEIVES CLOSE SIGNAL AS SOON AS CONTROL CIRCUIT ENABLED BY RMS-2054, AND CANNOT BE REOPENED	PERIODIC TESTING	REDUNDANT SWITCH RMS-2054	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	
02.4.02.04.1	NOV-883	42CC OR 42CCA (CONTACTORS)	OFF (CONTACTOR OPEN)	VALVE CANNOT BE REMOTE-MANUALLY CLOSED FOR RECIRCULATION	CONTROL ROOM INDICATION	REDUNDANT CHECK VALVE (CRS-301)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
02.4.02.04.2	NOV-883	42CC OR 42CCA (CONTACTORS)	ON (CONTACTOR CLOSED)	1 OF 2 REDUNDANT CONTACTORS CLOSE IN VALVE CLOSE CRT, REDUCING CLOSE LOGIC TO 1/1 ON REMAINING CONTACTOR	PERIODIC TESTING	REDUNDANT CLOSE CONTACTOR	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	*VERIFICATION NEEDED THAT EXISTING SURVEILLANCES WOULD DETECT THIS FAILURE
02.4.02.05.1	NOV-883	MCC-3 (42-1395)	VOLTS LOW	VALVE CANNOT BE REMOTE-MANUALLY CLOSED FOR RECIRCULATION	CONTROL ROOM INDICATION	REDUNDANT CHECK VALVE (CRS-301)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
02.4.03.01.1	NOV-1100C	VALVE/ACTUATOR	OPEN	VCT CANNOT BE ISOLATED ON LOW-LOW LEVEL OR FOR INJECTION, RESULTING IN GAS BINDING/LOSS OF PRES-SELECTED CHARGING PUMP AND PORTION OF COMMON SUCTION PIPING	PERIODIC TESTING	NONE FOR SBLOCA. REDUNDANT CHECK VALVE AND CHARGING PUMP FOR CLR AND MLR IN LBLOCA. CHARGING NOT CREDITED FOR INJECTION IN LBLOCA, NSLR OR SCTR	POTENTIAL LOSS OF BOTH RECIRCULATION IN SBLOCA IF SECOND CHARGING PUMP AUTO-STARTS BEFORE SIS/SISLOP. LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING RECIRCULATION FOR LBLOCA, NSLR, SCTR	*EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SIMS/UNIT RECIRC BY TEST OR ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SIN ONEFBF UNIT 1
TABLE 2-1: COLD LBG RECIRCULATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMBRSNT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
02.4.03.01.2	NOV-1100C	VALVE/ACTUATOR	CLOSED	VCT ISOLATED DURING NORMAL OPERATION. REQUIRED POSITION POST-SIS/SISLOP	CONTROL ROOM INDICATION	NOV-1100B AND D BYPASS FCV-5051 PREVENTS SUCTION LOSS	LOSS OF SEISMIC CATEGORY A SUCTION TO BOTH CHARGING PUMPS PRIOR TO SIS/SISLOP	FCV-5051 CONTROL SYSTEM AND NITROGEN SUPPLY AND WBRPP
02.4.03.02.1	NOV-1100C	LC-11008B (RELAT)	HIGH LEVEL	NOV-1100C WILL NOT AUTO-CLOSE ON LOW VCT LEVEL DURING NORMAL OPS. NO EFFECT ON SBQ ACTUATION OR (IP IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	LO-LO-LO TRIP OF TRAIN B CHARGING PUMP (G-8A) PREVENTS LOSS OF BOTH PUMPS DUE TO CAVITATION / GAS BINDING	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING RECIRCULATION	LC-11008B LO-LO-LO TRIP IS NOT REQ'D
02.4.03.02.2	NOV-1100C	LC-11008B (RELAT)	LOW LEVEL	NOV-1100C WILL NOT AUTO-OPEN ON HIGH VCT LEVEL AND MAY CLOSE SPURIOUSLY DURING NORMAL OPS. NO EFFECT ON SBQ ACTUATION OR (IP IN MANUAL) POST-SIS/SISLOP	PERIODIC TESTING	REDUNDANT CONTACTS FROM NOV-1100B AND NOV-1100D DURING NORMAL OPS, NONE REQUIRED FOR INJECTION OR RECIRC	REDUCED REDUNDANCY AGAINST SPURIOUS NOV-1100C CLOSURE DURING NORMAL OPS. NONE FOR INJECTION OR RECIRCULATION IF PLACED IN MANUAL MODE PRIOR TO SBQ BLOCK/REJECT	
02.4.03.03.1	NOV-1100C	LS-9 (NOV-1100B)	CONTACTS OPEN	1 OF 2 INTERLOCK CONTACTS DISABLED TO NOV-1100C SBQ AND VCT LOW LEVEL AUTO-CLOSE CETS	PERIODIC TESTING	REDUNDANT CONTACTS FROM NOV-1100D	REDUCED RELIABILITY FOR NOV-1100C AUTO-CLOSURE DURING NORMAL OPS AND FOR SIS/SISLOP	
02.4.03.03.2	NOV-1100C	LS-9 (NOV-1100B)	CONTACTS CLOSED	INTERLOCK DEGRADED. NOV-1100C WILL AUTO-CLOSE CONCURRENTLY WITH NOV-1100B AND NOV-1100D OPENING ON LOW VCT LEVEL OR SIS/SISLOP	PERIODIC TESTING	REDUNDANT CONTACTS FROM SIS RELAT AND LC-11008B	REDUCED RELIABILITY FOR BOTH CHARGING PUMPS DURING NORMAL OPS	
02.4.03.04.1	NOV-1100C	LS-9 (NOV-1100D)	CONTACTS OPEN	(SAME AS 2.4.3.3.1)	(SAME AS 2.4.3.3.1)	REDUNDANT CONTACTS FROM NOV-1100B	(SAME AS 2.4.3.3.1)	
02.4.03.04.2	NOV-1100C	LS-9 (NOV-1100D)	CONTACTS CLOSED	(SAME AS 2.4.3.3.2)	(SAME AS 2.4.3.3.2)	(SAME AS 2.4.3.3.2)	(SAME AS 2.4.3.3.2)	
02.4.03.05.1	NOV-1100C	LS-10 (NOV-1100B)	CONTACTS OPEN	1 OF 2 INTERLOCK CONTACTS DISABLED TO NOV-1100C AUTO-OPEN VCT HIGH LEVEL CRY. NO EFFECT ON SBQ OR AUTO-CLOSE CETS	PERIODIC TESTING	NONE REQUIRED	NONE	
02.4.03.05.2	NOV-1100C	LS-10 (NOV-1100B)	CONTACTS CLOSED	INTERLOCK DEGRADED. NOV-1100C WILL AUTO-OPEN ON HIGH VCT LEVEL CONCURRENTLY WITH NOV-1100B/D CLOSURE SIGNAL DURING NORMAL OPS. NO EFFECT ON SBQ ACTUATION	PERIODIC TESTING	LS-9 AND LS-10 INTERLOCKS TO NOV-1100B AND NOV-1100D PREVENT CONCURRENT CLOSURE	REDUCED REDUNDANCY AGAINST LOSS OF CHARGING PUMP SUCTION DURING NORMAL OPERATIONS	
02.4.03.06.1	NOV-1100C	LS-10 (NOV-1100D)	CONTACTS OPEN	(SAME AS 2.4.3.5.1)	(SAME AS 2.4.3.5.1)	(SAME AS 2.4.3.5.1)	(SAME AS 2.4.3.5.1)	
02.4.03.06.2	NOV-1100C	LS-10 (NOV-1100D)	CONTACTS CLOSED	(SAME AS 2.4.3.5.2)	(SAME AS 2.4.3.5.2)	(SAME AS 2.4.3.5.2)	(SAME AS 2.4.3.5.2)	
02.4.03.07.1	NOV-1100C	SIX (NOV-1100B)	ON	NOV-1100B AUTO-OPENS THEN NOV-1100C AUTO-CLOSES, REALIGNING CHARGING PUMP SUCTION TO BVST	CONTROL ROOM INDICATION	NONE REQUIRED FOR INJECTION, CLR OR HLR. REDUNDANT MANUAL VALVES FOR SECONDARY RECIRC	REQUIRES MANUAL CHARGING STATION REALIGNMENT DISABLED FOR SECONDARY RECIRC	
02.4.03.07.2	NOV-1100C	SIX (NOV-1100B)	OFF	NOV-1100B AUTO-OPEN AND NOV-1100C AUTO-CLOSE ON SBQ 1 SIS/SISLOP DISABLED. SBQ 2 AUTO-OPEN OF NOV-1100D AND AUTO-CLOSE OF NOV-1100C UNEXPECTED	PERIODIC TESTING	REDUNDANT VALVE (NOV-1100D) AND RELAT	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONDFRE UNIT 1
TABLE 2-1: COLD LBC RECIRCULATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
02.4.03.04.1	NOV-1100C	SEE (NOV-1100D)	ON	NOV-1100D AUTO-OPENS THEN NOV-1100C AUTO-CLOSURE, REALIGNING CHARGING PUMP SUCTION TO BUS1	(SAMB AS 2.4.3.7.1)	(SAMB AS 2.4.3.7.1)	(SAMB AS 2.4.3.7.1)	
02.4.03.04.2	NOV-1100C	SEE (NOV-1100D)	OFF	NOV-1100D AUTO-OPEN AND NOV-1100C AUTO-CLOSE ON SEQ 2 SIS/SISLOP DISABLED. NO EFFECT ON NOV-1100D AUTO-OPEN AND NOV-1100C AUTO-CLOSE ON SEQ 1 SIS/SISLOP	(SAMB AS 2.4.3.7.2)	(SAMB AS 2.4.3.7.2)	(SAMB AS 2.4.3.7.2)	
02.4.03.09.1	NOV-1100C	SS (POWER SEL. SW.)	HCC-1 CONTACTS CLOSED	TRAIN A POWER SELECTED FOR NOV-1100C. NORMAL FOR BUS #1C (TRAIN A) CHARGING PUMP PRE-SELECTION	CONTROL ROOM INDICATION	NONE REQUIRED FOR BUS #1C CHARGING PUMP PRE-SELECTION. ADMINISTRATIVE CONTROL PRECLUDES CROSS-TRAIN ALIGNMENT	NONE IF BUS #1C CHARGING PUMP PRE-SELECTION. POTENTIAL LOSS OF BOTH TRAINS OF CHARGING FOR CLR AND BLR IF CROSS-TRAIN ALIGNMENT AND LOSS OF ONE TRAIN OF POWER OCCURS	MULTIPLE FAILURE SCENARIO (ADMIN CONTROL PLUS POWER FAILURES) IS OUTSIDE DESIGN BASIS
02.4.03.09.2	NOV-1100C	SS (POWER SEL. SW.)	HCC-2A CONTACTS CLOSED	TRAIN B POWER SELECTED FOR NOV-1100C. NORMAL FOR BUS #2C (TRAIN B) CHARGING PUMP PRE-SELECTION	CONTROL ROOM INDICATION	NONE REQUIRED FOR BUS #2C CHARGING PUMP PRE-SELECTION. ADMINISTRATIVE CONTROL PRECLUDES CROSS-TRAIN ALIGNMENT	NONE IF BUS #2C CHARGING PUMP PRE-SELECTION. POTENTIAL LOSS OF BOTH TRAINS OF CHARGING FOR CLR AND BLR IF CROSS-TRAIN ALIGNMENT AND LOSS OF ONE TRAIN OF POWER OCCURS	MULTIPLE FAILURE SCENARIO (ADMIN CONTROL PLUS POWER FAILURES) IS OUTSIDE DESIGN BASIS
02.4.03.09.3	NOV-1100C	SS (POWER SEL. SW.)	CONTACTS OPEN (OR OFF)	LOSS OF NOV-1100C MOTIVE AND CONTROL POWER, RESULTING IN GAS BINDING OF PRE-SELECTED CHARGING PUMP AND PORTION OF COMMON SUCTION PIPING	CONTROL ROOM INDICATION	NONE FOR INJECTION, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR CLR AND BLR	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING RECIRC	EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION PIPING ON RECIRC OPERATION OF REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED
02.4.03.09.4	NOV-1100C	SS (POWER SEL. SW.)	CONTACTS SHORTED	NOV-1100C POWER SELECTION CANNOT BE CHANGED DUE TO RELAY LOCK-UP	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAMB AS 2.4.3.9.1 AND 2.4.3.9.1)	(SAMB AS 2.4.3.9.1 AND 2.4.3.9.2)	
02.4.03.09.5	NOV-1100C	SS (POWER SEL. SW.)	CONTACTS GROUNDED	LOSS OF BOTH TRAINS OF POWER TO NOV-1100C VIA OVERCURRENT TRIP OF BREAKS 8-1198 AND 42-12A76	CONTROL ROOM INDICATION, ANNUNCIATION	(SAMB AS 2.4.3.9.3)	(SAMB AS 2.4.3.9.3)	(SAMB AS 2.4.3.9.3) BOUNDS SHORT IN RELAYS 83-1 OR 83-2
02.4.03.10.1	NOV-1100C	83-1 (RBLAT)	ON (CONTACTS OPEN)	(SAMB AS 2.4.3.9.2)	(SAMB AS 2.4.3.9.2)	(SAMB AS 2.4.3.9.2)	(SAMB AS 2.4.3.9.2)	
02.4.03.10.2	NOV-1100C	83-1 (RBLAT)	OFF (CONTACTS CLOSED)	TRAIN B POWER CANNOT BE SELECTED FOR NOV-1100C	(SAMB AS 2.4.3.9.2)	(SAMB AS 2.4.3.9.2)	(SAMB AS 2.4.3.9.2)	
02.4.03.11.1	NOV-1100C	83-2 (RBLAT)	ON (CONTACTS OPEN)	(SAMB AS 2.4.3.9.1)	(SAMB AS 2.4.3.9.1)	(SAMB AS 2.4.3.9.1)	(SAMB AS 2.4.3.9.1)	
02.4.03.11.2	NOV-1100C	83-2 (RBLAT)	OFF (CONTACTS CLOSED)	TRAIN A POWER CANNOT BE SELECTED FOR NOV-1100C	(SAMB AS 2.4.3.9.1)	(SAMB AS 2.4.3.9.1)	(SAMB AS 2.4.3.9.1)	
02.4.03.12.1	NOV-1100C	HCC-1 (8-1198)	VOLTS LOW	LOSS OF TRAIN A POWER TO NOV-1100C, RESULTING IN FAILURE TO CLOSE AND LOSS OF TRAIN A CHARGING PUMP IF PRESELECTED	CONTROL ROOM INDICATION	NONE FOR INJECTION, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR CLR AND BLR	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING CLR AND BLR	EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 2-1: COLD LBS RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.03.13.1	MOV-1100C	MCC-2A (42-12A76)	VOLTS LOW	LOSS OF TRAIN B POWER TO MOV-1100C, RESULTING IN FAILURE TO CLOSE AND LOSS OF TRAIN B CHARGING PUMP IF PRESUBJECTED	CONTROL ROOM INDICATION	NONE FOR INJECTION. REDUNDANT CHECK VALVE AND CHARGING PUMP FOR CLR AND HLR	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING CLR AND HLR	*EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS
02.4.04.01.1	LC-1100B LOOP	LC-1100B1 (RBLAT)	HIGH LEVEL	HIGH VCT LEVEL SIGNAL TO NOV-1100B/C/D, CAUSING NOV-1100C OPENING AND NOV-1100B/D CLOSING IF IN AUTO. DISABLES LO-LO-LO TRIP OF G-8A. NO EFFECT ON SBQ ACTUATION OR POST-SIS/SISLOP (IF IN MANUAL)	PERIODIC TESTING	NONE FOR SBLOCA. NONE REQUIRED FOR LBLOCA, HSLB OR SCGR IF NOV-1100B/C/D PLACED IN MANUAL PRIOR TO SBQ BLOCK/RESET	*POTENTIAL LOSS OF BOTH CHARGING PUMPS FOR SBLOCA IF SECOND CHARGING PUMP AUTO-STARTS PRIOR TO SIS/SISLOP. NONE FOR LBLOCA, HSLB OR SCGR IF NOV-1100B/C/D PLACED IN MANUAL PRIOR TO SBQ BLOCK/RESET	*INCLUDES LT-1100. POWER SUPPLY. NORMAL POSITION OF CONTROLLER OUTPUT. PRA REQUIRED TO JUSTIFY THIS CONDITION UNTIL CYCLE 12 ECCS UPGRADES
02.4.04.01.2	LC-1100B LOOP	LC-1100B1 (RBLAT)	LOW LEVEL	LOW VCT LEVEL SIGNAL TO NOV-1100B/C/D, CAUSING NOV-1100B/D OPENING AND NOV-1100C CLOSING IF IN AUTO. ALSO CAUSES LO-LO-LO TRIP OF G-8B. NO EFFECT ON SBQ ACTUATION OR POST-SIS/SISLOP	PERIODIC TESTING	NONE REQUIRED	TRAIN B CHARGING PUMP WILL NOT AUTO-START DURING INJECTION, BUT AVAILABLE FOR RECIRC WITH LEVEL TRIP OVERRIDE	CHARGING PUMPS NOT CREDITED FOR INJECTION
02.4.04.02.1	LC-1100B LOOP	VITAL BUS #1 (8-1415V)	VOLTS LOW	LOW VCT LEVEL SIGNAL TO NOV-1100B/C/D, CAUSING NOV-1100B/D OPENING AND NOV-1100C CLOSING IF IN AUTO. ALSO CAUSES LO-LO-LO TRIP OF G-8A. NO EFFECT ON SBQ ACTUATION OR POST-SIS/SISLOP	CONTROL ROOM INDICATION	NONE REQUIRED	TRAIN B CHARGING PUMP WILL NOT AUTO-START DURING INJECTION, BUT AVAILABLE FOR RECIRC WITH LEVEL TRIP OVERRIDE	CHARGING PUMPS NOT CREDITED FOR INJECTION
02.4.05.01.1	CV-410	VALVE/ACTUATOR	OPEN	VALVE WILL NOT CLOSE ON NOV-1100B/D INTERLOCKS POST-SIS/SISLOP TO ISOLATE SEAL WATER RETURN TO VCT	PERIODIC TEST	REDUNDANT VALVE (CV-411)	REDUCED REDUNDANCY FOR ISOLATION OF SEAL WATER RETURN TO VCT	INCLUDES SV-410. INJECTION/CLR/HLR BOUNDARY FUNCTION
02.4.05.01.2	CV-410	VALVE/ACTUATOR	CLOSED	SEAL WATER RETURN TO VCT ISOLATED. NO EFFECT ON CHARGING PUMPS DUE TO DIRECT SEAT WATER HI PATH TO PUMP SUCTION LINES	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	
02.4.05.02.1	CV-410	LS-5 (NOV-1100B)	CONTACTS OPEN	(SAME AS 2.4.5.1.2)	(SAME AS 2.4.5.1.2)	(SAME AS 2.4.5.1.2)	(SAME AS 2.4.5.1.2)	
02.4.05.02.2	CV-410	LS-5 (NOV-1100B)	CONTACTS CLOSED	VALVE WILL NOT CLOSE ON NOV-1100B OPEN SIGNAL (SAME AS 2.4.5.1.2)	PERIODIC TESTING	(SAME AS 2.4.5.1.1)	(SAME AS 2.4.5.1.1)	
02.4.05.03.1	CV-410	LS-5 (NOV-1100D)	CONTACTS OPEN	(SAME AS 2.4.5.1.2)	(SAME AS 2.4.5.1.2)	(SAME AS 2.4.5.1.2)	(SAME AS 2.4.5.1.2)	
02.4.05.03.2	CV-410	LS-5 (NOV-1100D)	CONTACTS CLOSED	VALVE WILL NOT CLOSE ON NOV-1100D OPEN SIGNAL (SAME AS 2.4.5.1.1)	(SAME AS 2.4.5.1.1)	(SAME AS 2.4.5.1.1)	(SAME AS 2.4.5.1.1)	
02.4.06.01.1	CV-411	VALVE/ACTUATOR	OPEN	VALVE WILL NOT CLOSE ON NOV-1100B/D INTERLOCKS POST-SIS/SISLOP TO ISOLATE SEAL WATER RETURN TO VCT	PERIODIC TEST	REDUNDANT VALVE (CV-410)	REDUCED REDUNDANCY FOR ISOLATION OF SEAL WATER RETURN TO VCT	INCLUDES SV-411. INJECTION/CLR/HLR BOUNDARY FUNCTION

EMERGENCY COBB COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
TABLE 2-1: COLD LBG RECIRCULATION PHSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	EMERGENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.06.01.2	CV-411	VALVE ACTUATOR	CLOSED	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	
02.4.06.02.1	CV-411	LS-6 (NOV-1100B)	CONTACTS OPEN	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	
02.4.06.02.2	CV-411	LS-6 (NOV-1100B)	CONTACTS CLOSED	(SAMB AS 2.4.5.2.2)	(SAMB AS 2.4.5.1.1)	(SAMB AS 2.4.5.1.1)	(SAMB AS 2.4.5.1.1)	
02.4.06.03.1	CV-411	LS-6 (NOV-1100D)	CONTACTS OPEN	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	(SAMB AS 2.4.5.1.2)	
02.4.06.03.2	CV-411	LS-6 (NOV-1100D)	CONTACTS CLOSED	(SAMB AS 2.4.5.3.2)	(SAMB AS 2.4.5.1.1)	(SAMB AS 2.4.5.1.1)	(SAMB AS 2.4.5.1.1)	
02.4.07.01.1	CV-410 CV-411	VITAL BUS #1 (B-1402V)	VOLTS LOW	CV-410 AND CV-411 CLOSURE, ISOLATING SEAL WATER RETURN TO VCT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
02.4.08.01.1	PIC-1111 LOOP	PIC-1111	OUTPUT HIGH	LOW DISCHARGE PRESSURE AUTO-START DISABLED TO BOTH CHARGING PUMPS. NO EFFECT ON SIS/SISLOP ACTUATION OR AFTER SBQ BLOCK/RSBT	PERIODIC TESTING	NONE REQUIRED	NONE	
02.4.08.01.2	PIC-1111 LOOP	PIC-1111	OUTPUT LOW	LOW DISCHARGE PRESSURE AUTO-START SIGNAL TO BOTH CHARGING PUMPS, CAUSING START OF IDLE PUMP DURING NORMAL OPERATION AND AFTER SBQ BLOCK/RSBT	CONTROL ROOM INDICATION, ANNUNCIATION	NOV-1100C CLOSURE AS REQUIRED FOR INJECTION. NONE REQUIRED PRIOR TO SBQ BLOCK/RSBT OR DURING CLR/HLR	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION (AFTER SBQ BLOCK/RSBT)	
02.4.08.01.3	PIC-1111 LOOP	PIC-1111	SBQ	LOW DISCHARGE PRESSURE AUTO-START SIGNAL MAY OCCUR TO BOTH CHARGING PUMPS, CAUSING START OF DE-SELECTED PUMP AFTER SBQ BLOCK/RSBT	CONTROL ROOM INDICATION, ANNUNCIATION	PCV-1115A/B/C/D/E/F AND PCV-1112 MANUAL CONTROL LIMITS CHARGING FLOW TO WITHIN CAPABILITY OF OPERATING RECIRCULATION PUMP(S)	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING CLR AND HLR	CHARGING PUMPS AND PIC-1111 ENVIRONMENT NOT HAZARDOUS UNTIL POST-LOCA RECIRCULATION IS INITIATED
02.4.08.02.1	PIC-1111Z LOOP	PIC-1111Z (RELAY)	CONTACTS CLOSED (OPF)	LOW CHARGING PUMP DISCHARGE PRESSURE SIGNAL TO AUTO-START CRT OF BOTH CHARGING PUMPS, CAUSING START OF IDLE PUMP DURING NORMAL OPS AND FOLLOWING SBQ BLOCK/RSBT. DOES NOT AFFECT SIS/SISLOP TRIP OF DE-SELECTED PUMP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED DURING SIS/SISLOP. NOV-1100C CLOSURE AS REQUIRED TO PREVENT GAS BINDING OF DE-SELECTED PUMP FOLLOWING SBQ BLOCK/RSBT	NONE. START OF ONE CHARGING PUMP AND TRIP/LOCKOUT OF OTHER ON SIS/SISLOP IS UNEXPECTED, AND RESTART OF DE-SELECTED PUMP FOLLOWING SBQ BLOCK/RSBT IS ACCEPTABLE AS LONG AS NOV-1100C WAS CLOSED	PIC IS ELECTRO-MECHANICAL SWITCH (FOIBORO MODEL 418) VS. CURRENT LOOP
02.4.08.02.2	PIC-1111Z LOOP	PIC-1111Z (RELAY)	CONTACTS OPEN (ON)	CHARGING PUMP AUTO-START ON LOW DISCHARGE PRESSURE DISABLED DURING NORMAL OPS. NO EFFECT ON SIS/SISLOP OR FOLLOWING SBQ BLOCK/RSBT	PERIODIC TESTING	NONE REQUIRED FOR INJECTION OR RECIRCULATION	NONE FOR INJECTION OR RECIRCULATION	
02.4.08.02.3	PIC-1111Z LOOP	PIC-1111Z (RELAY)	CONTACTS GROUNDED	(SAMB AS 2.4.8.2.2)	(SAMB AS 2.4.8.2.2)	(SAMB AS 2.4.8.2.2)	(SAMB AS 2.4.8.2.2)	DC SYSTEMS ARE UNGROUNDED. FAILURE OF ONE TRAIL MAY OCCUR WITH A PRE-EXISTING GROUND, HOWEVER SUCH A DOUBLE FAILURE SCENARIO IS OUTSIDE THE DESIGN BASIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM ONEFBF UNIT 1
 TABLE 2-1: COLD LSG RECIRCULATION FHBA

ITEM #	DEVICES ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
02.4.08.02.4	PIC-1111 LOOP	PIC-1111E (RBLAT)	INPUT OPEN	(SAME AS 2.4.0.2.1)	(SAME AS 2.4.0.2.1)	(SAME AS 2.4.0.2.1)	(SAME AS 2.4.0.2.1)	
02.4.08.02.5	PIC-1111 LOOP	PIC-1111E (RBLAT)	INPUT SHORT	VITAL BUS #4 SUPPLY TO PIC-1111E MAY TRIP. AUTO-START EFFECTS SAME AS 2.4.0.2.1)	(SAME AS 2.4.0.2.1)	(SAME AS 2.4.0.2.1)	(SAME AS 2.4.0.2.1)	
02.4.08.03.1	PIC-1111 LOOP	VITAL BUS #1 (B-1109V)	VOLTS LOW	LOW DISCHARGE PRESSURE AUTO-START SIGNAL TO BOTH CHARGING PUMPS, CAUSING START OF IDLE PUMP DURING NORMAL OPERATION AND AFTER SEQ BLOCK/RSBT	CONTROL ROOM INDICATION, ANNUNCIATION	MOV-1100C CLOSURES AS REQUIRED FOR INJECTION. NONE REQUIRED PRIOR TO SEQ BLOCK/RSBT OR DURING CLR/HLR	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION (AFTER SEQ BLOCK/RSBT)	
02.4.08.03.2	PIC-1111 LOOP	VITAL BUS #4 (B-1416V)	VOLTS LOW	LOW CHARGING PUMP DISCHARGE PRESSURE SIGNAL TO AUTO-START SET OF BOTH CHARGING PUMPS, CAUSING START OF IDLE PUMP DURING NORMAL OPS AND FOLLOWING SEQ BLOCK/RSBT. DOES NOT AFFECT SIS/SISLOP TRIP OF DE-SELECTED PUMP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED DURING SIS/SISLOP. MOV-1100C CLOSURES AS REQUIRED TO PREVENT GAS BINDING OF DE-SELECTED PUMP FOLLOWING SEQ BLOCK/RSBT	NONE. START OF ONE CHARGING PUMP AND TRIP/LOCKOUT OF OTHER ON SIS/SISLOP IS UNAFFECTED, AND RESTART OF DE-SELECTED PUMP FOLLOWING SEQ BLOCK/RSBT IS ACCEPTABLE AS LONG AS MOV-1100C HAS CLOSED	
02.4.09.01.1	PCV-1112	VALVE/ACTUATOR	OPEN	PCV-1112 CANNOT BE CLOSED FOR CLR BOUNDARY OR MODULATED FOR HLR PRIMARY PATH FLOW CONTROL	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVES (CV-304, CV-305) FOR CLR BOUNDARY, REDUNDANT PATH FOR HLR	REDUCED REDUNDANCY FOR CLR BOUNDARY ISOLATION, LOSS OF HLR PRIMARY PATH	
02.4.09.01.2	PCV-1112	VALVE/ACTUATOR	CLOSED	PCV-1112 DOES NOT OPEN FOR INJECTION AND CANNOT BE MODULATED FOR HLR PRIMARY PATH FLOW CONTROL. NORMAL FOR CLR	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE FOR INJECTION, NONE REQUIRED FOR CLR, REDUNDANT PATH FOR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A, AND HLR INJECTION	CHARGING NOT CREDITED FOR INJECTION
02.4.09.02.1	PCV-1112	PC-1112 LOOP	SIGNAL HIGH	PCV-1112 CANNOT BE CLOSED FOR CLR BOUNDARY FUNCTION OR MODULATED FOR HLR PRIMARY PATH FLOW CONTROL	CONTROL ROOM INDICATION	(SAME AS 2.4.9.1.1)	(SAME AS 2.4.9.1.1)	PC-1112 MANUAL MODE, USED FOR PCV-1112 MODULATION/CLOSURE, UNAFFECTED BY AUTOMATIC INPUTS FROM LC-130F AND PIT-1112. (B)(2) INTERACTION FROM NON-SQ PIP-1112 PRECLUDED BY POWER SUPPLY TR-1112
02.4.09.02.2	PCV-1112	PC-1112 LOOP	SIGNAL LOW	PCV-1112 CANNOT BE MODULATED FOR HLR PRIMARY PATH FLOW CONTROL. NORMAL FOR CLR	CONTROL ROOM INDICATION	REDUNDANT PATH FOR HLR	LOSS OF HLR PRIMARY PATH	
02.4.09.03.1	PCV-1112	SV-1112	ON (OPEN)	(SAME AS 2.4.9.1.1)	(SAME AS 2.4.9.1.1)	(SAME AS 2.4.9.1.1)	(SAME AS 2.4.9.1.1)	*SV-1112 POWER MUST BE LOCKED OUT AT C-34 PANEL AND DSD SUCH TO PRECLUDE SIMILAR FAILURE DUE TO BQ
02.4.09.03.2	PCV-1112	SV-1112	OFF (MODULATE)	PCV-1112 DOES NOT FULLY OPEN FOR INJECTION. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	PERIODIC TESTING	NONE FOR INJECTION	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A	CHARGING NOT CREDITED FOR INJECTION
02.4.09.04.1	PCV-1112	SSQ 1 (S1-1,3)	OFF (CONTACTS OPEN)	PCV-1112 DOES NOT FULLY OPEN FOR INJECTION ON SEQ 1 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	PERIODIC TESTING	REDUNDANT SEQ	REDUCED REDUNDANT FOR CHARGING PUMP INJECTION ALIGNMENT	CHARGING NOT CREDITED FOR INJECTION

EMERGENCY COBB COOLING SYSTEM SINGLE FAILURE ANALYSIS

SAN ONOFFER UNIT 1

TABLE Z-1: COLD LSG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON PCS	REMARKS
02.4.09.04.2	PCV-1112	SBQ 1 (51-1.3)	ON (CONTACTS CLOSED)	PCV-1112 FULLY OPENS FOR INJECTION ON SBQ 1 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR DUE TO OVERRIDE IN SV CRT	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	
02.4.09.05.1	PCV-1112	SBQ 2 (51-1.3)	OFF (CONTACTS OPEN)	PCV-1112 DOES NOT FULLY OPEN FOR INJECTION ON SBQ 2 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	PERIODIC TESTING	REDUNDANT SBQ	REDUCED REDUNDANCE FOR CHARGING PUMP INJECTION ALIGNMENT	CHARGING NOT CREDITED FOR INJECTION
02.4.09.05.2	PCV-1112	SBQ 2 (51-1.3)	ON (CONTACTS CLOSED)	PCV-1112 FULLY OPENS FOR INJECTION ON SBQ 2 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR DUE TO OVERRIDE IN SV CRT	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	
02.4.09.06.1	PCV-1112	REG BUS #1 (8-119)	VOLTS LOW	PCV-1112 FAILS CLOSED AFTER SV-1112 DE-ENERGIZED (BY OVERRIDE OR SBQ BLOCK/RESET)	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	
02.4.09.07.1	PCV-1112	125VDC BUS #1 (72-110)	VOLTS LOW	SV-1112 CANNOT BE ENERGIZED TO FULLY OPEN PCV-1112 AUTOMATICALLY FOR INJECTION. MODULATION UNAFFECTED FOR COLD LSG RECIRC BOUNDARY AND HOT LSG RECIRC PRIMARY PATH FUNCTIONS	CONTROL ROOM INDICATION	NONE FOR INJECTION	IMPOSSIBILITY OF CHARGING PUMP INJECTION PATH TO LOOP A	CHARGING FLOW NOT CREDITED FOR INJECTION
02.4.09.08.1	PCV-1112	ISA	PRESSURE LOW	ISA UNAVAILABLE FOR PCV-1112 OPENING (INJECTION) OR MODULATION (HLR)	CONTROL ROOM INDICATION, ANNUNCIATION	BACKUP NITROGEN	PCV-1112 OPENS AND MODULATES AS REQUIRED ON BACKUP NITROGEN	
02.4.09.09.1	PCV-1112	GM1 (PC99s)	PRESSURE LOW	GM1 UNAVAILABLE FOR PCV-1112 OPENING (INJECTION) OR MODULATION (HLR)	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, REDUNDANT PATH FOR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH, WITH CONCURRENT FAILURE OF ISA	CHARGING FLOW NOT CREDITED FOR INJECTION
02.4.10.01.1	CV-304	VALVE/ACTUATOR	OPEN	CV-304 OPENS (NORMAL) BUT CANNOT BE CLOSED FOR HLR PRIMARY PATH OR BACKUP CLR BOUNDARY FUNCTIONS	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION, REDUNDANT VALVE (PCV-1112) FOR CLR, REDUNDANT PATH FOR HLR	LOSS OF HLR PRIMARY PATH, REDUCED REDUNDANCE FOR CLR BOUNDARY	
02.4.10.01.2	CV-304	VALVE/ACTUATOR	CLOSED	CV-304 ISOLATES CHARGING PUMP INJECTION PATH TO LOOP A. NORMAL FOR CLR AND HLR	CONTROL ROOM INDICATION	NONE FOR INJECTION, NONE REQUIRED FOR CLR OR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO LOOP A. NONE FOR CLR OR HLR	CHARGING NOT CREDITED FOR INJECTION
02.4.11.01.1	CV-305	VALVE/ACTUATOR	OPEN	CV-305 OPENS FOR PZR AUX SPRAY AND CANNOT BE RECLOSED FOR CLR BOUNDARY FUNCTION. NORMAL FOR HLR PRIMARY PATH	CONTROL ROOM INDICATION	REDUNDANT VALVE (PCV-1112) FOR CLR BOUNDARY, NONE REQUIRED FOR HLR	REDUCED REDUNDANCE FOR CLR BOUNDARY, NONE FOR HLR	INCLUDES HY-1305
02.4.11.01.2	CV-305	VALVE/ACTUATOR	CLOSED	CV-305 CANNOT BE OPENED FOR PRIMARY PATH HLR. NORMAL FOR CLR BOUNDARY	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PATH FOR HLR, NONE REQUIRED FOR CLR	LOSS OF HLR PRIMARY PATH, NONE FOR CLR	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
02.4.12.01.1	CV-304 CV-305	UTILITY BUS (U-1508)	VOLTS LOW	CV-304 AND CV-305 CLOSE, CANNOT BE OPENED, ISOLATING CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH. VALVES FAIL TO CLR POSITION	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, REDUNDANT PATH FOR HLR, NONE REQUIRED FOR CLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH, NONE FOR CLR	CHARGING NOT CREDITED FOR INJECTION
02.4.12.02.1	CV-304 CV-305	ISA	PRESSURE LOW	ISA UNAVAILABLE TO CV-304 AND CV-305. CV-304 CLOSURE, ISOLATING CHARGING PUMP INJECTION TO RCS LOOP A	CONTROL ROOM ANNUNCIATION	NONE FOR INJECTION, BACKUP #2 FOR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A. CV-305 INJECTION POSITIONS AS REQUIRED FOR CLR AND HLR USING BACKUP #2	CHARGING NOT CREDITED FOR INJECTION
02.4.12.03.1	CV-304 CV-305	GMI (POBVs)	PRESSURE LOW	BACKUP #2 UNAVAILABLE FOR CV-305 OPENING (HLR)	PERIODIC SURVEILLANCE	REDUNDANT PATH FOR HLR	LOSS OF HLR PRIMARY PATH WITH CONCURRENT ISA FAILURE	
02.4.12.03.2	CV-304 CV-305	CV-532	CLOSED	ISOLATES BACKUP #2 TO CV-305 INSIDE CONTAINMENT (HLR)	CONTROL ROOM INDICATION	LOCAL MANUAL OPERATION OF REDUNDANT BYPASS VALVE IN BACKUP #2 SUPPLY	LOSS OF AUTOMATIC #2 BACKUP TO CV-305	INCLUDES SV-532A. MANUAL BYPASS VALVE LOCATED ON SAFE SIDE OF SHIELD WALL. ACCESS AND USE BOUNDED BY EXISTING DOSE CALCULATIONS
02.4.12.03.3	CV-304 CV-305	125VDC BUS #2 (72-220)	VOLTS LOW	ISOLATES BACKUP #2 TO CV-305 INSIDE CONTAINMENT (HLR) BY CLOSING CV-532	CONTROL ROOM INDICATION	LOCAL MANUAL OPERATION OF REDUNDANT BYPASS VALVE IN BACKUP #2 SUPPLY	LOSS OF AUTOMATIC #2 BACKUP TO CV-305	HANDUAL BYPASS VALVE LOCATED ON SAFE SIDE OF SHIELD WALL. ACCESS AND USE BOUNDED BY EXISTING DOSE CALCULATIONS
02.4.13.01.1	PCV-1115A	VALVE/ACTUATOR	OPEN	CLR FLOW TO RCS LOOP A CANNOT BE THROTTLED BELOW ABOUT 80 GPM	CONTROL ROOM INDICATION	NONE REQUIRED, SINCE COMBINED CLR/HLR FLOW REMAINS WITHIN INITIAL CLR LIMIT OF ABOUT 350 GPM FOR COMBINED CLR/HLR	INABILITY TO THROTTLE CLR FLOW TO RCS LOOP A BELOW ABOUT 80 GPM	VALVE IN SERVICE DURING NORMAL OPS FOR SEAL INJECTION TO LOOP A RCP
02.4.13.01.2	PCV-1115A	VALVE/ACTUATOR	CLOSED	LOW RANGE CLR FLOW CONTROL LOST FOR RCS LOOP A, CAUSING DROP IN LOOP A CLR FLOW UNTIL PCV-1115D OPENED TO COMPENSATE	CONTROL ROOM INDICATION	PARALLEL VALVE (PCV-1115D), REDUNDANT FLOW PATHS TO RCS LOOPS B AND C	REDUCED CLR FLOW TO RCS LOOP A UNTIL PCV-1115D OPENED TO COMPENSATE	VALVE IN SERVICE DURING NORMAL OPS FOR SEAL INJECTION TO LOOP A RCP
02.4.13.02.1	PCV-1115A	PT-1115A	SIGNAL HIGH	(SAME AS 2.4.13.1.1)	(SAME AS 2.4.13.1.1)	(SAME AS 2.4.13.1.1)	(SAME AS 2.4.13.1.1)	POSITION DEMAND SIGNAL. ACTUAL CONTROLLER OUTPUT IS REVERSE ACTING DUE TO FAIL OPEN DESIGN OF VALVE
02.4.13.02.2	PCV-1115A	PT-1115A	SIGNAL LOW	(SAME AS 2.4.13.1.2)	(SAME AS 2.4.13.1.2)	(SAME AS 2.4.13.1.2)	(SAME AS 2.4.13.1.2)	
02.4.14.01.1	PCV-1115D	VALVE/ACTUATOR	OPEN	INCREASE IN CLR FLOW TO RCS LOOP A, PREVENTING CLR FLOW BALANCE AND DIVERTING FLOW FROM RCS LOOPS B, C AND HLR PRIMARY PATH	CONTROL ROOM INDICATION	BOTH RECIRC PUMPS OPERATE AS REQUIRED TO PREVENT INADEQUATE CHARGING PUMP MPSR DURING TRANSIENT UNTIL NOV-356 CAN BE CLOSED TO ISOLATE FAILED PCV	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH HLR UNTIL FAILED PCV ISOLATED	*BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING
02.4.14.01.2	PCV-1115D	VALVE/ACTUATOR	CLOSED	HIGH RANGE CLR FLOW LOST TO RCS LOOP A	CONTROL ROOM INDICATION	REDUNDANT PATHS TO RCS LOOPS B AND C	IMPERFECTION OF INITIAL CLR TO RCS LOOP A	CLR FLOW REDUCED BY PROCEEDURE 5 BBS POST-LOCA TO WITHIN CAPABILITY OF PCV-1115A/B/C
02.4.14.02.1	PCV-1115D	PT-1115D	SIGNAL HIGH	INCREASE IN CLR FLOW TO RCS LOOP A IF TRAIN A CONTROLLER ALIGNED	CONTROL ROOM INDICATION	REDUNDANT CONTROLLERS	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP A	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ON/FRS UNIT 1
TABLE 2-1: COLD LRG RECIRCULATION PRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
02.4.14.02.2	PCV-1115D	PT-1115D	SIGNAL LOW	DECREASE IN CLR FLOW TO RCS LOOP A IF TRAIN A CONTROLLER ALIGNED	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP A	
02.4.14.03.1	PCV-1115D	SV-1115AD SV-1115DA SV-1115DB	OFF	PCV-1115D TRAIN B CONTROLLER CANNOT BE ALIGNED, CONTROL REMAINS ALIGNED TO TRAIN A CONTROLLER	CONTROL ROOM INDICATION, PERIODIC TEST	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN B FLOW CONTROLLER FOR CLR TO RCS LOOP A	TRAIN A CONTROLLER NORMALLY ALIGNED. MISALIGNMENT OF INDIVIDUAL SVs BOUNDED BY FAILURE OF ASSOCIATED PCV
02.4.14.03.2	PCV-1115D	SV-1115AD SV-1115DA SV-1115DB	ON	PCV-1115D TRAIN A CONTROLLER CANNOT BE ALIGNED, CONTROL ALIGNS TO TRAIN B CONTROLLER	CONTROL ROOM INDICATION, PERIODIC TEST	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP A	MISALIGNMENT OF INDIVIDUAL SVs BOUNDED BY FAILURE OF ASSOCIATED PCV
02.4.14.04.1	PCV-1115D	TR-1115D	SIGNAL HIGH	INCREASE IN CLR FLOW TO RCS LOOP A IF TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROLLER	(SAME AS 2.4.14.3.1)	
02.4.14.04.2	PCV-1115D	TR-1115D	SIGNAL LOW	DECREASE IN CLR FLOW TO RCS LOOP A IF TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROLLER	(SAME AS 2.4.14.3.1)	
02.4.14.05.1	PCV-1115D	GMI	PRESSURE LOW	(SAME AS 2.4.14.1.2)	(SAME AS 2.4.14.1.2)	(SAME AS 2.4.14.1.2)	(SAME AS 2.4.14.1.2)	SEPARATE BACKUP W2 SUPPLY FOR EACH OF PCV-1115D/B/F
02.4.15.01.1	PCV-1115A PCV-1115D	PT-1115A PT-1115D LOOP	SIGNAL HIGH	INCREASE IN CLR FLOW TO LOOP A VIA PCV-1115A/D OPENING, CLR FLOW TO RCS LOOP A CANNOT BE THROTTLED BELOW 80 GPM EVEN WITH PCV-1115D TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION	(SAME AS 2.4.14.1.1)	(SAME AS 2.4.14.1.1)	(SAME AS 2.4.14.1.1) COMMON SPLIT-RANGE CONTROL LOOP FOR PCV-1115A AND PCV-1115D (TRAIN A)
02.4.15.01.2	PCV-1115A PCV-1115D	PT-1115A PT-1115D LOOP	SIGNAL LOW	LOSS OF TRAIN A CLR FLOW CONTROL FOR RCS LOOP A	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN A FLOW CONTROLLER FOR RCS LOOP A	
02.4.16.01.1	PCV-1115B	VALVE/ACTUATOR	OPEN	CLR FLOW TO RCS LOOP B CANNOT BE THROTTLED BELOW ABOUT 80 GPM	CONTROL ROOM INDICATION	NONE REQUIRED, SINCE COMBINED CLR/HLR FLOW REMAINS WITHIN INITIAL CLR LIMIT OF ABOUT 350 GPM	INABILITY TO THROTTLE CLR FLOW TO RCS LOOP B BELOW ABOUT 80 GPM	VALVE IN SERVICE DURING NORMAL OPS FOR SRAL INJECTION TO LOOP B RCP
02.4.16.01.2	PCV-1115B	VALVE/ACTUATOR	CLOSED	LOW RANGE CLR FLOW CONTROL LOST FOR RCS LOOP B, CAUSING DROP IN LOOP B CLR FLOW UNTIL PCV-1115B OPENED TO COMPENSATE	CONTROL ROOM INDICATION	PARALLEL VALVE (PCV-1115B), REDUNDANT FLOW PATHS TO RCS LOOPS A AND C	REDUCED CLR FLOW TO RCS LOOP B UNTIL PCV-1115B OPENED TO COMPENSATE	VALVE IN SERVICE DURING NORMAL OPS FOR SRAL INJECTION TO LOOP B RCP
02.4.16.02.1	PCV-1115B	PT-1115B	SIGNAL HIGH	(SAME AS 2.4.16.1.1)	(SAME AS 2.4.16.1.1)	(SAME AS 2.4.16.1.1)	(SAME AS 2.4.16.1.1)	POSITION DEMAND SIGNAL. ACTUAL CONTROLLER OUTPUT IS REVERSE ACTING DUE TO FAIL OPEN DESIGN OF VALVE
02.4.16.02.2	PCV-1115B	PT-1115B	SIGNAL LOW	(SAME AS 2.4.16.1.2)	(SAME AS 2.4.16.1.2)	(SAME AS 2.4.16.1.2)	(SAME AS 2.4.16.1.2)	
02.4.17.01.1	PCV-1115B	VALVE/ACTUATOR	OPEN	INCREASE IN CLR FLOW TO RCS LOOP B, PREVENTING CLR FLOW BALANCE AND DIVERTING FLOW FROM RCS LOOPS A, C AND HLR PRIMARY PATH	CONTROL ROOM INDICATION	BOTH RECIRC PUMPS OPERATE AS REQUIRED TO PREVENT INADEQUATE CHARGING PUMP WPSH DURING TRANSIENT UNTIL MOV-357 CAN BE CLOSED TO ISOLATE FAILED PCV	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH CLR UNTIL FAILED PCV ISOLATED	BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING
02.4.17.01.2	PCV-1115B	VALVE/ACTUATOR	CLOSED	HIGH RANGE CLR FLOW LOST TO RCS LOOP B	CONTROL ROOM INDICATION	REDUNDANT PATHS TO RCS LOOPS A AND C	INOPERABILITY OF INITIAL CLR TO CLR FLOW REDUCED BY PROCEEDURE 5 HRS POST-LOCK (?) WITHIN CAPABILITY OF PCV-1115A/B/C	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFF UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMBREDENT COMPENSATING PROVISIONS	EFFECT ON RCS	REMARKS
02.4.17.02.1	PCV-1115R	FY-1115R	SIGNAL HIGH	INCREASE IN CLR FLOW TO RCS LOOP B IF TRAIN A CONTROLLER ALIGNED	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP B	
02.4.17.02.2	PCV-1115R	FY-1115R	SIGNAL LOW	DECREASE IN CLR FLOW TO RCS LOOP B IF TRAIN A CONTROLLER ALIGNED	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP B	
02.4.17.03.1	PCV-1115R	SV-1115BE SV-1115BA SV-1115BB	OFF	PCV-1115R TRAIN B CONTROLLER CANNOT BE ALIGNED, CONTROL REMAINS ALIGNED TO TRAIN A CONTROLLER	CONTROL ROOM INDICATION, PERIODIC TEST	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN B FLOW CONTROLLER FOR CLR TO RCS LOOP B	TRAIN A CONTROLLER NORMALLY ALIGNED. MISALIGNMENT OF INDIVIDUAL SVs BOUNDED BY FAILURE OF ASSOCIATED PCV
02.4.17.03.2	PCV-1115R	SV-1115BR SV-1115BA SV-1115BB	ON	PCV-1115R TRAIN A CONTROLLER CANNOT BE ALIGNED, CONTROL ALIGNS TO TRAIN B CONTROLLER	CONTROL ROOM INDICATION, PERIODIC TEST	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP B	MISALIGNMENT OF INDIVIDUAL SVs BOUNDED BY FAILURE OF ASSOCIATED PCV
02.4.17.04.1	PCV-1115R	VM-1115R	SIGNAL HIGH	INCREASE IN CLR FLOW TO RCS LOOP B IF TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROLLER	(SAME AS 2.4.17.3.1)	
02.4.17.04.2	PCV-1115R	VM-1115R	SIGNAL LOW	DECREASE IN CLR FLOW TO RCS LOOP B IF TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROLLER	(SAME AS 2.4.17.3.1)	
02.4.17.05.1	PCV-1115R	CM1	PRESSURE LOW	(SAME AS 2.4.17.1.2)	(SAME AS 2.4.17.1.2)	(SAME AS 2.4.17.1.2)	(SAME AS 2.4.17.1.2)	SEPARATE BACKUP N2 SUPPLY FOR EACH OF PDV-1115D/B/F
02.4.18.01.1	PCV-1115R PCV-1115R	PY-1115R PY-1115R LOOP	SIGNAL HIGH	INCREASE IN CLR FLOW TO LOOP B VIA PCV-1115R/B OPENING, CLR FLOW TO RCS LOOP B CANNOT BE THROTTLED BELOW 80 GPM EVEN WITH PCV-1115R TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION	(SAME AS 2.4.17.1.1)	(SAME AS 2.4.17.1.1)	(SAME AS 2.4.17.1.1) COMMON SPLIT-RANGE CONTROL LOOP FOR PCV-1115R AND PCV-1115R (TRAIN A)
02.4.18.01.2	PCV-1115R PCV-1115R	PY-1115R PY-1115R LOOP	SIGNAL LOW	LOSS OF TRAIN A CLR FLOW CONTROL FOR RCS LOOP B	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN A FLOW CONTROLLER FOR RCS LOOP B	
02.4.19.01.1	PCV-1115C	VALVE/ACTUATOR	OPEN	CLR FLOW TO RCS LOOP C CANNOT BE THROTTLED BELOW ABOUT 80 GPM	CONTROL ROOM INDICATION	NONE REQUIRED, SINCE COMBINED CLR/HLR FLOW REMAINS WITHIN INITIAL CLR LIMIT OF ABOUT 350 GPM FOR COMBINED CLR/HLR	INABILITY TO THROTTLE CLR FLOW TO RCS LOOP C BELOW ABOUT 80 GPM	VALVE IN SERVICE DURING NORMAL OPS FOR SBAL INJECTION TO LOOP C RCP
02.4.19.01.2	PCV-1115C	VALVE/ACTUATOR	CLOSED	LOW RANGE CLR FLOW CONTROL LOST FOR RCS LOOP C, CAUSING DROP IN LOOP C CLR FLOW UNTIL PCV-1115P OPENED TO COMPENSATE	CONTROL ROOM INDICATION	PARALLEL VALVE (PCV-1115P), REDUNDANT FLOW PATHS TO RCS LOOPS A AND B	REDUCED CLR FLOW TO RCS LOOP C UNTIL PCV-1115P OPENED TO COMPENSATE	VALVE IN SERVICE DURING NORMAL OPS FOR SBAL INJECTION TO LOOP C RCP
02.4.19.02.1	PCV-1115C	PY-1115C	SIGNAL HIGH	(SAME AS 2.4.19.1.1)	(SAME AS 2.4.19.1.1)	(SAME AS 2.4.19.1.1)	(SAME AS 2.4.19.1.1)	POSITION DEMAND SIGNAL. ACTUAL CONTROLLER OUTPUT IS REVERSE ACTING DUE TO FAIL OPEN DESIGN OF VALVE
02.4.19.02.2	PCV-1115C	PY-1115C	SIGNAL LOW	(SAME AS 2.4.19.1.2)	(SAME AS 2.4.19.1.2)	(SAME AS 2.4.19.1.2)	(SAME AS 2.4.19.1.2)	
02.4.20.01.1	PCV-1115P	VALVE/ACTUATOR	OPEN	INCREASE IN CLR FLOW TO RCS LOOP C, PREVENTING CLR FLOW BALANCE AND DIVERTING FLOW FROM RCS LOOPS A, B AND HLR PRIMARY PATH	CONTROL ROOM INDICATION	BOTH RECIRC PUMPS OPERATE AS REQUIRED TO PREVENT INADEQUATE CHARGING PUMP MPM DURING TRANSIENT UNTIL NOV-358 CAN BE CLOSED TO ISOLATE FAULTY PCV	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH HLR UNTIL FAILED PCV ISOLATED	BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONDFRE UNIT 1
 TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	EMERGENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
02.4.20.01.2	PCV-1115F	VALVE/ACTUATOR	CLOSED	HIGH RANGE CLR FLOW LOST TO RCS LOOP C	CONTROL ROOM INDICATION	REDUNDANT PATHS TO RCS LOOPS A AND B	IMPOSSIBILITY OF INITIAL CLR TO RCS LOOP B	CLR FLOW PRODUCED BY PROCEDURE 5 HRS POST-LOCA TO WITHIN CAPABILITY OF PCV-1115A/B/C
02.4.20.02.1	PCV-1115F	FT-1115F	SIGNAL HIGH	INCREASE IN CLR FLOW TO RCS LOOP C IF TRAIN A CONTROLLER ALIGNED	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP C	
02.4.20.02.2	PCV-1115F	FT-1115F	SIGNAL LOW	DECREASE IN CLR FLOW TO RCS LOOP C IF TRAIN A CONTROLLER ALIGNED	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP C	
02.4.20.03.1	PCV-1115F	SV-1115CF SV-1115PA SV-1115PB	OFF	PCV-1115F TRAIN B CONTROLLER CANNOT BE ALIGNED, CONTROL REMAINS ALIGNED TO TRAIN A CONTROLLER	CONTROL ROOM INDICATION, PERIODIC TEST	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN B FLOW CONTROLLER FOR CLR TO RCS LOOP C	TRAIN A CONTROLLER NORMALLY ALIGNED. MISALIGNMENT OF INDIVIDUAL SVs BOUNDED BY FAILURE OF ASSOCIATED PCV
02.4.20.03.2	PCV-1115F	SV-1115CF SV-1115PA SV-1115PB	ON	PCV-1115F TRAIN A CONTROLLER CANNOT BE ALIGNED, CONTROL ALIGNS TO TRAIN B CONTROLLER	CONTROL ROOM INDICATION, PERIODIC TEST	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN A FLOW CONTROLLER FOR CLR TO RCS LOOP C	MISALIGNMENT OF INDIVIDUAL SVs BOUNDED BY FAILURE OF ASSOCIATED PCV
02.4.20.04.1	PCV-1115F	TM-1115F	SIGNAL HIGH	INCREASE IN CLR FLOW TO RCS LOOP C IF TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROLLER	(SAME AS 2.4.20.3.1)	
02.4.20.04.2	PCV-1115F	TM-1115F	SIGNAL LOW	DECREASE IN CLR FLOW TO RCS LOOP C IF TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROLLER	(SAME AS 2.4.20.3.1)	
02.4.20.05.1	PCV-1115F	GNI	PRBS:URS LOW	(SAME AS 2.4.20.1.2)	(SAME AS 2.4.20.1.2)	(SAME AS 2.4.20.1.2)	(SAME AS 2.4.20.1.2)	SEPARATE BACKUP M2 SUPPLY FOR EACH OF FDV-1115D/B/F
02.4.21.01.1	PCV-1115C PCV-1115F	FT-1115C FT-1115F LOOP	SIGNAL HIGH	INCREASE IN CLR FLOW TO LOOP C VIA PCV-1115C/F OPENING, CLR FLOW TO RCS LOOP C CANNOT BE THROTTLED BELOW 80 GPM EVEN WITH PCV-1115F TRAIN B CONTROLLER ALIGNED	CONTROL ROOM INDICATION	(SAME AS 2.4.20.1.1)	(SAME AS 2.4.20.1.1)	(SAME AS 2.4.20.1.1) COMMON SPLIT-RANGE CONTROL LOOP FOR PCV-1115C AND PCV-1115F (TRAIN A)
02.4.21.01.2	PCV-1115C PCV-1115F	FT-1115C FT-1115F LOOP	SIGNAL LOW	LOSS OF TRAIN A CLR FLOW CONTROL FOR RCS LOOP C	CONTROL ROOM INDICATION	REDUNDANT CONTROLLER AND FLOW PATHS	LOSS OF TRAIN A FLOW CONTROLLER FOR RCS LOOP C	
02.4.22.01.1	PCV-1115A/D PCV-1115B/B PCV-1115C/F	VITAL BUS BA (B-1416V)	VOLTS LOW	PCV-1115A/B/C FAIL OPEN AND PCV-1115D/B/F FAIL CLOSED IF TRAIN A CONTROLLERS ALIGNED. CLR FLOW CANNOT BE THROTTLED BELOW ABOUT 80 GPM PER RCS LOOP	CONTROL ROOM INDICATION	REDUNDANT CONTROLLERS	LOSS OF TRAIN A CLR FLOW CONTROL TO RCS LOOPS A, B AND C, AND INABILITY TO THROTTLE CLR FLOW BELOW ABOUT 80 GPM PER LOOP FOR COMBINED CLR/HLR	*HYDRAULIC CALC REQUIRED TO VERIFY FLOW THROUGH WIDE OPEN FCV-1115A/B/C AND UPPER LIMIT FOR PRIMARY PATH HLR FLOW TO REMAIN WITHIN RECIRC PUMP FLOW CAPABILITIES
02.4.22.02.1	PCV-1115A/D PCV-1115B/B PCV-1115C/F	ISA	PRESSURE LOW	PCV-1115A/B/C FAIL OPEN AND CLR FLOW CANNOT BE THROTTLED BELOW ABOUT 80 GPM PER RCS LOOP. PCV-1115D/B/F MODULATE ON BACKUP M2 AS REQUIRED	CONTROL ROOM INDICATION, ANNUNCIATION	BACKUP M2 FOR PCV-1115D/B/F FLOW CONTROL	INABILITY TO CONTROL CLR FLOW ON ISA OR THROTTLE CLR FLOW BELOW 80 GPM PER RCS LOOP FOR COMBINED CLR/HLR	*HYDRAULIC CALC REQUIRED TO VERIFY FLOW THROUGH WIDE OPEN FCV-1115A/B/C, AND UPPER LIMIT FOR PRIMARY PATH HLR FLOW TO REMAIN WITHIN THE CAPABILITIES OF A SINGLE RECIRC PUMP FOR THIS POTENTIAL COMMON-CAUSE FAILURE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT I.D.	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.23.01.1	PCV-1115D PCV-1115B PCV-1115P	CSAS INVERTER (102-6)	VOLTS LOW	TRAIN B CONTROLLERS DISABLED FOR PCV-1115D/B/P	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTROLLERS	LOSS OF 1 OF 2 REDUNDANT CONTROLLERS FOR EACH OF PCV-1115D/B/P FOR CLR FLOW CONTROL	
02.4.23.02.1	PCV-1115D PCV-1115B PCV-1115P	125VDC BUS #2 (172-223)	VOLTS LOW	LOSS OF POWER TO TRAIN B CSAS INVERTERS. TRAIN B CONTROLLERS DISABLED FOR PCV-1115D/B/P	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTROLLERS	LOSS OF 1 OF 2 REDUNDANT CONTROLLERS FOR EACH OF PCV-1115D/B/P FOR CLR FLOW CONTROL	
02.4.23.03.1	PCV-1115D PCV-1115B PCV-1115P	SMCB #2 125VDC CONTROL POWER (052-1226)	VOLTS LOW	CONTROLLER SELECTOR VALVES FOR FDV-1115D/B/P FAIL IN TRAIN A POSITIONS, TRAIN B CONTROLLERS CANNOT BE ALIGNED	CONTROL ROOM INDICATION	REDUNDANT TRAIN A CONTROLLERS	LOSS OF 1 OF 2 REDUNDANT CONTROLLERS FOR EACH OF PCV-1115D/B/P FOR CLR FLOW CONTROL	
02.4.24.01.1	PT-3114A LOOP	PI-3114A	SIGNAL HIGH	HIGH CLR FLOW INDICATION FOR RCS LOOP A	CONTROL ROOM INDICATION	REDUNDANT LOOPS	CLR FLOW TO LOOP A MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-354 TO PREVENT EXCEEDING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-356 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115D FAILURE AND PI-3114A FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP
02.4.24.01.2	PT-3114A LOOP	PI-3114A	SIGNAL LOW	LOW CLR FLOW INDICATION FOR RCS LOOP A	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	*PCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
02.4.24.02.1	PT-3114A LOOP	CTO MIST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	(SAME AS 2.4.24.1.2)	(SAME AS 2.4.24.1.2)	(SAME AS 2.4.24.1.2)	(SAME AS 2.4.24.1.2)	(SAME AS 2.4.24.1.2)
02.4.24.03.1	PT-3114A LOOP	VITAL BUS #5 (8-2903V)	VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOP A	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	*PCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
02.4.25.01.1	PT-2114B LOOP	PI-2114B	SIGNAL HIGH	HIGH CLR FLOW INDICATION FOR RCS LOOP B	CONTROL ROOM INDICATION	REDUNDANT LOOPS	CLR FLOW TO LOOP B MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-357 TO PREVENT EXCEEDING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-357 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115B FAILURE AND PI-2114B FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
02.4.25.01.2	PT-2114B LOOP	PI-2114B	SIGNAL LOW	LOW CLR FLOW INDICATION FOR RCS LOOP B	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP B WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	*PCV-1115B FAILURE AND PI-2114B FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW

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SAN ONOFRE UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.25.02.1	PT-2114C LOOP	PT-2114C	SIGNAL HIGH	HIGH CLR FLOW INDICATION FOR RCS LOOP C	CONTROL ROOM INDICATION	REDUNDANT LOOPS	CLR FLOW TO LOOP C MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-3580 TO PREVENT RECHARGING RECHRG PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-358 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115F FAILURE AND PT-2114C FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
02.4.25.02.2	PT-2114C LOOP	PT-2114C	SIGNAL LOW	LOW CLR FLOW INDICATION FOR RCS LOOP C	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECHRG PUMP LIMITATIONS	*PCV-1115F FAILURE AND PT-2114C FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
02.4.25.03.1	PT-2114B LOOP PT-2114C LOOP	C69 M5ST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOPS B AND C	PERIODIC TESTING	NONE AVAILABLE	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECHRG PUMP LIMITATIONS	*PCV-1115B/P FAILURE AND PT-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
02.4.25.04.1	PT-2114B LOOP PT-2114C LOOP	VITAL BUS #3A (8-3313V)	VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOPS B AND C	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE AVAILABLE	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECHRG PUMP LIMITATIONS	*PCV-1115B/P FAILURE AND PT-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
02.4.26.01.1	CV-2145	VALVE/ACTUATOR	OPEN (OR NORMAL)	LOSS OF CHARGING PUMP DISCHARGE SAMPLE LINE ISOLATION FOR CLR AND HLR PRIMARY PATH BOUNDARY FUNCTION	LOCAL INDICATION	NONE REQUIRED FOR CLR OR HLR FLOW RATE. BACKUP MANUAL VALVE (BSS-323) FOR INVENTORY	*DIVERSION OF CLR AND HLR FLOW/INVENTORY TO NON-SAFETY RELATED SAMPLE SYSTEM	BACKUP ISOLATION VALVE NOT ACCESSIBLE DURING RECIRCULATION WITH THE SOURCE TERM
02.4.26.01.2	CV-2145	VALVE/ACTUATOR	CLOSED	CHARGING PUMP DISCHARGE SAMPLE LINE ISOLATED. NORMAL FOR CLR AND HLR	LOCAL INDICATION	NONE REQUIRED	NONE	ALSO ISOLATES SAMPLE LINE TO NON-SAFETY RELATED PASS SYSTEM
02.4.27.01.1	CV-406A	VALVE/ACTUATOR	OPEN	NOV-1100C BYPASSED VIA CV-406A/B, POTENTIALLY GAS-BINDING BOTH CHARGING PUMPS DURING VCT LEVEL TRANSIENT PRECEDING SIS/SISLOP IN SBLOCA, OR PRE-SELECTED CHARGING PUMP DURING LBLOCA, MSLB OR SGTR INJECTION. NO EFFECT IF DURING RECHRG	CONTROL ROOM INDICATION	NONE FOR SBLOCA, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR RECHRG IN OTHER EVENTS	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	*INCLUDES BY-406A. REDUNDANT VALVE CV-406B NORMALLY OPEN, DOES NOT AUTO-CLOSE ON SIS/SISLOP OR LOW VCT LEVEL. EFFECT OF GAS BINDING IN COMMON PART OF SUCTION LINES (?) REDUNDANT PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECHRG BY TEST OR ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONEBB UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.27.01.2	CV-106A	VALVE/ACTUATOR	CLOSED	HAZUP PATH FROM BLENDING TBB TO VCT ISOLATED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION
02.4.27.01.3	CV-106A	VALVE/ACTUATOR	NO	VALVE FAILS OPEN. NO EFFECT ON MONS CLR OR HLR SINCE HARSH ENVIRONMENT IN VALVE AREA DOES NOT OCCUR UNTIL RECIRC IS INITIATED, WHICH SEATS VCT CHECK VALVE TO PREVENT GAS BINDING		NONE REQUIRED	NONE	(b)(2) FUSE PROTECTS OTHER UTILITY BUS LOADS
02.4.27.02.1	CV-106B	VALVE/ACTUATOR	OPEN	HAZUP PATH FROM BLENDING TBB TO CHARGING PUMP SUCTION CANNOT BE ISOLATED DURING INJECTION. CHARGING PUMP SUCTION PIPING BEHIND BOUNDARY (VCT CHECK VALVE VCC-301) UNAPPECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE CV-106A PREVENTS GAS BINDING OF CHARGING PUMPS VIA CV-106B	REDUCED REDUNDANCY FOR VCT ISOLATION POST-SIS/SISLOP	*NORMAL POSITION. INCLUDES SV-106B. DOES NOT AUTO-CLOSE ON SIS/SISLOP OR LOW VCT LEVEL. UPGRADE TO SR AND ADD TO 1ST PRGM REQD FOR VCT ISOL FUNCTION. NO. MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP SIMILAR TO NOV-1100C BORIC ACID SYSTEM NOT CREDITED POST-ACCIDENT. MUST CREDITED FOR SAFE SHUTDOWN
02.4.27.02.2	CV-106B	VALVE/ACTUATOR	CLOSED	HAZUP PATH FROM BLENDING TBB TO CHARGING PUMP SUCTION ISOLATED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	(b)(2) FUSE PROTECTS OTHER UTILITY BUS LOADS
02.4.27.02.3	CV-106B	VALVE/ACTUATOR	NO	VALVE FAILS OPEN. NO EFFECT ON MONS CLR OR HLR SINCE HARSH ENVIRONMENT DOES NOT OCCUR UNTIL RECIRC IS INITIATED, WHICH SEATS VCT CHECK VALVE TO PREVENT GAS BINDING		NONE REQUIRED	NONE	
02.4.27.03.1	CV-106A CV-106B	CONTROL SWITCH	VCT	CV-106A OPENS, CV-106B CLOSSES, ALIGNING HAZUP FROM BLENDING TBB TO VCT. CLOSED VALVE PREVENTS GAS BINDING BY THIS PATH	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
02.4.27.03.2	CV-106A CV-106B	CONTROL SWITCH	DIRECT	CV-106B OPENS, CV-106A CLOSSES, ALIGNING HAZUP FROM BLENDING TBB TO VCT. CLOSED VALVE PREVENTS GAS BINDING BY THIS PATH	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION
02.4.27.03.3	CV-106A CV-106B	CONTROL SWITCH	CONTACTS OPEN	CV-106A AND CV-106B OPEN, BYPASSING NOV-1100C AND POTENTIALLY GAS-BINDING BOTH CHARGING PUMPS DURING VCT LEVEL TRANSIENT PRECEDING SIS/SISLOP IN SBLOCA, OR PRESSELECTED CHARGING PUMP DURING LBLOCA, HSLB OR SGTR INJECTION. NO EFFECT IF DURING RECIRC	CONTROL ROOM INDICATION	(SARB AS 2.4.27.1.1)	*(SARB AS 2.4.27.1.1)	*(SARB AS 2.4.27.1.1)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ON-PRESS UNIT 1
TABLE 2-1: COLD LEG RECIRCULATION PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.27.03.4	CV-406A CV-406B	CONTROL SWITCH	CONTACTS CLOSE	CV-406A AND CV-406B CLOSE, ISOLATING MAKEUP PATH FROM BLENDING THE TO VCT AND CHARGING PUMP INJECTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BORIC ACID SYSTEM NOT CREDITED POST-ACCIDENT, NEXT AVAILABLE FOR SAFB SHUTDOWN
02.4.27.03.5	CV-406A CV-406B	CONTROL SWITCH	CONTACTS GROUND	(b)(2) PUSH BLOWS, DE-ENERGIZING AND OPENING CV-406A/B, WHICH BYPASSES NOV-1100C, POTENTIALLY GAS-BINDING BOTH CHG PPS DURING VCT LEVEL TRANSIENT PRECEDING SIS/SISLOP IN SBLOCA, OR PRE-SELECTED PUMP IN LBLOCA/HSLB/SGTR INJECTION. NO EFFECT ON RECIRC	CONTROL ROOM INDICATION	(SASB AS 2.4.27.1.1)	(SASB AS 2.4.27.1.1)	(SASB AS 2.4.27.1.1)
02.4.27.04.1	CV-406A CV-406B	UTILITY BUS (B-1518)	VOLTS LOW	CV-406A AND CV-406B OPEN, BYPASSING NOV-1100C, POTENTIALLY GAS-BINDING BOTH CHARGING PUMPS DURING VCT LEVEL TRANSIENT PRECEDING SIS/SISLOP IN SBLOCA, AND PRESELECTED PUMP DURING LBLOCA, HSLB, SGTR INJECTION. NO EFFECT IF DURING RECIRC	CONTROL ROOM INDICATION	NONE FOR SBLOCA, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR RECIRC IN OTHER EVENTS	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	*AT LEAST ONE OF CV-406A/B MUST BE FAIL CLOSED AND/OR LOCKED CLOSED. ECCS MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP SIMILAR TO NOV-1100C FAILURE TO CLOSE
02.4.27.05.1	CV-406A CV-406B	ISA	PRESSURE LOW	CV-406A AND CV-406B OPEN, BYPASSING NOV-1100C, POTENTIALLY GAS-BINDING BOTH CHARGING PUMPS DURING VCT LEVEL TRANSIENT PRECEDING SIS/SISLOP IN SBLOCA, AND PRESELECTED PUMP DURING LBLOCA, HSLB, SGTR INJECTION. NO EFFECT IF DURING RECIRC	CONTROL ROOM INDICATION	NONE FOR SBLOCA, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR RECIRC IN OTHER EVENTS	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	*AT LEAST ONE OF CV-406A/B MUST BE FAIL-CLOSED AND/OR LOCKED CLOSED. ECCS MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP SIMILAR TO NOV-1100C FAILURE TO CLOSE
02.4.28.01.1	BCV-427A	VALVE/ACTUATOR	OPEN	RCP SEAL RETURN DIVERTED TO LOOP B VAPOR SEAL HEAD TANK, WHICH OVERFLOWS TO RCDT	CONTROL ROOM INDICATION	NONE FOR SI INVENTORY, NONE REQUIRED FOR FLOW	*UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. NONE ON SI OR CLR FLOW DUE TO CONTINUING RCP SEAL FUNCTIONING	*NEXT INVENTORY AND SI/FW LO-LO BUST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT
02.4.28.01.2	BCV-427A	VALVE/ACTUATOR	CLOSED	LOOP A VAPOR SEAL HEAD TANK CANNOT BE REFILLED WITHOUT LOCAL MANUAL OPERATION OF BYPASS VALVE. NO EFFECT ON INJECTION OR RECIRC FLOW OR INVENTORY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION
02.4.28.01.3	BCV-427A	VALVE/ACTUATOR	BQ	VALVE FAILS CLOSED DUE TO POWER ISOLATION BY (b)(2) PUSH	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	(b)(2) PUSH PROTECTS OTHER I2S VDC BUS SI LOADS
02.4.28.02.1	BCV-427B	VALVE/ACTUATOR	OPEN	RCP SEAL RETURN DIVERTED TO LOOP B VAPOR SEAL HEAD TANK, WHICH OVERFLOWS TO RCDT	CONTROL ROOM INDICATION	NONE FOR SI INVENTORY, NONE REQUIRED FOR FLOW	*UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. NONE ON SI OR CLR FLOW DUE TO CONTINUING RCP SEAL FUNCTIONING	*NEXT INVENTORY AND SI/FW LO-LO BUST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONDFRB UNIT 1
 TABLE 2-1: COLD LEG RECIRCULATION FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
02.4.28.02.2	BCV-427B	VALVE/ACTUATOR	CLOSED	LOOP B VAPOR SEAL HEAD TANK CANNOT BE REFILLED WITHOUT LOCAL MANUAL OPERATION OF BYPASS VALVE. NO EFFECT ON INJECTION OR RECIRC FLOW OR INVENTORY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION
02.4.28.02.3	BCV-427B	VALVE/ACTUATOR	EQ	VALVE FAILS CLOSED DUE TO POWER ISOLATION BY (b)(2) PUSH RCP SEAL RETURN DIVERTED TO LOOP C VAPOR SEAL HEAD TANK, WHICH OVERFLOWS TO RCDT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	(b)(2) PUSH PROTECTS OTHER 125 VDC BUS #1 LOADS
02.4.28.03.1	BCV-427C	VALVE/ACTUATOR	OPEN	LOOP C VAPOR SEAL HEAD TANK CANNOT BE REFILLED WITHOUT LOCAL MANUAL OPERATION OF BYPASS VALVE. NO EFFECT ON INJECTION OR RECIRC FLOW OR INVENTORY	CONTROL ROOM INDICATION	NONE FOR SI INVENTORY, NONE REQUIRED FOR FLOW	*UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. NONE ON SI OR CLR FLOW DUE TO CONTINUED RCP SEAL FUNCTIONING	*RWST INVENTORY AND SI/PW LO-LO RWST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT
02.4.28.03.2	BCV-427C	VALVE/ACTUATOR	CLOSED	LOOP C VAPOR SEAL HEAD TANK CANNOT BE REFILLED WITHOUT LOCAL MANUAL OPERATION OF BYPASS VALVE. NO EFFECT ON INJECTION OR RECIRC FLOW OR INVENTORY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION
02.4.28.03.3	BCV-427C	VALVE/ACTUATOR	EQ	VALVE FAILS CLOSED DUE TO POWER ISOLATION BY (b)(2) PUSH	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	(b)(2) PUSH PROTECTS OTHER 125 VDC BUS #1 LOADS
02.4.28.04.1	BCV-427A BCV-427B BCV-427C	UTILITY BUS (8-1502)	VOLTS LOW	VALVES FAIL AS-IS, CONTROL RELAY OPERATE AND RESET COILS CANNOT BE ENERGIZED TO CHANGE STATE OF CONTACTS IN SOLENOID VALVE POWER CIRCUITS	CONTROL ROOM INDICATION	NONE FOR SI/RCS INVENTORY, NONE REQUIRED FOR INJECTION OR CLR FLOW	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, NONE FOR INJECTION OR CLR FLOW DUE TO CONTINUED FUNCTIONING OF RCP SEALS	*RWST INVENTORY AND SI/PW LO-LO RWST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT
02.4.28.05.1	BCV-427A BCV-427B BCV-427C	125VDC BUS #1 (72-130)	VOLTS LOW	VALVES FAIL CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	

TABLE 2-2: COLD LEG RECIRCULATION BOUNDARY VALVE ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
BOUNDARY VALVE ANALYSIS

--- SAFETY RELATED BOUNDARY ---				--- SAFETY RELATED BACKUP ---			--- NON-SAFETY RELATED BACKUP ---			REMARKS
ITEM #	TAG #	MC/AUTO?	LOCKED?	TAG #	MC/AUTO?	TAG #	MC/AUTO?			
02.1.01	CRS-006	CLOSED	NO	NONE		CAP			# G-45A MINIFLOW VENT/DRAIN	
02.1.02	CRS-016	CHECK		NONE REQUIRED		PV-2077		OPEN	# RBCIRC PUMP G-45A BEARING SERVICE WATER SUPPLY. NON-BQ BACKUP VALVE OPENS AS PART OF PUMP START, HOWEVER, AUTOMATIC CONTAINMENT ISOLATION VALVES CV-537 AND CV-115 PREVENT DILUTION OF SUMP BY CONTINUED SERVICE WATER FLOW	
02.1.03	UNE NEEDLE	CLOSED	NO	NONE		NONE			# G-8B DISCHARGE PRESSURE INSTRUMENT (PT-1119B) DRAIN	
02.2.01	CRS-007	CLOSED	NO	NONE		CAP			# G-45B MINIFLOW VENT/DRAIN	
02.2.02	CRS-017	CHECK		NONE REQUIRED		PV-3077		OPEN	# RBCIRC PUMP G-45B BEARING SERVICE WATER SUPPLY. NON-BQ BACKUP VALVE OPENS AS PART OF PUMP START, HOWEVER, AUTOMATIC CONTAINMENT ISOLATION VALVES CV-537 AND CV-115 PREVENT DILUTION OF SUMP BY CONTINUED SERVICE WATER FLOW	
02.2.03	UNE NEEDLE	CLOSED	NO	NONE		NONE			# G-8A DISCHARGE PRESSURE INSTRUMENT (PT-1119A) DRAIN	
02.2.04	VCC-374	CLOSED	NO	NONE		VCC-348, 384		CLOSED	# G-8A DSD MINIFLOW LINE TO RWST	
02.3.01	CRS-004	CLOSED	NO	NONE		CAP			# G-45A/PT-500 TEST CONNECTION	
02.3.02	CRS-002	CLOSED	NO	NONE		CAP			# G-45A/PT-500 TEST CONNECTION	
02.3.03	CRS-003	CLOSED	NO	NONE		CAP			# G-45B/PT-501 TEST CONNECTION	
02.3.04	CRS-001	CLOSED	NO	NONE		CAP			# G-45B/PT-501 TEST CONNECTION	
02.3.05	CRS-031	CLOSED	NO	NONE		CRS-029, 030		CLOSED	# REACTOR CAVITY DEWATERING PUMP DISCHARGE ISOLATION	
02.3.06	CRS-027	CLOSED	YES	NONE		CRS-026, 028		CLOSED	# REPUBLIC CAVITY DEWATERING ISOLATION	
02.3.07	CRS-043	CLOSED	NO	NONE		CAP			# SPRAY NOZZLE BYPASS VENT/DRAIN	
02.3.08	CRS-042	CLOSED	YES	NONE		NONE			# SPRAY NOZZLE BYPASS	
02.3.09	CRS-317	CLOSED	NO	NONE		CAP			# RBCIRC LINE VENT BETWEEN PENETRATION AND RBCIRC HI	
02.3.10	CRS-358	CLOSED	NO	NONE		NONE			# RBCIRC LINE DRAIN BETWEEN PENETRATION AND RBCIRC HI	
02.3.11	CRS-318	CLOSED	NO	NONE		NONE			# RBCIRC LINE DRAIN DOWNSTREAM OF RBCIRC HI	
02.3.12	CRS-319	OPEN	NO	NONE		CRS-320		CLOSED	# RBCIRC LINE DRAIN BETWEEN HI AND CHARGING SUCTION. VALVE OPEN VIOLATES LTS SEISMIC BOUNDARY CRITERIA	
02.3.13	CRS-323	CLOSED	NO	NONE		NONE			# RBCIRC LINE VENT BETWEEN HI AND CHARGING CONNECTION	
02.3.14	CRS-326	CLOSED	NO	NONE		NONE			# RBCIRC LINE VENT BETWEEN HI AND CHARGING CONNECTION	
02.3.15	CRS-325	CLOSED	NO	NONE		NONE			# RBCIRC LINE DRAIN BETWEEN HI AND CHARGING CONNECTION	
02.3.16	CRS-321	CLOSED	YES	CRS-322		CHECK			# REPUBLIC WATER PUMP DISCHARGE BYPASS TO SUCTION	
02.3.17	CRS-311	CLOSED	NO	NONE		CRS-312, 313, 315		CLOSED	# RWST SUCTION CONNECTION TO FILTER PUMP	
02.3.18	CRS-310	CLOSED	NO	NONE		NONE			# RWST SUCTION DRAIN	
02.3.19	CRS-301	CHECK		MOV-993		OPEN			# RWST OUTLET CHECK VALVE NOT SEAT LEAKAGE TESTED. REDUNDANT VALVE MOV-883 CLOSED FOR RBCIRC BY PROCEDURE BUT MAY BE SINGLE FAILURE	
02.3.20	CRS-426	CLOSED	NO	NONE		NONE			# SPENT PULP PIT SUCTION CONNECTION	
02.3.21	VCC-389	CLOSED	NO	NONE		NONE			# MOV-1100B/D UPSTREAM SAMPLE	
02.3.22	VCC-335	CLOSED	NO	NONE		NONE			# MOV-1100B/D DOWNSTREAM DRAIN	

EMERGENCY COOLING SYSTEM SINGLE FAILURES ANALYSIS
SAN ONOFFERS UNIT 1
BOUNDARY VALVE ANALYSIS

ITEM #	SAFETY RELATED BOUNDARY				SAFETY RELATED BACKUP		NON-SAFETY RELATED BACKUP			REMARKS
	TAG #	NC/AUTO?	CLOSED?	LOCATED?	TAG #	NC/AUTO?	TAG #	NC/AUTO?		
02.3.23	VCC-323	CLOSED	NO	NONE					FLASH TANK PATH VENT	
02.3.24	VCC-324	CLOSED	NO	VCC-405		CLOSED			FLASH TANK PATH ISOLATION	
02.3.25	BA9-345	CLOSED	NO	NONE					BLENDING TBE BYPASS	
02.3.26	VCC-301	CHCK		MOV-1100C, CV-406B, VCC-311		AUTO			VCT OUTLET CHCK. REDUNDANT VALVES REQUIRED TO ISOLATE HYDROGEN COVER GAS FLOW TO CHARGING PUMP SUCTION. VCC-311 IS CHCK VALVE. CV-406B AND SERIES VALVE CV-406A FAIL OPEN AND ARE NON-AUTOMATIC	
02.3.27	CV-410	AUTO		CV-411		AUTO			SEAL WATER RETURN TO VCT	
02.3.29	RV-249	RBLIFP		NONE REQUIRED					PASSIVE. SEAL WATER BY RBLIFP TO VCT. SET PT 140 PSIG	
02.3.30	VCC-354	CLOSED	NO	NONE					SEAL WATER RETURN DRAIN	
02.3.31	VCC-347	CLOSED	NO	NONE					SEAL WATER RETURN DRAIN	
02.3.32	VCC-346	CLOSED	NO	NONE					SEAL WATER RETURN VENT	
02.3.33	VCC-383	CLOSED	NO	NONE					SEAL WATER RETURN FILTER DRAIN	
02.3.34	VCC-352	CLOSED	NO	NONE					SEAL WATER RETURN FILTER VENT	
02.3.35	VCC-322	CLOSED	NO	NONE					DIRECT BORIC ACID INJECTION PATH TO CHARGING PUMP SUCTION. BORIC ACID SYSTEM DOES NOT MEET LTS SEISMIC CRITERIA	
02.3.36	CV-528	OPEN	NO	CV-527		OPEN			SEAL WATER RETURN CONTAINMENT ISOLATION. VALVES ARE REMOTE-MANUAL. ROI REV REQD TO SPECIFY CLOSURE ON SIS/SISLOP	
02.3.37	PMU-352	CHCK		PMU-351		CHCK			DIRECT DILUTION PATH TO CHARGING PUMP SUCTION	
02.3.38	SA3-319	CHCK		NONE REQUIRED					PASSIVE. BORIC ACID TRANSFER PUMP DISCHARGE. SERIES VALVE CV-334 FAILS OPEN. VALVE IS NOT IN 1ST PROGRAM	
02.3.39	VCC-321	CLOSED	NO	NONE					DIRECT BORIC ACID INJECTION PATH TO CHARGING PUMP SUCTION. BORIC ACID SYSTEM DOES NOT MEET LTS SEISMIC CRITERIA	
02.3.40	RV-259	RBLIFP		VCC-314		OPEN			PASSIVE. TEST PUMP DISCHARGE RBLIFP TO VCT. LEAKAGE IN RECIRC MODE WITH FAILED VCT REQUIRES VCC-314 CLOSURE	
02.3.41	UNE WHEEL	CLOSED	NO	NONE					TEST PUMP PRESSURE INSTRUMENT (PI-1120) DRAIN	
02.3.42	CV-2145	OPEN		NONE					CHARGING PUMP DISCHARGE SAMPLE ISOLATION. ROI DOES NOT REQUIRE CLOSURE OF CV-2145	
02.3.43	RCP-317	CHCK		MOV-880		CLOSED			ALTERNATE CLR PATH FROM BSP WTR PUMP	
02.3.44	RCP-313	CLOSED	NO	NONE					BLIND FLANGE	
02.3.45	RCP-303	CLOSED	NO	NONE					RCP-307	
02.3.46	RCP-305	CLOSED	NO	NONE					RCP-307	
02.3.47	RCP-314	CLOSED	NO	NONE					BLIND FLANGE	
02.3.48	RCP-304	CLOSED	NO	NONE					RCP-308	
02.3.49	RCP-305	CLOSED	NO	NONE					RCP-308	
02.3.50	CS3-327	CLOSED	NO	NONE					NONE	
02.3.51	CS3-329	CLOSED	NO	NONE					NONE	
02.3.52	RCP-043	CLOSED	NO	NONE					RCP-045	
02.3.53	RCP-057	CLOSED	NO	NONE					NONE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONGFBB UNIT 1
 BOUNDARY VALVE ANALYSIS

ITEM #	SAFETY RELATED BOUNDARY		SAFETY RELATED BACKUP		NON-SAFETY RELATED BACKUP		REMARKS
	TAG #	NC/AUTO?	TAG #	NC/AUTO?	TAG #	NC/AUTO?	
02.3.54	RCP-012	CLOSED	NO	NONE			# RCP A VAPOR SEAL HEAD TANK MAKEUP DRAIN
02.3.55	RCP-069	CLOSED	NO	NONE			# VAPOR SEAL HEAD TANK MAKEUP BYPASS. OPEN RESULTS IN FLOW TO RCDT
02.3.56	BCV-427A	CLOSED	NO	NONE			# RCP A VAPOR SEAL HEAD TANK MAKEUP. OPEN RESULTS IN FLOW TO RCDT
02.3.57	RCP-044	CLOSED	NO	NONE	RCP-046	CLOSED	# RCP B SEAL RETURN VENT
02.3.58	RCP-062	CLOSED	NO	NONE			# RCP B SEAL RETURN DRAIN
02.3.59	RCP-018	CLOSED	NO	NONE			# RCP B VAPOR SEAL HEAD TANK MAKEUP DRAIN
02.3.60	RCP-068	CLOSED	NO	NONE			# RCP B VAPOR SEAL HEAD TANK MAKEUP BYPASS. OPEN RESULTS IN FLOW TO RCDT
02.3.61	BCV-427B	CLOSED	NO	NONE			# RCP B VAPOR SEAL HEAD TANK MAKEUP. OPEN RESULTS IN FLOW TO RCDT
02.3.62	RCP-142	CLOSED	NO	NONE	RCP-144	CLOSED	# RCP C SEAL RETURN VENT
02.3.63	RCP-154	CLOSED	NO	NONE			# RCP C SEAL RETURN DRAIN
02.3.64	RCP-020	CLOSED	NO	NONE			# RCP C VAPOR SEAL HEAD TANK MAKEUP DRAIN
02.3.65	RCP-165	CLOSED	NO	NONE			# RCP C VAPOR SEAL HEAD TANK MAKEUP BYPASS. OPEN RESULTS IN FLOW TO RCDT
02.3.66	BCV-427C	CLOSED	NO	NONE			# RCP C VAPOR SEAL HEAD TANK MAKEUP. OPEN RESULTS IN FLOW TO RCDT
02.3.67	RCP-027	CLOSED	NO	NONE	BLIND FLANGE		# LOOP A SEAL INJECTION FILTER VENT
02.3.68	RCP-009	CLOSED	NO	NONE	RCP-013	CLOSED	# LOOP A SEAL INJECTION FILTER DRAIN
02.3.69	RCP-011	CLOSED	NO	NONE	RCP-013	CLOSED	# LOOP A SEAL INJECTION FILTER DRAIN
02.3.70	RCP-029	CLOSED	NO	NONE	RCP-031	CLOSED	# RCP A SEAL INJECTION DRAIN
02.3.71	RCP-329	CLOSED	NO	NONE	BLIND FLANGE		# LOOP B SEAL INJECTION FILTER VENT
02.3.72	RCP-010	CLOSED	NO	NONE	RCP-014	CLOSED	# LOOP B SEAL INJECTION FILTER DRAIN
02.3.73	RCP-012	CLOSED	NO	NONE	RCP-014	CLOSED	# LOOP B SEAL INJECTION FILTER DRAIN
02.3.74	RCP-030	CLOSED	NO	NONE	RCP-032	CLOSED	# RCP B SEAL INJECTION DRAIN
02.3.75	RCP-126	CLOSED	NO	NONE	BLIND FLANGE		# LOOP C SEAL INJECTION FILTER VENT
02.3.76	RCP-109	CLOSED	NO	NONE	RCP-112	CLOSED	# LOOP C SEAL INJECTION FILTER DRAIN
02.3.77	RCP-110	CLOSED	NO	NONE	RCP-112	CLOSED	# LOOP C SEAL INJECTION FILTER DRAIN
02.3.78	RCP-128	CLOSED	NO	NONE	RCP-130	CLOSED	# RCP C SEAL INJECTION DRAIN
02.3.79	SIS-003	CHECK		MOV-850A	AUTO		# LOOP B SEAL INJECTION FILTER VENT
02.3.80	SIS-010	CHECK		MOV-850B	AUTO		# LOOP B SEAL INJECTION FILTER DRAIN
02.3.81	SIS-004	CHECK		MOV-850C	AUTO		# LOOP C SEAL INJECTION FILTER DRAIN
02.3.82	PCV-1112	OPEN	NO	CV-304, CV-305	OPEN		# CV-304 IS NORMALLY OPEN, CV-305 NORMALLY CLOSED. CV-304 FAILS CLOSED ON LOSS OF AIR. OTHERS HAVE BACKUP WZ FOR BLR PRIMARY PATH FUNCTION

SECTION 3: HOT LEG RECIRCULATION

HOT LEG RECIRCULATION NOTES

1. Item numbers in this section have been assigned as follows:
 - 03.1: Primary Hot Leg Recirculation (HLR) path and boundary devices
 - 03.2: Alternate HLR path and boundary devices.
2. Table 3-1 is the Failure Modes and Effects Analysis (FMEA) for the HLR function. Table 3-2 is the associated boundary valve analysis.
3. The HLR function uses portions of the Cold Leg Recirc (CLR) and Containment Spray (CSS) systems, as well as RCS boundary devices for the Safety Injection (SIS) function. The HLR FMEA and boundary valve analysis tables include only those items unique to HLR or which are part of CLR/CSS/SIS but have different functions (eg. safe state) for HLR service. To limit the ECCS_SFA database to a reasonable size, items with the same function for HLR as for CLR/CSS/SIS have not been duplicated to this Section.
4. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.
5. Potential single failure susceptibilities in the Boundary Valve Analysis table are flagged with "*" in the unlabelled field adjacent to REMARKS. Items flagged with "#" in the unlabelled field adjacent to REMARKS are acceptable from a single failure standpoint subject to credit for SEP Topic III-6 seismic boundary criteria.

HOT LEG RECIRCULATION REFERENCES

Piping and Instrumentation Diagrams

5178100	Reactor Coolant System
5178105	Pressurizer System
5178110	RCP Seal Water System (Sh 1)
5178111	RCP Seal Water System (Sh 2)
5178120	Containment Spray and Recirculation System (Sh 1)
5178121	Containment Spray and Recirculation System (Sh 2)
5178130	Letdown and Residual Heat Removal System
5178135	Volume Control and Charging System (Sh 1)
5178136	Volume Control and Charging System (Sh 2)
5178140	Letdown Demineralizer System
5178145	Boric Acid System
5178150	Reactor Cycle Sampling System
5178403	Gaseous Nitrogen System (Sh 4)
5178404	Gaseous Nitrogen System (Sh 5)
5178443	Instrument and Service Air System (Sh 4)
5178447	Instrument and Service Air System (Sh 8)
5178449	Instrument and Service Air System (Sh 10)

Elementary Diagrams

63719	FY-1112
64362	CV-525/527
64371	CV-526/528
455437	CV-410/411
455438	CV-412
455448	CV-276, CV-202/203/204, CV-287/288, CV-304/305, CV-413/414
5151796	MOV-813/814, MOV-822A/822B, MOV-833/834
5151907	Vertical Board Instrument Power Supply
5159553	Train B CIS Relays
5159756	CV-957
5180605	CV-962

Other Drawings

63714	Loop: PY-1430C/H
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Procedures

S01-1.0-10	Reactor Trip or Safety Injection
S01-1.0-12	SI Termination
S01-1.0-20	Loss of Reactor Coolant
S01-1.0-22	Post-LOCA Cooldown and Depressurization
S01-1.0-23	Transfer to Cold Leg Injection and Recirculation
S01-1.0-24	Transfer to Hot Leg Recirculation
S01-4-39	Safety Injection Alignment
S01-4-41	Containment Spray and Recirculation System Alignment
S01-12.3-7	Monthly Sequencer Testing
S01-12.3-35	Containment Spray and Recirculation System Safety Related Alignment
S01-14-40	Control of Locked Valves

Other Documents

SD-S01-580 System Description: Safety Injection, Recirculation and Containment Spray Systems

SD-S01-590 System Description: Safeguard Load Sequencing System

M89048 Response to Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety Related Systems", dated July 5, 1989

TABLE 3-1: HOT LEG RECIRCULATION FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 3-1: HOT LCG RECIRCULATION FMEA

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.1.01.01.1	MANUAL VALVES, PRIMARY PATH FLOW							THERE ARE NO VALVES IN THIS CATEGORY
03.1.01.02.1	CATCH VALVES, PRIMARY PATH FLOW		NONE (PASSIVE)					INCLUDES VCC-003
03.1.02.01.1	MANUAL VALVES, PRIMARY PATH BOUNDARY		OPEN	DIVERSION OF PRIMARY PATH HLR FLOW TO LOOP A OR B COLD LCG	PERIODIC SURVEILLANCE	ALTERNATE PATH	HLR PRIMARY PATH DISABLED	REFER TABLE 3-2. NORMAL THROTTLED POSITION OF PZR-020, -021 CONSIDERED IN ANALYSIS OF HLR FLOW REQUIREMENTS. ADMINISTRATIVE CONTROLS OR VALVE LOCKING REQUIRED, SINCE MISPOSITIONING IS NOT DETECTABLE DURING NORMAL OPERATION
03.1.02.01.2	MANUAL VALVES, PRIMARY PATH BOUNDARY		CLOSED	REDUCED WARM-UP FLOW THROUGH PZR SPRAY LINE. NO EFFECT ON ECCS	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
03.1.02.02.1	CRV OR RELIEF VLV, PRIMARY PATH BOUNDARY							THERE ARE NO VALVES IN THIS CATEGORY
03.1.03.01.1	PIT-1112 LOOP	PT-1112	SIGNAL HIGH	PRIMARY PATH HLR FLOW MAY BE SET LOW BY REMOTE-MANUAL CONTROL (MODULATION) OF PCV-1112	CONTROL ROOM INDICATION	ALTERNATE PATH	POTENTIAL LOSS OF HLR PRIMARY PATH	*METHOD OF DETECTION (COMPARISON OF FCV-1112 POSITION DEMAND, PIT-1112 FLOW INDICATION, CHARGING PUMP MOTOR AMPS, FI-3114A/2114B/2114C FLOW INDICATION AND PCV-1115D/E/F POSITION DEMAND) CANNOT DISTINGUISH BETWEEN PCV AND INDICATION FAILURES
03.1.03.01.2	PIT-1112 LOOP	PT-1112	SIGNAL LOW	PRIMARY PATH HLR FLOW MAY BE SET HIGH BY REMOTE-MANUAL CONTROL (MODULATION) OF PCV-1112	CONTROL ROOM INDICATION	ALTERNATE PATH	POTENTIAL IMBALANCE IN CLR/HLR FLOW	*(SAME AS 3.1.3.1.1)
03.1.03.01.3	PIT-1112 LOOP	PT-1112	HQ	PRIMARY PATH HLR FLOW CANNOT BE MEASURED	CONTROL ROOM INDICATION	ALTERNATE PATH	POTENTIAL IMBALANCE IN CLR/HLR FLOW OR LOSS OF HLR PRIMARY PATH	*(SAME AS 3.1.3.1.1)
03.1.03.02.1	PIT-1112 LOOP	RRC BUS #4 (8-1489)	VOLTS LOW	DOWNSCALE FAILURE OF HLR PRIMARY PATH FLOW INDICATION	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	*RANGE INADEQUATE FOR HLR PRIMARY PATH FUNCTION, BACKUP FLOW DETERMINATION METHOD REQUIRED IN BOL IS IRRESPECTIVE OF PIT-1112 FAILURE
03.1.04.01.1	FCV-1112	VALVE/ACTUATOR	OPEN	FCV-1112 CANNOT BE CLOSED FOR CLR BOUNDARY OR MODULATED FOR HLR PRIMARY PATH FLOW CONTROL	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVES (CV-304, CV-305) FOR CLR BOUNDARY, REDUNDANT PATH FOR HLR	REDUCED REDUNDANCY FOR CLR BOUNDARY ISOLATION, LOSS OF HLR PRIMARY PATH	

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EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPBB UNIT 1

TABLE 3-1: HOT LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.1.04.01.2	PCV-1112	VALVE/ACTUATOR	CLOSED	PCV-1112 DOES NOT OPEN FOR INJECTION AND CANNOT BE MODULATED FOR HLR PRIMARY PATH FLOW CONTROL. NORMAL FOR CLR	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE FOR INJECTION, NONE REQUIRED FOR CLR, REDUNDANT PATH FOR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A, AND HLR PRIMARY PATH	CHARGING NOT CREDITED FOR INJECTION
03.1.04.02.1	PCV-1112	PC-1112 LOOP	SIGNAL HIGH	PCV-1112 CANNOT BE CLOSED FOR CLR BOUNDARY FUNCTION OR MODULATED FOR HLR PRIMARY PATH FLOW CONTROL	CONTROL ROOM INDICATION	(SAME AS 3.1.4.1.1)	(SAME AS 3.1.4.1.1)	PC-1112 MANUAL MODE, USED FOR PCV-1112 MODULATION/CLOSURE, UNAFFECTED BY AUTOMATIC INPUTS FROM LC-110P AND PIT-1112. (B)(2) INTERACTION FROM MON-BQ PIT-1112 PRECLUDED BY POWER SUPPLY TG-1112
03.1.04.02.2	PCV-1112	PC-1112 LOOP	SIGNAL LOW	PCV-1112 CANNOT BE MODULATED FOR HLR PRIMARY PATH FLOW CONTROL. NORMAL FOR CLR	CONTROL ROOM INDICATION	REDUNDANT PATH FOR HLR	LOSS OF HLR PRIMARY PATH	
03.1.04.03.1	PCV-1112	SV-1112	ON (OPEN)	(SAME AS 3.1.4.1.1)	(SAME AS 3.1.4.1.1)	(SAME AS 3.1.4.1.1)	(SAME AS 3.1.4.1.1)	*SV-1112 POWER MUST BE LOCKED OUT AT C-38 PANEL AND DSD SWGR TO PRECLUDE SIMILAR FAILURE DUE TO BQ
03.1.04.03.2	PCV-1112	SV-1112	OFF (MODULATE)	PCV-1112 DOES NOT FULLY OPEN FOR INJECTION. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	PERIODIC TESTING	NONE FOR INJECTION	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A	CHARGING NOT CREDITED FOR INJECTION
03.1.04.04.1	PCV-1112	SRQ 1 (51-1,3)	OFF (CONTACTS OPEN)	PCV-1112 DOES NOT FULLY OPEN FOR INJECTION ON SRQ 1 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	PERIODIC TESTING	REDUNDANT SRQ	REDUCED REDUNDANCY FOR CHARGING PUMP INJECTION ALIGNMENT	CHARGING NOT CREDITED FOR INJECTION
03.1.04.04.2	PCV-1112	SRQ 1 (51-1,3)	ON (CONTACTS CLOSED)	PCV-1112 FULLY OPENS FOR INJECTION ON SRQ 1 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	
03.1.04.05.1	PCV-1112	SRQ 2 (51-1,3)	OFF (CONTACTS OPEN)	PCV-1112 DOES NOT FULLY OPEN FOR INJECTION ON SRQ 2 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	PERIODIC TESTING	REDUNDANT SRQ	REDUCED REDUNDANCY FOR CHARGING PUMP INJECTION ALIGNMENT	CHARGING NOT CREDITED FOR INJECTION
03.1.04.05.2	PCV-1112	SRQ 2 (51-1,3)	ON (CONTACTS CLOSED)	PCV-1112 FULLY OPENS FOR INJECTION ON SRQ 2 SIS/SISLOP. NO EFFECT ON MODULATION OR CLOSURE OF PCV FOR CLR AND HLR	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	
03.1.04.06.1	PCV-1112	RBC BUS #1 (6-118)	VOLTS LOW	PCV-1112 FAILS CLOSED AFTER SV-1112 DE-ENERGIZED (BY OVERRIDE OR SRQ BLOCK/RESET)	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	
03.1.04.07.1	PCV-1112	125VDC BUS #1 (72-136)	VOLTS LOW	SV-1112 CANNOT BE ENERGIZED TO FULLY OPEN PCV-1112 AUTOMATICALLY FOR INJECTION	CONTROL ROOM INDICATION	NONE FOR INJECTION, NONE REQUIRED FOR CLR OR HLR	INOPERABILITY OF CHARGING PUMP INJECTION PATH TO LOOP A, NONE REQUIRED FOR CLR OR HLR	CHARGING FLOW NOT CREDITED FOR INJECTION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 3-1: HOT LRG RECIRCULATION FNBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
03.1.04.08.1	PCV-1112	ISA	PRESSURE LOW	ISA UNAVAILABLE FOR PCV-1112	CONTROL ROOM INDICATION, ANNUNCIATION	BACKUP NITROGEN	PCV-1112 OPENS AND MODULATES AS REQUIRED ON BACKUP NITROGEN	
03.1.04.09.1	PCV-1112	GNI (PORV _s)	PRESSURE LOW	GNI UNAVAILABLE FOR PCV-1112	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, REDUNDANT PATH FOR HLR	LOSS OF CHARGING PUMP INJECTION CHARGING FLOW NOT CREDITED FOR PATH TO RCS LOOP A AND HLR PRIMARY PATH, WITH CONCURRENT FAILURE OF ISA	INJECTION
03.1.05.01.1	CV-304	VALVE/ACTUATOR	OPEN	CV-304 OPENS (NORMAL) BUT CANNOT BE CLOSED FOR HLR PRIMARY PATH OR BACKUP CLR BOUNDARY FUNCTIONS	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION, REDUNDANT VALVE (PCV-1112) FOR CLR, REDUNDANT PATH FOR HLR	LOSS OF HLR PRIMARY PATH, REDUCED REDUNDANCY FOR CLR BOUNDARY	
03.1.05.01.2	CV-304	VALVE/ACTUATOR	CLOSED	CV-304 ISOLATES CHARGING PUMP INJECTION PATH TO LOOP A.	CONTROL ROOM INDICATION	NONE FOR INJECTION, NONE REQUIRED FOR CLR OR HLR	LOSS OF CHARGING PUMP INJECTION CHARGING NOT CREDITED FOR PATH TO LOOP A. NONE FOR CLR OR INJECTION	
03.1.06.01.1	CV-305	VALVE/ACTUATOR	OPEN	NORMAL FOR CLR AND HLR CV-305 OPENS FOR PZR AUX SPRAY AND CANNOT BE RECLOSURE FOR CLR BOUNDARY FUNCTION. NORMAL FOR HLR PRIMARY PATH	CONTROL ROOM INDICATION	REDUNDANT VALVE (PCV-1112) FOR CLR BOUNDARY, NONE REQUIRED FOR HLR	REDUCED REDUNDANCY FOR CLR BOUNDARY, NONE FOR HLR	INCLUDES HT-1305
03.1.06.01.2	CV-305	VALVE/ACTUATOR	CLOSED	CV-305 CANNOT BE OPENED FOR PRIMARY PATH HLR. NORMAL FOR CLR BOUNDARY	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PATH FOR HLR, NONE REQUIRED FOR CLR	LOSS OF HLR PRIMARY PATH, NONE FOR CLR	
03.1.07.01.1	CV-304 CV-305	UTILITY BUS (8-1508)	VOLTS LOW	CV-304 AND CV-305 CLOSE, CANNOT BE OPENED, ISOLATING CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH. VALVES FAIL TO CLR POSITION	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, REDUNDANT PATH FOR HLR, NONE REQUIRED FOR CLR	LOSS OF CHARGING PUMP INJECTION CHARGING NOT CREDITED FOR PATH TO RCS LOOP A AND HLR PRIMARY PATH, NONE FOR CLR	*CHARGING NOT CREDITED FOR INJECTION. REALIGNMENT OF UTILITY BUS VIA TRANSFER SV #7 REQUIRED TO PRECLUDE COMMON-MODE FAILURE OF HLR (DUE TO LOSS OF TRAIN B POWER) BY RESTORING SAFETY-RELATED POWER TO UTILITY BUS
03.1.07.02.1	CV-304 CV-305	ISA	PRESSURE LOW	ISA UNAVAILABLE TO CV-304 AND CV-305. CV-304 CLOSES, ISOLATING CHARGING PUMP INJECTION TO RCS LOOP A	CONTROL ROOM ANNUNCIATION	NONE FOR INJECTION, BACKUP N2 FOR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A. CV-305 INJECTION	CHARGING NOT CREDITED FOR INJECTION
03.1.07.03.1	CV-304 CV-305	GNI (PORV _s)	PRESSURE LOW	BACKUP N2 UNAVAILABLE FOR CV-305 OPENING (HLR)	PERIODIC SURVEILLANCE	REDUNDANT PATH FOR HLR	LOSS OF HLR PRIMARY PATH WITH CONCURRENT ISA FAILURE	
03.1.07.03.2	CV-304 CV-305	CV-532	CLOSED	ISOLATES BACKUP N2 TO CV-305 INSIDE CONTAINMENT (HLR)	CONTROL ROOM INDICATION	LOCAL MANUAL OPERATION OF REDUNDANT BYPASS VALVE IN BACKUP N2 SUPPLY	LOSS OF AUTOMATIC N2 BACKUP TO CV-305	INCLUDES SV-532A. MANUAL BYPASS VALVE LOCATED ON SAFE SIDE OF SHIELD WALL. ACCESS AND USE BOUNDED BY EXISTING DOSE CALCULATIONS
03.1.07.03.3	CV-304 CV-305	125VDC BUS #2 (17-220)	VOLTS LOW	ISOLATES BACKUP N2 TO CV-305 INSIDE CONTAINMENT (HLR) BY CLOSING CV-532	CONTROL ROOM INDICATION	LOCAL MANUAL OPERATION OF REDUNDANT BYPASS VALVE IN BACKUP N2 SUPPLY	LOSS OF AUTOMATIC N2 BACKUP TO CV-305	MANUAL BYPASS VALVE LOCATED ON SAFE SIDE OF SHIELD WALL. ACCESS AND USE BOUNDED BY EXISTING DOSE CALCULATIONS
03.1.08.01.1	PCV-130C	VALVE/ACTUATOR	OPEN	PARTIAL OR COMPLETE DIVERSION OF HLR PRIMARY PATH FLOW TO RCS LOOP B COLD LRG	CONTROL ROOM INDICATION	ALTERNATE PATH	LOSS OF HLR PRIMARY PATH	EXISTING DOSE CALCULATIONS *INCLUDES HT-1430C. PCV-1112 SETTING MUST INCLUDE MARGIN FOR UNDETECTABLE PARTIAL OPENING OF VALVE WITHIN LIMIT SWITCH HYSTERESIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONDPRR UNIT 1
TABLE 3-1: HOT LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.1.01.01.2	PCV-430C	VALVE/ACTUATOR	CLOSED	NONE. NORMAL FOR HLR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.1.09.01.1	PCV-430B	VALVE/ACTUATOR	OPEN	PARTIAL OR COMPLETE DIVERSION OF HLR PRIMARY PATH FLOW TO RCS LOOP A COLD LEG	CONTROL ROOM INDICATION	ALTERNATE PATH	LOSS OF HLR PRIMARY PATH	*INCLUDES MV-1430B. PCV-1112 SETTING MUST INCLUDE MARGIN FOR UNDETECTABLE PARTIAL OPENING OF VALVE WITHIN LIMIT. SWITCH HYSTERESIS
03.1.09.01.2	PCV-430B	VALVE/ACTUATOR	CLOSED	NONE. NORMAL FOR HLR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.1.10.01.1	PCV-430C PCV-430B	PC-430C/H LOOP	SIGNAL HIGH	DIVERSION OF PRIMARY PATH HLR FLOW TO LOOP A AND B COLD LEGS	CONTROL ROOM INDICATION	ALTERNATE PATH	LOSS OF HLR PRIMARY FLOW PATH	PC-430C AND PC-430B SIGNAL PROVIDED FROM PT-430, -431, OR -432 VIA SV. P/430
03.1.10.01.2	PCV-430C PCV-430B	PC-430C/H LOOP	SIGNAL LOW	NONE. NORMAL FOR HLR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.1.10.01.3	PCV-430C PCV-430B	PC-430C/H LOOP	EQ	DIVERSION OF PRIMARY PATH HLR FLOW TO LOOP A AND B COLD LEGS	CONTROL ROOM INDICATION	NONE IF ALTERNATE PATH EQ OR SINGLE FAILURE OCCURS	*LOSS OF HLR PRIMARY FLOW PATH	EQ UPGRADE OF BOTH HLR FLOW PATHS REQUIRED
03.1.10.02.1	PCV-430C PCV-430B	RSG BUS #1 (B-1187)	VOLTS LOW	DIVERSION OF PRIMARY PATH HLR FLOW TO LOOP A AND B COLD LEGS	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	
03.1.10.03.1	PCV-430C PCV-430B	ISA	PRESSURE LOW	NONE. NORMAL FOR HLR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.1.11.01.1	PT-3114A LOOP	PI-3114A	SIGNAL HIGH	HIGH CLR FLOW INDICATION FOR RCS LOOP A	CONTROL ROOM INDICATION	REDUNDANT LOOPS	CLR FLOW TO LOOP A MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-356 TO PREVENT EXCEEDING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-356 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115D FAILURE AND PI-3114A FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP
03.1.11.01.2	PT-3114A LOOP	PI-3114A	SIGNAL LOW	LOW CLR FLOW INDICATION FOR RCS LOOP A	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	*PCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
03.1.11.02.1	PT-3114A LOOP	CTO WRST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	(SAME AS 2.4.24.1.2)	(SAME AS 2.4.24.1.2)	(SAME AS 2.4.24.1.2)	*SAME AS 2.4.24.1.2)	*SAME AS 2.4.24.1.2)
03.1.11.03.1	PT-3114A LOOP	VITAL BUS #5 (B-2903V)	VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOP A	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY EXCEEDING RECIRC PUMP FLOW LIMITATIONS	*PCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
03.1.12.01.1	PT-2114B LOOP	PI-2114B	SIGNAL HIGH	HIGH CLR FLOW INDICATION FOR RCS LOOP B	CONTROL ROOM INDICATION	REDUNDANT LOOPS	CLR FLOW TO LOOP B MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-357 TO PREVENT EXCEEDING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-357 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115B FAILURE AND PI-2114B FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 3-1: HOT LNG RECIRCULATION FNRA

ITRM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
03.1.12.01.2	PT-2114B LOOP	PI-2114B	SIGNAL LOW	LOW CLR FLOW INDICATION FOR RCS LOOP B	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP B WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY DECREASING RECIRC PUMP LIMITATIONS	*PCV-1115B FAILURE AND PI-2114B FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
03.1.12.02.1	PT-2114C LOOP	PI-2114C	SIGNAL HIGH	HIGH CLR FLOW INDICATION FOR RCS LOOP C	CONTROL ROOM INDICATION	REDUNDANT LOOPS	CLR FLOW TO LOOP C MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-358 TO PREVENT DECREASING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-358 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115F FAILURE AND PI-2114C FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
03.1.12.02.2	PT-2114C LOOP	PI-2114C	SIGNAL LOW	LOW CLR FLOW INDICATION FOR RCS LOOP C	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY DECREASING RECIRC PUMP LIMITATIONS	*PCV-1115F FAILURE AND PI-2114C FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
03.1.12.03.1	PT-2114B LOOP PT-2114C LOOP	CE9 WEST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOPS B AND C	PERIODIC TESTING	NONE AVAILABLE	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY DECREASING RECIRC PUMP LIMITATIONS	*PCV-1115B/F FAILURE AND PI-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
03.1.12.04.1	PT-2114B LOOP PT-2114C LOOP	VITAL BUS #3A (8-3313V)	VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOPS B AND C	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE AVAILABLE	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY DECREASING RECIRC PUMP LIMITATIONS	*PCV-1115B/F FAILURE AND PI-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW
03.2.01.01.1	MANUAL VALVES, ALTERNATE PATH FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	INCLUDES CBS-340, 341, LDS-020, RHR-002, 004, 016, 025, 026
03.2.01.01.2	MANUAL VALVES, ALTERNATE PATH FLOW		CLOSED	ALTERNATE HLR PATH TO LOOP C HOT LNG ISOLATED FROM CONTAINMENT SPRAY HEADER	PERIODIC SURVEILLANCE	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	ALTERNATE PATH NOT USED UNLESS PRIMARY HLR PATH DISTRACTABLY FAILS
03.2.01.02.1	CBRC VALVES, ALTERNATE PATH FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES CBS-020

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM OPERB UNIT 1
 TABLE 3-1: HOT LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.2.02.01.1	MANUAL VALVES, ALTERNATE PATH BOUNDARY		OPEN	DIVERSION OF ALTERNATE PATH HLR FLOW TO CONTAINMENT	PERIODIC SURVEILLANCE	REDUNDANT PRIMARY PATH	LOSS OF ALTERNATE HLR FLOW PATH	SEE TABLE 3-2. ALTERNATE PATH NOT USED UNLESS PRIMARY PATH DETECTABLY FAILS
03.2.02.01.2	MANUAL VALVES, ALTERNATE PATH BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
03.2.02.02.1	CHECK OR RELIEF VLVS, ALT PATH BOUNDARY		NORMAL (PASSIVE)	NONE	PERIODIC TESTING	NONE REQUIRED	NONE	SEE TABLE 3-2. ALTERNATE HLR PRESSURE INSUFFICIENT TO LEFT BY-206
03.2.03.01.1	MOV-822A	VALVE/ACTUATOR	OPEN	NONE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	ONE OF MOV-822A AND B IS NORMALLY OPEN FOR LETDOWN NON-REGENERATIVE COOLING *MOV-822A OR B MUST BE OPEN WITH POWER-LOCKOUT DURING NORMAL OPERATION DUE TO POST-LOCA FLOODING OF ACTUATOR, WHICH IS NOT QUALIFIED FOR SUBMERGENCE
03.2.03.01.2	MOV-822A	VALVE/ACTUATOR	CLOSED	LOSS OF ALTERNATE HLR PATH VIA CONTROL ROOM INDICATION, MOV-822A	PERIODIC TESTING	REDUNDANT VALVE MOV-822B AND REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF MCC
03.2.03.01.3	MOV-822A	VALVE/ACTUATOR	EQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION, CAUSING LOSS OF ALTERNATE HLR PATH IF ONE OF MOV-822A/B IS NOT INITIALLY OPEN	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	
03.2.03.02.1	MOV-822A	MCC-1 (42-1164)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, CANNOT BE ALIGNED FOR ALTERNATE HLR PATH TO LOOP C	CONTROL ROOM INDICATION	REDUNDANT VALVE MOV-822B, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	
03.2.04.01.1	MOV-822B	VALVE/ACTUATOR	OPEN	NONE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	ONE OF MOV-822A AND B IS NORMALLY OPEN FOR LETDOWN NON-REGENERATIVE COOLING *MOV-822A OR B MUST BE OPEN WITH POWER-LOCKOUT DURING NORMAL OPERATION DUE TO POST-LOCA FLOODING OF ACTUATOR, WHICH IS NOT QUALIFIED FOR SUBMERGENCE
03.2.04.01.2	MOV-822B	VALVE/ACTUATOR	CLOSED	LOSS OF ALTERNATE HLR PATH VIA CONTROL ROOM INDICATION, MOV-822B	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE MOV-822A AND REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF MCC
03.2.04.01.3	MOV-822B	VALVE/ACTUATOR	EQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION, CAUSING LOSS OF ALTERNATE HLR PATH IF ONE OF MOV-822A/B IS NOT INITIALLY OPEN	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	
03.2.04.02.1	MOV-822B	MCC-2 (42-1266)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, CANNOT BE ALIGNED FOR ALTERNATE HLR PATH TO LOOP C	CONTROL ROOM INDICATION	REDUNDANT VALVE MOV-822A, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	
03.2.05.01.1	MOV-813	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES VALVES OPEN FOR ALTERNATE HLR PATH TO LOOP C	CONTROL ROOM INDICATION	NONE REQUIRED FOR ALTERNATE HLR	NONE FOR ALTERNATE HLR	REDUNDANT VALVE MOV-814 ENSURES RCS INTEGRITY

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONDPRE UNIT 1

TABLE 3-1: HOT LRG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
03.2.05.01.2	MOV-813	VALVE/ACTUATOR	CLOSED	ALTERNATE HLR PATH CANNOT BE ALIGNED TO LOOP C HOT LRG	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	NORMAL POSITION
03.2.05.01.3	MOV-813	VALVE/ACTUATOR	BQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION. IF CLOSED, PREVENTS ALIGNMENT OF ALTERNATE HLR PATH	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF MCC. ACTUATOR WILL BE REPLACED WITH BQ MODEL BY DCP 3548.00
03.2.05.02.1	MOV-813	PC-425X	CONTACTS OPEN	(SAME AS 3.2.5.1.2)	PERIODIC TESTING	(SAME AS 3.2.5.1.2)	(SAME AS 3.2.5.1.2)	NORMAL POSITION. RCS PRESSURE INTERLOCK
03.2.05.02.2	MOV-813	PC-425X	CONTACTS CLOSED	RCS PRESSURE INTERLOCK DEGRADED, PERMITTING REMOTE-MANUAL OPERATION OF VALVE AT ANY TIME	PERIODIC TESTING	NONE REQUIRED FOR ALTERNATE HLR	NONE FOR ALTERNATE HLR	REDUNDANT VALVE MOV-814 PROVIDES RCS INTEGRITY
03.2.05.03.1	MOV-813	MCC-1 (42-1169)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, ALTERNATE HLR PATH CANNOT BE ALIGNED TO LOOP C HOT LRG	CONTROL ROOM INDICATION	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	
03.2.06.01.1	MOV-814	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES VALVES OPEN FOR ALTERNATE HLR PATH TO LOOP C HOT LRG	CONTROL ROOM INDICATION	NONE REQUIRED FOR ALTERNATE HLR	NONE FOR ALTERNATE HLR	REDUNDANT VALVE MOV-813 ENSURES RCS INTEGRITY
03.2.06.01.2	MOV-814	VALVE/ACTUATOR	CLOSED	ALTERNATE HLR PATH CANNOT BE ALIGNED TO LOOP C HOT LRG	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	NORMAL POSITION
03.2.06.01.3	MOV-814	VALVE/ACTUATOR	BQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION. IF CLOSED, PREVENTS ALIGNMENT OF ALTERNATE HLR PATH	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF MCC. ACTUATOR WILL BE REPLACED WITH BQ MODEL BY DCP 3548.00
03.2.06.02.1	MOV-814	MCC-2 (42-1291)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, ALTERNATE HLR PATH CANNOT BE ALIGNED TO LOOP C HOT LRG	CONTROL ROOM INDICATION	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	
03.2.07.01.1	MOV-833	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES VALVES OPENS BETWEEN ALTERNATE HLR PATH AND LOOP A COLD LRG	CONTROL ROOM INDICATION	REDUNDANT VALVE MOV-834, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	
03.2.07.01.2	MOV-833	VALVE/ACTUATOR	CLOSED	VALVE REMAINS IN ALTERNATE HLR PATH BOUNDARY ALIGNMENT	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL DURING MODES 1, 2 AND 3
03.2.07.01.3	MOV-833	VALVE/ACTUATOR	BQ	VALVES FAILS AS-IS, WITH LOSS OF POSITION INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION
03.2.07.02.1	MOV-833	MCC-1 (42-1170)	VOLTS LOW	VALVE FAILS AS-IS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.08.01.1	MOV-834	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES VALVES OPENS BETWEEN ALTERNATE HLR PATH AND LOOP A COLD LRG	CONTROL ROOM INDICATION	REDUNDANT VALVE MOV-833, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	
03.2.08.01.2	MOV-834	VALVE/ACTUATOR	CLOSED	VALVE REMAINS IN ALTERNATE HLR PATH BOUNDARY ALIGNMENT	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL DURING MODES 1, 2 AND 3
03.2.08.01.3	MOV-834	VALVE/ACTUATOR	BQ	VALVES FAILS AS-IS, WITH LOSS OF POSITION INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION
03.2.08.02.1	MOV-834	PC-425X	CONTACTS OPEN	(SAME AS 3.2.8.1.2)	PERIODIC TESTING	(SAME AS 3.2.8.1.2)	(SAME AS 3.2.8.1.2)	NORMAL POSITION. RCS PRESSURE INTERLOCK
03.2.08.02.2	MOV-834	PC-425X	CONTACTS CLOSED	RCS PRESSURE INTERLOCK DEGRADED, PERMITTING REMOTE-MANUAL MOV-834 OPENING AT ANY TIME	PERIODIC TESTING	NONE REQUIRED	NONE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 3-1: HOT LEG RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.2.08.01.1	NOV-834	MCC-2 (42-1272)	VOLTS LOW	VALVE FAILS AS-IS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.09.01.1	NOV-813 NOV-834	PT-425 LOOP	HIGH PRESSURE (RELAY OFF)	PRESSURIZER PRESSURE INTERLOCK WILL NOT CLEAR, PREVENTING OPENING OF BYPASS VALVE	CONTROL ROOM INDICATION, PERIODIC TESTING	PRIMARY HLR PATH	INOPERABILITY OF ALTERNATE HLR PATH	VALVE NOV-813 REQUIRED TO OPEN FOR ALTERNATE HLR FLOW PATH
03.2.09.01.2	NOV-813 NOV-834	PT-425 LOOP	LOW PRESSURE (RELAY ON)	PRESSURIZER PRESSURE INTERLOCK CLEARS, PERMITTING REMOTE-MANUAL OPENING OF NOV-813 AND NOV-834	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR ALTERNATE HLR	NONE FOR ALTERNATE HLR	REDUNDANT VALVES NOV-814 AND NOV-833 PROVIDE RCS INTEGRITY
03.2.09.02.1	NOV-813 NOV-834	BBG BUS #4 (8-1486)	VOLTS LOW	PRESSURIZER PRESSURE INTERLOCK CLEARS, PERMITTING REMOTE-MANUAL OPENING OF NOV-813 AND NOV-834	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR ALTERNATE HLR	NONE FOR ALTERNATE HLR	REDUNDANT VALVES NOV-814 AND NOV-833 PROVIDE RCS INTEGRITY. LOSS OF POWER TO PT-425 LOOP CAUSES PC-425 TO ENERGIZE OUTPUT RELAY PC-425I, CLOSING PERMISSIVE CONTACTS IN NOV-813/834 OPENING CIRCUITS
03.2.09.03.1	NOV-813 NOV-834	VITAL BUS #4 (8-1406V)	VOLTS LOW	PRESSURIZER PRESSURE INTERLOCK WILL NOT CLEAR, PREVENTING OPENING OF NOV-813 AND NOV-834	CONTROL ROOM INDICATION, PERIODIC TESTING	PRIMARY HLR PATH	INOPERABILITY OF ALTERNATE HLR	VALVE NOV-813 REQUIRED TO OPEN FOR ALTERNATE HLR FLOW PATH. PC-425I RELAY IS ENERGIZE-TO-ACTUATE FOR CONTACT CLOSURE IN VALVE OPENING CIRCUIT
03.2.10.01.1	CV-525	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES (CONTAINMENT) ISOLATION VALVES CANNOT BE CLOSED FOR ALTERNATE HLR BOUNDARY	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE CV-526, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	NORMAL FOR LETDOWN. INCLUDES AIR ISOLATION BY-2525
03.2.10.01.2	CV-525	VALVE/ACTUATOR	CLOSED	LETDOWN ISOLATED, VALVE REMAINS IN ALTERNATE HLR PATH BOUNDARY ALIGNMENT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.10.02.1	CV-525	VITAL BUS #1 (8-1111V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	INTERNAL DUMP VALVE IS DE-ENERGIZE TO ACTUATE
03.2.10.03.1	CV-525	ISA	PRESSURE LOW	VALVE DRIFTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE PRESENT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.11.01.1	CV-526	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES (CONTAINMENT) ISOLATION VALVES CANNOT BE CLOSED FOR ALTERNATE HLR BOUNDARY	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE CV-525, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	NORMAL FOR LETDOWN. INCLUDES AIR ISOLATION BY-3526
03.2.11.01.2	CV-526	VALVE/ACTUATOR	CLOSED	LETDOWN ISOLATED, VALVE REMAINS IN ALTERNATE HLR PATH BOUNDARY ALIGNMENT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.11.02.1	CV-526	VITAL BUS #5 (8-2309V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	INTERNAL DUMP VALVE IS DE-ENERGIZE TO ACTUATE
03.2.11.03.1	CV-526	ISA	PRESSURE LOW	VALVE DRIFTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE PRESENT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS

SAN ONOFFER UNIT 1

TABLE 3-1: HOT LEG RECIRCULATION PMBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.2.12.01.1	CV-202	VALVE/ACTUATOR	OPEN	LETDOWN FROM RCS LOOP A NOT ISOLATED, DIVERTING ALTERNATE HLR PATH FLOW	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR FLOW PATH BOUNDARY INTEGRITY	NORMAL POSITION. INCLUDES PT-1202
03.2.12.01.2	CV-202	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	
03.2.12.02.1	CV-203	VALVE/ACTUATOR	OPEN	(SAME AS 3.2.12.1.1)	PERIODIC TESTING	(SAME AS 3.2.12.1.1)	(SAME AS 3.2.12.1.1)	NORMAL POSITION. INCLUDES PT-1203
03.2.12.02.2	CV-203	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	
03.2.12.03.1	CV-204	VALVE/ACTUATOR	OPEN	(SAME AS 3.2.12.1.1)	PERIODIC TESTING	(SAME AS 3.2.12.1.1)	(SAME AS 3.2.12.1.1)	NORMAL POSITION. INCLUDES PT-1204
03.2.12.03.2	CV-204	VALVE/ACTUATOR	CLOSED	NO EFFECT	PERIODIC TESTING	NONE REQUIRED	NONE	
03.2.12.04.1 (NOT USED)								
03.2.12.05.1	CV-202, 203, 204	SEQ 1 (50-1, 3)	OFF (OPEN)	LETDOWN FROM RCS LOOP A COLD LEG WILL NOT ISOLATE ON TRAIN A SIS/SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT INPUT FROM TRAIN B SEQ	REDUCED RELIABILITY FOR ALTERNATE HLR PATH BOUNDARY ISOLATION	INCLUDES RELAY 03-12
03.2.12.05.2	CV-202, 203, 204	SEQ 1 (50-1, 3)	ON (CLOSED)	LETDOWN ISOLATED FROM RCS LOOP A COLD LEG	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.12.06.1	CV-202, 203, 204	SEQ 2 (50-1, 3)	OFF (OPEN)	LETDOWN FROM RCS LOOP A COLD LEG WILL NOT ISOLATE ON TRAIN B SIS/SISLOP	PERIODIC TESTING	REDUNDANT INPUT FROM TRAIN A SEQUENCE	REDUCED RELIABILITY FOR ALTERNATE HLR PATH BOUNDARY ISOLATION	INCLUDES 03-10. VALVES CAN ALSO BE REMOTE-MANUALLY CLOSED FOR ALTERNATE HLR PATH BOUNDARY
03.2.12.06.2	CV-202, 203, 204	SEQ 2 (50-1, 3)	ON (CLOSED)	LETDOWN ISOLATED FROM LOOP A COLD LEG	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.12.07.1	CV-202, 203, 204	03-10 (RELAY)	ON	AUTO-CLOSE SIGNAL TO CV-202/203, DE-ENERGIZING RESPECTIVE SOLENOID PILOTS PT1202/1203 AND CLOSING VALVES	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SEQ #1 SIS/SISLOP. FAILURE PREVENTS RE-OPENING CV-202/203 TO RE-ESTABLISH LETDOWN. PARALLEL VALVE CV-204 UNAFFECTED
03.2.12.07.2	CV-202, 203, 204	03-10 (RELAY)	OFF	SEQ #1 AUTO-CLOSE SIGNAL DISABLED TO CV-202/203. REDUNDANT SIGNAL FROM SEQ #2 VIA RELAY 03-12 UNAFFECTED	PERIODIC TESTING	REDUNDANT SIGNAL FROM SEQ #2	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LETDOWN	POSITION OF RELAY DURING NORMAL OPERATION. PARALLEL VALVE CV-204 AUTO-CLOSE SIGNALS FROM SEQ #1 AND #2 VIA RELAYS 03-11 AND 03-13 UNAFFECTED
03.2.12.08.1	CV-202, 203, 204	03-11 (RELAY)	ON	CONTACTS CLOSE TO PROVIDE SEQ #1 SEAL-IN SIGNAL TO RELAYS 03-10 AND 03-11, RESULTING IN AUTO-CLOSE SIGNAL TO CV-202/203/204 WHICH DE-ENERGIZES RESPECTIVE SOLENOID PILOTS PT1202/1203/1204 AND CLOSERS VALVES	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SEQ #1 SIS/SISLOP. FAILURE PREVENTS RE-OPENING VALVES TO RE-ESTABLISH LETDOWN IF DESIRED
03.2.12.08.2	CV-202, 203, 204	03-11 (RELAY)	OFF	SEQ #1 SEAL-IN FOR CV-202/203/204 AND AUTO-CLOSE SIGNAL TO CV-204 DISABLED. REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #2 VIA RELAYS 03-12 AND 03-13 UNAFFECTED	PERIODIC TESTING	REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #2	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LETDOWN	POSITION OF RELAY DURING NORMAL OPERATION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 3-1: HOT LBG RECIRCULATION FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.2.12.09.1	CV-202, 203, 204	83-12 (RBLAT)	ON	AUTO-CLOSE SIGNAL TO CV-204 WHICH DE-ENERGIZES SOLENOID PILOT FT1204 AND CLOSES VALVE	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SEQ #2 SIS/SISLOP. FAILURE PREVENTS RE-OPENING CV-204 TO RE-ESTABLISH LFTDOWN. PARALLEL VALVES CV-202/203 UNAPPECTED
03.2.12.09.2	CV-202, 203, 204	83-12 (RBLAT)	OFF	SEQ #2 AUTO-CLOSE SIGNAL DISABLED TO CV-202/203. REDUNDANT SIGNAL FROM SEQ #1 VIA RELAY 83-10 UNAPPECTED	PERIODIC TESTING	REDUNDANT SIGNAL FROM SEQ #1	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LFTDOWN	POSITION OF RBLAT DURING NORMAL OPERATION. PARALLEL VALVE CV-204 AUTO-CLOSE SIGNALS FROM SEQ #1 AND #2 VIA RELAYS 83-11 AND 83-13 UNAPPECTED
03.2.12.10.1	CV-202, 203, 204	83-13 (RBLAT)	ON	CONTACTS CLOSE TO PROVIDE SEQ #2 SEAL-IN SIGNAL TO RELAYS 83-12 AND 83-13, RESULTING IN AUTO-CLOSE SIGNAL TO CV-202/203/204 WHICH DE-ENERGIZES RESPECTIVE SOLENOID PILOTS FT1202/1203/1204 AND CLOSES VALVES	CONTROL ROOM INDICATION	NONE REQUIRED FOR ECCS	NONE FOR ECCS	NORMAL POSITION FOLLOWING SEQ #2 SIS/SISLOP. FAILURE PREVENTS RE-OPENING VALVES TO RE-ESTABLISH LFTDOWN IF DESIRED
03.2.12.10.2	CV-202, 203, 204	83-13 (RBLAT)	OFF	SEQ #2 SEAL-IN FOR CV-202/203/204 AND AUTO-CLOSE SIGNAL TO CV-204 DISABLED. REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #1 VIA RELAYS 83-10 AND 83-11 UNAPPECTED	PERIODIC TESTING	REDUNDANT SIGNALS AND SEAL-IN FROM SEQ #1	REDUCED RELIABILITY FOR SIS/SISLOP ISOLATION OF LFTDOWN	POSITION OF RBLAT DURING NORMAL OPERATION
03.2.12.11.1	CV-202, 203, 204	UTILITY BUS (8-1518)	VOLTS LOW	SOLENOID VALVES FOR CV-202, 203, 204 AND SEQ RELAYS 83-10, 83-12 DE-ENERGIZE, ISOLATING LFTDOWN FROM LOOP A COLD LBG DIVERSION OF ALTERNATE HLR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	INCLUDES SV-413, Z90/C-1413
03.2.13.01.1	CV-413	VALVE/ACTUATOR	OPEN	FLOW TO RCP SEAL WATER RETURN NORMAL FOR ALTERNATE HLR PATH BOUNDARY	CONTROL ROOM INDICATION	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	
03.2.13.01.2	CV-413	VALVE/ACTUATOR	CLOSED		CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION
03.2.13.01.3	CV-413	VALVE/ACTUATOR	EQ	DIVERSION OF ALTERNATE HLR PATH FLOW TO RCP SEAL WATER RETURN OR RCDT	NONE	NONE, IF HLR PRIMARY PATH IS SINGLE FAILURE	*POTENTIAL COMMON-CAUSE LOSS OF FUSE PROVIDES (b)(2) ALTERNATE HLR PATH TO RCDT WITH CV-200 EQ FAILURE	PROTECTION OF OTHER VITAL BUS LOADS. CHECK VALVE TO BE INSTALLED BY DCP 3548 WILL PREVENT FLOW DIVERSION WITH THIS FAILURE
03.2.13.02.1	CV-413	VITAL BUS #4 (8-1402V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.13.03.1	CV-413	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.14.01.1	CV-412	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES VALVES OPEN FROM ALTERNATE HLR PATH TO SEAL WATER RETURN	CONTROL ROOM INDICATION	REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH BOUNDARY	INCLUDES SV-412, Z90/C-1412. NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 3-1: HOT LEG RECIRCULATION PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
03.2.14.01.2	CV-412	VALVE/ACTUATOR	CLOSED	NORMAL FOR ALTERNATE HLR PATH	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.14.01.3	CV-412	VALVE/ACTUATOR	BQ	BOUNDARY DIVERSION OF ALTERNATE HLR FLOW TO RCP SEAL WATER RETURN	NONE	NONE IF HLR PRIMARY PATH IS SINGLE FAILURE	*POTENTIAL COMMON-CAUSE LOSS OF FUSE PROVIDES (b)(2) ALTERNATE HLR FLOW TO RCP SEAL WATER RETURN	PROTECTION OF OTHER VITAL BUS LOADS. DCP 3548 WILL INSTALL CHECK VALVE TO PREVENT FLOW DIVERSION VIA THIS PATH
03.2.14.02.1	CV-412	410X (RELAY)	CONTACTS CLOSED (ON)	VALVE WILL NOT CLOSE ON CV-410 CLOSURE, MAY DIVERT RECESS LETDOWN TO RCDT VIA RV-2004 DURING NORMAL OPERATION	PERIODIC TESTING	REDUNDANT INPUT FROM CV-411	REDUCED RELIABILITY FOR ALTERNATE HLR PATH BOUNDARY	INTERLOCK FROM CV-410. NORMAL POSITION FOR SEAL WATER RETURN
03.2.14.02.2	CV-412	410X (RELAY)	CONTACTS OPEN (OFF)	VALVE CLOSURE, CANNOT BE BROPPENED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	
03.2.14.03.1	CV-412	411X (RELAY)	CONTACTS CLOSED (ON)	VALVE WILL NOT CLOSE ON CV-411 CLOSURE, MAY DIVERT RECESS LETDOWN TO RCDT VIA RV-2004 DURING NORMAL OPERATION	PERIODIC TESTING	REDUNDANT INPUT FROM CV-410	REDUCED RELIABILITY FOR ALTERNATE HLR PATH BOUNDARY	INTERLOCK FROM CV-411. NORMAL POSITION FOR SEAL WATER RETURN
03.2.14.03.2	CV-412	411X (RELAY)	CONTACTS OPEN (OFF)	VALVE CLOSURE, CANNOT BE BROPPENED	PERIODIC TESTING	NONE REQUIRED	NONE	
03.2.14.04.1	CV-412	VITAL BUS #4 (8-1402V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.14.05.1	CV-412	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.15.01.1	CV-288	VALVE/ACTUATOR	NORMAL	VALVE ALIGNED TO RECESS LETDOWN BX	CONTROL ROOM INDICATION	REDUNDANT VALVES CV-287, RCV-1117 PREVENT DIVERSION OF ALTERNATE HLR FLOW TO LOOP B COLD LEG	NONE	THREE-WAY AIR-OP VALVE. INCLUDES BY-1288, Z30/C-1288
03.2.15.01.2	CV-288	VALVE/ACTUATOR	DIVERT	VALVE ALIGNED TO RCDT	CONTROL ROOM INDICATION	REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH BOUNDARY	
03.2.15.01.3	CV-288	VALVE/ACTUATOR	BQ	DIVERSION OF ALTERNATE HLR FLOW TO RCP SEAL WATER RETURN OR RCDT	NONE	NONE IF PRIMARY HLR PATH IS SINGLE FAILURE	*POTENTIAL COMMON-CAUSE LOSS OF FUSE PROVIDES (b)(2) ALTERNATE HLR FLOW TO RCDT	PROTECTION OF OTHER UTILITY BUS LOADS. CHECK VALVE TO BE INSTALLED BY DCP 3548 WILL PREVENT FLOW DIVERSION WITH THIS FAILURE
03.2.15.02.1	CV-288	UTILITY BUS (8-1508)	VOLTS LOW	VALVE FAILS TO NORMAL POSITION	CONTROL ROOM INDICATION	REDUNDANT VALVES CV-287 AND RCV-1117 PREVENT DIVERSION OF ALTERNATE HLR FLOW TO LOOP B COLD LEG	NONE	
03.2.15.03.1	CV-288	ISA	PRESSURE LOW	VALVE FAILS TO NORMAL POSITION	CONTROL ROOM INDICATION	REDUNDANT VALVES CV-287 AND RCV-1117 PREVENT DIVERSION OF ALTERNATE HLR FLOW TO LOOP B COLD LEG	NONE	
03.2.16.01.1	CV-962	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES VALVES OPEN IN ALTERNATE HLR PATH (BHR) SAMPLE LINE TO CHEM LAB	CONTROL ROOM INDICATION	REDUNDANT VALVE CV-957, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH BOUNDARY	INCLUDES SV-962, Z30/C-2962
03.2.16.01.2	CV-962	VALVE/ACTUATOR	CLOSED	ALTERNATE HLR PATH (BHR) SAMPLE LINE ISOLATED TO CHEM LAB	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 3-1: HOT LEG RECIRCULATION PNEA

ITER #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.2.16.02.1	CV-962	VITAL BUS #3A (8-3311V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.16.03.1	CV-962	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.17.01.1	CV-957	VALVE/ACTUATOR	OPEN	1 OF 2 SERIES VALVES OPEN IN ALTERNATE HLR PATH (RRR) SAMPLE LINE TO CERN LAB	CONTROL ROOM INDICATION	REDUNDANT VALVE CV-962, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH BOUNDARY	INCLUDES SV-957, ZSQ/C-3957
03.2.17.01.2	CV-957	VALVE/ACTUATOR	CLOSED	ALTERNATE HLR PATH (RRR) SAMPLE LINE ISOLATED TO CERN LAB	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL
03.2.17.02.1	CV-957	D12, D12-1 (RELAYS)	CONTACTS OPEN (OPR)	VALVE WILL CLOSE WHEN REMAINING RELAY IS DE-ENERGIZED ON TRAIN B CIS	PERIODIC TESTING	NONE REQUIRED	NONE	TRAIN B CONTAINMENT ISOLATION SIGNAL RELAYS
03.2.17.02.2	CV-957	D12, D12-1 (RELAYS)	CONTACTS CLOSED	VALVE WILL NOT CLOSE ON TRAIN B CIS	PERIODIC TESTING	REDUNDANT VALVE CV-962, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH BOUNDARY	NORMAL POSITION
03.2.17.03.1	CV-957	VITAL BUS #6 (A-3001V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.17.04.1	CV-957	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	

TABLE 3-2: HOT LEG RECIRCULATION BOUNDARY VALVE ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
BOUNDARY VALVE ANALYSIS

--- SAFETY RELATED BOUNDARY ---					SAFETY RELATED BACKUP		--- NON-SAFETY RELATED BACKUP ---			REMARKS
ITEM #	TAG #	NC/AUTO?	LOCKED?		TAG #	NC/AUTO?	TAG #	NC/AUTO?		
03.1.01	VCC-001	CLOSED	NO	NONE			BLIND FLANGE			# REGENERATIVE HE CHARGING-RIDE VENT
03.1.02	CV-304	OPEN	NO	NONE			NONE			# NORMAL CHARGING PATH ISOLATION VALVE
03.1.03	PCV-430C	OPEN	NO	NONE			NONE			# PRESSURIZER SPRAY VALVE. NON-EQ CONTROLLER, WITH PARTIAL OPEN FAILURE NOT DETECTABLE BY EQ LIMIT SWITCHES. ROI PRIMARY PATH HLR FLOW MUST INCLUDE ALLOWANCE FOR THIS UNDETECTABLE BYPASS FLOW
03.1.04	PVC-430B	OPEN	NO	NONE			NONE			# PRESSURIZER SPRAY VALVE. NON-EQ CONTROLLER, WITH PARTIAL OPEN FAILURE NOT DETECTABLE BY EQ LIMIT SWITCHES. ROI PRIMARY PATH HLR FLOW MUST INCLUDE ALLOWANCE FOR THIS UNDETECTABLE BYPASS FLOW
03.1.05	PZR-020	OPEN	NO	NONE			NONE			# PRESSURIZER SPRAY HRRP-WARN BYPASS. NORMALLY THROTTLED BUT POSITION NOT ADMINISTRATIVELY CONTROLLED
03.1.06	PZR-021	OPEN	NO	NONE			NONE			# PRESSURIZER SPRAY HRRP-WARN BYPASS. NORMALLY THROTTLED BUT POSITION NOT ADMINISTRATIVELY CONTROLLED
03.2.01	CRS-342	CLOSED	NO	NONE			NONE			# ALTERNATE HLR CONTAINMENT PENETRATION H2 TEST VALVE
03.2.02	LDS-022	CLOSED	NO	NONE			NONE			# ALTERNATE HLR/LTDOWN VENT
03.2.03	CV-525	OPEN	NO	CV-526		OPEN				# LTDOWN INSIDE CONTAINMENT ISOLATION VALVE. ROI REV REQUIRED TO REQUIRE CLOSURE ON SIS/SISLOP
03.2.04	LDS-021	CLOSED	NO	NONE			NONE			# LTDOWN/ALTERNATE HLR INSIDE CONTAINMENT PENETRATION H2 TEST VALVE
03.2.06	RHR-028	CLOSED	NO	NONE			NONE			# RHR FLOW CONTROL VALVE DRAIN
03.2.07	RS3-014	CLOSED	NO	NONE			NONE			# RHR SAMPLE CONTAINMENT PENETRATION H2 TEST VALVE
03.2.08	CV-962	AUTO	NO	CV-959, RS3-310		CLOSED				# RHR SAMPLE INSIDE CONTAINMENT ISOLATION. VALVE NORMALLY CLOSED
03.2.09	NOV-033	CLOSED	NO	NOV-034		CLOSED				# NOV-033 AND NOV-034 ARE RHR DISCHARGE ISOLATIONS TO LOOP 1 COLD LEG. BOTH ACTUATORS NON-EQ
03.2.10	RHR-024	CLOSED	NO	NONE			BLIND FLANGE			# RHR HI R21A VENT
03.2.11	RHR-020	CLOSED	NO	NONE			CAP			# RHR HI R21A DRAIN
03.2.12	RHR-021	CLOSED	NO	NONE			CAP			# RHR HI R21B DRAIN
03.2.13	RHR-023	CLOSED	NO	NONE			CAP			# RHR HI R21B VENT
03.2.14	RHR-018	CLOSED	NO	NONE			BLIND FLANGE			# RHR HI COMMON INLET LINE VENT
03.2.15	RV-206	RBLIBF	NO	NONE REQUIRED						# RHR RBLIBF TO PZR RBLIBF TANK. VALVE PROTECTS RHR HE/PIPING AGAINST CV-202/203/204 LEAKAGE POST-SIS/SISLOP, AND AUGMENTS OVERPRESSURE MITIGATION SYSTEM (OMS) FOR NORMAL SHUTDOWN BEHIND LTDOWN ISOLATION TO RHR. CV-412 AND CV-413 ARE NON-EQ. NEW CHECK VALVE TO BE INSTALLED PER DCP 3548.0
03.2.16	CV-413	CLOSED	NO	CV-412		AUTO				# RHR PUMP G-14A DISCHARGE LINE DRAIN
03.2.17	RHR-012	CLOSED	NO	NONE			BLIND FLANGE			# RHR PUMP G-14A CASING VENT
03.2.18	RHR-006	CLOSED	NO	NONE			BLIND FLANGE			# RHR PUMP G-14A CASING DRAIN
03.2.19	RHR-008	CLOSED	NO	NONE			NONE			# RHR PUMP G-14B DISCHARGE LINE DRAIN
03.2.20	RHR-011	CLOSED	NO	NONE			BLIND FLANGE			# RHR PUMP G-14B CASING VENT
03.2.21	RHR-005	CLOSED	NO	NONE			BLIND FLANGE			# RHR PUMP G-14B CASING DRAIN

EMERGENCY COOLING SYSTEM SINGLE FAILURE ANALYSIS

RAM DRUMS UNIT 1

BOUNDARY VALVE ANALYSIS

--- SAFETY RELATED BOUNDARY ---				--- SAFETY RELATED BACKUP ---		--- NON-SAFETY RELATED BACKUP ---		REMARKS
ITEM #	TAG #	NC/AUTO?	LOCKED?	TAG #	NC/AUTO?	TAG #	NC/AUTO?	

01.2.22	RRR-007	CLOSED	NO	NONE				
01.2.23	RRR-001	CLOSED	NO	NONE				

NONE
BLIND FLANGE

* RRR PUMP G-148 CASING DRAIN
* RRR PUMP COMMON SUCTION HEADER VENT

SECTION 4: SECONDARY RECIRCULATION

SECONDARY RECIRCULATION NOTES

1. Secondary Recirculation is used for long-term decay heat removal following a secondary system rupture (MSLB, FWLB-D) in containment. Consistent with Standard Review Plan Section 15.1.5, non-safety related systems and equipment may be credited for such events following a single failure. For purposes of this criterion at SONGS 1, the assumed failure is a common-cause loss of the Residual Heat Removal (RHR) system. Since loss of RHR is a common-cause failure, secondary recirculation is evaluated assuming an additional random single failure.
2. Consistent with the above, secondary recirculation credits non-safety related portions of the Containment Spray and Recirculation system (between the refueling water pump discharge and RWST) and Main Feedwater system (between the HV-852A/B valves and the FW isolation valves in the mezzanine). The non-safety related Instrument and Service Air (ISA) system is also credited for operation of HV-852A/B and CV-142, 143, 144. The redundant air compressors are powered from safety related busses, and so would be available after a loss of offsite power. As such, ISA single failures are bounded by isolation of the branch connections to the above valves as indicated in the FMEA table, and the ISA system is not explicitly evaluated. For HV-852A/B, redundant connections from the service air and instrument air headers prevent loss of air to these components due to single active failure of a branch isolation valve.
3. Item numbers in this section have been assigned as follows:
 - 04.1: Train A pumping and boundary devices
 - 04.2: Train B pumping and boundary devices
 - 04.3: Common flow path and boundary devices.
4. Table 4-1 is the Failure Modes and Effects Analysis (FMEA) for the Secondary Recirculation function. Table 4-2 is the associated boundary valve analysis.
5. The secondary recirculation functions of the recirculation pumps, refueling water pumps, SI/FW pumps and realignment valves, SI header valves, and FW isolation valves are addressed in Sections 1 (Safety Injection), 2 (Cold Leg Recirculation), and 5 (Containment Spray) of this analysis. This section addresses the additional train-common systems/equipment or functions (such as FW bypass valve modulation) required for secondary recirculation.
6. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the

associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.

7. Potential single failure susceptibilities in the Boundary Valve Analysis table are flagged with "*" in the unlabelled field adjacent to REMARKS. Items flagged with "#" in the unlabelled field adjacent to REMARKS are acceptable from a single failure standpoint subject to credit for SEP Topic III-6 seismic boundary criteria.

SECONDARY RECIRCULATION REFERENCES

Piping and Instrumentation Diagrams

5178115	Safety Injection System (Sh 1)
5178120	Containment Spray and Recirculation System (Sh 1)
5178121	Containment Spray and Recirculation System (Sh 2)
5178145	Boric Acid System
5178167	Radwaste Liquid Processing (Sh 3)
5178205	Feedwater System (Sh 1)
5178206	Feedwater System (Sh 2)
5178220	Auxiliary Feedwater System (Sh 1)
5178225	Main Steam System (Sh 1)
5178227	Main Steam System (Sh 3)
5178228	Main Steam System (Sh 4)
5178270	Secondary Chemical Feed System
5178300	Spent Fuel Pit Cooling System
5178441	Instrument and Service Air System (Sh 2)
5178442	Instrument and Service Air System (Sh 3)
5178443	Instrument and Service Air System (Sh 4)
5178444	Instrument and Service Air System (Sh 5)
5178446	Instrument and Service Air System (Sh 7)
5178448	Instrument and Service Air System (Sh 9)

Elementary Diagrams

449408 (Sh 1)	FCV-456 and CV-142
5150407	Steam Generator Blowdown CV-100 and CV-100B
5159842	Auxiliary Feedwater Actuation (AFWAS), Train A
5159843	Auxiliary Feedwater Actuation (AFWAS), Train B

Loop Diagrams

451775	AFWS Actuation Train A (LT-2400A/B/C)
451776	AFWS Actuation Train B (LT-3400A/B/C)

Other Drawings

5112416	Schematic: Auxiliary Relay Rack R12 (Front)
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Procedures

SO1-1.0-10	Reactor Trip or Safety Injection
SO1-1.0-12	SI Termination
SO1-1.0-30	Loss of Secondary Coolant
SO1-1.0-32	Loss of RHR Following Loss of Secondary Coolant in Containment
SO1-14-40	Control of Locked Valves

Other Documents

SD-SO1-210	System Description: Condensate and Feedwater Systems
SD-SO1-260	System Description: Feedwater Control System
SD-SO1-420	System Description: Compressed Air Systems
SD-SO1-580	System Description: Safety Injection, Recircula- tion and Containment Spray Systems
SD-SO1-590	System Description: Safeguard Load Sequencing System

M89048

Response to Generic Letter 88-14, "Instrument Air
Supply System Problems Affecting Safety Related
Systems", dated July 5, 1989

TABLE 4-1: SECONDARY RECIRCULATION FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPR UNIT 1

TABLE 4-1: SECONDARY RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
04.1.01.01.1 (NONE)								TRAIN A AND B PUMPING/PATH COMPONENTS FOR SECONDARY RECIRC ARE COVERED IN SECTIONS 1 (SI/MPW), 2 (CLR) AND 5 (CONTAINMENT SPRAY)
04.1.02.01.1 (NONE)								TRAIN A AND B BOUNDARY COMPONENTS FOR SECONDARY RECIRC ARE COVERED IN SECTIONS 1 (SI/MPW), 2 (CLR) AND 5 (CONTAINMENT SPRAY)
04.1.03.01.1	LT-2400A LT-2400B LT-2400C LOOPS	LT-2400A LT-2400B LT-2400C	OUTPUT HIGH	TRAIN A NARROW RANGE LEVEL INDICATION AND APW CHANNEL DISABLED FOR ONE OR MORE S/Gs	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT APW TRAIN PROVIDES NR LEVEL INDICATION AND AUTOMATIC BLOWDOWN ISOLATION	TRAIN A NARROW RANGE LEVEL INDICATION AND APW ACTUATION DISABLED FOR ONE OR MORE S/Gs	INCLUDES LT-2400A/B/C, ASSOCIATED LOOP DEVICES AND NEXT POWER SUPPLY
04.1.03.01.2	LT-2400A LT-2400B LT-2400C LOOPS	LT-2400A LT-2400B LT-2400C	OUTPUT LOW	TRAIN A NARROW RANGE LEVEL INDICATION DISABLED AND APW CHANNEL TRIPPED FOR ONE OR MORE S/G	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT APW TRAIN TO PROVIDE NR LEVEL INDICATION, NONE REQUIRED FOR AUTOMATIC BLOWDOWN ISOLATION	TRAIN A NARROW RANGE LEVEL INDICATION DISABLED FOR ONE OR MORE S/G, BLOWDOWN ISOLATED IF TWO OR MORE	
04.1.03.02.1	LT-2400B LT-2400C LOOPS	LT-2400B LT-2400C	VOLTS LOW	TRAIN A NARROW RANGE LEVEL AUTO-ACTUATION DISABLED, BLOWDOWN ISOLATED ON TRAIN A APW RELAY DE-ENERGIZING	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN TO PROVIDE NR LEVEL INDICATION AND AUTOMATIC BLOWDOWN ISOLATION	TRAIN A NARROW RANGE LEVEL INDICATION AND APW FLOW DISABLED, BLOWDOWN ISOLATED	
04.1.03.03.1	PI-127		OUTPUT HIGH	LOCAL INDICATION FOR TRAIN A REFUELING WATER PUMP G-27M DISCHARGE PRESSURE DISABLED	CONTROL ROOM INDICATION	REDUNDANT TRAIN, REDUNDANT CONTROL ROOM INSTRUMENTATION FOR REFUELING WATER PUMP DISCHARGE HEADER PRESSURE (SAME AS 4.1.3.3.1)	LOCAL INDICATION DISABLED FOR CONTAINMENT SPRAY/SECONDARY RECIRCULATION FLOW SPLIT FROM TRAIN A REFUELING WATER PUMP (SAME AS 4.1.3.3.1)	LOCAL MECHANICAL INSTRUMENT, REDUNDANT CONTROL ROOM INSTRUMENT PI-18/PI-165 ALSO MECHANICAL
04.1.03.03.2	PI-127		OUTPUT LOW	(SAME AS 4.1.3.3.1)	(SAME AS 4.1.3.3.1)	(SAME AS 4.1.3.3.1)	(SAME AS 4.1.3.3.1)	
04.2.01.01.1 (NONE)								TRAIN A AND B PUMPING/PATH COMPONENTS FOR SECONDARY RECIRC ARE COVERED IN SECTIONS 1 (SI/MPW), 2 (CLR) AND 5 (CONTAINMENT SPRAY)
04.2.02.01.1 (NONE)								TRAIN A AND B BOUNDARY COMPONENTS FOR SECONDARY RECIRC ARE COVERED IN SECTIONS 1 (SI/MPW), 2 (CLR) AND 5 (CONTAINMENT SPRAY)
04.2.03.01.1	LT-3400A LT-3400B LT-3400C LOOPS	LT-3400A LT-3400B LT-3400C	OUTPUT HIGH	TRAIN B NARROW RANGE LEVEL INDICATION AND APW CHANNEL DISABLED FOR ONE OR MORE S/Gs	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT APW TRAIN PROVIDES NR LEVEL INDICATION AND AUTOMATIC BLOWDOWN ISOLATION	TRAIN B NARROW RANGE LEVEL INDICATION AND APW ACTUATION DISABLED FOR ONE OR MORE S/Gs	INCLUDES LT-3400A/B/C, ASSOCIATED LOOP DEVICES AND NEXT POWER SUPPLY

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM ONOFFER UNIT 1
 TABLE 4-1: SECONDARY RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
04.2.01.01.2	LT-3400A LT-3400B LT-3400C LOOPS	LT-3400A LT-3400B LT-3400C	OUTPUT LOW	TRAIN B NARROW RANGE LEVEL INDICATION DISABLED AND APW CHANNEL TRIPPED FOR ONE OR MORE S/Gs	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT APW TRAIN TO PROVIDE TRAIN B NARROW RANGE LEVEL NB LEVEL INDICATION, NONE REQUIRED FOR AUTOMATIC BLOWDOWN ISOLATION	INDICATION DISABLED FOR ONE OR MORE S/Gs, BLOWDOWN ISOLATED IF TWO OR MORE	
04.2.03.02.1	LT-3400A LT-3400B LT-3400C LOOPS	VITAL BUS #5 (8-2901V)	VOLTS LOW	TRAIN B NARROW RANGE LEVEL INDICATION AND APW AUTO-ACTUATION DISABLED, BLOWDOWN ISOLATED ON TRAIN B APW RELAY DE-ENERGIZING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT APW TRAIN TO PROVIDE TRAIN B NARROW RANGE LEVEL NB LEVEL INDICATION, NONE REQUIRED FOR AUTOMATIC BLOWDOWN ISOLATION	INDICATION DISABLED, BLOWDOWN ISOLATED	
04.2.03.03.1	PI-206		OUTPUT HIGH	LOCAL INDICATION FOR TRAIN B REFUELING WATER PUMP G-279 DISCHARGE PRESSURE DISABLED	CONTROL ROOM INDICATION	REDUNDANT TRAIN, REDUNDANT CONTROL ROOM INSTRUMENTATION FOR REFUELING WATER PUMP DISCHARGE HEADER PRESSURE	LOCAL INDICATION DISABLED FOR CONTAINMENT SPRAY/SECONDARY RECIRCULATION FLOW SPLIT FROM TRAIN B REFUELING WATER PUMP	LOCAL MECHANICAL INSTRUMENT. REDUNDANT CONTROL ROOM INSTRUMENT PT-18/PI-165 ALSO MECHANICAL
04.2.03.03.2	PI-206		OUTPUT LOW	(SAME AS 4.2.3.3.1)	(SAME AS 4.2.3.3.1)	(SAME AS 4.2.3.3.1)	(SAME AS 4.2.3.3.1)	
04.3.01.01.1	MANUAL VALVES, COMMON FLOW PATH		OPEN	NONE FOR PWS VALVES (NORMALLY OPEN). FOR CRS-338, LOSS OF FLOW CONTROL FOR SECONDARY RECIRC TO RWST	PERIODIC SURVEILLANCE	ADMINISTRATIVELY CONTROLLED LOCKING TO PREVENT OPENING PRIOR TO SECONDARY RECIRC, NONE DURING SECONDARY RECIRC	POTENTIAL DIVERGENCE OF CONTAINMENT SPRAY FLOW AND LOSS OF SECONDARY RECIRC SUMP INVENTORY TO RWST	*INCLUDES CRS-338, PWS-455 OR 492, PWS-377 AND 381 (S/G A), PWS-372 AND 376 (S/G B), PWS-415 AND 419 (S/G C). BOI DOES NOT INCLUDE ALIGNMENT VERIFICATION FOR APPLICABLE VALVES. REDUNDANT ISOLATION VALVE AND FLOW PATH REQUIRED
04.3.01.01.2	MANUAL VALVES, COMMON FLOW PATH		CLOSED	SECONDARY RECIRC PATH ISOLATED FROM REFUELING WATER PUMPS TO RWST OR FROM MAIN PW PUMPS TO ONE OR MORE S/G	PERIODIC SURVEILLANCE	NONE FOR CRS-338, REDUNDANT PATHS TO OTHER S/G FOR PWS VALVES	*LOSS OF SECONDARY RECIRC FOR CRS-338 CLOSURE, LOSS OF SECONDARY RECIRC PATH TO ONE OR MORE S/G FOR PWS VALVE CLOSURE	*BOI DOES NOT INCLUDE ALIGNMENT VERIFICATION FOR ALL APPLICABLE VALVES. REQUIRES REDUNDANT PATH AND VALVES OR HYDRAULIC CALCULATION TO VERIFY ADEQUACY OF EXISTING 2 INCH REFUELING WATER FILTER PUMP LINES
04.3.01.02.1	CHECK VALVES, COMMON FLOW PATH		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES PWS-379 AND 007 (S/G A), PWS-378 AND 006 (S/G B), PWS-417 AND 012 (S/G C)
04.3.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	DIVERGENCE OF SECONDARY RECIRC FLOW/INVENTORY TO CHARGING PUMPS, CONDENSER, BORIC ACID SYSTEM, RADWASTE, SPENT FUEL PIT, SPRAY PUMP SUCTION OR ATMOSPHERE	PERIODIC SURVEILLANCE	REDUNDANT VALVES, ADMINISTRATIVELY CONTROLLED LOCKING	*LOSS OF SECONDARY RECIRC FLOW/INVENTORY	*SEE TABLE 4-2. BOI DOES NOT INCLUDE ALIGNMENT VERIFICATION OF ALL APPLICABLE VALVES. MUST SPECIFY LOCAL CLOSURE OF VCC-326 (TO PROTECT AGAINST FCV-5C51 ACTION) AND PROVIDE RESPONSE NOT-OBTAINED OPTIONS IF MOV-1100B/D DOES NOT CLOSE (EG. CLOSE CRS-425)
04.3.02.01.2	MANUAL VALVES, COMMON BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	*VALVE LOCKING PROGRAM DOES NOT COVER SECONDARY RECIRC FUNCTION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1
TABLE 4-1: SECONDARY RECIRCULATION PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
04.3.02.02.1	CHK OR RBLTRF VLV, COMMON BOUNDARY		NORMAL (PASSIVE)			PERIODIC TESTING		*SEE TABLE 4-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. IST PROGRAM DOES NOT INCLUDE SCP-358, 359, 398
04.3.03.01.1	CV-142	VALVE/ACTUATOR	OPEN	MAIN PW BYPASS VALVE TO S/G A CANNOT BE CLOSED OR THROTTLED	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT ISOLATION VALVES (BV-852A/B) FOR SI, REDUNDANT MANUAL BLOCK VALVE AND REDUNDANT S/Gs FOR SECONDARY RECIRC	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G A FOR SI, LOSS OF SECONDARY RECIRC FLOW	NORMAL POSITION DURING STARTUP/SHUTDOWN. INCLUDES FC-142 CONTROL LOOP
04.3.03.01.2	CV-142	VALVE/ACTUATOR	CLOSED	MAIN PW BYPASS ISOLATED TO S/G A	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A	SINGLE FAILURES AFFECTING THE ASSOCIATED SOLENOID VALVES ARE ADDRESSED IN SECTION 1 OF THIS ANALYSIS
04.3.04.01.1	CV-144	VALVE/ACTUATOR	OPEN	MAIN PW BYPASS VALVE TO S/G B CANNOT BE CLOSED OR THROTTLED	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT ISOLATION VALVES (BV-852A/B) FOR SI, REDUNDANT MANUAL BLOCK VALVE AND REDUNDANT S/Gs FOR SECONDARY RECIRC	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G B FOR SI, LOSS OF SECONDARY RECIRC FLOW	NORMAL POSITION DURING STARTUP/SHUTDOWN. INCLUDES FC-144 CONTROL LOOP
04.3.04.01.2	CV-144	VALVE/ACTUATOR	CLOSED	MAIN PW BYPASS ISOLATED TO S/G B	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G B	SINGLE FAILURES AFFECTING THE ASSOCIATED SOLENOID VALVES ARE ADDRESSED IN SECTION 1 OF THIS ANALYSIS
04.3.05.01.1	CV-143	VALVE/ACTUATOR	OPEN	MAIN PW BYPASS VALVE TO S/G C CANNOT BE CLOSED OR THROTTLED	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT ISOLATION VALVES (BV-852A/B) FOR SI, REDUNDANT MANUAL BLOCK VALVE AND REDUNDANT S/Gs FOR SECONDARY RECIRC	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G C FOR SI, LOSS OF SECONDARY RECIRC FLOW	NORMAL POSITION DURING STARTUP/SHUTDOWN. INCLUDES FC-143 CONTROL LOOP
04.3.05.01.2	CV-143	VALVE/ACTUATOR	CLOSED	MAIN PW BYPASS ISOLATED TO S/G C	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G C	SINGLE FAILURES AFFECTING THE ASSOCIATED SOLENOID VALVES ARE ADDRESSED IN SECTION 1 OF THIS ANALYSIS
04.3.06.01.1	CV-142, CV-143, CV-144	APVI (RBLAT)	OFF	APVAs-A AND APVAs-B SIGNALS DISABLED TO CHECK VALVE BACKUP MODE FOR MAIN PW BYPASS VALVES (TRAIN A SOLENOID VALVES FOR CV-142, 143, 144) AND TO BLOWDOWN ISOLATION VALVES (SOLENOID VALVE SV-81 FOR CV-100, 100A, 100B)	PERIODIC TESTING	APV TANK FOR SHORT TERM INVENTORY, REDUNDANT MANUAL CONTROLS OR LOCAL VALVES FOR LONG TERM	LOSS OF AUTOMATIC BLOWDOWN ISOLATION, POTENTIAL DIVERSION OF SECONDARY RECIRC INVENTORY FROM SYSTEM UNTIL REDUNDANT VALVES CLOSED	NORMAL POSITION
04.3.06.01.2	CV-142, CV-143, CV-144	APVI (RBLAT)	ON	BLOWDOWN ISOLATION VALVES (CV-100, 100A, 100B) CLOSE, MAIN PW BYPASS VALVES (CV-142, 143, 144) CLOSE VIA ASSOCIATED SOLENOID VALVES ON TURBINE TRIP COINCIDENT WITH MAIN PW PUMP TRIP. SIS/SISLOP CLOSE OF CV-142, 143, 144 FOR SI UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONDFRR UNIT 1
TABLE 4-1: SECONDARY RECIRCULATION PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
04.3.06.02.1	CV-142 CV-143 CV-144	MCC-2A (8-2A29)	VOLTS LOW	MAIN FW BYPASS VALVES REMOTE MANUAL CONTROL DISABLED FOR S/G A/B/C	CONTROL ROOM INDICATION	LOCAL MANUAL CONTROL AT VALVE POSITIONERS	REDUCED RELIABILITY OF MAIN FW BYPASS VALVES FOR SECONDARY RECIRC FLOW CONTROL	ROI DOES NOT ADDRESS REQUIREMENTS FOR LOCAL CONTROL
04.3.06.03.1	CV-142 CV-143 CV-144	125VDC BUS #1 (72-130)	VOLTS LOW	MAIN FW BYPASS VALVES TO S/G A/B/C WILL NOT CLOSE ON TRIN A SIS/SISLOP, VALVE MODULATION UNAPFFECTED. AUTOMATIC S/G BLOWDOWN ISOLATION ON APWAS-A AND APWAS-B DISABLED BY OR-DEMURGIZING OF RELAY APW1. MANUAL CONTROL UNAPFFECTED	CONTROL ROOM INDICATION	REDUNDANT TRIN B SIGNAL AND SOLENOID VALVES TO CLOSE BYPASS VALVES FOR SI, CONTROL ROOM HANDSWITCH FOR REMOTE MANUAL CONTROL OF BLOWDOWN ISOLATION VV	REDUCED RELIABILITY OF MAIN FW BYPASS VALVES FOR SI BOUNDARY, POTENTIAL DIVERSION OF SECONDARY RECIRC INVENTORY FROM SYSTEM UNTIL BLOWDOWN ISOLATION VALVES CLOSED REMOTE-MANUALLY	BLOWDOWN ISOLATION NOT ADDRESSED IN ROI
04.3.06.04.1	CV-142 CV-143 CV-144	ISA	PRESSURE LOW	MAIN FEEDWATER BYPASS VALVES FAIL CLOSED TO S/G A/B/C	CONTROL ROOM ANNUNCIATION	NONE REQUIRED FOR SI. NONE FOR SECONDARY RECIRC	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C	*COMMON-CAUSE FAILURE NOT POSTULATED DURING SECONDARY RECIRC, BUT SINGLE FAILURE OF ISA-960 COULD ISOLATE ISA TO CV. EVALUATION OF MANUAL BYPASS PATHS REQUIRED FOR MITIGATING EFFECTS ON SECONDARY RECIRC
04.3.07.01.1	CV-100	VALVE/ACTUATOR	OPEN	S/G BLOWDOWN ALIGNED TO FLASH TANK, CANNOT BE ISOLATED FROM CONTROL ROOM	CONTROL ROOM INDICATION, PERIODIC TESTING	APW TANK FOR SHORT TERM INVENTORY, REDUNDANT MANUAL VALVES FOR LONG TERM	POTENTIAL DIVERSION OF SECONDARY RECIRC INVENTORY FROM SYSTEM UNTIL REDUNDANT VALVE(S) CLOSED LOCALLY	*INCLUDES PWS-580, ZSO/C-2182. REDUNDANT VALVE PWS-526 NORMALLY CLOSED. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI OR VALVE LOCKING PROGRAM NORMAL POSITION
04.3.07.01.2	CV-100	VALVE/ACTUATOR	CLOSED	S/G BLOWDOWN ISOLATED TO FLASH TANK	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
04.3.07.02.1	CV-100A	VALVE/ACTUATOR	OPEN	S/G BLOWDOWN ALIGNED TO OUTFALL	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE CV-100B	REDUCED REDUNDANCY FOR BLOWDOWN ISOLATION (SECONDARY RECIRC BOUNDARY)	*NORMAL POSITION. VALVE IS NON-SAFETY RELATED BACKUP TO CV-100B. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI
04.3.07.02.2	CV-100A	VALVE/ACTUATOR	CLOSED	S/G BLOWDOWN ISOLATED TO OUTFALL	PERIODIC TESTING	NONE REQUIRED	NONE	
04.3.07.03.1	CV-100B	VALVE/ACTUATOR	OPEN	S/G BLOWDOWN ALIGNED TO OUTFALL	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE CV-100A	REDUCED REDUNDANCY FOR BLOWDOWN ISOLATION (SECONDARY RECIRC BOUNDARY)	*NORMAL POSITION. INCLUDES PWS-161 AND ZSO/C-2182. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI
04.3.07.03.2	CV-100B	VALVE/ACTUATOR	CLOSED	(SAME AS 4.3.7.2.2)	(SAME AS 4.3.7.2.2)	(SAME AS 4.3.7.2.2)	(SAME AS 4.3.7.2.2)	
04.3.07.04.1	CV-100 CV-100A CV-100B	SV-81	ON (OPEN)	S/G BLOWDOWN CANNOT BE ISOLATED FROM CONTROL ROOM	PERIODIC TESTING	APW TANK FOR SHORT-TERM INVENTORY, REDUNDANT MANUAL VALVES (PWS-524 OR PWS-518, 522, 523) FOR LONG TERM	POTENTIAL DIVERSION OF SECONDARY RECIRC INVENTORY FROM SYSTEM UNTIL REDUNDANT VALVE(S) CLOSED LOCALLY	*NORMAL POSITION. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI
04.3.07.04.2	CV-100 CV-100A CV-100B	SV-81	OFF (CLOSED)	CV-100, 100A, 100B CLOSE, ISOLATING S/G BLOWDOWN TO FLASH TANK AND OUTFALL	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
04.3.07.05.1	CV-100 CV-100A CV-100B	APW1 (RELAT)	CONTACTS OPEN (ON)	(SAME AS 4.3.7.4.2)	(SAME AS 4.3.7.4.2)	(SAME AS 4.3.7.4.2)	(SAME AS 4.3.7.4.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONOPRR UNIT 1
TABLE 4-1: SECONDARY RECIRCULATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
04.3.07.05.2	CV-100 CV-100A CV-100B	APWZ (RRLAT)	CONTACTS CLOSED (OFF)	S/G BLOWDOWN WILL NOT ISOLATE AUTOMATICALLY ON APWAS-A OR APWAS-B, MANUAL CONTROL UNAPERCIBED	PERIODIC TESTING	CONTROL ROOM HANDSWITCH FOR REMOTE MANUAL CONTROL	POTENTIAL DIVERSION OF SECONDARY RECIRC INVENTORY FROM SYSTEM UNTIL VALVES CLOSED	*NORMAL POSITION, BLOWDOWN ISOLATION NOT ADDRESSED IN BOI SYSTEM UNTIL VALVES CLOSED REMOTE-MANUALLY
04.3.07.06.1	CV-100 CV-100A CV-100B	125VDC BUS #1 (72-121)	VOLTS LOW	SV-84 DE-EMERGIZES, CLOSING CV-100, 100A, 100B, THEREBY ISOLATING S/G BLOWDOWN TO FLASH TANK AND OUTFALL	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
04.3.07.07.1	CV-100 CV-100A CV-100B	ISA	PRESSURE LOW	CV-100, 100A, 100B FAIL CLOSED, ISOLATING S/G BLOWDOWN TO FLASH TANK AND OUTFALL	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
04.3.08.01.1	LT-1950		OUTPUT HIGH	LOCAL INDICATION DISABLED FOR RWST LEVEL (USED FOR MANUAL MODULATION OF CRS-336)	CONTROL ROOM INDICATION	REDUNDANT CONTROL ROOM INSTRUMENTS FOR RWST LEVEL	LOCAL INDICATION DISABLED FOR RWST LEVEL	LOCAL MECHANICAL INSTRUMENT FOR RWST LEVEL. CONTROL ROOM INSTRUMENTATION INCLUDES PNEUMATIC INSTRUMENT LT-950 AND TRAIN B POWERED INSTRUMENT LT-3020
04.3.08.01.2	LT-1950		OUTPUT LOW	(SAME AS 4.3.8.1.1)	(SAME AS 4.3.8.1.1)	(SAME AS 4.3.8.1.1)	(SAME AS 4.3.8.1.1)	

TABLE 4-2: SECONDARY RECIRCULATION BOUNDARY VALVE ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
BOUNDARY VALVE ANALYSIS

ITEM #	--- SAFETY RELATED BOUNDARY ---			--- SAFETY RELATED BACKUP ---			--- NON-SAFETY RELATED BACKUP ---			REMARKS
	TAG #	MC/AUTO?	LOCKED?	TAG #	MC/AUTO?		TAG #	MC/AUTO?		
04.1.01 (NONE)										* SEE TABLES 1-2 (SI), 2-2 (CLR), 5-2 (CONTAINMENT SPRAI) FOR TRAIN A AND B BOUNDARY VALVES
04.2.01 (NONE)										* SEE TABLES 1-2 (SI), 2-2 (CLR), 5-2 (CONTAINMENT SPRAI) FOR TRAIN A AND B BOUNDARY VALVES
04.3.01	CBS-425	OPRN	TBS	CBS-426 AND: CBS-316 OR NOV-1100B/D + VCC-326	OPRN	NONE				* RWST/RECIRC SUCTION PATH ISOLATION TO CHARGING PUMPS. BOI DOES NOT REQUIRE CLOSURE OF VCC-326 OR PROVIDE RESPONSE-NOT-OBTAINED OPTIONS FOR NOV-1100B/D
04.3.02	CBS-389	CLOSED	NO	PNU-356, BAS-360 (CHRC VALVES), CBS-384	CLOSED	NONE				* MAKEUP ISOLATION TO RWST AND SPENT PULB POOL
04.3.03	CBS-383	CLOSED	NO	NONE		CAP/PLANGE				* RWST FILTER PUMP DISCHARGE VENT. VALVE AND PIPING ARE NON-SAFETY RELATED
04.3.04	CBS-380	CLOSED	NO	NONE		CAP/PLANGE				* RWST FILTER PUMP DISCHARGE VENT. VALVE AND PIPING ARE NON-SAFETY RELATED
04.3.05	CBS-315	CLOSED	NO	CBS-311, 312		CLOSED	NONE			* RWST FILTER PUMP BYPASS ISOLATION. VALVE AND PIPING ARE NON-SAFETY RELATED. VALVE CBS-313 WOULD ALIGN FLOW TO RWST VIA G-60 SUCTION (IF OPN) AS REQUIRED FOR SECONDARY RECIRC FUNCTION
04.3.06	CBS-376	CLOSED	NO	NONE		NONE				* RWST FILTER DRAIN TO AUX BLDG PUMP VIA RWST OVERFLOW
04.3.07	CBS-371	CLOSED	NO	NONE		CBS-372		CLOSED		* RWST FILTER PUMP VENT. VALVE AND PIPING ARE NON-SAFETY RELATED
04.3.08	CBS-364	CHCK	NO	NONE REQUIRED						* RWST FILTER PUMP DISCHARGE CHECK VALVE. VALVE WOULD ALIGN FLOW TO RWST VIA G-60 SUCTION (IF OPEN) AS REQUIRED FOR SECONDARY RECIRC FUNCTION
04.3.09	CBS-373	CLOSED	NO	NONE		RVL-508		CLOSED		* RWST FILTER PUMP DISCHARGE TO RADWASTE ION EXCHANGER SYSTEM. VALVE AND PIPING ARE NON-SAFETY RELATED
04.3.10	CBS-374	CLOSED	NO	SFP-325		CLOSED	NONE			* RWST FILTER PUMP DISCHARGE TO RADWASTE ION EXCHANGER SYSTEM
04.3.11	SCP-359	CHCK	NO	NONE REQUIRED						* S/G A CHEMICAL INJECTION
04.3.12	SCP-398	CHCK	NO	NONE REQUIRED						* S/G B CHEMICAL INJECTION
04.3.13	SCP-358	CHCK	NO	NONE REQUIRED						* S/G C CHEMICAL INJECTION
04.3.14	APW-321	CHCK	NO	NONE REQUIRED						* S/G A AUX FW LINE
04.3.15	APW-447	CLOSED	NO	NONE		CAP				* S/G A APW FW LINE DRAIN
04.3.16	APW-322	CHCK	NO	NONE REQUIRED						* S/G B AUX FW LINE
04.3.17	APW-398	CLOSED	NO	NONE		CAP				* S/G B APW FW LINE DRAIN
04.3.18	APW-324	CHCK	NO	NONE REQUIRED						* S/G C AUX FW LINE
04.3.19	APW-370	CLOSED	NO	NONE		CAP				* S/G C APW FW LINE DRAIN
04.3.20	FWS-009	CLOSED	NO	NONE		CAP				* S/G A MAIN FW LINE DRAIN
04.3.21	FWS-008	CLOSED	NO	NONE		CAP				* S/G B MAIN FW LINE DRAIN
04.3.22	FWS-014	CLOSED	NO	NONE		CAP				* S/G C MAIN FW LINE DRAIN
04.3.23	MSS-003	CLOSED	NO	NONE		MSS-001		CLOSED		* S/G A SECONDARY SIDE DRAIN
04.3.24	MSS-012	CLOSED	NO	NONE		MSS-010		CLOSED		* S/G B SECONDARY SIDE DRAIN
04.3.25	MSS-004	CLOSED	NO	NONE		MSS-002		CLOSED		* S/G C SECONDARY SIDE DRAIN

SECTION 5: CONTAINMENT SPRAY

CONTAINMENT SPRAY AND HYDRAZINE INJECTION NOTES

1. Item numbers in this section have been assigned as follows:
 - 05.1: Train A pumping, flow path and boundary devices
 - 05.2: Train B pumping, flow path and boundary devices
 - 05.3: Common flow path and boundary devices.
2. Table 5-1 is the Failure Modes and Effects Analysis (FMEA) for the Containment Spray and Hydrazine Injection functions. Table 5-2 is the associated boundary valve analysis.
3. The boundary valve analysis for those portions of the Containment Recirculation and Spray system common to Cold Leg Recirculation is contained in Table 2-2.
4. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.
5. Potential single failure susceptibilities in the Boundary Valve Analysis table are flagged with "*" in the unlabelled field adjacent to REMARKS. Items flagged with "#" in the unlabelled field adjacent to REMARKS are acceptable from a single failure standpoint subject to credit for SEP Topic III-6 seismic boundary criteria.

CONTAINMENT SPRAY AND HYDRAZINE INJECTION REFERENCES

Piping and Instrumentation Diagrams

5178110 RCP Seal Water System (Sh 1)
5178120 Containment Spray and Recirculation System (Sh 1)
5178121 Containment Spray and Recirculation System (Sh 2)
5178125 Containment Spray Hydrazine Addition System
5178400 Gaseous Nitrogen System (Sh 1)
5178443 Instrument and Service Air System (Sh 4)
5178449 Instrument and Service Air System (Sh 10)

Elementary Diagrams

64346 Hydrazine Additive Pumps
64354 Containment Spray Actuation System Train A (Sh 1)
64355 Containment Spray Actuation System Train A (Sh 2)
64356 CV-82 and CV-114
64357 Refueling Water Pumps
64359 SV-600
64361 SV-601
64363 CV-517
64365 CSAS Train B
64369 CV-518
64374 MOV-883
64383 CSAS Inverter System
455693 CV-92
5130826 Containment Spray and Hydrazine Addition Control System Train A (Sh 1)
5130827 Containment Spray and Hydrazine Addition Control System Train A (Sh 2)
5130876 4.16 kV Buses Undervoltage and Generator Underfrequency Relays
5159793 Containment Spray and Hydrazine Addition Control System Train B (Sh 1)
5180775 Containment Spray and Hydrazine Addition Control System Train B (Sh 2)

Procedures

SO1-1.0-20 Loss of Reactor Coolant
SO1-1.0-23 Transfer to Cold Leg Injection and Recirculation
SO1-1.0-24 Transfer to Hot Leg Recirculation
SO1-1.0-30 Loss of Secondary Coolant
SO1-4-41 Containment Spray and Recirculation System Alignment
SO1-14-40 Control of Locked Valves
SO1-12.3-35 Containment Spray and Recirculation System Safety Related Alignment

Other Documents

SD-SO1-580 System Description: Safety Injection, Recirculation and Containment Spray Systems
SD-SO1-590 System Description: Safeguard Load Sequencing System
M89048 Response to Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety Related Systems", dated July 5, 1989

TABLE 5-1: CONTAINMENT SPRAY FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.1.01.01.1	MANUAL VALVES, TRAIN A FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	INCLUDES CBS-302, 305, 310 (MINIFLOW), SNA-302, 304, 306 (HYDRAZINE)
05.1.01.01.2	MANUAL VALVES, TRAIN A FLOW		CLOSED	TRAIN A CONTAINMENT SPRAY OR HYDRAZINE PUMPING SUCTION, DISCHARGE OR MINIFLOW ISOLATED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	LOSS OF TRAIN A CONTAINMENT SPRAY AND HYDRAZINE ADDITION PUMPING	
05.1.01.02.1	CHECK VALVES, TRAIN A FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES CBS-304, SNA-306
05.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	DIVERSION OF TRAIN A HYDRAZINE FLOW TO HYDRAZINE TANK OR LOSS OF HYDRAZINE INVENTORY TO ATMOSPHERE	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR FLOW RATE, NONE FOR INVENTORY	LOSS OF TRAIN A HYDRAZINE FLOW OR REDUCTION IN DURATION OF HYDRAZINE FLOW FOR BOTH TRAINS DUE TO INVENTORY LOSS THROUGH UNLOCKED VALVES	SEE TABLE 5-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
05.1.02.01.2	MANUAL VALVES, TRAIN A BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
05.1.02.02.1	CHECK OR RELIEF VALVES, TRAIN A BOUNDARY		NORMAL (PASSIVE)	NONE. VALVE OPENS TO RECIRC G-200A FLOW TO HYDRAZINE TANK ONLY IF SV-600 REMAINS CLOSED	PERIODIC TESTING	NONE REQUIRED	NONE	INCLUDES RV-2003A. VALVE SETPOINT VERIFIED AS PART OF ASRS II IST
05.1.03.01.1	G-27N	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN A FLOW FOR CONTAINMENT SPRAY AND ALTERNATE HOT LEG RECIRC	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR CONTAINMENT SPRAY AND ALTERNATE HOT LEG RECIRC	
05.1.03.02.1	G-27N	SWGR #1 (52-1119)	OPEN	TRAIN A SPRAY PUMP FAILS TO START OR TRIPS IF RUNNING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR CONTAINMENT SPRAY AND ALTERNATE HOT LEG RECIRC	
05.1.03.02.2	G-27N	SWGR #1 (52-1119)	CLOSED	TRAIN A SPRAY PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON)	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER FOR SISLOP OR INABILITY TO TRIP FOR RECIRCULATION	NOTE SPECIFY AT MOST 1 SPRAY PUMP RUNNING IN RECIRC, DUE TO RECIRC PUMP FLOW LIMITATIONS
05.1.03.03.1	G-27N	AP95 (RELAY)	ON	TRAIN A SPRAY PUMP TRIPS ON BUS UNDERVOLTAGE AND MOTOR OVERLOAD DEPRATED, AUTO START SIGNAL SEALED-IN, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, OVERRIDE FOR PUMP TRIP FOR RECIRCULATION AFTER SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER FOR SISLOP	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.1.03.03.2	G-27N	AP95 (RELAY)	OFF	TRAIN A SPRAY PUMP AUTO-START AND UNDERVOLTAGE/OVERLOAD TRIP DEPRAT DISABLED. MANUAL START UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR INJECTION, MANUAL START OR REDUNDANT TRAIN FOR RECIRCULATION	INOPERABILITY OF TRAIN A FOR INJECTION MODE CONTAINMENT SPRAY, NONE FOR RECIRCULATION (DUE TO MANUAL START CAPABILITY)	
05.1.03.04.1	G-27N	AP96 (RELAY)	ON (CONTACTS OPEN)	TRAIN A SPRAY PUMP MANUAL TRIP DEPRATED, PUMP CANNOT BE TRIPPED SICHTP VIA OVERRIDE AFTER AP95 RELAY ENERGIZED ON CSAS	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, OVERRIDE FOR PUMP TRIP DURING RECIRC	NONE	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.1.03.04.2	G-27N	AP96 (RELAY)	OFF (CONTACTS CLOSED)	TRAIN A SPRAY PUMP MANUAL TRIP NOT DEPRATED ON CSAS	PERIODIC TESTING	AUTO-START SIGNAL, REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CONTAINMENT SPRAY PUMPING	NORMAL POSITION DURING OPERATION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.1.03.05.1	G-27M	127-5X1 (UV RELAY)	CONTACTS OPEN	TRAIN A SPRAY PUMP UNDERVOLTAGE TRIP DEPRATED, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR HIBLOP IF PUMP ALREADY RUNNING. NO EFFECT ON AUTO-START IF INITIALLY OFF	PERIODIC TESTING	REDUNDANT TRAIN FOR HIBLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER FOR HIBLOP, NONE FOR SIS	
05.1.03.05.2	G-27M	127-511 (UV RELAY)	CONTACTS CLOSED	TRAIN A SPRAY PUMP UV TRIP SIGNAL, PREVENTING MANUAL START. AUTO-START AND OVERRIDE FUNCTIONS UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CONTAINMENT SPRAY AND ALY HOT LEG RECIRC PUMPING	
05.1.03.06.1	G-27M	5VGR #1 125VDC CONTROL POWER	VOLTS LOW	PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON)	POTENTIAL LOSS OF TRAIN A CONTAINMENT SPRAY AND HYDRAZINE PUMPING OR INABILITY TO TRIP SPRAY PUMP FOR RECIRCULATION	
05.1.04.01.1	CV-517	VALVE/ACTUATOR	OPEN	VALVE OPENS FOR INJECTION BUT CANNOT BE RECLOSURE FOR RECIRCULATION	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR INJECTION, REDUNDANT RECIRC PUMPS FOR RECIRCULATION CAPACITY	NONE FOR INJECTION, INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF SINGLE RECIRC PUMP PER DOI	*INCLUDES PT-2517. NORMAL POSITION. DOI DOES NOT CURRENTLY REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED BY HYDRAULIC CALC HCT34-012 SUPPL D
05.1.04.01.2	CV-517	VALVE/ACTUATOR	CLOSED	VALVE DOES NOT OPEN FOR INJECTION MODE SPRAY FLOW, REMAINS IN RECIRC ALIGNMENT	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT HI-FLOW PATH THROUGH 1 OF 2 REDUNDANT HI-FLOW SPRAY CV-518 FOR INJECTION MODE, NONE REQUIRED FOR RECIRC MODE	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS IMPROBABLE FOR INJECTION, NO EFFECT ON RECIRC	
05.1.04.02.1	CV-517	AVS7 (RELAY)	CONTACTS CLOSED (ON)	CSAS OPEN SIGNAL TO VALVE, NO EFFECT ON MANUAL CLOSE DEPRAT OR OVERRIDE FUNCTIONS	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, OVERRIDE FOR RECIRC	NONE	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.1.04.02.2	CV-517	AVS7 (RELAY)	CONTACTS OPEN (OFF)	CSAS SIGNAL DEPRATED TO CV-517 AUTO-OPEN AND OVERRIDE. MANUAL OPEN AND CLOSE DEPRAT UNAFFECTED, SO THAT VALVE CANNOT BE RECLOSURE IF MANUALLY OPENED	PERIODIC TESTING	REDUNDANT VALVE FOR INJECTION, REDUNDANT RECIRC PUMPS AND PRIMARY PATH FOR HOT LEG RECIRC	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS POTENTIALLY IMPROBABLE FOR INJECTION, POTENTIAL INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF ONE RECIRC PUMP, AFFECTING PUMP HEAD FOR ALTERNATE HLR PATH	*NORMAL POSITION. DOI DOES NOT CURRENTLY REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED BY HYDRAULIC CALC HCT34-012 SUPPL D
05.1.04.03.1	CV-517	AVS8 (RELAY)	CONTACTS OPEN (ON)	MANUAL CLOSE DEPRATED, OVERRIDE AND AUTO/MANUAL OPEN UNAFFECTED	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, OVERRIDE FOR RECIRCULATION	NONE	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.1.04.03.2	CV-517	AVS8 (RELAY)	CONTACTS CLOSED (OFF)	MANUAL CLOSE DEPRAT DISABLED. OVERRIDE AND AUTO/MANUAL OPEN UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A HI-FLOW SPRAY PATH	NORMAL POSITION
05.1.04.04.1	CV-517	RMS-2059	CONTACTS CLOSED	CV-517 AND CV-518 CLOSE, CANNOT BE BROPPENED IF FIS-520, FIS-521 LOOPS SEE HIGH/LOW RECIRC PUMP FLOW COMBINATION	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	SPRAY FLOW LIMITER CIRCUIT INCLUDES FIS-520/521 LOOPS, AND ISOL RELAY 113V84 TO CV-518. FAILURE HAS NO CONSEQUENCE SINCE BOTH LOOPS SEE LO RECIRC PP FLO DURING INJECTION (IE, RECIRC PUMPS OFF), AND CV-517/518 ARE CLOSED FOR RECIRC. LOOP PTS ARE ALSO RC

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION AREA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.1.04.04.2	CV-517	RMS-2059	CONTACTS OPEN	SPRAY FLOW LIMITER DISABLED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
05.1.04.05.1	CV-517	VITAL BUS #1 (0-1113V)	VOLTS LOW	CV-517 FAILS CLOSED, CANNOT BE REOPENED	CONTROL INDICATION	REDUNDANT HI-FLOW PATH THROUGH CV-518 FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS INOPERABLE FOR INJECTION, NO EFFECT ON RECIRCULATION	
05.1.04.06.1	CV-517	ISA	PRESSURE LOW	CV-517 DRIFTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE, CANNOT BE REOPENED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-518 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP IF CLOSED, BUT TECH SPEC CHANGE REQD. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBOCA) TO REMAIN BOUNDED BY ANALYSIS
05.1.05.01.1	CV-82	VALVE/ACTUATOR	OPEN	VALVE OPEN FOR CONTAINMENT SPRAY BUT CANNOT BE RECLOSED FOR CONTAINMENT ISOLATION	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY OR INJECTION MODE, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL IN SPRAY RISER FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*INCLUDES SV-120, ZSO/C-1002. *BOI PERMITS SPRAY PUMPS TO BE TRIPPED AFTER PRESSURE REDUCTION POST-LOCA. VALVE FAILURE ON LOSS OF AIR NOT CONSISTENT WITH BASIS FOR ACCEPTANCE OF PENETRATION CONFIGURATION UNDER SRP TOPIC VI-4.
05.1.05.01.2	CV-82	VALVE/ACTUATOR	CLOSED	VALVE WILL NOT OPEN MANUALLY OR AUTOMATICALLY ON CSAS FOR CONTAINMENT SPRAY	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE	1 OF 2 REDUNDANT CONTAINMENT SPRAY PATHS INOPERABLE	NORMAL POSITION
05.1.05.02.1	CV-82	AV55 (RELAY)	CONTACTS CLOSED (ON)	CSAS OPEN SIGNAL TO VALVE	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 5.1.5.1.1)	(SAME AS 5.1.5.1.1)	
05.1.05.02.2	CV-82	AV55 (RELAY)	CONTACTS OPEN (OFF)	CSAS SIGNAL TO CV-82 AUTO-OPEN DEPRATED. NO EFFECT ON MANUAL CLOSE DEPRAT OR MANUAL OPEN	PERIODIC TESTING	REDUNDANT VALVE FOR INJECTION, MANUAL OPEN OR REDUNDANT VALVE FOR RECIRCULATION	1 OF 2 REDUNDANT CONTAINMENT SPRAY PATHS INOPERABLE FOR INJECTION MODE	NORMAL POSITION
05.1.05.03.1	CV-82	AV56 (RELAY)	CONTACTS OPEN (ON)	CV-82 MANUAL CLOSE DEPRATED. NO EFFECT ON MANUAL OR AUTO-OPEN	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 5.1.5.1.1)	(SAME AS 5.1.5.1.1)	
05.1.05.03.2	CV-82	AV56 (RELAY)	CONTACTS CLOSED (OFF)	CV-82 MANUAL CLOSE DEPRAT DEPRATED	PERIODIC TESTING	REDUNDANT VALVE	REDUCED RELIABILITY OF TRAIN A CONTAINMENT SPRAY PATH	
05.1.05.04.1	CV-82	VITAL BUS #1 (0-1111V)	VOLTS LOW	CV-82 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION POST-LOCA. NOT CONSISTENT WITH SRP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF CONTAINMENT ISOLATION CONFIGURATION FOR THE SPRAY PENETRATION
05.1.05.05.1	CV-82	ISA	PRESSURE LOW	CV-82 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION. NOT CONSISTENT WITH SRP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF THE ISOLATION CONFIGURATION FOR THIS PENETRATION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.1.06.01.1	G-200A	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN A HYDRAZINE FLOW TO SPRAY PUMP DISCHARGE HEADER	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN A HYDRAZINE PUMPING	
05.1.06.01.2	G-200A	PUMP/MOTOR	RQ	TRAIN A HYDRAZINE PUMP MOTOR FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING AFTER 2 HOURS FOLLOWING CSAS ENSURES MINIMUM 2 HR OPERATION	
05.1.06.02.1	G-200A	HCC-1 (42-1153)	OPEN	TRAIN A HYDRAZINE PUMP FAILS TO START OR TRIPS IF RUNNING	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN A HYDRAZINE PUMPING	ADDITIONAL HYDRAZINE DELIVERY. MOTOR CONTROLLER BREAKER PRECLUDES (b)(2) IMPACT ON OTHER ECC LOADS
05.1.06.02.2	G-200A	HCC-1 (42-1153)	CLOSED	TRAIN A HYDRAZINE PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING	CONTROL ROOM INDICATION	REDUNDANT VALVE CONTROLS TO PREVENT FLOW UNTIL REQUIRED, REDUNDANT TRAIN TO PROVIDE FLOW FOR SISLOP	REDUCED RELIABILITY OF TRAIN A ELECTRICAL POWER FOR SISLOP, HYDRAZINE SYSTEM ISOLATION FOR SIS AND SISLOP	SMALL MOTOR SIZE NOT EXPECTED TO RESULT IN ACTUAL LOSS OF TRAIN A BUS DURING SISLOP
05.1.06.03.1	G-200A	APS1 (RELAY)	CONTACTS OPEN (OFF)	TRAIN A HYDRAZINE PUMP AUTO-START DEPRATED, MANUAL START UNAPPECTED	PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN A HYDRAZINE PUMPING	NORMAL POSITION
05.1.06.03.2	G-200A	APS1 (RELAY)	CONTACTS CLOSED (ON)	TRAIN A HYDRAZINE PUMP AUTO-START SIGNAL SEALED-IN. OVERRIDE, LOW LEVEL AND MANUAL TRIPS UNAPPECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP	(SAME AS 5.1.6.3.2)	
05.1.06.04.1	G-200A	APS2 (RELAY)	CONTACTS CLOSED (OFF)	TRAIN A HYDRAZINE PUMP MANUAL TRIP DEPRATED	PERIODIC TESTING	REDUNDANT PUMP	REDUCED RELIABILITY OF TRAIN A HYDRAZINE PUMPING	NORMAL POSITION
05.1.06.04.2	G-200A	APS2 (RELAY)	CONTACTS OPEN (ON)	TRAIN A HYDRAZINE PUMP MANUAL TRIP DEPRATED, PUMP CANNOT BE TRIPPED MANUALLY EXCEPT VIA OVERRIDE AFTER APS1 RELAY ENERGIZED ON CSAS. LOW LEVEL TRIP UNAPPECTED	PERIODIC TESTING	NONE REQUIRED	NONE	
05.1.06.05.1	G-200A	LIS-500A LOOP	OUTPUT OPEN (OFF)	TRAIN A HYDRAZINE PUMP LOW LEVEL TRIP DEPRATED, MANUAL TRIP UNAPPECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. EQUIPMENT PROTECTION FUNCTION ONLY
05.1.06.05.2	G-200A	LIS-500A LOOP	OUTPUT CLOSED (ON)	TRAIN A HYDRAZINE PUMP LOW LEVEL TRIP SIGNAL SEALED-IN. PUMP WILL TRIP IF RUNNING AND CANNOT BE RESTARTED (SAME AS 5.1.6.5.1)	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN A HYDRAZINE PUMPING	
05.1.06.05.3	G-200A	LIS-500A LOOP	INPUT OPEN	BLOWS SUPPLY PUSB, CAUSING LOSS OF POWER TO PT-501, PIS-500, LIS-500A, PIS-510 AND PIS-520, -521, -522 LOOPS. RESULTS IN LOSS OF CH A INPUT TO TRAIN A/B CSAS LOGIC, DEPRAT OF LOW LEVEL TRIP FOR G-200A, AND LOW FLOW SIGNALS TO FLOW LIMITER	(SAME AS 5.1.6.5.1) CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 5.1.6.5.1) REDUNDANT INPUTS FOR CSAS LOGIC, REDUNDANT HYDRAZINE PUMP	(SAME AS 5.1.6.5.1) LOSS OF 1 OF 3 CONTAINMENT HI-HI PRESSURE INPUTS TO TRAIN A AND B CSAS LOGIC, REDUCED RELIABILITY OF TRAIN A HYDRAZINE PUMP	PIS-520 AND PIS-521 BOTH FAIL LOW, ENSURING THAT SPRAY FLOW LIMITER CANNOT DISABLE CV-511 AND CV-510 EVEN IF ARMED

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION PMBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.1.06.05.5	G-200A	LIS-500A LOOP	RQ	MAY CAUSE SPURIOUS LOW LEVEL SIGNAL TO TRAIN A HYDRAZINE PUMP 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING AFTER 2 HOURS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. LIS-500A DEVICE PROVIDES ISOLATION OF NON-RQ INTS FROM OTHER LOADS ON SAME POWER SUPPLY
05.1.06.06.1	G-200A	VITAL BUS #1 (8-1116V)	VOLTS LOW	LOSS OF POWER TO PT-501, PIS-511, PIS-500, LIS-500A, PIS-510 AND PIS-520 AND -521 LOOPS, CAUSING LOW CH. A CONTAINMENT PRESSURE SIGNAL TO CSAS A/B LOGIC, AND DEPRATING LOW LEVEL TRIP OF TRAIN A HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CHANNELS FOR CSAS, REDUNDANT HYDRAZINE PUMP	LOSS OF 1 OF 3 REDUNDANT CONTAINMENT BI-BI PRESSURE INPUTS TO CSAS TRAIN A/B LOGIC AND REDUCED RELIABILITY OF TRAIN A HYDRAZINE PUMP	
05.1.07.01.1	SV-600	VALVE/ACTUATOR	OPEN	VALVE ALIGNS FOR TRAIN A HYDRAZINE FLOW, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	REDUNDANT PUMP CONTROLS TO PREVENT FLOW UNTIL REQUIRED	REDUCED RELIABILITY AGAINST SPURIOUS HYDRAZINE SYSTEM ACTUATION	SPURIOUS SYSTEM ACTUATION WOULD DEplete HYDRAZINE INVENTORY SUCH THAT DOSE CALC ASSUMPTIONS COULD NOT BE MET FOR A SUBSEQUENT LOCA NORMAL POSITION
05.1.07.01.2	SV-600	VALVE/ACTUATOR	CLOSED	VALVE DOES NOT OPEN FOR TRAIN A HYDRAZINE FLOW	PERIODIC TESTING	REDUNDANT TRAIN	IMOPERABILITY OF TRAIN A HYDRAZINE INJECTION	
05.1.07.01.3	SV-600	VALVE/ACTUATOR	RQ	TRAIN A HYDRAZINE ISOLATION VALVE FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE FLOW AFTER 2 HRS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. PUST PROVIDED (b)(2) PROTECTION OF OTHER DC BUS LOADS
05.1.07.02.1	SV-600	AVS2 (RELAY)	CONTACTS OPEN (OFF)	TRAIN A HYDRAZINE ISOLATION VALVE AUTO-OPEN AND OVERRIDE DEPRATED, MANUAL OPEN UNAPPECTED	PERIODIC TESTING	(SAME AS 5.1.7.1.2)	(SAME AS 5.1.7.1.2)	NORMAL POSITION
05.1.07.02.2	SV-600	AVS2 (RELAY)	CONTACTS CLOSED (ON)	TRAIN A HYDRAZINE ISOLATION VALVE AUTO-OPEN SIGNAL AND OVERRIDE PERMISSIVE SEALED-IN	CONTROL ROOM INDICATION	(SAME AS 5.1.7.1.1)	(SAME AS 5.1.7.1.1)	
05.1.07.03.1	SV-600	AVS1 (RELAY)	CONTACTS CLOSED (OFF)	TRAIN A HYDRAZINE ISOLATION VALVE MANUAL CLOSE DEPRAT DEPRATED	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A HYDRAZINE ADDITION	NORMAL POSITION
05.1.07.03.2	SV-600	AVS1 (RELAY)	CONTACTS OPEN (ON)	TRAIN A HYDRAZINE ISOLATION VALVE MANUAL CLOSE DEPRATED, VALVE CANNOT BE CLOSED RECPT VIA OVERRIDE AFTER AVS2 EMERGIZED ON CSAS	PERIODIC TESTING	(SAME AS 5.1.7.1.1)	(SAME AS 5.1.7.1.1)	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.1.07.04.1	SV-600	125VDC BUS #1 (72-122)	VOLTS LOW	TRAIN A HYDRAZINE ISOLATION VALVE FAILS CLOSED, CANNOT BE REOPENED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	IMOPERABILITY OF TRAIN A HYDRAZINE ADDITION	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.2.01.01.1	HANDVAL VALVES, TRAIN B FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	INCLUDES CRS-301, 307, 320 (MINIFLOW), SBA-301, 303, 307 (HYDRAZINE)
05.2.01.01.2	HANDVAL VALVES, TRAIN B FLOW		CLOSED	TRAIN B CONTAINMENT SPRAY OR HYDRAZINE PUMPING SUCTION, DISCHARGE OR MINIFLOW ISOLATED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	LOSS OF TRAIN B CONTAINMENT SPRAY AND HYDRAZINE ADDITION PUMPING	
05.2.01.02.1	CHECK VALVES, TRAIN B FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES CRS-305, SBA-305
05.2.02.01.1	HANDVAL VALVES, TRAIN B BOUNDARY		OPEN	DIVERSION OF TRAIN B HYDRAZINE FLOW TO HYDRAZINE TANK OR LOSS OF HYDRAZINE INVENTORY TO ATMOSPHERE	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR FLOW RATE, NONE FOR INVENTORY	LOSS OF TRAIN B HYDRAZINE FLOW OR REDUCTION IN DURATION OF HYDRAZINE FLOW FOR BOTH TRAINS DUE TO INVENTORY LOSS THROUGH UNLOCKED VALVES	SEE TABLE 5-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
05.2.02.01.2	HANDVAL VALVES, TRAIN B BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
05.2.02.02.1	CHECK OR RELIEF VALVES, TRAIN B BOUNDARY		NORMAL (PASSIVE)	NONE. VALVE OPENS TO RECIRC G-200B FLOW TO HYDRAZINE TANK ONLY IF SV-601 REMAINS CLOSED	PERIODIC TESTING	NONE REQUIRED	NONE	INCLUDES RV-2003B. VALVE SETPOINT VERIFIED AS PART OF ASB II 1ST
05.2.03.01.1	G-278	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN B FLOW FOR CONTAINMENT SPRAY AND ALTERNATE HOT LEG RECIRC	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR CONTAINMENT SPRAY AND ALTERNATE HOT LEG RECIRC	
05.2.03.02.1	G-279	SMGR #2 (52-1219)	OPEN	TRAIN B SPRAY PUMP FAILS TO START OR TRIPS IF RUNNING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR CONTAINMENT SPRAY AND ALTERNATE HOT LEG RECIRC	
05.2.03.02.2	G-279	SMGR #2 (52-1219)	CLOSED	TRAIN B SPRAY PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON)	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER FOR SISLOP OR INABILITY TO TRIP FOR RECIRCULATION	ROI: SPECIFY AT MOST 1 SPRAY PUMP RUNNING IN RECIRC, DUE TO RECIRC PUMP FLOW LIMITATIONS
05.2.03.03.1	G-278	BP95 (RELAY)	ON	TRAIN B SPRAY PUMP TRIPS ON BUS UNDERVOLTAGE OR MOTOR OVERLOAD DEPRATED, AUTO START SIGNAL BRAKE-IN, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, OVERRIDE FOR PUMP TRIP FOR RECIRCULATION AFTER SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER FOR SISLOP	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.2.03.03.2	G-279	BP95 (RELAY)	OFF	TRAIN B SPRAY PUMP AUTO-START AND UNDERVOLTAGE/OVERLOAD TRIP DEPRAT DISABLED. MANUAL START UNAPFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR INJECTION, MANUAL START OR REDUNDANT TRAIN FOR RECIRCULATION	INOPERABILITY OF TRAIN B FOR INJECTION MODE CONTAINMENT SPRAY, NONE FOR RECIRCULATION (DUE TO MANUAL START CAPABILITY)	
05.2.03.04.1	G-278	BP96 (RELAY)	ON (CONTACTS OPEN)	TRAIN B SPRAY PUMP MANUAL TRIP DEPRATED, PUMP CANNOT BE TRIPPED RECEIPT VIA OVERRIDE AFTER BP95 RELAY ENERGIZED ON CSAS	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, OVERRIDE FOR PUMP TRIP DURING RECIRC	NONE	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.2.03.04.2	G-279	BP96 (RELAY)	OFF (CONTACTS CLOSED)	TRAIN B SPRAY PUMP MANUAL TRIP NOT DEPRATED ON CSAS	PERIODIC TESTING	AUTO-START SIGNAL, REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B CONTAINMENT SPRAY PUMPING	NORMAL POSITION DURING OPERATION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.2.03.05.1	G-278	127-611 (UV RELAY)	CONTACTS OPEN	TRAIN B SPRAY PUMP UNDERVOLTAGE TRIP DEPRATED, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP IF PUMP ALREADY RUNNING. NO EFFECT ON AUTO-START IF INITIALLY OFF	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER FOR SISLOP, NONE FOR SIS	
05.2.03.05.2	G-278	127-611 (UV RELAY)	CONTACTS CLOSED	TRAIN B SPRAY PUMP UV TRIP SIGNAL, PREVENTING MANUAL START. AUTO-START AND OVERRIDE FUNCTIONS UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B CONTAINMENT SPRAY AND ALT HOT LEG RECIRC PUMPING	
05.2.03.06.1	G-278	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON)	POTENTIAL LOSS OF TRAIN B CONTAINMENT SPRAY AND HYDRAZINE PUMPING OR INABILITY TO TRIP SPRAY PUMP FOR RECIRCULATION	
05.2.04.01.1	CV-518	VALVE/ACTUATOR	OPEN	VALVE OPENS FOR INJECTION BUT CANNOT BE RECLOSED FOR RECIRCULATION	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION, REDUNDANT RECIRC PUMPS FOR RECIRCULATION CAPACITY	NONE FOR INJECTION, INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF SINGLE RECIRC PUMP PER ROI	*INCLUDES PT-3518. NORMAL POSITION. ROI DOES NOT CURRENTLY REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED BY HYDRAULIC HC734-012 SUPPL D
05.2.04.01.2	CV-518	VALVE/ACTUATOR	CLOSED	VALVE DOES NOT OPEN FOR INJECTION MODE SPRAY FLOW, REMAINS IN RECIRC ALIGNMENT	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT HI-FLOW PATH THROUGH CV-517 FOR INJECTION MODE, NONE REQUIRED FOR RECIRC MODE	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS IMPROPERABLE FOR INJECTION, NO EFFECT ON RECIRC	
05.2.04.02.1	CV-518	BV87 (RELAY)	CONTACTS CLOSED (ON)	CSAS OPEN SIGNAL TO VALVE, NO EFFECT ON MANUAL CLOSE DEPRAT- OR OVERRIDE FUNCTIONS	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, OVERRIDE FOR RECIRC	NONE	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.2.04.02.2	CV-518	BV87 (RELAY)	CONTACTS OPEN (OFF)	CSAS SIGNAL DEPRATED TO CV-518 AUTO-OPEN AND OVERRIDE. MANUAL OPEN AND CLOSE DEPRAT UNAFFECTED, SO THAT VALVE CANNOT BE RECLOSED IF MANUALLY OPENED	PERIODIC TESTING	REDUNDANT VALVE FOR INJECTION, REDUNDANT RECIRC PUMPS AND HOT LEG RECIRC PATH FOR RECIRC	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS POTENTIALLY IMPROPERABLE FOR INJECTION, POTENTIAL INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF ONE RECIRC PUMP, AFFECTING PUMP HEAD FOR ALTERNATE HLR PATH	*NORMAL POSITION. ROI DOES NOT CURRENTLY REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED IN HYDRAULIC CALC HC734-012 SUPPL D
05.2.04.03.1	CV-518	BV88 (RELAY)	CONTACTS OPEN (ON)	MANUAL CLOSE DEPRATED, OVERRIDE AND AUTO/MANUAL OPEN UNAFFECTED	PERIODIC TESTING	NONE REQUIRED FOR INJECTION, OVERRIDE FOR RECIRCULATION	NONE	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.2.04.03.2	CV-518	BV88 (RELAY)	CONTACTS CLOSED (OFF)	MANUAL CLOSE DEPRAT DISABLED. OVERRIDE AND AUTO/MANUAL OPEN UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B HI-FLOW SPRAY PATH	NORMAL POSITION
05.2.04.04.1	CV-518	113VR4 (RELAY)	CONTACTS CLOSED	CV-518 CLOSERS, CANNOT BE REOPENED	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT VALVE FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS DISABLED DURING INJECTION, NO EFFECT ON RECIRCULATION	ISOLATION RELAY FROM NON-EQ SPRAY FLOW LIMITER CIRCUIT IN CV-517 CONTROLS
05.2.04.04.2	CV-518	113VR4 (RELAY)	CONTACTS OPEN	SPRAY FLOW LIMITER SIGNAL DISABLED TO CV-518	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
05.2.04.05.1	CV-518	CSAS INVERTER (102-4)	VOLTS LOW	CV-518 FAILS CLOSED, CANNOT BE REOPENED	CONTROL INDICATION	REDUNDANT HI-FLOW PATH THROUGH CV-517 FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS IMPROPERABLE FOR INJECTION, NO EFFECT ON RECIRCULATION	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS OPERATOR UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION FMEA

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.2.04.06.1	CV-510	ISA	PRESSURE LOW	CV-510 DRIFTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE, CANNOT BE REOPENED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	REDUNDANT VALVE CV-511 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPN OR DECLARED INOP IF CLOSED. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SHALLSTAY IN-LOCA) TO REMAIN BOUNDED BY ANALYSIS. TECH SPEC CHANGE REQUIRED
05.2.05.01.1	CV-114	VALVE/ACTUATOR	OPEN	VALVE OPEN FOR CONTAINMENT SPRAY BUT CANNOT BE RECLOSED FOR CONTAINMENT ISOLATION	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY OR INJECTION MODE, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL IN SPRAY RISER FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	INCLUDES BV-118, ISO/C-1114. DOIC PERMIT SPRAY PUMPS TO BE TRIPPED AFTER PRESSURE REDUCTION POST-LOCA. VALVE FAILURE ON LOSS OF AIR NOT CONSISTENT WITH BASIS FOR ACCEPTANCE OF PENETRATION CONFIGURATION UNDER SSP TOPIC VI-4.
05.2.05.01.2	CV-114	VALVE/ACTUATOR	CLOSED	VALVE WILL NOT OPEN MANUALLY OR AUTOMATICALLY ON CSAS FOR CONTAINMENT SPRAY	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE	1 OF 2 REDUNDANT CONTAINMENT SPRAY PATHS INOPERABLE	NORMAL POSITION
05.2.05.02.1	CV-114	BV95 (RELAY)	CONTACTS CLOSED (ON)	CSAS OPEN SIGNAL TO VALVE	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 5.2.5.1.1)	(SAME AS 5.2.5.1.1)	
05.2.05.02.2	CV-114	BV95 (RELAY)	CONTACTS OPEN (OFF)	CSAS SIGNAL TO CV-114 AUTO-OPEN DEPRATED. NO EFFECT ON MANUAL CLOSE DEPRAT OR MANUAL OPEN	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT VALVE FOR INJECTION, MANUAL OPEN OR REDUNDANT VALVE FOR RECIRCULATION	1 OF 2 REDUNDANT CONTAINMENT SPRAY PATHS INOPERABLE FOR INJECTION MODE	NORMAL POSITION
05.2.05.03.1	CV-114	BV96 (RELAY)	CONTACTS OPEN (ON)	CV-114 MANUAL CLOSE DEPRATED. NO EFFECT ON MANUAL OR AUTO-OPEN	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 5.2.5.1.1)	(SAME AS 5.2.5.1.1)	
05.2.05.03.2	CV-114	BV96 (RELAY)	CONTACTS CLOSED (OFF)	CV-114 MANUAL CLOSE DEPRAT DEPRATED	PERIODIC TESTING	REDUNDANT VALVE	REDUCED RELIABILITY OF TRAIN B CONTAINMENT SPRAY PATH	
05.2.05.04.1	CV-114	VITAL BUS #2 (8-1214V)	VOLTS LOW	CV-114 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	DOIC PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION POST-LOCA. NOT CONSISTENT WITH SSP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF CONTAINMENT ISOLATION CONFIGURATION FOR THE SPRAY PENETRATION
05.2.05.05.1	CV-114	ISA	PRESSURE LOW	CV-114 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	DOIC PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION. NOT CONSISTENT WITH SSP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF THE ISOLATION CONFIGURATION FOR THIS PENETRATION
05.2.06.01.1	G-200B	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN B HYDRAZINE FLOW TO SPRAY PUMP DISCHARGE HEADER	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN B HYDRAZINE PUMPING	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.2.06.01.2	G-200B	PUMP/MOTOR	BQ	TRAIN B HYDRAZINE PUMP MOTOR FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING AFTER 2 HOURS	MINIMUM 2 HR OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. MOTOR CONTROLLER BREAKER PRECLUDES (b)(2) IMPACT ON OTHER ECC LOADS
05.2.06.02.1	G-200B	MCC-2A (42-12A79)	OPEN	TRAIN B HYDRAZINE PUMP FAILS TO START OR TRIPS IF RUNNING	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN B HYDRAZINE PUMPING	
05.2.06.02.2	G-200B	MCC-2A (42-12A79)	CLOSED	TRAIN B HYDRAZINE PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING	CONTROL ROOM INDICATION	REDUNDANT VALVE CONTROLS TO PREVENT FLOW UNTIL REQUIRED. REDUNDANT TRAIN TO PROVIDE FLOW FOR SISLOP	REDUCED RELIABILITY OF TRAIN B ELECTRICAL POWER FOR SISLOP. HYDRAZINE SYSTEM ISOLATION FOR SIS AND SISLOP	SMALL MOTOR SIZE NOT EXPECTED TO RESULT IN ACTUAL LOSS OF TRAIN B BUS DURING SISLOP
05.2.06.03.1	G-200B	BPS1 (RELAY)	CONTACTS OPEN (OFF)	TRAIN B HYDRAZINE PUMP AUTO-START DEPRATED, MANUAL START UNAFFECTED	PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN B HYDRAZINE PUMPING	NORMAL POSITION
05.2.06.03.2	G-200B	BPS1 (RELAY)	CONTACTS CLOSED (ON)	TRAIN B HYDRAZINE PUMP AUTO-START SIGNAL SEALED-IN. OVERRIDEN, LOW LEVEL AND MANUAL TRIPS UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP	(SAME AS 5.2.6.2.2)	
05.2.06.04.1	G-200B	BPS2 (RELAY)	CONTACTS CLOSED (OFF)	TRAIN B HYDRAZINE PUMP MANUAL TRIP DEPRAT DEPRATED	PERIODIC TESTING	REDUNDANT PUMP	REDUCED RELIABILITY OF TRAIN B HYDRAZINE PUMPING	NORMAL POSITION
05.2.06.04.2	G-200B	BPS2 (RELAY)	CONTACTS OPEN (ON)	TRAIN B HYDRAZINE PUMP MANUAL TRIP DEPRATED, PUMP CANNOT BE TRIPPED MANUALLY EXCEPT VIA OVERRIDEN AFTER BPS1 RELAY EMERGIIZED ON CSAS. LOW LEVEL TRIP UNAFFECTED	PERIODIC TESTING	NONE REQUIRED	NONE	
05.2.06.05.1	G-200B	LIS-500B LOOP	OUTPUT OPEN (OFF)	TRAIN B HYDRAZINE PUMP LOW LEVEL TRIP DEPRATED, MANUAL TRIP UNAFFECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. EQUIPMENT PROTECTION FUNCTION ONLY
05.2.06.05.2	G-200B	LIS-500B LOOP	OUTPUT CLOSED (ON)	TRAIN B HYDRAZINE PUMP LOW LEVEL TRIP SIGNAL SEALED-IN, PUMP WILL TRIP IF RUNNING AND CANNOT BE RESTARTED	CONTROL ROOM ANNUNCIATION	REDUNDANT PUMP	INOPERABILITY OF TRAIN B HYDRAZINE PUMPING	
05.2.06.05.3	G-200B	LIS-500B LOOP	INPUT OPEN	(SAME AS 5.2.6.5.1)	(SAME AS 5.2.6.5.1)	(SAME AS 5.2.6.5.1)	(SAME AS 5.2.6.5.1)	
05.2.06.05.4	G-200B	LIS-500B LOOP	INPUT SHORT	BLOWS SUPPLY PUSB, CAUSING LOSS OF POWER TO PT-502, PIS-501, LIS-500B AND PIS-512 LOOPS. RESULTS IN LOSS OF CH B INPUT TO TRAIN A/B CSAS LOGIC, DEPRAT OF LOW LEVEL TRIP FOR G-200B, AND LOW FLOW SIGNALS TO FLOW LIMITER	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT INPUTS FOR CSAS LOGIC, REDUNDANT HYDRAZINE PUMP	LOSS OF 1 OF 3 CONTAINMENT HI-HI PRESSURE INPUTS TO TRAIN A AND B CSAS LOGIC, REDUCED RELIABILITY OF TRAIN B HYDRAZINE PUMP	
05.2.06.05.5	G-200B	LIS-500B LOOP	BQ	MAY CAUSE SPURIOUS LOW LEVEL SIGNAL TO TRAIN B HYDRAZINE PUMP 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING APTER 2 HOURS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. LIS-500B DEVICE PROVIDES ISOLATION OF NON-BQ INTR FROM OTHER LOADS ON SAME POWER SUPPLY

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRR UNIT 1
 TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.2.06.06.1	G-2000	CSAS INVERTER (T02-1)	VOLTS LOW	LOSS OF POWER TO PT-502, PIS-512, PIS-501 AND LIS-500A LOOPS, CAUSING LOW CR. B CONTAINMENT PRESSURE SIGNAL TO CSAS A/B LOGIC, AND DEPRATING LOW LEVEL TRIP OF TRAIN B HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CHANNELS FOR CSAS, REDUNDANT HYDRAZINE PUMP	LOSS OF 1 OF 3 REDUNDANT CONTAINMENT HI-HI PRESSURE INPUTS TO CSAS TRAIN A/B LOGIC AND REDUCED RELIABILITY OF TRAIN B HYDRAZINE PUMP	
05.2.07.01.1	SV-601	VALVE/ACTUATOR	OPEN	VALVE ALIGNS FOR TRAIN B HYDRAZINE FLOW, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	REDUNDANT PUMP CONTROLS TO PREVENT FLOW UNTIL REQUIRED	REDUCED RELIABILITY AGAINST SPURIOUS HYDRAZINE SYSTEM ACTUATION	SPURIOUS SYSTEM ACTUATION WOULD DEplete HYDRAZINE INVENTORY SUCH THAT BORE CALC ASSUMPTIONS COULD NOT BE MET FOR A SUBSEQUENT LOCA NORMAL POSITION
05.2.07.01.2	SV-601	VALVE/ACTUATOR	CLOSED	VALVE DOES NOT OPEN FOR TRAIN B HYDRAZINE FLOW	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B HYDRAZINE INJECTION	
05.2.07.01.3	SV-601	VALVE/ACTUATOR	EQ	TRAIN B HYDRAZINE ISOLATION VALVE FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE FLOW AFTER 2 HRS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. PUST PROVIDES (b)(2) PROTECTION OF OTHER DC BUS LOADS
05.2.07.02.1	SV-601	BVS2 (RELAY)	CONTACTS OPEN (OFF)	TRAIN B HYDRAZINE ISOLATION VALVE AUTO-OPEN AND OVERRIDE DEPRATED, MANUAL OPEN UNAFFECTED	PERIODIC TESTING	(SAME AS 5.2.7.1.2)	(SAME AS 5.2.7.1.2)	NORMAL POSITION
05.2.07.02.2	SV-601	BVS2 (RELAY)	CONTACTS CLOSED (ON)	TRAIN B HYDRAZINE ISOLATION VALVE AUTO-OPEN SIGNAL AND OVERRIDE PERMISSIVE BEHALD-IN	CONTROL ROOM INDICATION	(SAME AS 5.2.7.1.1)	(SAME AS 5.2.7.1.1)	
05.2.07.03.1	SV-601	BVS1 (RELAY)	CONTACTS CLOSED (OFF)	TRAIN B HYDRAZINE ISOLATION VALVE MANUAL CLOSE DEPRAT DEPRATED	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B HYDRAZINE ADDITION	NORMAL POSITION
05.2.07.03.2	SV-601	BVS1 (RELAY)	CONTACTS OPEN (ON)	TRAIN B HYDRAZINE ISOLATION VALVE MANUAL CLOSE DEPRATED, VALVE CANNOT BE CLOSED EXCEPT VIA OVERRIDE AFTER BVS2 ENERGIZED ON CSAS	PERIODIC TESTING	(SAME AS 5.2.7.1.1)	(SAME AS 5.2.7.1.1)	OVERRIDE FUNCTION NORMALLY REQUIRED POST-CSAS
05.2.07.04.1	SV-601	125VDC BUS #2 (72-220)	VOLTS LOW	TRAIN B HYDRAZINE ISOLATION VALVE FAILS CLOSED, CANNOT BE REOPENED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B HYDRAZINE ADDITION	
05.3.01.01.1	HANUAL VALVES, COMMON FLOW		OPEN	NONE	PERIODIC SURVILLANCE	NONE REQUIRED	NONE	INCLUDES: CRS-011
05.3.01.01.2	HANUAL VALVES, COMMON FLOW		CLOSED	CONTAINMENT SPRAY HEADER ISOLATED INSIDE CONTAINMENT	PERIODIC SURVILLANCE	ADMINISTRATIVE CONTROLLED VALVE LOCKING PRECLUDES FAILURE	LOSS OF BOTH TRAINS OF CONTAINMENT SPRAY AND HYDRAZINE INJECTION	
05.3.01.02.1	CHECK VALVES, COMMON FLOW		NONE (PASSIVE)					*INCLUDES CRS-301, SBA-315. CRS-301 NOT LEAK TESTED FOR RECIRC BOUNDARY FUNCTION IN 1ST PROGRAM

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRE UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.3.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	DIVERSION OF BOTH TRAINS OF CONTAINMENT SPRAY AND HYDRAZINE INJECTION TO ATMOSPHERE, RWST, HYDRAZINE TANK OR OTHER SYSTEMS	PERIODIC SURVEILLANCE	SEE TABLE 5-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	FLOWS OF BOTH TRAINS OF CONTAINMENT SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SUITABLE BACKUP DEVICES	SEE TABLE 5-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
05.3.02.01.2	MANUAL VALVES, COMMON BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
05.3.02.02.1	CHECK OR RELIEF VALVES, COMMON BOUNDARY		NORMAL (PASSIVE)	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	INCLUDES RV-2000, -2001, -2002
05.3.03.01.1	NOV-883	VALVE/ACTUATOR	OPEN	NORMAL FOR INJECTION, LOSS OF REMOTE-MANUAL BOUNDARY ISOLATION FOR RECIRCULATION	PERIODIC TESTING	REDUNDANT CHECK VALVE (CRS-301)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
05.3.03.01.2	NOV-883	VALVE/ACTUATOR	CLOSED	NORMAL FOR RECIRC, LOSS OF INJECTION MODE SUCTION TO BOTH REFUELING WATER PUMPS AND CHARGING PUMPS	CONTROL ROOM INDICATION	POWER LOCK OUT BY REDUNDANT CONTROL SWITCHES AND CONTACTORS PER WRC BRANCH TECHNICAL POSITION ICSB-10	NOT APPLICABLE, FAILURE PRECLUDED BY POWER LOCK-OUT	REFUELING WATER PUMPS PROVIDE CONTAINMENT SPRAY PUMPING CAPABILITY FOR ZONES 1
05.3.03.02.1	NOV-883	RMS-2054	CONTACTS OPEN	NOV-883 CONTROL CIRCUIT DISABLED, CAUSING LOSS OF REMOTE-MANUAL BOUNDARY ISOLATION CAPABILITY FOR RECIRCULATION	PERIODIC TESTING	(SAME AS 5.3.3.1.1)	(SAME AS 5.3.3.1.1)	*(SAME AS 5.3.3.1.1)
05.3.03.02.2	NOV-883	RMS-2054	CONTACTS CLOSED	NOV-883 CONTROL CIRCUIT, INCLUDING RMS-2047, ENABLED	CONTROL ROOM INDICATION	REDUNDANT SWITCH RMS-2047	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	
05.3.03.03.1	NOV-883	RMS-2047	OPEN POSITION (CONTACTS B/C CLOSED)	VALVE ACTUATOR RECEIVES OPEN SIGNAL AS SOON AS CONTROL CIRCUIT ENABLED BY RMS-2054, CANNOT BE CLOSED	PERIODIC TESTING	(SAME AS 5.3.3.1.1)	(SAME AS 5.3.3.1.1)	*(SAME AS 5.3.3.1.1). HANDSWITCH IS SPRING RETURN TO NEUTRAL POSITION
05.3.03.03.2	NOV-883	RMS-2047	CLOSE POSITION (CONTACTS B/F CLOSED)	VALVE ACTUATOR RECEIVES CLOSE SIGNAL AS SOON AS CONTROL CIRCUIT ENABLED BY RMS-2054, AND CANNOT BE REOPENED	PERIODIC TESTING	REDUNDANT SWITCH RMS-2054	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	HANDSWITCH IS SPRING RETURN TO NEUTRAL POSITION
05.3.03.04.1	NOV-883	42-CC OR 42A-CC (CONTACTORS)	OFF (CONTACTOR OPEN)	VALVE CANNOT BE REMOTE-MANUALLY CLOSED FOR RECIRCULATION	CONTROL ROOM INDICATION	REDUNDANT CHECK VALVE (CRS-301)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
05.3.03.04.2	NOV-883	42-CC OR 42A-CC (CONTACTORS)	ON (CONTACTOR CLOSED)	1 OF 2 SERIES CONTACTORS (42-CC OR 42A-CC) CLOSE IN VALVE CLOSE CMT, REDUCING CLOSE LOGIC TO 1/1 ON REMAINING CONTACTOR	PERIODIC TESTING	SECOND CLOSE CONTACTOR	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	*VERIFICATION NEEDED THAT EXISTING SURVEILLANCES WOULD DETECT THIS FAILURE
05.3.03.05.1	NOV-883	NCC-3 (42-1330)	VOLTS LOW	VALVE CANNOT BE REMOTE-MANUALLY CLOSED FOR RECIRCULATION	CONTROL ROOM INDICATION	REDUNDANT CHECK VALVE (CRS-301)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPR UNIT 1
TABLE 5-1: CONTAINMENT SPRAY AND HYDRAZINE INJECTION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.3.04.01.1	NOV-800	VALVE/ACTUATOR	OPEN	CONTAINMENT SPRAY PUMPS ALIGNED TO SEAL WATER/COLD LEG RECIRCULATION SYSTEM	CONTROL ROOM INDICATION	CHECK VALVE BCP-317 REMAINS SEATED DURING INJECTION AND RECIRCULATION BY CHARGING PUMP DISCHARGE HEAD	REDUCED RELIABILITY OF CONTAINMENT SPRAY BOUNDARY	ERY-802 MAY DIVERT FLOW TO VCT. ALTERNATE COLD LEG RECIRC NOT CREDITED BECAUSE UNANALYZED FOR FLOW/HEAD ADEQUACY
05.3.04.01.2	NOV-800	VALVE/ACTUATOR	CLOSED	NONE	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
05.3.04.02.1	NOV-800	HCC-2 (42-1262)	VOLTS LOW	VALVE FAILS AS-18	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
05.3.05.01.1	CV-92	VALVE/ACTUATOR	OPEN	DIVERSION OF BOTH TRAINS OF CONTAINMENT SPRAY AND HYDRAZINE INJECTION TO FIRE SUPPRESSION BRANCH IN CONTAINMENT	CONTROL ROOM INDICATION	FAILURE IS PRECLUDED BY IC88-18 POWER LOCKOUT VIA REDUNDANT CONTROL SWITCHES NS-1092 AND NS-1092A	LOSS OF BOTH TRAINS OF CONTAINMENT SPRAY	INCLUDES NON-EQ SV-116 AND Z80/C-1092. EQ FAILURE OPEN OR (b)(2) IMPACT PRECLUDED BY IC88-18 POWER LOCK OUT
05.3.05.01.2	CV-92	VALVE/ACTUATOR	CLOSED	NONE	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
05.3.05.02.1	CV-92	NS-1092	CONTACTS OPEN	VALVE FAILS IN CLOSED POSITION, CANNOT BE OPENED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. VALVE ONLY OPENED FOR FIRE SUPPRESSION IN CONTAINMENT
05.3.05.02.2	CV-92	NS-1092	CONTACTS CLOSED	VALVE WILL OPEN AS SOON AS NS-1092A ACTUATED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROL SWITCH NS-1092A	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE OPENING	
05.3.05.03.1	CV-92	NS-1092A	CONTACTS OPEN	(SAME AS 5.3.5.2.1)	(SAME AS 5.3.5.2.1)	(SAME AS 5.3.5.2.1)	(SAME AS 5.3.5.2.1)	(SAME AS 5.3.5.2.1)
05.3.05.03.2	CV-92	NS-1092A	CONTACTS CLOSED	VALVE WILL OPEN AS SOON AS NS-1092 ACTUATED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT CONTROL SWITCH NS-1092	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE OPENING	
05.3.05.04.1	CV-92	VITAL BUS #1 (4-1102V)	VOLTS LOW	VALVE FAILS IN CLOSED POSITION, CANNOT BE OPENED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
05.3.05.05.1	CV-92	ISA	PRESSURE LOW	VALVE FAILS IN CLOSED POSITION, CANNOT BE OPENED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	

TABLE 5-2: CONTAINMENT SPRAY BOUNDARY VALVE ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM OPERATOR UNIT 1
BOUNDARY VALVE ANALYSIS

ITEM #	---SAFETY RELATED BOUNDARY---				---SAFETY RELATED BACKUP---			---NON-SAFETY RELATED BACKUP---			REMARKS
	TAG #	MC/AUTO?	LOCKED?		TAG #	MC/AUTO?		TAG #	MC/AUTO?		
05.1.01	CRS-332	CLOSED	NO	NONE			NONE				G-27H CASING DRAIN TO AUX BLDG PUMP
05.1.02	UNKNOWN	CLOSED	NO	NONE			NONE				G-200A PRESSURE INSTRUMENT DRAIN (TO ATMOSPHERE)
05.1.03	BV-2003A	RELIEF		NONE REQUIRED							G-200A DISCHARGE RELIEF TO HYDRAZINE TANK. SETPOINT VERIFIED AS PART OF ASME SECTION XI 1ST PROGRAM
05.1.04	SHA-324	CLOSED	NO	NONE			CAP				G-200A DISCHARGE VENT
05.2.01	CRS-331	CLOSED	NO	NONE			NONE				G-27H CASING DRAIN TO AUX BLDG PUMP
05.2.02	UNKNOWN	CLOSED	NO	NONE			NONE				G-200B PRESSURE INSTRUMENT DRAIN (TO ATMOSPHERE)
05.2.03	BV-2003B	RELIEF		NONE REQUIRED							G-200B DISCHARGE RELIEF TO HYDRAZINE TANK. SETPOINT VERIFIED AS PART OF ASME SECTION XI 1ST PROGRAM
05.2.04	SHA-325	CLOSED	NO	NONE			CAP				G-200B DISCHARGE VENT
05.3.01	CRS-321	CLOSED	YES								REFUELING WATER PUMP G-27H, G-27S RECIRCULATION TO SUCTION
05.3.02	SHA-310	CLOSED	YES								G-200A RECIRCULATION TO HYDRAZINE TANK
05.3.03	SHA-309	CLOSED	YES								G-200B RECIRCULATION TO HYDRAZINE TANK
05.3.04	SHA-314	CLOSED	NO	NONE			SHA-313		CHECK		HYDRAZINE TANK RECIRCULATION PUMP DISCHARGE ISOLATION. PUMP AND PIPING ARE MSR
05.3.05	SHA-317	CLOSED	NO	NONE			UNKNOWN VENT		CLOSED		HYDRAZINE TANK RECIRCULATION PUMP SUCTION ISOLATION. PUMP AND PIPING ARE MSR
05.3.06	SHA-316	CLOSED	NO	NONE			CAP				HYDRAZINE TANK FILL CONNECTION
05.3.07	BV-2000	RELIEF		NONE REQUIRED							HYDRAZINE TANK PRESSURE RELIEF. SETPOINT VERIFIED AS PART OF ASME SECTION XI 1ST PROGRAM
05.3.08	BV-2001	RELIEF		NONE REQUIRED							HYDRAZINE TANK VACUUM RELIEF. SETPOINT VERIFIED AS PART OF ASME SECTION XI 1ST PROGRAM
05.3.09	BV-2002	RELIEF		NONE REQUIRED							HYDRAZINE TANK VACUUM RELIEF. SETPOINT VERIFIED AS PART OF ASME SECTION XI 1ST PROGRAM
05.3.10	UNKNOWN	CLOSED	NO	NONE			NONE				HYDRAZINE TANK PRESSURE INSTRUMENT VENT
05.3.11	SHA-319	CLOSED	NO	NONE			NONE				HYDRAZINE TANK VENT
05.3.12	SHA-336	CHECK		NONE REQUIRED							HYDRAZINE TANK NITROGEN COVER GAS SUPPLY. SR/MSR BOUNDARY WITHIN PART CHECK VALVE TO PCV-500
05.3.13	UNKNOWN	CLOSED	NO	NONE			NONE				HYDRAZINE TANK LEVEL INSTRUMENT (LT-500A) SEAL POT VENT
05.3.14	UNKNOWN	CLOSED	NO	NONE			NONE				HYDRAZINE TANK LEVEL INSTRUMENT (LT-500B) SEAL POT VENT
05.3.15	SHA-318	CLOSED	NO	NONE			NONE				HYDRAZINE TANK SAMPLE LINE. DRAIN VALVE SHA-323 DOES NOT ISOLATE SAMPLE CONNECTION
05.3.16	SHA-322	CLOSED	NO	NONE			NONE				HYDRAZINE TANK DRAIN
05.3.17	CRS-338	CLOSED	YES								REFUELING WATER PUMP RECIRCULATION TO RWST. OPENED/THROTTLED FOR SECONDARY RECIRCULATION
05.3.18	CRS-337	CLOSED	NO	NONE			CAP				REFUELING WATER PUMP DISCHARGE HEADER VENT/DRAIN
05.3.19	CRS-361	CLOSED	YES								REFUELING WATER PUMP DISCHARGE CONNECTION TO RWST FILTER PUMP SUCTION
05.3.20	CRS-382	CLOSED	NO	NONE			CRS-352, 356, 360, 370		CHECK		FIRE SUPPRESSION HOSE CONNECTION TO CONTAINMENT SPRAY (REFUELING WATER PUMP DISCHARGE HEADERS). BACKUP VALVES ARE MSRPP

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRIS UNIT 1
 BOUNDARY VALVE ANALYSIS

ITEM #	---SAFETY RELATED BOUNDARY---			---SAFETY RELATED BACKUP---			---NON-SAFETY RELATED BACKUP---			REMARKS
	TAG #	MC/AUTO?	LOCKED?	TAG #	MC/AUTO?		TAG #	MC/AUTO?		
05.3.21	CRS-339	CLOSED	NO	NONE						* REPUMLING WATER PUMP DISCHARGE HEADER VENT
05.3.22	CRS-341	CLOSED	NO	CRS-342 (M2) NOV-813, 814, 833, 834 (DHR) CV-202, 203, 204 (LDS)			AUTO			ALTERNATE COLD LNG RECIRCULATION LINE. CHECK VALVE CRS-828 PREVENTS BACKFLOW FROM LITDOWN/RHR INTO SPRAY HEADER
05.3.23	NOV-880	CLOSED	NO	RCP-331			CHECK			ALTERNATE COLD LNG RECIRCULATION LINE. CHECK VALVE PREVENTS BACKFLOW FROM SBAL INJECTION/CLR INTO SPRAY SYSTEM. CHARGING PUMP HEAD KEEPS CHECK VALVE SHUT TO PREVENT FORWARD FLOW FROM SPRAY SYSTEM INTO SBAL INJECTION/CLR HEADER
05.3.24	CRS-346	CLOSED	NO	CAP						SPRAY FLOW LIMITER ORIFICE RO-526 TAP ISOLATION
05.3.25	CRS-347	CLOSED	NO	CAP						SPRAY FLOW LIMITER ORIFICE RO-526 TAP ISOLATION
05.3.26	CRS-348	CLOSED	NO	CAP						SPRAY FLOW LIMITER ORIFICE RO-525 TAP ISOLATION
05.3.27	CRS-349	CLOSED	NO	CAP						SPRAY FLOW LIMITER ORIFICE RO-525 TAP ISOLATION
05.3.28	CRS-350	CLOSED	NO	NONE			CAP			* SPRAY HEADER VENT
05.3.29	UNKNOWN	CLOSED	NO	NONE			NONE			* SPRAY HEADER FLOW INSTRUMENT VENT
05.3.30	UNKNOWN	CLOSED	NO	NONE			NONE			* SPRAY HEADER FLOW INSTRUMENT VENT
05.3.31	CV-92	CLOSED	YES							FIRE SUPPRESSION HEADER ISOLATION. VALVE LOCKING VIA REDUNDANT POWER ISOLATION DEVICES PER ICSB-18
05.3.32	CRS-021	CLOSED	NO	NONE			CRS-022, 023		CLOSED	* REPUMLING CAVITY FILL/DRAIN
05.3.33	CRS-040	CLOSED	NO	NONE			CAP			* SPRAY HEADER TEST CONNECTION
05.3.34	CRS-042	CLOSED	YES							SPRAY NOZZLE BYPASS TO REPUMLING WATER PUMP SUCTION
05.3.35	CRS-045	OPRN	NO	NONE			NONE			* SPRAY RISER DRAIN. FLOW LIMITED BY ORIFICE FO-2013 AND SPECIFICALLY ADDRESSED BY SYSTEM HYDRAULIC CALCULATIONS
05.3.36	CRS-044	CLOSED	NO	NONE			CAP			* SPRAY HEADER TEST CONNECTION

SECTION 6: COMPONENT COOLING WATER

COMPONENT COOLING WATER (CCW) NOTES

1. Item numbers in this section have been assigned as follows:
 - 06.1: Train A CCW pumping, valves and boundary devices
 - 06.2: Train B CCW pumping, valves and boundary devices
 - 06.3: Train C CCW pumping, valves and boundary devices
 - 06.4: Common flow path and boundary devices.
2. Table 6-1 is the Failure Modes and Effects Analysis (FMEA) for the CCW function. Table 6-2 is the associated boundary valve analysis.
3. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.
4. Potential single failure susceptibilities in the Boundary Valve Analysis table are flagged with "*" in the unlabelled field adjacent to REMARKS. Items flagged with "#" in the unlabelled field adjacent to REMARKS are acceptable from a single failure standpoint subject to credit for SEP Topic III-6 seismic boundary criteria.

COMPONENT COOLING WATER SYSTEM REFERENCES

Piping and Instrumentation Diagrams

5178310 Component Cooling Water System (Sh 1)
5178311 Component Cooling Water System (Sh 2)
5178312 Component Cooling Water System (Sh 3)
5178443 Instrument and Service Air System (Sh 4)
5178449 Instrument and Service Air System (Sh 10)

Elementary Diagrams

63718 Auxiliary Coolant System (TC-601A/B, PC-605)
64364 CV-737A
64369 CV-737B
450516 Emergency Thermal Barrier Cooling Pump G-964
455378 MOV-720A, MOV-720B
455449 CV-722A, CV-722B, CV-722C
5149971 Component Cooling Water Pumps G-15A, G-15B, G-15C
5150876 4160 V Buses Undervoltage, Underfrequency Relays
5150885 480V Bus Undervoltage Relays

Procedures

SO1-1.0-23 Transfer to Cold Leg Injection and Recirculation
SO1-2.1-10 CCW System Malfunction
SO1-4-19 CCW System Operation
SO1-4-38 CCW System Alignment
SO1-7-11 Saltwater Cooling System
SO1-12.3-31 CCW System Safety Related Alignment
SO1-14-40 Control of Locked Valves
SO1-V-2.15 Inservice Testing of Valves Program

Other Documents

SD-SO1-330 System Description: Component Cooling Water System
SD-SO1-580 System Description: Safety Injection, Recirculation and Containment Spray Systems
M89048 Response to Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety Related Systems", dated July 5, 1989

TABLE 6-1: COMPONENT COOLING WATER FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.1.01.01.1	HANUAL VALVES, TRAIN A FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION. INCLUDES CCM-302, 326, 346, 310, 370, 331
06.1.01.01.2	HANUAL VALVES, TRAIN A FLOW		CLOSED	TRAIN A CCM PUMP SUCTION, DISCHARGE OR MINIFLOW ISOLATED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN TO SERVE ALL REQUIRED LOADS	LOSS OF TRAIN A CCM PUMPING CAPABILITY	
06.1.01.02.1	CBCKE VALVES, TRAIN A FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES CCM-322
06.1.02.01.1	HANUAL VALVES, TRAIN A BOUNDARY		OPEN	DIVERSION OF TRAIN A CCM PUMP FLOW AND LOSS OF SYSTEM INVENTORY	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR FLOW, NONE FOR INVENTORY	POTENTIAL LOSS OF BOTH TRAINS OF CCM FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SB BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. MAKE-UP SYSTEM IS NON-SAFETY RELATED AND NON-ESSENTIAL, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT
06.1.02.01.2	HANUAL VALVES, TRAIN A BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION
06.1.02.02.1	CBCKE OR RELIEF VALVES, TRAIN A BOUNDARY		NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
06.1.03.01.1	G-15A	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN A CCM PUMP OUTPUT TO REQUIRED LOADS	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CCM PUMPING	THE THREE CCM PUMPS CONNECT TO A COMMON SUPPLY AND RETURN HEADER SYSTEM SERVING ALL LOADS
06.1.03.02.1	G-15A	SWGR #1 (52-1121)	OPEN	TRAIN A CCM PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 6.1.3.1.1)	(SAME AS 6.1.3.1.1)	NORMAL POSITION FOR STANDBY SERVICE
06.1.03.02.2	G-15A	SWGR #1 (52-1121)	CLOSED	TRAIN A CCM PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH PUMP RUNNING
06.1.03.03.1	G-15A	CS: 52-1121 (CONTROL SWITCH)	START	TRAIN A CCM PUMP STARTS AS SOON AS OVERLOAD OR UNDERVOLTAGE TRIP CLEARS, CANNOT BE TRIPPED MANUALLY. START CONDITION ARMS AUTO-START CIRCUITS OF G-15B/C FOR G-15A OVERLOAD OR UNDERVOLTAGE CONDITION	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	G-15A CONTROL SWITCH
06.1.03.03.2	G-15A	CS: 52-1121 (CONTROL SWITCH)	STOP	TRAIN A CCM PUMP TRIPS AND CANNOT BE RESTARTED MANUALLY OR AUTOMATICALLY DUE TO BRER ANTI-PUMPING	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CCM PUMP	
06.1.03.03.3	G-15A	CS: 52-1121 (CONTROL SWITCH)	MANUAL (OUT OF AUTO)	TRAIN A CCM PUMP WILL NOT AUTO-START ON SIS/SISLOP OR OTHER SIGNALS, MANUAL START/STOP UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CCM PUMP FOR INJECTION, INITIAL RECIRC	STCRB SPKS 3.3.1 ACTION ENTRY REQUIRED IF PUMP IS NOT IN AUTO MODE
06.1.03.03.4	G-15A	CS: 52-1121 (CONTROL SWITCH)	OPEN (ALL CONTACTS)	TRAIN A CCM PUMP CANNOT BE STARTED OR TRIPPED, AND AUTOSTART DISABLED FOR G-15B/C ON G-15A OVERLOAD OR UNDERVOLTAGE FAILURE	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CCM PUMP, POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM OPERATOR UNIT 1
TABLE 6-1: COMPONENT COOLING WATER FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.1.03.03.5	G-15A	CS: 52-1121	SHORT/GROUND (CONTROL SWITCH) (ALL CONTACTS)	TRAIN A CCW PUMP TRIPS, CANNOT BE RESTARTED DUE TO BRRR ANTI-PUMPING, AUTOSTART DISABLED FOR G-15B/C OR G-15A OVERLOAD OR UNDERVOLTAGE FAILURE	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	IMPROBABILITY OF TRAIN A CCW PUMP, POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP	1125VDC SYSTEMS NORMALLY UNGROUNDED. TECH SPEC ACTION ENTRY REQUIRED IF EITHER SYSTEM NEGATIVE POLE GROUNDED TO PRECLUDE COMMON-MODE LOSS OF CONTROL POWER TO TRAIN A/B DUE TO THIS SINGLE FAILURE
06.1.03.04.1	G-15A	PC-6051	CONTACTS OPEN (ON)	TRAIN A CCW PUMP AUTO-START DISABLED ON LOW DISCHARGE PRESSURE, NO EFFECT ON SIS/SISLOP START FROM SEQ 1	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT TRAIN FOR NON-SIS/SISLOP EVENTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN A CCW PUMPING FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	NORMAL POSITION WITH AT LEAST ONE CCW PUMP RUNNING
06.1.03.04.2	G-15A	PC-6051	CONTACTS CLOSED (OFF)	TRAIN A CCW PUMP AUTO-STARTS AS SOON AS 100 BUS VOLTAGE PRESENT	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION UNTIL AT LEAST ONE CCW PUMP RUNNING
06.1.03.05.1	G-15A	SEQ 1	CONTACTS OPEN (20-5,7) (OFF)	TRAIN A CCW PUMP AUTO-START ON SIS/SISLOP DISABLED, OTHER AUTO-START SIGNALS AND MANUAL START/STOP UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN	IMPROBABILITY OF TRAIN A CCW PUMP FOR INJECTION, INITIAL RECIRCULATION	NORMAL POSITION
06.1.03.05.2	G-15A	SEQ 1	CONTACTS CLOSED (20-5,7) (ON)	TRAIN A CCW PUMP AUTO-STARTS, MANUAL TRIP UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL IMPROBABILITY OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	
06.1.03.06.1	G-15A	CS: 52-1221	CONTACTS OPEN (CONTROL SWITCH) (STOP/AFTER STOP)	TRAIN A CCW PUMP WILL NOT AUTO-START ON G-15B OVERLOAD OR BUS UNDERVOLTAGE, SIS/SISLOP AUTO-START UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR NON-SIS/SISLOP EVENTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN A CCW PUMP FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	G-15B CONTROL SWITCH
06.1.03.06.2	G-15A	CS: 52-1221	CONTACTS CLOSED (CONTROL SWITCH) (START/AFTER START)	TRAIN A CCW PUMP WILL AUTO-START ON G-15B OVERLOAD OR BUS UNDERVOLTAGE AS SOON AS TRAIN A BUS VOLTAGE PRESENT	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL COMMON-MODE LOSS OF TRAIN A ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND TRAIN B CCW PUMP OVERLOAD OR BUS UNDERVOLTAGE DURING SISLOP, NONE FOR SIS	NORMAL POSITION.
06.1.03.07.1	G-15A	27-2 (SWGR2 UV RELAY) 86 (52-1221 OVLD RELAY)	CONTACTS OPEN (UV ON, OVLD OFF)	(SAME AS 6.1.3.6.1)	(SAME AS 6.1.3.6.1)	(SAME AS 6.1.3.6.1)	(SAME AS 6.1.3.6.1)	NORMAL POSITION. SWGR #2 BUS UNDERVOLTAGE AND G-15B OVERLOAD RELAYS. 86 RELAY ALSO ACTUATED BY 27-111 UV RELAY FOR SWGR #2
06.1.03.07.2	G-15A	27-2 (SWGR2 UV RELAY) 86 (52-1221 OVLD RELAY)	CONTACTS CLOSED (UV OFF, OVLD ON)	(SAME AS 6.1.3.6.2)	(SAME AS 6.1.3.6.2)	(SAME AS 6.1.3.6.2)	(SAME AS 6.1.3.6.2)	
06.1.03.08.1	G-15A	CS: 52-1305	CONTACTS OPEN (CONTROL SWITCH) (STOP/AFTER STOP)	TRAIN A CCW PUMP WILL NOT AUTO-START ON G-15C OVERLOAD OR BUS UNDERVOLTAGE, SIS/SISLOP AUTO-START UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR NON-SIS/SISLOP EVENTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN A CCW PUMP FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	G-15C CONTROL SWITCH

EMERGENCY CORE COOLING SYSTEM SINGLE-FAILURE ANALYSIS
SAB ONOPRE UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.1.03.08.2	G-15A	CS: 52-1305 (CONTROL SWITCH)	CONTACTS CLOSED (START/APTR START)	TRAIN A CCW PUMP WILL AUTO-START ON G-15C OVERLOAD OR BUS UNDERVOLTAGE AS SOON AS TRAIN A BUS VOLTAGE PRESENT	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL COMMON-MODE LOSS OF TRAIN A ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND SWING BUS UNDERVOLTAGE FOLLOWING SIS/SISLOP TRIP OF SWCR #3	
06.1.03.09.1	G-15A	27-2 (SWGR3 UV RBLAY) 06 (52-1305 OVLD RBLAY)	CONTACTS OPEN (UV ON, OVLD OFF)	(SAME AS 6.1.3.8.1)	(SAME AS 6.1.3.8.1)	(SAME AS 6.1.3.8.1)	(SAME AS 6.1.3.8.1)	NORMAL POSITION. SWGR #3 BUS UNDERVOLTAGE AND G-15C OVERLOAD RELAYS. 06 RBLAY ALSO ACTUATED BY 27-1X1 UV RBLAY FOR SWGR #3
06.1.03.09.2	G-15A	27-2 (SWGR3 UV RBLAY) 06 (52-1305 OVLD RBLAY)	CONTACTS CLOSED (UV OFF, OVLD ON)	(SAME AS 6.1.3.8.2)	(SAME AS 6.1.3.8.2)	(SAME AS 6.1.3.8.2)	(SAME AS 6.1.3.8.2)	
06.1.03.10.1	G-15A	27-1X1 (UV RBLAY)	CONTACTS OPEN (OFF)	TRAIN A CCW PUMP WILL NOT TRIP ON SWCR #1 UNDERVOLTAGE	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION. SWGR #1 UNDERVOLTAGE RBLAY
06.1.03.10.2	G-15A	27-1X1 (UV RBLAY)	CONTACTS CLOSED (ON)	TRAIN A CCW PUMP TRIPS, CANNOT BE RESTARTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CCW PUMP	
06.1.03.11.1	G-15A	SWCR #1 125VDC CONTROL POWER	VOLTS LOW	TRAIN A CCW PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CCW PUMP	SEE WIRING DIAGRAM 112790 AND ONE LINE DIAGRAM 5102169 FOR POWER SUPPLY
06.1.04.01.1	NOV-720B	VALVE/ACTUATOR	OPEN	CCW FLOW ALIGNED TO TRAIN A SVC/CCW HE	CONTROL ROOM INDICATION	TRAIN A SVC PP TO RESTORE COOLING FOR NON-SIS/SISLOP EVENTS W/ TRAIN B SVC PP IN SERVICE. NONE REQD FOR SIS/SISLOP OR W/ TRAIN A SVC PP IN SERVICE	REDUCTION OF CCW HEAT REMOVAL CAPACITY FOR NON-SIS/SISLOP EVENTS WITH TRAIN B SVC PUMP IN SERVICE, NONE FOR SIS/SISLOP OR OPENING	NORMAL POSITION WITH TRAIN A SVC PUMP IN SERVICE. SVC PUMP DOES NOT AUTO-START ON VALVE
06.1.04.01.2	NOV-720B	VALVE/ACTUATOR	CLOSED	CCW FLOW CANNOT BE ALIGNED TO TRAIN A SVC/CCW HE	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SVC/CCW HE	
06.1.04.02.1	NOV-720B	52I/AI (RBLAY)	CONTACTS OPEN (OFF)	NOV-720B WILL NOT AUTOMATICALLY ALIGN TRAIN A SVC/CCW HE ON TRAIN A SVC PUMP START (EG. SVC PUMP START ON SIS/SISLOP), MANUAL ACTUATION UNAPPECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR INJECTION, INITIAL RECIRC	INOPERABILITY OF TRAIN A SVC/CCW HE FOR INJECTION AND INITIAL RECIRCULATION	
06.1.04.02.2	NOV-720B	52I/AI (RBLAY)	CONTACTS CLOSED (ON)	(SAME AS 6.1.4.1.1)	(SAME AS 6.1.4.1.1)	(SAME AS 6.1.4.1.1)	(SAME AS 6.1.4.1.1)	
06.1.04.03.1	NOV-720B	HCC-1 (42-1187)	VOLTS LOW	VALVE FAILS AS-IS, WILL NOT ALIGN TRAIN A SVC/CCW HE IF CLOSED, CANNOT BE CLOSED RECHPT LOCALLT IF OPEN (EG. FOR SVC PUMP FAILURE)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SVC/CCW HE	
06.1.05.01.1	CV-737A	VALVE/ACTUATOR	OPEN	CCW FLOW ALIGNED TO RECIRC HE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE (NORMAL FOR RECIRCULATION)	INCLUDES HY-2737A, 230/C-2737A. SINGLE TRAIN FLOW WITH VALVE OPEN ADEQUATE FOR ALL REQUIRED LOADS IN INJECTION OR RECIRCULATION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 6-1: COMPONENT COOLING WATER FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.1.05.01.2	CV-137A	VALVE/ACTUATOR	CLOSED	TRAIN A VALVE CANNOT BE OPENED PERIODIC TESTING	PERIODIC TESTING	REDUNDANT VALVE	INOPERABILITY OF TRAIN A VALVE FOR RECIRCULATION OR CCW FLOW	
06.1.05.02.1	CV-137A	VITAL BUS #1 (S-1114V)	VOLTS LOW	VALVE FAILS OPEN, ALIGNING CCW CONTROL ROOM INDICATION FLOW TO RECIRC HI	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
06.1.05.03.1	CV-137A	ISA	PRESSURE LOW	VALVE DRIFTS OPEN IF INTERNAL HYDRAULIC LEAKAGE PRESENT, ALIGNING CCW FLOW TO RECIRC HI	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE ACTUATOR USES AIR-OPERATED HYDRAULIC PUMP TO MAINTAIN ACCUMULATOR PRESSURE NORMAL POSITION. INCLUDES CCW-303, 327, 347, 311, 311, 330
06.2.01.01.1	MANUAL VALVES, TRAIN B FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
06.2.01.01.2	MANUAL VALVES, TRAIN B FLOW		CLOSED	TRAIN B CCW PUMP SUCTION, DISCHARGE OR MINIFLOW ISOLATED	PERIODIC SURVEILLANCE	REDUNDANT TRAIN TO SERVE ALL REQUIRED LOADS	LOSS OF TRAIN B CCW PUMPING CAPABILITY	
06.2.01.02.1	CHECK VALVES, TRAIN B FLOW		NONE (PASSIVE)		PERIODIC TESTING			INCLUDES CCW-323
06.2.02.01.1	MANUAL VALVES, TRAIN B BOUNDARY		OPEN	DIVERSION OF TRAIN B CCW PUMP FLOW AND LOSS OF SYSTEM INVENTORY	PERIODIC SURVEILLANCE	REDUNDANT TRAIN FOR FLOW, NONE FOR INVENTORY	POTENTIAL LOSS OF BOTH TRAINS OF CCW FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH BE BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. MAKE-UP SYSTEM IS NON-SAFETY RELATED AND NON-SEISMIC, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT
06.2.02.01.2	MANUAL VALVES, TRAIN B BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION
06.2.02.02.1	CHECK OR RELIEF VALVES, TRAIN B BOUNDARY		NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
06.2.03.01.1	G-15B	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN B CCW PUMP OUTPUT TO REQUIRED LOADS	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCW PUMPING	THE THREE CCW PUMPS CONNECT TO A COMMON SUPPLY AND RETURN HEADER SYSTEM SERVING ALL LOADS
06.2.03.02.1	G-15B	SWGR #2 (52-1221)	OPEN	TRAIN B CCW PUMP FAILS TO START OR TRIP AFTER STARTING	PERIODIC TESTING	(SAME AS 6.2.3.1.1)	(SAME AS 6.2.3.1.1)	NORMAL POSITION FOR STANDBY SERVICE
06.2.03.02.2	G-15B	SWGR #2 (52-1221)	CLOSED	TRAIN B CCW PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH PUMP RUNNING
06.2.03.03.1	G-15B	CS: 52-1221 (CONTROL SWITCH)	START	TRAIN B CCW PUMP STARTS AS SOON AS OVERLOAD OR UNDERVOLTAGE TRIP CLEARS, CANNOT BE TRIPPED MANUALLY. START CONDITION ARMS AUTO-START CIRCUITS OF G-15A/C FOR G-15B OVERLOAD OR UNDERVOLTAGE CONDITION	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	G-15B CONTROL SWITCH
06.2.03.03.2	G-15B	CS: 52-1221 (CONTROL SWITCH)	STOP	TRAIN B CCW PUMP TRIPS AND CANNOT BE RESTARTED MANUALLY OR AUTOMATICALLY DUE TO BRER ANTI-PUMPING	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCW PUMP	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.2.03.03.3 G-15B	CS: 52-1221 (CONTROL SWITCH)	52-1221	MANUAL (OUT OF AUTO)	TRAIN B CCM PUMP WILL NOT AUTO-START ON SIS/SISLOP OR OTHER SIGNALS, MANUAL START/STOP UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCM PUMP FOR INJECTION, INITIAL RECIRC	STEP 3.3.1 ACTION ENTRY REQUIRED IF PUMP IS NOT IN AUTO MODE
06.2.03.03.4 G-15B	CS: 52-1221 (CONTROL SWITCH)	52-1221	OPEN (ALL CONTACTS)	TRAIN B CCM PUMP CANNOT BE STARTED OR TRIPPED, AND AUTOSTART DISABLED FOR G-15A/C ON G-15B OVERLOAD OR UNDERVOLTAGE FAILURE	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCM PUMP, POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP	
06.2.03.03.5 G-15B	CS: 52-1221 (CONTROL SWITCH)	52-1221	SHORT/GROUND (ALL CONTACTS)	TRAIN B CCM PUMP TRIPS, CANNOT BE RESTARTED DUE TO BRRR ANTI-PUMPING, AUTOSTART DISABLED FOR G-15A/C ON G-15B OVERLOAD OR UNDERVOLTAGE FAILURE	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCM PUMP, POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP	125VDC SYSTEMS NORMALLY UNGROUNDED. TECH SPEC ACTION ENTRY REQUIRED IF EITHER SYSTEM NEGATIVE POLE GROUNDED TO PRECLUDE COMMON-MODE LOSS OF CONTROL POWER TO TRAIN A/B DUE TO THIS SINGLE FAILURE
06.2.03.04.1 G-15B	PC-6051 (RELAY)	PC-6051	CONTACTS OPEN (ON)	TRAIN B CCM PUMP AUTO-START DISABLED ON LOW DISCHARGE PRESSURE, NO EFFECT ON SIS/SISLOP START FROM SEQ 2	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT TRAIN FOR NON-SIS/SISLOP EVENTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN B CCM PUMPING FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	NORMAL POSITION WITH AT LEAST ONE CCM PUMP RUNNING
06.2.03.04.2 G-15B	PC-6051 (RELAY)	PC-6051	CONTACTS CLOSED (OFF)	TRAIN B CCM PUMP AUTO-STARTS AS SOON AS 400 BUS VOLTAGE PRESENT	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION UNTIL AT LEAST ONE CCM PUMP RUNNING
06.2.03.05.1 G-15B	SEQ 2 (28-5,7)	SEQ 2	CONTACTS OPEN (OFF)	TRAIN B CCM PUMP AUTO-START ON SIS/SISLOP DISABLED, OTHER AUTO-START SIGNALS AND MANUAL START/STOP UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCM PUMP FOR INJECTION, INITIAL RECIRCULATION	NORMAL POSITION
06.2.03.05.2 G-15B	SEQ 2 (28-5,7)	SEQ 2	CONTACTS CLOSED (ON)	TRAIN B CCM PUMP AUTO-STARTS, MANUAL TRIP UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	
06.2.03.06.1 G-15B	CS: 52-1121 (CONTROL SWITCH)	52-1121	CONTACTS OPEN (STOP/AFTER STOP)	TRAIN B CCM PUMP WILL NOT AUTO-START ON G-15A OVERLOAD OR BUS UNDERVOLTAGE, SIS/SISLOP AUTO-START UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR NON-SIS/SISLOP EVENTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN B CCM PUMP FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	G-15A CONTROL SWITCH
06.2.03.06.2 G-15B	CS: 52-1121 (CONTROL SWITCH)	52-1121	CONTACTS CLOSED (START/AFTER START)	TRAIN B CCM PUMP WILL AUTO-START ON G-15A OVERLOAD OR BUS UNDERVOLTAGE AS SOON AS TRAIN B BUS VOLTAGE PRESENT	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL COMMON-MODE LOSS OF TRAIN B ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND TRAIN A CCM PUMP OVERLOAD OR BUS UNDERVOLTAGE DURING SISLOP, NONE FOR SIS	NORMAL POSITION.
06.2.03.07.1 G-15B	27-2 (SWGR1 UV RELAY) 86 (52-1121 OVLD RELAY)	27-2 (SWGR1 UV RELAY) 86 (52-1121 OVLD RELAY)	CONTACTS OPEN (UV ON, OVLD OFF)	(SAME AS 6.2.3.6.1)	(SAME AS 6.2.3.6.1)	(SAME AS 6.2.3.6.1)	(SAME AS 6.2.3.6.1)	NORMAL POSITION. SWGR #1 BUS UNDERVOLTAGE AND G-15A OVERLOAD RELAYS. 86 RELAY ALSO ACTUATED BY 27-131 UV RELAY FOR SWGR #1

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRE UNIT 1
 TABLE 6-1: COMPONENT COOLING WATER PHRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.2.03.07.2	G-15B	27-2 (SWGR1 UV RELAY) 86 (52-1121 OVLD RELAY)	CONTACTS CLOSED (UV OFF, OVLD ON)	(SAME AS 6.2.3.6.2)	(SAME AS 6.2.3.6.2)	(SAME AS 6.2.3.6.2)	†(SAME AS 6.2.3.6.2)	
06.2.03.08.1	G-15B	CS: 52-1305 (CONTROL SWITCH)	CONTACTS OPEN (STOP/AFTER STOP)	TRAIN B CCM PUMP WILL NOT AUTO-START ON G-15C OVERLOAD OR BUS UNDERVOLTAGE, SIS/SISLOP AUTO-START UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR NON-SIS/SISLOP EVENTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN B CCM PUMP FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	G-15C CONTROL SWITCH
06.2.03.08.2	G-15B	CS: 52-1305 (CONTROL SWITCH)	CONTACTS CLOSED (START/AFTER START)	TRAIN B CCM PUMP WILL AUTO-START ON G-15C OVERLOAD OR BUS UNDERVOLTAGE AS SOON AS TRAIN B BUS VOLTAGE PRESENT	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	†POTENTIAL COMMON-MODE LOSS OF TRAIN B ELECTRICAL POWER, BUS TO OUT OF SEQUENCE BUS LOADING AND BUSING BUS UNDERVOLTAGE FOLLOWING SIS/SISLOP TRIP OF SWGR #3	
06.2.03.09.1	G-15B	27-2 (SWGR3 UV RELAY) 86 (52-1305 OVLD RELAY)	CONTACTS OPEN (UV ON, OVLD OFF)	(SAME AS 6.2.3.8.1)	(SAME AS 6.2.3.8.1)	(SAME AS 6.2.3.8.1)	(SAME AS 6.2.3.8.1)	NORMAL POSITION. SWGR #3 BUS UNDERVOLTAGE AND G-15C OVERLOAD RELAYS. 86 RELAY ALSO ACTUATED BY 27-111 UV RELAY FOR SWGR #3
06.2.03.09.2	G-15B	27-2 (SWGR3 UV RELAY) 86 (52-1305 OVLD RELAY)	CONTACTS CLOSED (UV OFF, OVLD ON)	(SAME AS 6.2.3.8.2)	(SAME AS 6.2.3.8.2)	(SAME AS 6.2.3.8.2)	†(SAME AS 6.2.3.8.2)	
06.2.03.10.1	G-15B	27-111 (UV RELAY)	CONTACTS OPEN (OFF)	TRAIN B CCM PUMP WILL NOT TRIP ON SWGR #2 UNDERVOLTAGE	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION. SWGR #2 UNDERVOLTAGE RELAY
06.2.03.10.2	G-15B	27-111 (UV RELAY)	CONTACTS CLOSED (ON)	TRAIN B CCM PUMP TRIPS, CANNOT BE RESTARTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCM PUMP	
06.2.03.11.1	G-15B	SWGR #2 125VDC CONTROL POWER VALVE/ACTUATOR	VOLTS LOW	TRAIN B CCM PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCM PUMP	
06.2.04.01.1	MOV-720A	MOV-720A VALVE/ACTUATOR	OPEN	CCM FLOW ALIGNED TO TRAIN B SWC/CCM BX	CONTROL ROOM INDICATION	TRAIN B SWC PP TO RESTORE COOLING FOR NON-SIS/SISLOP EVENTS OR W/ TRAIN A SWC PP IN SERVICE. NONE REQD FOR SIS/SISLOP OR W/ TRAIN B SWC PP IN SERVICE	REDUCTION OF CCM HEAT REMOVAL CAPACITY FOR NON-SIS/SISLOP EVENTS OR WITH TRAIN A SWC PUMP DOES NOT AUTO-START ON VALVE IN SERVICE, NONE FOR SIS/SISLOP OPENING OR WITH TRAIN B SWC PUMP IN SERVICE.	NORMAL POSITION WITH TRAIN B SWC PUMP IN SERVICE. SWC PUMP DOES NOT AUTO-START ON VALVE
06.2.04.01.2	MOV-720A	MOV-720A VALVE/ACTUATOR	CLOSED	CCM FLOW CANNOT BE ALIGNED TO TRAIN B SWC/CCM BX	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SWC/CCM BX	
06.2.04.02.1	MOV-720A	521/A1 (RELAY)	CONTACTS OPEN (OFF)	MOV-720A WILL NOT AUTOMATICALLY ALIGN TRAIN B SWC/CCM BX ON TRAIN B SWC PUMP START (EG. SWC PUMP START ON SIS/SISLOP), MANUAL ACTUATION UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR INJECTION, INITIAL RECIRC	INOPERABILITY OF TRAIN B SWC/CCM BX FOR INJECTION AND INITIAL RECIRCULATION	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1

TABLE 6-1: COMPONENT COOLING WATER PBRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
06.2.04.02.2	NOV-720A	52X/A1 (RBLAY) BCC-2 (42-1200)	CONTACTS CLOSED (ON) VOLTS LOW	(SAME AS 6.2.4.1.1)	(SAME AS 6.2.4.1.1)	(SAME AS 6.2.4.1.1)	(SAME AS 6.2.4.1.1)	
06.2.04.03.1	NOV-720A			VALVE FAILS AS-IS, WILL NOT ALIGN TRAIN B SUC/CCW BY IF CLOSED, CANNOT BE CLOSED RECEIPT LOCALLY IF OPEN (EG. FOR SUC PUMP FAILURE)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SUC/CCW BY	
06.2.05.01.1	CV-737B	VALVE/ACTUATOR	OPEN	CCW FLOW ALIGNED TO RECIRC BY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE (NORMAL FOR RECIRCULATION)	INCLUDES BY-3737B, Z80/C-3737B. SINGLE TRAIN FLOW WITH VALVE OPEN ADEQUATE FOR ALL REQUIRED LOADS IN INJECTION OR RECIRCULATION
06.2.05.01.2	CV-737B	VALVE/ACTUATOR	CLOSED	TRAIN B VALVE CANNOT BE OPENED FOR CCW FLOW TO RECIRC BY	PERIODIC TESTING	REDUNDANT VALVE	INOPERABILITY OF TRAIN B VALVE FOR RECIRCULATION BY CCW FLOW	
06.2.05.02.1	CV-737B	VITAL BUS B2 (8-1214V)	VOLTS LOW	VALVE FAILS OPEN, ALIGNING CCW FLOW TO RECIRC BY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
06.2.05.03.1	CV-737B	ISA	PRESSURE LOW	VALVE DRIFTS OPEN IF INTERNAL HYDRAULIC LEAKAGE PRESENT, ALIGNING CCW FLOW TO RECIRC BY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE ACTUATOR USES AIR-OPERATED HYDRAULIC PUMP TO MAINTAIN ACCUMULATOR PRESSURE NORMAL POSITION. INCLUDES CCM-305, 329, 349, 313, 373
06.3.01.01.1	HANUAL VALVES, SOUTH PUMP FLOW		OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
06.3.01.01.2	HANUAL VALVES, SOUTH PUMP FLOW		CLOSED	SOUTH CCW PUMP SUCTION, DISCHARGE OR MINIFLOW ISOLATED	PERIODIC SURVEILLANCE	TRAIN A OR B TO SERVE ALL REQUIRED LOADS	LOSS OF SOUTH CCW PUMPING CAPABILITY	INCLUDES CCM-325
06.3.01.02.1	CHCK VALVES, SOUTH PUMP FLOW		NONE (PASSIVE)		PERIODIC TESTING			
06.3.02.01.1	HANUAL VALVES, SOUTH PUMP BOUNDARY		OPEN	DIVERSION OF SOUTH CCW PUMP FLOW AND LOSS OF SYSTEM INVENTORY	PERIODIC SURVEILLANCE	TRAIN A OR B FOR FLOW, NONE FOR INVENTORY	POTENTIAL LOSS OF TRAIN A AND B CCW FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SB BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. MAKE-UP SYSTEM IS NON-SAFETY RELATED AND NON-SAFETY, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT
06.3.02.01.2	HANUAL VALVES, SOUTH PUMP BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION
06.3.02.02.1	CRK OR RELIEF VALVES, SOUTH PP BOUNDARY		NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
06.3.03.01.1	G-15C	PUMP/MOTOR	LOW FLOW	REDUCED SOUTH CCW PUMP OUTPUT TO REQUIRED LOADS	PERIODIC TESTING	TRAIN A OR B TO SERVE ALL REQUIRED LOADS	INOPERABILITY OF SOUTH CCW PUMP	THE THREE CCW PUMPS CONNECT TO A COMMON SUPPLY AND RETURN HEADER SYSTEM SERVING ALL LOADS
06.3.03.02.1	G-15C	SVGR #3 (52-1305)	OPEN	SOUTH CCW PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 6.3.3.1.1)	(SAME AS 6.3.3.1.1)	NORMAL POSITION FOR STANDBY SERVICE
06.3.03.02.2	G-15C	SVGR #3 (52-1305)	CLOSED	SOUTH CCW PUMP STARTS OR FAILS TO TRIP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. TRAIN A/B BUS LOADING IMPACT PRECLUDED BY AUTOMATIC ISOLATION OF SVGR #3	NORMAL POSITION WITH PUMP RUNNING

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
06.3.03.03.1	G-15C	CS: 52-1305 (CONTROL SWITCH)	START	SOUTH CCM PUMP STARTS AS SOON AS OVERLOAD OR UNDERVOLTAGE TRIP CLEARS, CANNOT BE TRIPPED MANUALLY. START CONDITION ARMS AUTO-START CIRCUITS OF G-15A/B FOR G-15C OVERLOAD OR UNDERVOLTAGE CONDITION	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE. TRAIN A/B BUS LOADING IMPACT PRECLUDED FOR SIS/SISLOP EVENTS BY AUTOMATIC ISOLATION OF SWGR #3	G-15C CONTROL SWITCH
06.3.03.03.2	G-15C	CS: 52-1305 (CONTROL SWITCH)	STOP	SOUTH CCM PUMP TRIPS AND CANNOT BE RESTARTED MANUALLY OR AUTOMATICALLY DUE TO BBER ANTI-PUMPING	CONTROL ROOM INDICATION, PERIODIC TESTING	TRAIN A OR B TO SERVE ALL REQUIRED LOADS	INOPERABILITY OF SOUTH CCM PUMP	
06.3.03.03.3	G-15C	CS: 52-1305 (CONTROL SWITCH)	MANUAL (OUT OF AUTO)	SOUTH CCM PUMP WILL NOT AUTO-START ON LOW HEADER PRESSURE OR OTHER SIGNALS, MANUAL START/STOP UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	TRAIN A/B TO SERVE ALL REQUIRED LOADS	REDUCED RELIABILITY OF SWING CCM PUMP FOR NON-SIS/SISLOP EVENTS	
06.3.03.03.4	G-15C	CS: 52-1305 (CONTROL SWITCH)	OPEN (ALL CONTACTS)	SOUTH CCM PUMP CANNOT BE STARTED OR TRIPPED, AND AUTOSTART DISABLED FOR G-15A/B ON G-15C OVERLOAD OR UNDERVOLTAGE FAILURE	PERIODIC TESTING	TRAIN A OR B TO SERVE ALL REQUIRED LOADS	INOPERABILITY OF SOUTH CCM PUMP IF NOT INITIALLY RUNNING	TRAIN A/B BUS LOADING IMPACT PRECLUDED FOR SIS/SISLOP EVENTS BY AUTOMATIC ISOLATION OF SWGR #3
06.3.03.03.5	G-15C	CS: 52-1305 (CONTROL SWITCH)	SHORT/GROUND (ALL CONTACTS)	SOUTH CCM PUMP TRIPS, CANNOT BE RESTARTED DUE TO BBER ANTI-PUMPING, AUTOSTART DISABLED FOR G-15A/B ON G-15C OVERLOAD OR UNDERVOLTAGE FAILURE	CONTROL ROOM INDICATION, PERIODIC TESTING	TRAIN A/B TO SERVE ALL REQUIRED LOADS	INOPERABILITY OF SOUTH CCM PUMP	1125VDC SYSTEMS NORMALLY UNGROUNDED. TECH SPEC ACTION ENTRY REQUIRED IF EITHER SYSTEM NEGATIVE POLE GROUNDED TO PRECLUDE COMMON-MODE LOSS OF CONTROL POWER TO TRAIN A/B DUE TO THIS SINGLE FAILURE
06.3.03.04.1	G-15C	PC-6051 (RELAT)	CONTACTS OPEN (ON)	SOUTH CCM PUMP AUTO-START DISABLED ON LOW DISCHARGE PRESSURE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	TRAIN A/B TO SERVE ALL REQUIRED LOADS	REDUCED RELIABILITY OF SOUTH CCM PUMP FOR NON-SIS/SISLOP EVENTS	NORMAL POSITION WITH AT LEAST ONE CCM PUMP RUNNING
06.3.03.04.2	G-15C	PC-6051 (RELAT)	CONTACTS CLOSED (OFF)	SOUTH CCM PUMP AUTO-STARTS AS SOON AS SWING BUS VOLTAGE PRESENT	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE. TRAIN A/B BUS LOADING IMPACT PRECLUDED FOR SIS/SISLOP EVENTS BY AUTOMATIC ISOLATION OF SWGR #3	NORMAL POSITION UNTIL AT LEAST ONE CCM PUMP RUNNING
06.3.03.05.1	G-15C	SEQ	(NOT USED)					SEQ 2 CONTACTS REMOVED FROM PUMP CONTROL CIRCUIT
06.3.03.06.1	G-15C	CS: 52-1121 (CONTROL SWITCH)	CONTACTS OPEN (STOP/AFTER STOP)	SOUTH CCM PUMP WILL NOT AUTO-START ON G-15A OVERLOAD OR BUS UNDERVOLTAGE, LOW HEADER PRESSURE AUTO-START UNAFFECTED	PERIODIC TESTING	TRAIN B TO SERVE ALL REQUIRED LOADS	REDUCED RELIABILITY OF SOUTH CCM PUMP FOR NON-SIS/SISLOP EVENTS	G-15A CONTROL SWITCH
06.3.03.06.2	G-15C	CS: 52-1121 (CONTROL SWITCH)	CONTACTS CLOSED (START/AFTER START)	SOUTH CCM PUMP WILL AUTO-START ON G-15A OVERLOAD OR BUS UNDERVOLTAGE AS SOON AS SWING BUS VOLTAGE PRESENT	PERIODIC TESTING	NONE REQUIRED	NONE. TRAIN A/B BUS LOADING IMPACT FOR SIS/SISLOP EVENTS PRECLUDED BY AUTOMATIC ISOLATION OF SWGR #3	NORMAL POSITION.
06.3.03.07.1	G-15C	27-2 (SWGR1 UV RELAT) 86 (52-1121 OVLD RELAT)	CONTACTS OPEN (UV ON, OVLD OFF)	(SAME AS 6.3.3.6.1)	(SAME AS 6.3.3.6.1)	(SAME AS 6.3.3.6.1)	(SAME AS 6.3.3.6.1)	NORMAL POSITION. SWGR #1 BUS UNDERVOLTAGE AND G-15A OVERLOAD RELAYS. 86 RELAY ALSO ACTUATED BY 27-1X1 UV RELAY FOR SWGR #1

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ONOPER UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.3.03.07.2	G-15C	27-2 (SWGR1 UV RELAY) 86 (52-1121 OVLD RELAY)	CONTACTS CLOSED (UV OFF, OVLD ON)	(SAME AS 6.3.3.6.2)	(SAME AS 6.3.3.6.2)	(SAME AS 6.3.3.6.2)	(SAME AS 6.3.3.6.2)	
06.3.03.08.1	G-15C	CS: 52-1221 (CONTROL SWITCH)	CONTACTS OPEN (STOP/AFTER STOP)	SOUTH CCM PUMP WILL NOT AUTO-START ON G-15B OVERLOAD OR BUS UNDERVOLTAGE, LOW HEADER PRESSURE AUTO-START UNAFFECTED	PERIODIC TESTING	TRAIN A TO SERVE ALL REQUIRED LOADS	REDUCED RELIABILITY OF SOUTH CCM PUMP FOR SOB-SIS/SISLOP EVENTS	G-15B CONTROL SWITCH
06.3.03.08.2	G-15C	CS: 52-1221 (CONTROL SWITCH)	CONTACTS CLOSED (START/AFTER START)	SOUTH CCM PUMP WILL AUTO-START ON G-15B OVERLOAD OR BUS UNDERVOLTAGE AS SOON AS SWING BUS VOLTAGE PRESENT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
06.3.03.09.1	G-15C	27-2 (SWGR2 UV RELAY) 86 (52-1221 OVLD RELAY)	CONTACTS OPEN (UV ON, OVLD OFF)	(SAME AS 6.3.3.8.1)	(SAME AS 6.3.3.8.1)	(SAME AS 6.3.3.8.1)	(SAME AS 6.3.3.8.1)	NORMAL POSITION. SWGR #2 BUS UNDERVOLTAGE AND G-15B OVERLOAD RELAYS. 86 RELAY ALSO ACTUATED BY 27-1X1 UV RELAY FOR SWGR #2
06.3.03.09.2	G-15C	27-2 (SWGR2 UV RELAY) 86 (52-1221 OVLD RELAY)	CONTACTS CLOSED (UV OFF, OVLD ON)	(SAME AS 6.3.3.8.2)	(SAME AS 6.3.3.8.2)	(SAME AS 6.3.3.8.2)	(SAME AS 6.3.3.8.2)	
06.3.03.10.1	G-15C	27-1X1 (UV RELAY)	CONTACTS OPEN (OFF)	SOUTH CCM PUMP WILL NOT TRIP ON SWGR #3 UNDERVOLTAGE	PERIODIC TESTING	NONE REQUIRED	NONE. TRAIN A/B BUS LOADING IMPACT FOR SIS/SISLOP EVENTS PRECLUDED BY AUTOMATIC ISOLATION OF SWGR #3	NORMAL POSITION. SWGR #3 UNDERVOLTAGE RELAY
06.3.03.10.2	G-15C	27-1X1 (UV RELAY)	CONTACTS CLOSED (ON)	SOUTH CCM PUMP TRIPS, CANNOT BE RESTARTED	CONTROL ROOM INDICATION, PERIODIC TESTING	TRAIN A OR B TO SERVE ALL REQUIRED LOADS	INOPERABILITY OF SOUTH CCM PUMP	
06.3.03.11.1	G-15C	SWGR #3 125VDC CONTROL POWER	VOLTS LOW	SOUTH CCM PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	TRAIN A OR B TO SERVE ALL REQUIRED LOADS	INOPERABILITY OF SOUTH CCM PUMP IF NOT INITIALLY RUNNING	
06.4.01.01.1	MANUAL VALVES, COMMON FLOW PATH 399	CCW-387, 396	OPEN	EXCESS CCM FLOW TO SPENT FUEL PIT #1, DIVERTING FLOW FROM OTHER REQUIRED CCM LOADS	PERIODIC SURVEILLANCE, LOCAL INDICATION	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING PROGRAM	POTENTIAL REDUCTION OF CCM FLOW TO ECCS LOADS	SPENT FUEL PIT #1. CCM-399 PRESET TO THROTTLE FLOW
06.4.01.01.2	MANUAL VALVES, COMMON FLOW PATH 399	CCW-387, 396	CLOSED	CCW FLOW ISOLATED TO SPENT FUEL PIT #1, INCREASING FLOW TO OTHER REQUIRED CCM LOADS	PERIODIC SURVEILLANCE, LOCAL INDICATION	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING PROGRAM	NONE FOR ECCS LOADS, LOSS OF COOLING FOR SPENT FUEL PIT	
06.4.01.02.1	MANUAL VALVES, COMMON FLOW PATH 389, 390	CCW-375, 377	OPEN	EXCESS FLOW TO RECIRC #1, DIVERTING FLOW FROM OTHER REQUIRED CCM LOADS	PERIODIC SURVEILLANCE, LOCAL INDICATION	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING PROGRAM	POTENTIAL REDUCTION OF CCM FLOW TO OTHER ECCS LOADS	RECIRC #1, INCLUDING REBUBBLING WATER PUMP MINIFLOW COOLING. CCM-390 PRESET TO THROTTLE FLOW
06.4.01.02.2	MANUAL VALVES, COMMON FLOW PATH 389, 390	CCW-375, 377	CLOSED	CCW FLOW ISOLATED TO RECIRC #1, INCREASING FLOW TO OTHER REQUIRED CCM LOADS	PERIODIC SURVEILLANCE, LOCAL INDICATION	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING PROGRAM	LOSS OF COOLING FOR RECIRC #1 AND REBUBBLING WATER PUMP MINIFLOW	
06.4.01.03.1	MANUAL VALVES, COMMON FLOW PATH 351, 352, 353	CCW-301, 350	OPEN	EXCESS CCM FLOW TO RAD MONITOR AND SURGE TANK, DIVERTING FLOW FROM OTHER REQUIRED CCM LOADS	PERIODIC SURVEILLANCE, LOCAL INDICATION	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING PROGRAM	POTENTIAL REDUCTION OF CCM FLOW TO ECCS LOADS	*SURGE TANK/RAD MONITOR LINE. CCM-350, 352, 353 NOT IN LOCKING PROGRAM

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 6-1: COMPONENT COOLING WATER FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.01.03.2	MANUAL VALVES, COMMON FLOW PATH	CCW-301, 350, 351, 352, 353	CLOSED	CCW FLOW ISOLATED TO RAD MONITOR AND FROM BURGE TANK BACK TO PUMP SUCTION, CAUSING LOSS OF PUMP SUCTION PRESSURE CONTROL	PERIODIC SURVEILLANCE, LOCAL INDICATION	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING PROGRAM	LOSS OF ALL CCW PUMPS DUE TO LOSS OF SUCTION PRESSURE CONTROL	RETURN LINE VALVE CCW-301 IN LOCKING PROGRAM
06.4.01.04.1	MANUAL VALVES, COMMON FLOW PATH	CCW-404, 405, 406, 407, 408, 409, 410, 411	OPEN	EXCESS CCW FLOW TO REACTOR CYCLE SAMPLE HE, DIVERTING FLOW FROM REQUIRED CCW LOADS	PERIODIC SURVEILLANCE	NONE	*POTENTIAL REDUCTION OF CCW FLOW TO ECCS LOADS	*REACTOR CYCLE SAMPLE HE. CCW-407, 408, 409, 410 THROTTLE FLOW BUT NOT IN LOCKING PROGRAM. NO FLOW INDICATION PROVIDED. THEREFORE, SYSTEM HYDRAULIC BALANCE REQUIRED WITH VALVES FULLY OPEN
06.4.01.04.2	MANUAL VALVES, COMMON FLOW PATH	CCW-404, 405, 406, 407, 408, 409, 410, 411	CLOSED	CCW FLOW ISOLATED TO REACTOR CYCLE SAMPLE HE, INCREASING FLOW TO REQUIRED CCW LOADS	PERIODIC SURVEILLANCE	NONE REQUIRED FOR ECCS, PASS SYSTEM FOR POST-ACCIDENT SAMPLING	LOSS OF COOLING TO REACTOR CYCLE SAMPLE HE, NONE FOR ECCS	
06.4.01.05.1	MANUAL VALVES, COMMON FLOW PATH	CCW-421, 422, 423, 424	OPEN	EXCESS CCW FLOW TO CHARGING PUMP LUBE OIL COOLERS, DIVERTING FLOW FROM OTHER REQUIRED CCW LOADS	PERIODIC SURVEILLANCE	NONE	*POTENTIAL REDUCTION OF CCW FLOW TO OTHER ECCS LOADS	*CHARGING PUMP LUBE OIL COOLERS. FLOW INDICATION NOT PROVIDED AND VALVES NOT IN LOCKING PROGRAM
06.4.01.05.2	MANUAL VALVES, COMMON FLOW PATH	CCW-421, 422, 423, 424	CLOSED	CCW FLOW ISOLATED TO CHARGING PUMP LUBE OIL COOLERS, INCREASING FLOW TO OTHER REQUIRED CCW LOADS	PERIODIC SURVEILLANCE	NONE FOR SIS, REDUNDANT G-8A FAN COOLER FOR SISLOP	*LOSS OF BOTH CHARGING PUMPS FOR SIS, LOSS OF CHARGING PUMP G-8B FOR SISLOP	*ASSUMED PRE-EXISTING FAILURE IN ABSENCE OF VALVE LOCKING, BECAUSE COOLING DUTY FOR NORMAL OPERATION (VERIFIED BY LUBE OIL TEMPERATURE ALARMS) DOES NOT BOUND POST-ACCIDENT CHARGING PUMP HEAT LOADS
06.4.01.06.1	MANUAL VALVES, COMMON FLOW PATH	CCW-412, 415, 416	OPEN	EXCESS CCW FLOW TO SEAL WATER HE, DIVERTING FLOW FROM OTHER REQUIRED CCW LOADS	LOCAL INDICATION, PERIODIC SURVEILLANCE	NONE	*POTENTIAL REDUCTION IN CCW FLOW TO OTHER ECCS LOADS	*SEAL WATER HE. VALVE CCW-415 PRESRT TO THROTTLE FLOW. VALVES NOT IN LOCKING PROGRAM
06.4.01.06.2	MANUAL VALVES, COMMON FLOW PATH	CCW-412, 415, 416	CLOSED	CCW FLOW ISOLATED TO SEAL WATER HE, INCREASING FLOW TO OTHER REQUIRED CCW LOADS	LOCAL INDICATION, PERIODIC SURVEILLANCE	NONE	*POTENTIAL LOSS OF CHARGING PUMP SUCTION SUBCOOLING PRIOR TO REMOTE-MANUAL ISOLATION OF SEAL WATER RETURN LINE	SEAL WATER RETURN LINE ISOLATION VALVES NOT AUTOMATICALLY ISOLATED ON SIS/SISLOP OR CIS
06.4.01.07.1	MANUAL VALVES, COMMON FLOW PATH	CCW 425-427, 429-434, 436-440, 442, 495, 497	OPEN	EXCESS CCW FLOW TO RWL LOADS, DIVERTING FLOW FROM REQUIRED CCW LOADS	PERIODIC SURVEILLANCE	NONE	*POTENTIAL REDUCTION OF CCW FLOW TO ECCS LOADS	*RWL LOADS (WASTE GAS COMPRESSORS, AFTERCOOLERS, SAMPLE COOLERS, ETC). FLOW INDICATION NOT PROVIDED AND VALVES NOT IN LOCKING PROGRAM. THEREFORE, SYSTEM HYDRAULIC BALANCE REQUIRED WITH VALVES FULLY OPEN
06.4.01.07.2	MANUAL VALVES, COMMON FLOW PATH	CCW 425-427, 429-434, 436-440, 442, 495, 497	CLOSED	CCW FLOW ISOLATED TO RWL LOADS, INCREASING FLOW TO REQUIRED CCW LOADS	PERIODIC SURVEILLANCE	NONE REQUIRED	LOSS OF COOLING TO RWL LOADS	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PDBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.01.08.1	MANUAL VALVES, COMMON FLOW PATH 017, 019, 453, 476, 477	CCW-003, 009	OPEN	EXCESS CCW FLOW TO RCP-A BEARINGS AND THERMAL BARRIER COIL, DIVERTING FLOW FROM OTHER REQUIRED CCW LOADS	LOCAL INDICATION, PERIODIC SURVEILLANCE	NONE	POTENTIAL REDUCTION OF CCW FLOW TO OTHER ECCS LOADS	RCP-A MOTOR AND THERMAL BARRIER COOLING. VALVES NOT IN LOCKING PROGRAM
06.4.01.08.2	MANUAL VALVES, COMMON FLOW PATH 017, 019, 453, 476, 477	CCW-003, 009	CLOSED	CCW FLOW ISOLATED TO RCP-A BEARINGS AND THERMAL BARRIER COIL, INCREASING FLOW TO OTHER REQUIRED CCW LOADS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION, PERIODIC SURVEILLANCE	SEAL INJECTION FLOW FOR POST-ACCIDENT RCP SEAL INTEGRITY	LOSS OF CCW COOLING TO RCP-A THERMAL BARRIER, SEAL INJECTION UNAFFECTED	
06.4.01.09.1	MANUAL VALVES, COMMON FLOW PATH 036, 038, 457, 486, 487	CCW-006, 030	OPEN	EXCESS CCW FLOW TO RCP-B BEARINGS AND THERMAL BARRIER COIL, DIVERTING FLOW FROM OTHER REQUIRED CCW LOADS	LOCAL INDICATION, PERIODIC SURVEILLANCE	NONE	POTENTIAL REDUCTION OF CCW FLOW TO OTHER ECCS LOADS	RCP-B MOTOR AND THERMAL BARRIER COOLING. VALVES NOT IN LOCKING PROGRAM
06.4.01.09.2	MANUAL VALVES, COMMON FLOW PATH 036, 038, 457, 486, 487	CCW-006, 030	CLOSED	CCW FLOW ISOLATED TO RCP-B BEARINGS AND THERMAL BARRIER COIL, INCREASING FLOW TO OTHER REQUIRED CCW LOADS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION, PERIODIC SURVEILLANCE	SEAL INJECTION FLOW FOR POST-ACCIDENT RCP SEAL INTEGRITY	LOSS OF CCW COOLING TO RCP-B THERMAL BARRIER, SEAL INJECTION UNAFFECTED	
06.4.01.10.1	MANUAL VALVES, COMMON FLOW PATH 016, 018, 455, 481, 482	CCW-006, 010	OPEN	EXCESS CCW FLOW TO RCP-C BEARINGS AND THERMAL BARRIER COIL, DIVERTING FLOW FROM OTHER REQUIRED CCW LOADS	LOCAL INDICATION, PERIODIC SURVEILLANCE	NONE	POTENTIAL REDUCTION OF CCW FLOW TO OTHER ECCS LOADS	RCP-C MOTOR AND THERMAL BARRIER COOLING. VALVES NOT IN LOCKING PROGRAM
06.4.01.10.2	MANUAL VALVES, COMMON FLOW PATH 016, 018, 455, 481, 482	CCW-006, 010	CLOSED	CCW FLOW ISOLATED TO RCP-C BEARINGS AND THERMAL BARRIER COIL, INCREASING FLOW TO OTHER REQUIRED CCW LOADS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION, PERIODIC SURVEILLANCE	SEAL INJECTION FLOW FOR POST-ACCIDENT RCP SEAL INTEGRITY	LOSS OF CCW COOLING TO RCP-C THERMAL BARRIER, SEAL INJECTION UNAFFECTED	
06.4.01.11.1	MANUAL VALVES, COMMON FLOW PATH 030, 033, 038	CCW-026, 029	OPEN	EMERGENCY THERMAL BARRIER PUMP ALIGNED TO RCP-A, B AND C. NO EFFECT ON CCW FLOW UNLESS EMERGENCY THERMAL BARRIER PUMP G-964 STARTS	PERIODIC SURVEILLANCE	NONE REQUIRED IF G-964 OFF, REDUNDANT CCW PUMPS TO ENSURE REQUIRED FLOWS IF G-964 ON	NONE UNLESS G-964 ON, IN WHICH CASE POTENTIAL REDUCTION IN CCW FLOW TO OTHER REQUIRED CCW LOADS	NORMAL POSITION FOR STANDBY SERVICE OF EMERGENCY THERMAL BARRIER PUMP. VALVES NOT IN LOCKING PROGRAM
06.4.01.11.2	MANUAL VALVES, COMMON FLOW PATH 030, 033, 038	CCW-026, 029	CLOSED	EMERGENCY THERMAL BARRIER COOLING PATH ISOLATED TO RCP-A, B OR C	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE FOR ECCS	EMERGENCY THERMAL BARRIER PUMP NOT CREDITED FOR ECCS EVENTS
06.4.01.12.1	MANUAL VALVES, COMMON FLOW PATH 470	CCW-450, 469	OPEN	EXCESS CCW FLOW TO EXCESS LETDOWN HI, DIVERTING FLOW FROM ECCS LOADS	LOCAL INDICATION, PERIODIC SURVEILLANCE	NONE	POTENTIAL REDUCTION IN CCW FLOW TO ECCS LOADS	EXCESS LETDOWN HI, NOT NORMALLY IN SERVICE. CCW-469 PRESET TO THROTTLE FLOW. VALVES NOT IN LOCKING PROGRAM
06.4.01.12.2	MANUAL VALVES, COMMON FLOW PATH 470	CCW-450, 469	CLOSED	CCW FLOW ISOLATED TO EXCESS LETDOWN HI, INCREASING FLOW TO ECCS LOADS	LOCAL INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	LOSS OF COOLING TO EXCESS LETDOWN HI, NONE FOR ECCS LOADS	
06.4.01.13.1	MANUAL VALVES, COMMON FLOW PATH 070, 073, 443, 445, 459, 461, 463	CCW 041-046	OPEN	EXCESS CCW FLOW TO RBR PUMPS, DIVERTING FLOW FROM ECCS LOADS	PERIODIC SURVEILLANCE	NONE	POTENTIAL REDUCTION IN CCW FLOW TO ECCS LOADS	RBR HI AND RBR PUMP COOLING. RBR HI CCW FLOW CONTROLLED BY TCW-601A/B. VALVES NOT IN LOCKING PROGRAM
06.4.01.13.2	MANUAL VALVES, COMMON FLOW PATH 070, 073, 443, 445, 459, 461, 463	CCW 041-046	CLOSED	CCW FLOW ISOLATED TO RBR PUMPS AND/OR HI, INCREASING FLOW TO ECCS LOADS	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE FOR ECCS	RBR SYSTEM NOT CREDITED POST-ACCIDENT, SINCE DOES NOT MEET SINGLE FAILURE FOR VALVE ALIGNMENT AND IS NOT RQ

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
TABLE 6-1: COMPONENT COOLING WATER FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.01.14.1	MANUAL VALVES, COMMON FLOW PATH 058, 063,065,067,069, 447,463	CCM-050,052,054	OPEN	EXCESS CCM FLOW TO REACTOR SHIELD COOLING COILS	PERIODIC SURVEILLANCE	NONE	POTENTIAL REDUCTION IN CCM FLOW TO ECCS LOADS	*REACTOR SHIELD COOLING COILS FLOW INDICATION NOT PROVIDED AND VALVES NOT IN LOCKING PROGRAM. THERMOSTAT SYSTEM HYDRAULIC BALANCE REQUIRED WITH VALVES FULLY OPEN REACTOR SHIELD COOLING REQUIRED TO PREVENT LONG-TERM DEGRADATION OF SHIELD CONCRETE DURING NORMAL OPERATION *RCP-A THERMAL BARRIER COOLING/EMERGENCY THERMAL BARRIER PATH. CCM-001 AND 025 NOT IN 1ST PROGRAM *RCP-B THERMAL BARRIER COOLING/EMERGENCY THERMAL BARRIER PATH. CCM-024 AND 082 NOT IN 1ST PROGRAM *RCP-C THERMAL BARRIER COOLING/EMERGENCY THERMAL BARRIER PATH. CCM-002 AND 026 NOT IN 1ST PROGRAM
06.4.01.14.2	MANUAL VALVES, COMMON FLOW PATH 058, 063,065,067,069, 447,463	CCM-050,052,054	CLOSED	CCM FLOW ISOLATED TO REACTOR SHIELD COOLING COILS	CONTROL ROOM ANNUNCIATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE FOR ECCS	
06.4.01.15.1	CHECK VALVES, COMMON FLOW PATH 025, 035	CCM-001, 011,	NONE (PASSIVE)		PERIODIC TESTING			
06.4.01.16.1	CHECK VALVES, COMMON FLOW PATH 082, 092	CCM-024, 040,	NONE (PASSIVE)		PERIODIC TESTING			
06.4.01.17.1	CHECK VALVES, COMMON FLOW PATH 026, 032	CCM-002, 012,	NONE (PASSIVE)		PERIODIC TESTING			
06.4.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	DIVERSION OF BOTH TRAINS OF CCM PUMP FLOW AND LOSS OF CCM INVENTORY	PERIODIC SURVEILLANCE	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	POTENTIAL LOSS OF BOTH TRAINS OF CCM PUMPING DUE TO UNRESOLVABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SAFETY RELATED BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
06.4.02.01.2	MANUAL VALVES, COMMON BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
06.4.02.02.1	CHECK OR RELIEF VALVES, COMMON BOUNDARY		NORMAL (PASSIVE)		PERIODIC SURVEILLANCE (SURGE TANK MAKEUP REQUIREMENTS)		NONE	INCLUDES: PSV-1483, RV-787 (SURGE TANK VAPOR SPACE), RV-721A, 721B, 721C. VACUUM BREAKER AND RELIEF VALVES PREVENT LOSS OF SURGE TANK IF RCV-605 CLOSURE
06.4.03.01.1	TCV-601A	VALVE/ACTUATOR	OPEN	EXCESS CCM FLOW TO RBB BY B-21A, DIVERTING CCM FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	FLOW PATH ISOLATED BY BLOCK VALVE OR LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT CCM FLOW RATE	*INCLUDES PCV-1601A. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING, DUE TO INCREASED SPENT FUEL PIT HEAT LOAD RBB NOT CREDITED POST-ACCIDENT DUE TO ALIGNMENT VALVE SINGLE FAILURE AND SYSTEM BQ SUSCEPTIBILITIES
06.4.03.01.2	TCV-601A	VALVE/ACTUATOR	CLOSED	CCM FLOW ISOLATED TO RBB BY B-21A, INCREASING FLOW TO ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE FOR ECCS	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS

SAS ONOPER UNIT 1

TABLE 6-1: COMPONENT COOLING WATER FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.03.02.1	TCV-601A	TC-601A LOOP	OUTPUT HIGH (VALVE CLOSED)	(SAME AS 6.4.3.1.2)	(SAME AS 6.4.3.1.2)	(SAME AS 6.4.3.1.2)	(SAME AS 6.4.3.1.2)	INCLUDES TH-601A, TC-601A, TH-601A, TI-601A AND TM-601A NONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.03.02.2	TCV-601A	TC-601A LOOP	OUTPUT LOW (VALVE OPEN)	(SAME AS 6.4.3.1.1)	(SAME AS 6.4.3.1.1)	(SAME AS 6.4.3.1.1)	(SAME AS 6.4.3.1.1)	
06.4.03.02.3	TCV-601A	TC-601A LOOP	EQ	TCV-601A OPENS, CAUSING EXCESS CCW FLOW TO RHR BY R-21A AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	NONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.03.03.1	TCV-601A	13A	PRESSURE LOW	TCV-601A FAILS OPEN, CAUSING EXCESS CCW FLOW TO RHR BY R-21A AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*INCLUDES VALVE 13A-1242. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.04.01.1	TCV-601B	VALVE/ACTUATOR	OPEN	EXCESS CCW FLOW TO RHR BY R-21B, DIVERTING CCW FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	FLOW PATH ISOLATED BY BLOCK VALVE OR LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT CCW FLOW RATE	*INCLUDES PCV-1601B. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING, DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.04.01.2	TCV-601B	VALVE/ACTUATOR	CLOSED	CCW FLOW ISOLATED TO RHR BY R-21B, INCREASING FLOW TO ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE FOR ECCS	RHR NOT CREDITED POST-ACCIDENT DUE TO ALIGNMENT VALVE SINGLE FAILURE AND SYSTEM EQ SUSCEPTIBILITIES
06.4.04.02.1	TCV-601B	TC-601B LOOP	OUTPUT HIGH (VALVE CLOSED)	(SAME AS 6.4.4.1.2)	(SAME AS 6.4.4.1.2)	(SAME AS 6.4.4.1.2)	(SAME AS 6.4.4.1.2)	INCLUDES TH-601B, TC-601B, TH-601B, TI-601B AND TM-601B NONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.04.02.2	TCV-601B	TC-601B LOOP	OUTPUT LOW (VALVE OPEN)	(SAME AS 6.4.4.1.1)	(SAME AS 6.4.4.1.1)	(SAME AS 6.4.4.1.1)	(SAME AS 6.4.4.1.1)	
06.4.04.02.3	TCV-601B	TC-601B LOOP	EQ	TCV-601B OPENS, CAUSING EXCESS CCW FLOW TO RHR BY R-21B AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	NONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.04.03.1	TCV-601B	ISA	PRESSURE LOW	TCV-601B FAILS OPEN, CAUSING EXCESS CCW FLOW TO RHR BY B-21B AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*INCLUDES VALVE ISA-1243. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.05.01.1	TCV-601A TCV-601B	VITAL BUS #4 (8-1402V)	VOLTS LOW	TCV-601A/B FAIL OPEN, CAUSING EXCESS CCW FLOW TO RHR BY B-21A/B AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION	VALVES ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.06.01.1	PC-605 LOOP	PC-605	CONTACTS OPEN (LO HDR PRESS)	AUTO-START SIGNAL TO CCW AND EMERGENCY THERMAL BARRIER PUMPS, CAUSING PUMPS TO START AS SOON AS RESPECTIVE BUS VOLTAGE AVAILABLE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL RESPONSE FOLLOWING BUS UNDERVOLTAGE TRIPS FOR SISLOP EVENT
06.4.06.01.2	PC-605 LOOP	PC-605	CONTACTS CLOSED (NORMAL HDR PRESS)	AUTO-START SIGNAL ON LOW HDR PRESSURE DISABLED TO CCW AND EMERGENCY THERMAL BARRIER PUMPS, SIS/SISLOP AUTO-START OF G-15A/B UNAPPECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF CCW SYSTEM FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	NORMAL POSITION. SOUTH CCW PUMP G-15C NOT CREDITED FOR SIS/SISLOP EVENTS
06.4.06.01.3	PC-605 LOOP	PC-605	BQ	AUTO-START SIGNAL TO CCW AND EMERGENCY THERMAL BARRIER PUMPS, CAUSING PUMPS TO START AS SOON AS RESPECTIVE BUS VOLTAGE AVAILABLE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	BQ FAILURE (INCLUDING OPEN, SHORT OR GROUND) COULD MIMIC NORMAL RESPONSE FOLLOWING BUS UNDERVOLTAGE TRIPS FOR SISLOP EVENT
06.4.06.02.1	PC-605 LOOP (RELAY)	PC-605X (RELAY)	ON (NORMAL HDR PRESS)	(SAME AS 6.4.6.1.2)	(SAME AS 6.4.6.1.2)	(SAME AS 6.4.6.1.2)	(SAME AS 6.4.6.1.2)	
06.4.06.02.2	PC-605 LOOP (RELAY)	PC-605X (RELAY)	OFF (LO HDR PRESS)	(SAME AS 6.4.6.1.1)	(SAME AS 6.4.6.1.1)	(SAME AS 6.4.6.1.1)	(SAME AS 6.4.6.1.1)	
06.4.06.02.3	PC-605 LOOP (RELAY)	PC-605X (RELAY)	INPUT OPEN OR SHORT	(SAME AS 6.4.6.1.1)	(SAME AS 6.4.6.1.1)	(SAME AS 6.4.6.1.1)	(SAME AS 6.4.6.1.1)	
06.4.06.02.4	PC-605 LOOP (RELAY)	PC-605X (RELAY)	OUTPUT SHORT OR GROUND	AUTOSTART SIGNAL TO CCW AND EMERGENCY THERMAL BARRIER PUMPS, CAUSING PUMPS TO START AS SOON AS RESPECTIVE BUS VOLTAGE AVAILABLE. FAILURE PARALLELS POSITIVE POLE OF 125VDC CONTROL POWER FOR ALL 3 480 V BUSES	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	*COMMON-MODE LOSS OF BOTH ELECTRICAL TRAINS COULD OCCUR WITH PRE-EXISTING GROUND ON NEGATIVE POLE OF DC SYSTEM. TECH SPEC ACTION ENTRY REQUIRED WITH DC SYSTEM GROUNDED
06.4.06.03.1	PC-605 LOOP	VITAL BUS #4 (8-1415V)	VOLTS LOW	AUTOSTART SIGNAL TO CCW AND EMERGENCY THERMAL BARRIER PUMPS, CAUSING PUMPS TO START AS SOON AS RESPECTIVE BUS VOLTAGE AVAILABLE	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 6-1: COMPONENT COOLING WATER FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.07.01.1	CV-122A CV-122B CV-122C	VALVE/ACTUATOR	OPEN	CCW FLOW ALIGNED THROUGH THERMAL BARRIER COILS FOR RCP-A, B OR C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION. INCLUDES SOLENOID VALVES RV-1722A, 1722B, 1722C AND HAND SWITCHES HS-1722A, 1722B, 1722C. REMOTE-MANUAL ISOLATION REQUIRED FOR THERMAL BARRIER COIL FAILURE ONLY
06.4.07.01.2	CV-122A CV-122B CV-122C	VALVE/ACTUATOR	CLOSED	CCW FLOW ISOLATED TO THERMAL BARRIER COIL FOR RCP-A, B OR C	CONTROL ROOM INDICATION	SEAL INJECTION FOR POST-ACCIDENT RCP SEAL INTEGRITY	CCW COOLING LOST FOR RCP-A, B OR C SEAL, SEAL INJECTION UNAFFECTED	
06.4.07.01.3	CV-122A CV-122B CV-122C	VALVE/ACTUATOR	EQ	CCW FLOW ALIGNED THROUGH THERMAL BARRIER COILS FOR RCP-A, B OR C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SOLENOID VALVES RV-1722A, 1722B, 1722C NOT EQ. FUSES PROVIDED FOR (b)(2) PROTECTION OF OTHER CIRCUITS
06.4.07.02.1	CV-122A CV-122B CV-122C	VITAL BUS #2 (0-1204V)	VOLTS LOW	CV-122A, B AND C FAIL OPEN, ALIGNING CW FLOW THROUGH THERMAL BARRIER COILS FOR RCP-A, B AND C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVES NORMALLY OPEN, REMOTE-MANUALLY CLOSED FOR THERMAL BARRIER COIL FAILURE ONLY
06.4.07.03.1	CV-122A CV-122B CV-122C	ISA	PRESSURE LOW	CV-122A, B AND C FAIL OPEN, ALIGNING CW FLOW THROUGH THERMAL BARRIER COILS FOR RCP-A, B AND C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVES NORMALLY OPEN. THIS FAILURE WOULD PREVENT REMOTE-MANUALLY CLOSING FOR THERMAL BARRIER COIL FAILURE. VERIFICATION REQUIRED THAT FLOW RATE INTO CCW SYSTEM FOR THIS EVENT IS LESS THAN LOCAL THRESHOLD
06.4.08.01.1	G-964	PUMP/MOTOR	FLOW LOW	REDUCED EMERGENCY THERMAL BARRIER COOLING FLOW	PERIODIC TESTING	NONE REQUIRED	NONE FOR ECCS	PUMP NOT CREDITED FOR ECCS EVENTS
06.4.08.01.2	G-964	PUMP/MOTOR	EQ	MOTOR MAT FAULT, RESULTING IN UP TO 30A DRAIN ON 125VDC BUS #1 BEFORE OVERCURRENT TRIP OF BRKBRKR	CONTROL ROOM INDICATION (DC BUS AMPS)	NONE	*POTENTIAL COMMON-CAUSE LOSS OF TRAIN A 125VDC CONTROL POWER FOR LOCA, HSLB OR FWLB. WITH CONCURRENT SINGLE FAILURE OF TRAIN B, RESULTS IN LOSS OF ALL AC POWER	*PUMP/MOTOR AND CABLING NOT QUALIFIED FOR IN-CONTAINMENT ENVIRONMENT, CIRCUIT NOT ISOLATED ON SIS/SISLOP, EFFECT NOT ANALYZED IN DESIGN BASIS BATTERY LOADING CALCULATION
06.4.08.02.1	G-964	PC-605I (RELAT)	CONTACTS CLOSED (LO HDR PRESS)	EMERGENCY THERMAL BARRIER PUMP STARTS AFTER 10 SEC DELAY IF C/S IS IN AUTO	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	MOTOR OPERATION IS ANALYZED IN DESIGN BASIS BATTERY CALCULATION
06.4.08.02.2	G-964	PC-605I (RELAT)	CONTACTS OPEN (NORMAL HDR PRESS)	EMERGENCY THERMAL BARRIER PUMP AUTO-START ON LOW HEADER PRESSURE DISABLED, AUTO-START ON BUS #1C/2C UNDERVOLTAGE (LOP) UNAFFECTED IF C/S IN AUTO	PERIODIC TESTING	NONE REQUIRED	NONE FOR ECCS	PUMP NOT CREDITED FOR ECCS EVENTS
06.4.08.03.1	G-964	127-5I (UV RELAT)	CONTACTS CLOSED (ON)	BUS #1C UNDERVOLTAGE SIGNAL TO CONTROL ROOM ANNUNCIATION EMERGENCY THERMAL BARRIER PUMP AUTO-START CIRCUIT. LOP AUTO-START LOGIC BECOMES I/I ON BUS #2C INPUT	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	MOTOR OPERATION IS ANALYZED IN DESIGN BASIS BATTERY LOADING CALCULATIONS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN OMOFRE UNIT 1
TABLE 6-1: COMPONENT COOLING WATER PHEA

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.08.03.2	G-964	127-5X (UV RELAY)	CONTACTS OPEN (OFF)	BUS 81C UNDERVOLTAGE SIGNAL DISABLED TO EMERGENCY THERMAL BARRIER PUMP LOP AUTO-START CIRCUIT, AUTO-START ON LOW HEADER PRESSURE UNAFFECTED	PERIODIC TESTING	NONE REQUIRED	NONE FOR ECCS	NORMAL CONDITION
06.4.08.04.1	G-964	127-6X (UV RELAY)	CONTACTS CLOSED (ON)	BUS 82C UNDERVOLTAGE SIGNAL TO CONTROL ROOM ANNUNCIATION EMERGENCY THERMAL BARRIER PUMP AUTO-START CIRCUIT. LOP AUTO-START LOGIC BECOMES 1/1 ON BUS 81C INPUT	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	MOTOR OPERATION IS ANALYZED IN DESIGN BASIS BATTERY LOADING CALCULATIONS
06.4.08.04.2	G-964	127-6X (UV RELAY)	CONTACTS OPEN (OFF)	BUS 82C UNDERVOLTAGE SIGNAL DISABLED TO EMERGENCY THERMAL BARRIER PUMP LOP AUTO-START CIRCUIT, AUTO-START ON LOW HEADER PRESSURE UNAFFECTED	PERIODIC TESTING	NONE REQUIRED	NONE FOR ECCS	NORMAL CONDITION
06.4.08.05.1	G-964	125VDC BUS #1 (72-120)	VOLTS LOW	EMERGENCY THERMAL BARRIER PUMP CONTROL DISABLED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE FOR ECCS	EMERGENCY THERMAL BARRIER PUMP NOT CREDITED FOR ECCS EVENTS

TABLE 6-2: COMPONENT COOLING WATER BOUNDARY VALVE ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
BOUNDARY VALVE ANALYSIS

ITEM #	--- SAFETY RELATED BOUNDARY ---				--- SAFETY RELATED BACKUP ---			--- NON-SAFETY RELATED BACKUP ---			REMARKS
	TAG #	MC/AUTO?	LOCKED?	NONE	TAG #	MC/AUTO?	NONE	TAG #	MC/AUTO?		
06.1.01	CCW-306	CLOSED	NO	NONE			NONE			DRAIN VALVE ON THE TRAIN A CCM PUMP SUCTION LINE. PAID SHOWS NO CAP OR BACKUP.	
06.1.02	CCW-336	CLOSED	NO	NONE			CAP			DRAIN VALVE ON TRAIN A CCM PUMP DISCHARGE LINE.	
06.1.03	CCW-314	OPEN	NO	CCW-318	CLOSED					TRAIN A CCM PUMP CASING VENT VALVE.	
06.1.04	CCW-361	CLOSED	NO	NONE			CAP			VENT VALVE FOR TRAIN A CCM HEAT EXCHANGER.	
06.1.05	CCW-359	CLOSED	NO	NONE			CAP			DRAIN VALVE FOR TRAIN A CCM HEAT EXCHANGER.	
06.1.06	CCW-382	CLOSED	NO	NONE			CAP			VENT VALVE ON OUTLET LINE FROM TRAIN A CCM HEAT EXCHANGER.	
06.1.07	CCW-345	CLOSED	NO	NONE			NONE			DRAIN VALVE ON SUPPLY LINE TO TRAIN A CCM HEAT EXCHANGER. PAID SHOWS NO CAP OR BACKUP.	
06.1.08	CCW-381	CLOSED	NO	NONE			CAP			DRAIN VALVE ON DISCHARGE LINE FROM TRAIN A CCM HEAT EXCHANGER.	
06.2.01	CCW-397	CLOSED	NO	NONE			CAP			DRAIN VALVE ON TRAIN B CCM PUMP.	
06.2.02	CCW-337	CLOSED	NO	NONE			CAP			DRAIN VALVE FOR TRAIN B CCM PUMP DISCHARGE LINE.	
06.2.03	CCW-343	CLOSED	NO	NONE			CAP			VENT VALVE ON SUPPLY LINE TO TRAIN B CCM HEAT EXCHANGER.	
06.2.04	CCW-360	CLOSED	NO	NONE			CAP			VENT VALVE FOR TRAIN B CCM HEAT EXCHANGER.	
06.2.05	CCW-358	CLOSED	NO	NONE			CAP			DRAIN VALVE ON TRAIN B CCM HEAT EXCHANGER.	
06.2.06	CCW-380	CLOSED	NO	NONE			NONE			DRAIN VALVE ON OUTLET CCM LINE FROM TRAIN B CCM HEAT EXCHANGER. PAID SHOWS NO CAP OR BACKUP.	
06.2.07	CCW-344	CLOSED	NO	NONE			NONE			DRAIN VALVE ON SUPPLY LINE TO TRAIN B CCM HEAT EXCHANGER. PAID SHOWS NO CAP OR BACKUP.	
06.2.08	CCW-315	OPEN	NO	CCW-319	CLOSED					TRAIN B CCM PUMP CASING VENT	
06.3.01	CCW-309	CLOSED	NO	NONE			CAP			DRAIN VALVE ON TRAIN C CCM PUMP SUCTION LINE.	
06.3.02	CCW-339	CLOSED	NO	NONE			CAP			DRAIN VALVE ON TRAIN C CCM PUMP DISCHARGE.	
06.3.03	CCW-321	CLOSED	NO	CCW-317	OPEN					CASING VENT VALVE FOR TRAIN C CCM PUMP CASING	
06.4.01	CCW-354	CLOSED	NO	NONE			BCV-605, CCW-355 AND CCW-356	AUTO		BURGE TANK FILL MANIFOLD ISOLATION. BCV-605 AUTO-CLOSES ON HIGH RADIATION SIGNAL FROM RB-121F. REMAINING BACKUP VALVES ARE NORMALLY CLOSED	
06.4.02	CCW-378	CLOSED	NO	NONE			CAP			SAMPLE VALVE ON LINE BETWEEN BURGE TANK AND CCM PUMP SUCTION HEADER	
06.4.03	CCW-379	CLOSED	NO	NONE			PHU-325	CHRC		CONNECTION BETWEEN CCM AND PRIMARY MAKEUP WATER SYSTEM.	
06.4.04	CCW-397	CLOSED	NO	NONE			CAP			VENT VALVE LOCATED ON RETURN LINE FROM RECIRCULATION HEAT EXCHANGER	
06.4.05	CCW-394	CLOSED	NO	NONE			NONE			DRAIN VALVE ON RETURN LINE FROM RECIRCULATION HEAT EXCHANGER. PAID SHOWS NO CAP OR BACKUP.	
06.4.06	CCW-504	CLOSED	NO	NONE			NONE			DRAIN TO HOLDUP TANK BLC-C-20A VAULT. PAID SHOWS NO CAP OR BACKUP.	
06.4.07	CCW-391	CLOSED	NO	NONE			NONE			VENT LINE ON BYPASS AROUND CV-131A AND B. PAID SHOWS NO CAP OR BACKUP.	
06.4.08	CCW-505	CLOSED	NO	NONE			NONE			DRAIN VALVE ON RECIRCULATION HEAT EXCHANGER. PAID SHOWS NO CAP OR BACKUP.	
06.4.09	CCW-400	CLOSED	NO	NONE			NONE			VENT VALVE ON RETURN LINE FROM SPENT PUBL POOL. PAID SHOWS NO CAP OR BACKUP.	
06.4.10	CCW-388	CLOSED	NO	NONE			NONE			DRAIN VALVE ON CCM SUPPLY LINE TO SPENT PUBL POOL HEAT EXCHANGER. PAID SHOWS NO CAP OR BACKUP.	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
BOUNDARY VALVE ANALYSIS

ITEM #	--- SAFETY RELATED BOUNDARY ---			SAFETY RELATED BACKUP			--- NON-SAFETY RELATED BACKUP ---			REMARKS
	TAG #	MC/AUTO?	LOCKED?	TAG #	MC/AUTO?		TAG #	MC/AUTO?		
06.4.11	CCW-101	CLOSED	NO	NONE			NONE		# DRAIN VALVE ON RETURN CCM LINE FROM SPENT FUEL HEAT EXCHANGER. PAID SHOWS NO CAP OR BACKUP.	
06.4.12	UNE NEEDLE	CLOSED	NO	CCW-310, UNE NEEDLE	OPEN	NONE			# NEEDLE VALVE AT PI-605D. NO TAG NUMBER SHOWN ON PAID. BACKUP IS COMMON ROOT VALVE FOR PC-605	
06.4.13	UNE GLOBES	CLOSED	NO	NONE			NONE		# DRAIN VALVES AT LC-610A, LC-610B, LC-610. NO TAG NUMBERS SHOWN ON PAID	
06.4.14	CCW-194	CLOSED	NO	NONE			NONE		# SEAL WATER HI SUPPLY LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.15	CCW-113	CLOSED	NO	NONE			NONE		# SEAL WATER HI SUPPLY LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.16	CCW-114	CLOSED	NO	NONE			NONE		# SEAL WATER HI SUPPLY LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.17	CCW-117	CLOSED	NO	NONE			NONE		# SEAL WATER HI SUPPLY LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.18	CCW-120	CLOSED	NO	NONE			NONE		# SEAL WATER HI SUPPLY LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.19	CCW-195	CLOSED	NO	NONE			NONE		# SEAL WATER HI SUPPLY LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.20	CCW-141	CLOSED	NO	NONE			NONE		# RNL SUPPLY LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.21	CCW-126	CLOSED	NO	CAP					# RNL SUPPLY CONNECTION, SPARE	
06.4.22	CCW-135	CLOSED	NO	CAP					# RNL RETURN CONNECTION, SPARE	
06.4.23	CCW-154	CLOSED	NO	NONE			CAP		# RCP-A SUPPLY LINE VENT VALVE	
06.4.24	CCW-047	CLOSED	NO	NONE			CAP		# RCP-A SUPPLY LINE DRAIN VALVE	
06.4.25	CCW-005	CLOSED	NO	NONE			NONE		# RCP-A SUPPLY LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.26	CCW-013	CLOSED	NO	NONE			CCW-015	CLOSED	# RCP-A RETURN LINE VENT VALVE	
06.4.27	RV-721A	RELIEF		NONE REQUIRED					# RCP-A THERMAL BARRIER COIL RELIEF VALVE	
06.4.28	CCW-021	CLOSED	NO	NONE			NONE		# RCP-A RETURN LINE DRAIN VALVE	
06.4.29	CCW-180	CLOSED	NO	NONE			CAP		# RCP-A RETURN LINE DRAIN VALVE	
06.4.30	CCW-150	CLOSED	NO	NONE			CAP		# RCP-B RETURN LINE VENT VALVE	
06.4.31	CCW-084	CLOSED	NO	NONE			CAP		# RCP-B RETURN LINE DRAIN VALVE	
06.4.32	CCW-088	CLOSED	NO	NONE			NONE		# RCP-B RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.33	CCW-094	CLOSED	NO	NONE			NONE		# RCP-B RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.34	RV-721B	RELIEF		NONE REQUIRED					# RCP-B THERMAL BARRIER COIL RELIEF VALVE	
06.4.35	CCW-100	CLOSED	NO	NONE			NONE		# RCP-B RETURN LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.36	CCW-190	CLOSED	NO	NONE			CAP		# RCP-B RETURN LINE VENT VALVE	
06.4.37	CCW-156	CLOSED	NO	NONE			CAP		# RCP-C SUPPLY LINE VENT VALVE	
06.4.38	CCW-004	CLOSED	NO	NONE			CAP		# RCP-C SUPPLY LINE DRAIN VALVE	
06.4.39	CCW-008	CLOSED	NO	NONE			NONE		# RCP-C SUPPLY LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	
06.4.40	CCW-014	CLOSED	NO	NONE			NONE		# RCP-C RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFRE UNIT 1
 BOUNDARY VALVE ANALYSIS

ITEM #	--- SAFETY RELATED BOUNDARY ---			--- SAFETY RELATED BACKUP ---			--- NON-SAFETY RELATED BACKUP ---			REMARKS
	TAG #	MC/AUTO?	LOCKED?	TAG #	MC/AUTO?		TAG #	MC/AUTO?		
06.4.41	RV-721C	RELIEF			NONE REQUIRED					RCP-C THERMAL BARRIER COIL RELIEF VALVE
06.4.42	CCW-020	CLOSED	NO		NONE					RCP-C RETURN LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.43	CCW-005	CLOSED	NO		NONE					RCP-C RETURN LINE VENT VALVE
06.4.44	CCW-016	CLOSED	NO		NONE					EXCESS LETDOWN BY SUPPLY LINE DRAIN VALVE
06.4.45	CCW-005	CLOSED	NO		NONE					EXCESS LETDOWN BY SUPPLY LINE DRAIN VALVE
06.4.46	CCW-075	CLOSED	NO		NONE					EXCESS LETDOWN BY SUPPLY LINE VENT VALVE
06.4.47	CCW-077	CLOSED	NO		NONE					EXCESS LETDOWN BY RETURN LINE VENT VALVE
06.4.48	CCW-003	CLOSED	NO		NONE					EXCESS LETDOWN BY RETURN LINE DRAIN VALVE
06.4.49	CCW-451	CLOSED	NO		NONE					EXCESS LETDOWN BY RETURN LINE DRAIN VALVE
06.4.50	CCW-452	CLOSED	NO		NONE					EXCESS LETDOWN BY RETURN LINE VENT VALVE
06.4.51	CCW-471	CLOSED	NO		NONE					EXCESS LETDOWN BY RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.52	CCW-472	CLOSED	NO		NONE					EXCESS LETDOWN BY RETURN LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.53	CCW-475	CLOSED	NO		NONE					EXCESS LETDOWN BY RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.54	CCW-444	CLOSED	NO		NONE					RER BY R-21B SUPPLY LINE VENT VALVE
06.4.55	CCW-049	CLOSED	NO		NONE					RER BY R-21B SUPPLY LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.56	CCW-007	CLOSED	NO		NONE					RER BY R-21B RETURN LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.57	CCW-460	CLOSED	NO		NONE					RER BY R-21B RETURN LINE VENT VALVE
06.4.58	CCW-446	CLOSED	NO		NONE					RER BY R-21A SUPPLY LINE VENT VALVE
06.4.59	CCW-048	CLOSED	NO		NONE					RER BY R-21A SUPPLY LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.60	CCW-072	CLOSED	NO		NONE					RER BY R-21A RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.61	CCW-462	CLOSED	NO		NONE					RER BY R-21A RETURN LINE VENT VALVE
06.4.62	CCW-419	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL SUPPLY LINE VENT VALVE
06.4.63	CCW-448	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL SUPPLY LINE DRAIN VALVE
06.4.64	CCW-079	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL SUPPLY LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.65	CCW-080	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL SUPPLY LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.66	CCW-001	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL RETURN LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.67	CCW-078	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL RETURN LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.68	CCW-498	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.69	CCW-499	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL RETURN LINE DRAIN VALVE. PAID SHOWS NO CAP OR BACKUP
06.4.70	CCW-491	CLOSED	NO		NONE					REACTOR SHIELD COOLING COIL RETURN LINE VENT VALVE. PAID SHOWS NO CAP OR BACKUP

SECTION 7: SALTWATER COOLING

SALTWATER COOLING NOTES

1. Item numbers in this section have been assigned as follows:
 - 07.1: Train A SWC pumping, valves and boundary devices
 - 07.2: Train B SWC pumping, valves and boundary devices
 - 07.3: Auxiliary SWC pumping, valves and boundary devices
 - 07.4: Common flow path and boundary devices.
2. Table 7-1 is the Failure Modes and Effects Analysis (FMEA) for the SWC function. Table 7-2 is the associated boundary valve analysis.
3. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.
4. Potential single failure susceptibilities in the Boundary Valve Analysis table are flagged with "*" in the unlabelled field adjacent to REMARKS. Items flagged with "#" in the unlabelled field adjacent to REMARKS are acceptable from a single failure standpoint subject to credit for SEP Topic III-6 seismic boundary criteria.

SALTWATER COOLING SYSTEM REFERENCES

Piping and Instrumentation Diagrams

5178330 Circulating Water System (Sh 1)
5178331 Circulating Water System (Sh 2)
5178350 Salt Water Cooling System
5178380 Service and Domestic Water System (Sh 1)

Elementary Diagrams

455378 MOV-720A, MOV-720B
455513 MOV-9, MOV-11, MOV-12
455514 MOV-10
5149919 Salt Water Cooling Pumps G-13A, G-13B
5149975 Lockout Relays, Train B SISLOP
5150354 Auxiliary Salt Water Cooling Pump
5150885 480 V Bus Undervoltage Relays

Procedures

SO1-1.0-23 Transfer to Cold Leg Injection and Recirculation
SO1-2.4-1 Loss of Saltwater Cooling System
SO1-7-11 Saltwater Cooling System
SO1-14-40 Control of Locked Valves
SO1-V-2.15 Inservice Testing of Valves Program

Other Documents

SD-SO1-330 System Description: Component Cooling Water System
SD-SO1-340 System Description: Saltwater Cooling System
SD-SO1-580 System Description: Safety Injection, Recirculation and Containment Spray Systems
M89048 Response to Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety Related Systems", dated July 5, 1989

TABLE 7-1: SALTWATER COOLING FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 7-1: SALTWATER COOLING SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.1.01.01.1	MANUAL VALVES, TRAIN A FLOW		OPEN	POTENTIAL RUN-OUT OF TRAIN A SUC PUMP IF SUC-304 NOT THROTTLED TO < 3500 GPM	LOCAL INDICATION, PERIODIC TESTING	ADMINISTRATIVELY CONTROLLED VALVE LOCKING TO PRECLUDE FAILURE, REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN A SUC	NORMAL POSITION. INCLUDES: SUC-300, 302, 304. SERVICE WATER SUPPLY TO SUC PUMP BEARINGS (SUC-306, 310, 312) NOT REQUIRED FOR LONG-TERM POST-ACCIDENT SERVICE IF ALTERNATE COOLING PROVIDED
07.1.01.01.2	MANUAL VALVES, TRAIN A FLOW		CLOSED	TRAIN A SUC PUMP OR CCW HEAT EXCHANGER ISOLATED	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SUC	
07.1.01.02.1	CHECK VALVES, TRAIN A FLOW		NONE (PASSIVE)		LOCAL INDICATION, PERIODIC TESTING			INCLUDES SUC-302
07.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	DIVERSION OF TRAIN A SUC FLOW TO SCREEN WASH SYSTEM OR ATMOSPHERE, OR BYPASS OF TRAIN A SUC XI	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SUC, POTENTIAL INTAKE AREA FLOODING	POTENTIAL FLOODING BOUNDED BY CIRCULATING WATER SYSTEM EXPANSION JOINT FAILURE. SEE TABLE 7-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
07.1.02.01.2	MANUAL VALVES, TRAIN A BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
07.1.02.02.1	CHECK OR RELIEF VALVES, TRAIN A BOUNDARY		NORMAL (PASSIVE)	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE. APPLICABLE VALVES PROVIDE THERMAL RELIEF PROTECTION OF CCW HEAT EXCHANGERS	INCLUDES RV-59
07.1.03.01.1	G-13A	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN A SUC FLOW TO CCW XI	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SUC	
07.1.03.02.1	G-13A	SWGR #1 (52-1114)	OPEN	TRAIN A SUC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SUC	NORMAL POSITION FOR STANDBY SERVICE
07.1.03.02.2	G-13A	SWGR #1 (52-1114)	CLOSED	TRAIN A SUC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH TRAIN A SUC IN OPERATION
07.1.03.03.1	G-13A	SV-01	OPEN (ON)	NONE	LOCAL INDICATION	NONE REQUIRED	NONE	SERVICE WATER ISOLATION TO TRAIN A SUC PUMP BEARINGS. NORMAL POSITION IS OPEN WITH PUMP RUNNING. SOLENOID VALVE WIRED ACROSS 2 OF 3 PUMP MOTOR PHASES
07.1.03.03.2	G-13A	SV-01	CLOSED (OFF)	POTENTIAL LONG-TERM DEGRADATION OF TRAIN A SUC PUMP BEARINGS DURING NORMAL OR POST-ACCIDENT OPERATION	LOCAL INDICATION, PERIODIC TESTING (OF PUMP)	REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN A SUC	
07.1.03.03.3	G-13A	SV-01	SHORT/GROUND	LOSS OF TRAIN A SUC PUMP DUE TO OVERLOAD TRIP RESULTING FROM FAULTY ACROSS THE MOTOR PHASES WHICH POWER SOLENOID VALVE	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SUC	
07.1.03.04.1	G-13A	SRQ 1 (29-1,3)	CONTACTS OPEN (OFF)	TRAIN A SUC PUMP AUTO-START ON SIS/SISLOP DISABLED, OTHER AUTO-START SIGNALS AND MANUAL START/STOP UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SUC FOR INJECTION, INITIAL RECIRC	NORMAL POSITION. SIS/SISLOP AUTO-START DOES NOT REQUIRE PUMP CONTROL SWITCH IN AUTO

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRR UNIT 1
TABLE 7-1: SALTWATER COOLING SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.1.03.04.2	G-13A	89 1 (29-1,3)	CONTACTS CLOSED (ON)	TRAIN A SUC PUMP AUTO-STARTS, CONTROL ROOM INDICATION, CANNOT BE MANUALLY TRIPPED. UV PERIODIC TESTING TRIP UNAPPECTED		REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN A ELECTRICAL POWER DUE TO RELOADING AFTER DC REENERGIZES OUT OF SEQUENCE BUS LOADING FOR THE BUS	CANNOT PREVENT OUT OF SEQUENCE
07.1.03.05.1	G-13A	63 (52-1214 LOW DISCH PRESS RELAY)	CONTACTS OPEN (OFF)	TRAIN A SUC PUMP AUTO-START ON G-13B LOW DISCHARGE PRESSURE DISABLED, NO EFFECT ON SIS/SISLOP AUTO-START	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN A SUC FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	
07.1.03.05.2	G-13A	63 (52-1214 LOW DISCH PRESS RELAY)	CONTACTS CLOSED (ON)	TRAIN A SUC PUMP AUTO-STARTS IF IN AUTO	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN A ELECTRICAL POWER DUE TO OUT OF AUTO, OR BUS VOLTAGE OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	*SUC PUMPS MUST BE MAINTAINED TO INCLUDE SUC PUMP START CONCURRENT WITH DC BRKR CLOSURE
07.1.03.06.1	G-13A	86 (52-1214 OVLD RELAY)	CONTACTS OPEN (OFF)	TRAIN A SUC PUMP AUTO-START ON G-13B OVERLOAD OR BUS UNDERVOLTAGE DISABLED, NO AUTO-START	(SAME AS 7.1.3.5.1)	(SAME AS 7.1.3.5.1)	(SAME AS 7.1.3.5.1)	
07.1.03.06.2	G-13A	86 (52-1214 OVLD RELAY)	CONTACTS CLOSED (ON)	(SAME AS 7.1.3.5.2)	(SAME AS 7.1.3.5.2)	(SAME AS 7.1.3.5.2)	(SAME AS 7.1.3.5.2)	(SAME AS 7.1.3.5.2)
07.1.03.07.1	G-13A	27-112 (UV RELAY)	CONTACTS OPEN (OFF)	TRAIN A SUC PUMP WILL NOT TRIP ON SVGR #1 UNDERVOLTAGE	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	NORMAL POSITION. SVGR #1 UNDERVOLTAGE RELAY
07.1.03.07.2	G-13A	27-112 (UV RELAY)	CONTACTS CLOSED (ON)	TRAIN A SUC PUMP TRIPS, CANNOT BE RESTARTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SUC	
07.1.03.08.1	G-13A	62 (52-1114 LOW DISCH PRESS RELAY)	ON	TRAIN A SUC PUMP LOW DISCHARGE PRESSURE AUTO-START SIGNAL TO G-13B, NO EFFECT ON TRAIN A SUC	CONTROL ROOM INDICATION	REDUNDANT TRAIN (A) FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	INCLUDES PR-20. CIRCUIT ARMED BY RELAY 62 (TDC) 3-SUC AFTER TRAIN A SUC PUMP BRKR CLOSURE
07.1.03.08.2	G-13A	63 (52-1114 LOW DISCH PRESS RELAY)	OFF	TRAIN A SUC PUMP LOW DISCHARGE PRESSURE AUTO-START SIGNAL DISABLED TO G-13B, NO EFFECT ON TRAIN A SUC	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN B SUC FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	NORMAL POSITION
07.1.03.09.1	G-13A	86 (52-1114 OVLD RELAY)	ON	TRAIN A SUC PUMP TRIPS AND CANNOT BE RESTARTED, SENDS AUTO-START SIGNAL TO G-13B	CONTROL ROOM INDICATION	NONE SISLOP, REDUNDANT TRAIN FOR SIS	POTENTIAL LOSS OF SUC FUNCTION FOR SISLOP DUE TO LOSS OF TRAIN A SUC PUMP (SIS/SISLOP) AND POTENTIAL CONCURRENT LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING (SISLOP ONLY)	*SUC PUMPS MUST BE MAINTAINED FOR OUT OF AUTO OR BUS VOLTAGE CALCULATIONS REVISID TO CONSIDER SUC PUMP START CONCURRENT WITH DC BRKR CLOSURE
07.1.03.09.2	G-13A	86 (52-1114 OVLD RELAY)	OFF	TRAIN A SUC PUMP OVERLOAD AND BUS UNDERVOLTAGE AUTO-START SIGNAL DISABLED TO G-13B	(SAME AS 7.1.3.8.2)	(SAME AS 7.1.3.8.2)	(SAME AS 7.1.3.8.2)	NORMAL POSITION
07.1.03.10.1	G-13A	52I/4I (RELAY)	ON	AUTO-OPEN SIGNAL TO NOV-720B, DIVERTING CCW FLOW FROM COMMON HEADER THROUGH TRAIN A CCW HE. REDUCES CCW COOLING CAPACITY IF TRAIN A SUC PUMP NOT RUNNING	CONTROL ROOM INDICATION, PERIODIC TESTING	TRAIN A SUC PUMP TO RESTORE COOLING FOR NON-SIS/SISLOP EVENTS W/ TRAIN B SUC PUMP RUNNING. NONE REQUIRED FOR SIS/SISLOP OR W/ TRAIN A SUC PUMP RUNNING	REDUCTION OF CCW HEAT REMOVAL CAPACITY FOR NON-SIS/SISLOP EVENTS W/ TRAIN B SUC PUMP RUNNING, NONE FOR SIS/SISLOP OR W/ TRAIN A SUC PUMP RUNNING	NORMAL POSITION WITH TRAIN A SUC PUMP RUNNING

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 1-1: SALTWATER COOLING SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.1.03.10.2	G-13A	52R/A1 (RBLAT)	OFF	AUTO-OPEN SIGNAL TO NOV-7208 DISABLED, PREVENTING AUTOMATIC ALIGNMENT OF TRAIN A CCM BE	PERIODIC TESTING	REDUNDANT TRAIN FOR INJECTION, INITIAL RECIRCULATION	INOPERABILITY OF TRAIN A SMC/CCW FOR INJECTION AND INITIAL RECIRCULATION	NORMAL POSITION WITH TRAIN A SMC PUMP IN STANDBY SERVICE
07.1.03.11.1	G-13A	SERVICE WATER	PRESSURE LOW	POTENTIAL LONG-TERM DEGRADATION OF TRAIN A SMC PUMP BEARINGS, POTENTIAL SALTWATER BACKFLOW THROUGH NON-SEISMIC LINES POST-SIS/SISLOP	CONTROL ROOM INDICATION	NONE. BACKUP BEARING COOLING REQUIRED FOR LONG-TERM POST-SIS/SISLOP OPERATION	POTENTIAL INOPERABILITY OF SMC FOR LONG-TERM POST-SIS/SISLOP OPERATION	COMMON-CAUSE FAILURE MAY OCCUR DUE TO POSTULATED CONCURRENT SEISMIC EVENT. BACKUP BEARING COOLING STEPS REQUIRED IN 80s. ALSO, FAILURE REDUCES PUMP OUTPUT UNTIL BOUNDARY VALVES LOCALLY CLOSED, SO THAT PUMP IS REQUIRED WITH BACKFLOW CONDITIONS
07.1.03.12.1	G-13A	SMCR #1 125VDC CONTROL POWER	VOLTS LOW	TRAIN A SMC PUMP CANNOT BE STARTED OR TRIPPED, TRAIN A LOW DISCHARGE PRESSURE, OVERLOAD AND BUS UNDERVOLTAGE AUTO-START SIGNALS TO G-13B DISABLED	CONTROL ROOM INDICATION	REDUNDANT TRAIN (WITH MANUAL START CAPABILITY FOR NON-SIS/SISLOP EVENTS)	INOPERABILITY OF TRAIN A SMC, REDUCED RELIABILITY OF TRAIN B SMC FOR NON-SIS/SISLOP EVENTS	
07.2.01.01.1	HANUAL VALVES, TRAIN B FLOW		OPEN	POTENTIAL RUN-OUT OF TRAIN B SMC PUMP IF SMC-303 NOT THROTTLED TO < 3500 GPM	LOCAL INDICATION, PERIODIC TESTING	ADMINISTRATIVELY CONTROLLED VALVE LOCKING TO PRECLUDE FAILURE, REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN B SMC	NORMAL POSITION. INCLUDES: SMC-319, 301, 303. SERVICE WATER SUPPLY TO SMC PUMP BEARINGS (SMC-307, 311, 313) NOT REQUIRED FOR LONG-TERM POST-ACCIDENT SERVICE IF ALTERNATE COOLING PROVIDED
07.2.01.01.2	HANUAL VALVES, TRAIN B FLOW		CLOSED	TRAIN B SMC PUMP OR CCM HEAT EXCHANGER ISOLATED	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SMC	
07.2.01.02.1	CHECK VALVES, TRAIN B FLOW		NONE (PASSIVE)		LOCAL INDICATION, PERIODIC TESTING			INCLUDES SMC-303
07.2.02.01.1	HANUAL VALVES, TRAIN B BOUNDARY		OPEN	DIVERSION OF TRAIN B SMC FLOW TO SCREEN WASH SYSTEM OR ATMOSPHERE, OR BYPASS OF TRAIN B SMC BY	PERIODIC SURVEILLANCE	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SMC, POTENTIAL INTAKE AREA FLOODING	POTENTIAL FLOODING BOUNDED BY CIRCULATING WATER SYSTEM EXPANSION JOINT FAILURE. SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
07.2.02.01.2	HANUAL VALVES, TRAIN B BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
07.2.02.02.1	CHECK OR RELIEF VALVES, TRAIN B BOUNDARY		NORMAL (PASSIVE)	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE. APPLICABLE VALVES PROVIDE THERMAL RELIEF PROTECTION OF CCM HEAT EXCHANGERS	INCLUDES RV-58
07.2.03.01.1	G-13B	PUMP/MOTOR	LOW FLOW	REDUCED TRAIN B SMC FLOW TO CCM BY	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SMC	
07.2.03.02.1	G-13B	SMCR #2 (52-1214)	OPEN	TRAIN B SMC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SMC	NORMAL POSITION FOR STANDBY SERVICE
07.2.03.02.2	G-13B	SMCR #2 (52-1214)	CLOSED	TRAIN B SMC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH TRAIN B SMC IN OPERATION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRE UNIT 1
TABLE 1-1: SALTWATER COOLING SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.2.03.03.1 G-13B	9V-02		OPEN (ON)	NONE	LOCAL INDICATION	NONE REQUIRED	NONE	SERVICE WATER ISOLATION TO TRAIN B SUC PUMP BEARINGS. NORMAL POSITION IS OPEN WITH PUMP RUNNING. SOLENOID VALVE WIRED ACROSS 2 OF 3 PUMP MOTOR PHASES
07.2.03.03.2 G-13B	9V-02		CLOSED (OFF)	POTENTIAL LONG-TERM DEGRADATION OF TRAIN B SUC PUMP BEARINGS DURING NORMAL OR POST-ACCIDENT OPERATION	LOCAL INDICATION, PERIODIC TESTING (OF PUMP)	REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN B SUC	
07.2.03.03.3 G-13B	9V-02		SHORT/GROUND	LOSS OF TRAIN B SUC PUMP BUS TO OVERLOAD TRIP RESULTING FROM FAULT ACROSS THE MOTOR PHASES WHICH POWER SOLENOID VALVE	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SUC	
07.2.03.04.1 G-13B	SHQ 2 (29-9,11)		CONTACTS OPEN (OFF)	TRAIN B SUC PUMP AUTO-START ON PERIODIC TESTING SIS/SISLOP DISABLED, OTHER AUTO-START SIGNALS AND MANUAL START/STOP UNAFFECTED		REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SUC FOR INJECTION, INITIAL RECIRC	NORMAL POSITION. SIS/SISLOP AUTO-START DOES NOT REQUIRE PUMP CONTROL SWITCH IN AUTO
07.2.03.04.2 G-13B	SHQ 2 (29-9,11)		CONTACTS CLOSED (ON)	TRAIN B SUC PUMP AUTO-STARTS, CANNOT BE MANUALLY TRIPPED. UV TRIP UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN B ELECTRICAL POWER DUE TO RELOADING AFTER DC REENERGIZES OUT OF SEQUENCE BUS LOADING FOR THE BUS	CANNOT PREVENT OUT OF SEQUENCE OUT OF SEQUENCE BUS LOADING FOR THE BUS
07.2.03.05.1 G-13B	63 (52-1114 DISCH PRESS RELAY)		CONTACTS OPEN (OFF)	TRAIN B SUC PUMP AUTO-START ON PERIODIC TESTING G-13A LOW DISCHARGE PRESSURE DISABLED, NO EFFECT ON SIS/SISLOP AUTO-START		NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN B SUC FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	
07.2.03.05.2 G-13B	63 (52-1114 DISCH PRESS RELAY)		CONTACTS CLOSED (ON)	TRAIN B SUC PUMP AUTO-STARTS IF IN AUTO	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN B ELECTRICAL POWER DUE TO OUT OF AUTO, OR BUS VOLTAGE OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	*SUC PUMPS MUST BE MAINTAINED TO INCLUDE SUC PUMP START CONCURRENT WITH DC BREAK CLOSURE
07.2.03.06.1 G-13B	86 (52-1114 OVLD RELAY)		CONTACTS OPEN (OFF)	TRAIN B SUC PUMP AUTO-START ON (SAME AS 7.2.3.5.1) G-13A OVERLOAD OR BUS UNDERVOLTAGE DISABLED, NO EFFECT ON SIS/SISLOP AUTO-START		(SAME AS 7.2.3.5.1)	(SAME AS 7.2.3.5.1)	
07.2.03.06.2 G-13B	86 (52-1114 OVLD RELAY)		CONTACTS CLOSED (ON)	(SAME AS 7.2.3.5.2)	(SAME AS 7.2.3.5.2)	(SAME AS 7.2.3.5.2)	(SAME AS 7.2.3.5.2)	(SAME AS 7.2.3.5.2)
07.2.03.07.1 G-13B	27-122 (UV RELAY)		CONTACTS OPEN (OFF)	TRAIN B SUC PUMP WILL NOT TRIP ON SWGR #2 UNDERVOLTAGE	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	NORMAL POSITION. SWGR #2 UNDERVOLTAGE RELAY
07.2.03.07.2 G-13B	27-122 (UV RELAY)		CONTACTS CLOSED (ON)	TRAIN B SUC PUMP TRIPS, CANNOT BE RESTARTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SUC	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPEN UNIT 1
TABLE 7-1: SALTWATER COOLING SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.2.03.08.1	G-13B	63 (52-1214 LOW ON DISCH PRESS RELAY)		TRAIN B SMC PUMP LOW DISCHARGE CONTROL ROOM INDICATION PRESSURE AUTO-START SIGNAL TO G-13A, NO EFFECT ON TRAIN B SMC		REDUNDANT TRAIN (B) FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	INCLUDES PR-29...CIRCUIT ARMED BY RELAY 62 (TDC) 3 SEC AFTER TRAIN B SMC PUMP BREAK CLOSURE
07.2.03.08.2	G-13B	63 (52-1214 LOW OFF DISCH PRESS RELAY)		TRAIN B SMC PUMP LOW DISCHARGE PERIODIC TESTING PRESSURE AUTO-START SIGNAL DISABLED TO G-13A, NO EFFECT ON TRAIN B SMC		NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY OF TRAIN A SMC FOR NON-SIS/SISLOP EVENTS, NONE FOR SIS/SISLOP	NORMAL POSITION
07.2.03.09.1	G-13B	86 (52-1214 OVLD ON RELAY)		TRAIN B SMC PUMP TRIPS AND CANNOT BE RESTARTED, SENDS AUTO-START SIGNAL TO G-13A	CONTROL ROOM INDICATION	NONE SISLOP, REDUNDANT TRAIN FOR SIS	*POTENTIAL LOSS OF SMC FUNCTION FOR SISLOP DUE TO LOSS OF TRAIN B SMC PUMP (SIS/SISLOP) AND POTENTIAL CONCURRENT LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING (SISLOP ONLY)	*SMC PUMPS MUST BE MAINTAINED OUT OF AUTO OR BUS VOLTAGE CALCULATIONS REVISED TO CONSIDER SMC PUMP START CONCURRENT WITH DG BREAK CLOSURE
07.2.03.09.2	G-13B	86 (52-1214 OVLD OFF RELAY)		TRAIN B SMC PUMP OVERLOAD AND BUS UNDERVOLTAGE AUTO-START SIGNAL DISABLED TO G-13A	(SAME AS 7.2.3.9.2)	(SAME AS 7.2.3.9.2)	(SAME AS 7.2.3.9.2)	NORMAL POSITION
07.2.03.10.1	G-13B	522/AI (RELAY)	ON	AUTO-OPEN SIGNAL TO MOV-120A, DIVERTING CCW FLOW FROM COMMON HEADER THROUGH TRAIN B SMC HI. REDUCES CCW COOLING CAPACITY IF TRAIN B SMC PUMP NOT RUNNING	CONTROL ROOM INDICATION, PERIODIC TESTING	TRAIN B SMC PUMP TO RESTORE COOLING FOR NON-SIS/SISLOP EVENTS W/ TRAIN A SMC PUMP RUNNING, NONE REQUIRED FOR SIS/SISLOP OR W/ TRAIN B SMC PUMP RUNNING	REDUCTION OF CCW HEAT REMOVAL CAPACITY FOR NON-SIS/SISLOP EVENTS W/ TRAIN A SMC PUMP RUNNING, NONE FOR SIS/SISLOP OR W/ TRAIN B SMC PUMP RUNNING	NORMAL POSITION WITH TRAIN B SMC PUMP RUNNING
07.2.03.10.2	G-13B	522/AI (RELAY)	OFF	AUTO-OPEN SIGNAL TO MOV-120A DISABLED, PREVENTING AUTOMATIC ALIGNMENT OF TRAIN B CCW HI	PERIODIC TESTING	REDUNDANT TRAIN FOR INJECTION, INITIAL RECIRCULATION	IMPROBABILITY OF TRAIN B SMC/CCW FOR INJECTION AND INITIAL RECIRCULATION	NORMAL POSITION WITH TRAIN B SMC PUMP IN STANDBY SERVICE
07.2.03.11.1	G-13B	SERVICE WATER	PRESSURE LOW	POTENTIAL LONG-TERM DEGRADATION OF TRAIN B SMC PUMP BEARINGS, POTENTIAL SALTWATER BACKFLOW THROUGH NON-SBIS/IC LINES POST-SIS/SISLOP	CONTROL ROOM INDICATION	NONE, BACKUP BEARING COOLING REQUIRED FOR LONG-TERM POST-SIS/SISLOP OPERATION	*POTENTIAL IMPROBABILITY OF SMC FOR LONG-TERM POST-SIS/SISLOP OPERATION	*COMMON-CAUSE FAILURE MAY OCCUR DUE TO POSTULATED CONCURRENT SBIS/IC EVENT. BACKUP BEARING COOLING STRIPS REQUIRED IN HOLES. ALSO, FAILURE REDUCES PUMP OUTPUT UNTIL BOUNDARY VALVES LOCALLY CLOSED, SO THAT PUMP IS REQUIRED WITH BACKFLOW CONDITIONS
07.2.03.12.1	G-13B	SWCR #2 125VDC CONTROL POWER	VOLTS LOW	TRAIN B SMC PUMP CANNOT BE STARTED OR TRIPPED, TRAIN B LOW DISCHARGE PRESSURE, OVERLOAD AND BUS UNDERVOLTAGE AUTO-START SIGNALS TO G-13A DISABLED	CONTROL ROOM INDICATION	REDUNDANT TRAIN (WITH MANUAL START CAPABILITY FOR NON-SIS/SISLOP EVENTS)	IMPROBABILITY OF TRAIN B SMC, REDUCED RELIABILITY OF TRAIN A SMC FOR NON-SIS/SISLOP EVENTS	
07.3.01.01.1	MANUAL VALVES, AUX SMC FLOW		OPEN	AUX SMC PUMP ALIGNED TO TRAIN B CCW HI	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT TRAIN (A) FOR SIS/SISLOP EVENTS	POTENTIAL IMPROBABILITY OF TRAIN B SMC DUE TO BACKFLOW THROUGH NON-SAFETY RELATED PIPING FROM AUX SMC PUMP, POTENTIAL INTER AREA FLOODING	NORMAL POSITION (RECEIPT SMC-381). INCLUDES SMC-312, 343, 345, 379. VACUUM PRIMING VALVES REQUIRED FOR PUMP SUCTION CONTROL, SERVICE WATER VALVES FOR PUMP BEARING LONG TERM SERVICE. FLOODING BOUNDED BY CIRCULATING WATER SYSTEM EXPANSION JOINT FAILURE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 7-1: SALTWATER COOLING SYSTEM PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.3.01.01.2	MANUAL VALVES, AUX S/W FLOW		CLOSED	AUX S/W PUMP ISOLATED	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX S/W PUMP	NORMAL POSITION FOR S/W-301 WITH PUMP OFF. PUMP USED TO MEET TECH SPEC 3.3.1 ACTION FOR G-13A/B. INOPERABLE, BUT NOT SUITABLE FOR LONG-TERM OPERATION DUE TO POTENTIAL SUCTION STRAINER CLOGGING
07.3.01.02.1	CHECK VALVES, AUX S/W FLOW		NONE (PASSIVE)		LOCAL INDICATION, PERIODIC TESTING			INCLUDES S/W-338 (PUMP) AND 344 (VACUUM PRIMING SYSTEM)
07.3.02.01.1	MANUAL VALVES, AUX S/W BOUNDARY		OPEN	AUX S/W PUMP DISABLED DUE TO LOSS OF SUCTION/PRIME CONTROL	PERIODIC SURVEILLANCE	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX S/W PUMP	SEE TABLE 7-2 FOR DETAILED BOUNDARY VALVE ANALYSIS
07.3.02.01.2	MANUAL VALVES, AUX S/W BOUNDARY		CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
07.3.02.02.1	CHECK OR RELIEF VALVES, AUX S/W BOUNDARY		NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
07.3.03.01.1	G-13C	PUMP/MOTOR	LOW FLOW	REDUCED AUX S/W PUMP FLOW	PERIODIC TESTING	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX S/W PUMP	AUX S/W PUMP IS NOT CREDITED FOR SIS/SISLOP EVENTS (IE, IS NON-SEISMIC), BUT MAY BE REQUIRED PER TECH SPEC 3.3.1 ACTION STATEMENT FOR INOPERABILITY OF G-13A OR B
07.3.03.02.1	G-13C	SWGR #3 (52-1313)	OPEN	AUX PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 7.3.3.1.1)	(SAME AS 7.3.3.1.1)	NORMAL POSITION. PUMP MUST BE STARTED MANUALLY TO MEET TECH SPEC 3.3.1 ACTION STATEMENT REQUIREMENTS FOR G-13A OR B
07.3.03.02.2	G-13C	SWGR #3 (52-1313)	CLOSED	AUX S/W PUMP STARTS OR FAILS TO TRIP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE FOR SIS/SISLOP	SWGR #3 ISOLATED ON SIS/SISLOP
07.3.03.03.1	G-13C	SV-82	OPEN (ON)	NONE	LOCAL INDICATION	NONE REQUIRED	NONE	ISA ISOLATION TO VACUUM PRIMING SYSTEM REDUCTOR. NORMAL POSITION IS OPEN WHEN AUX S/W PUMP IS RUNNING
07.3.03.03.2	G-13C	SV-37A	CLOSED (OFF)	AUX S/W PUMP DISABLED DUE TO LOSS OF SUCTION/PRIME CONTROL	LOCAL INDICATION, PERIODIC TESTING (OF PUMP)	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX S/W PUMP	SOLENOID VALVE OPENING REQUIRED FOR VACUUM PRIME SYSTEM OPERATION
07.3.03.03.3	G-13C	SV-37A	SHORT	LOSS OF AUX S/W PUMP DUE TO PHASE FAULTY THROUGH SOLENOID VALVE	CONTROL ROOM INDICATION	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX S/W PUMP	125VDC SYSTEMS UNGROUNDED
07.3.03.04.1	G-13C	27-112 (UV RELAY)	CONTACTS OPEN (OFF)	AUX S/W PUMP WILL NOT TRIP ON SWGR #3 UNDERVOLTAGE IF RUNNING	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. SWGR #3 UNDERVOLTAGE RELAY. SWGR #3 ISOLATED ON SIS/SISLOP
07.3.03.04.2	G-13C	27-112 (UV RELAY)	CONTACTS CLOSED (ON)	AUX S/W PUMP TRIPS, CANNOT BE RESTARTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX S/W PUMP	
07.3.03.05.1	G-13C	SERVICE WATER	PRESSURE LOW	POTENTIAL LONG-TERM DEGRADATION OF AUX S/W PUMP BEARINGS	CONTROL ROOM INDICATION	REDUNDANT SAFETY RELATED TRAINS	POTENTIAL INOPERABILITY OF AUX S/W PUMP	AUX S/W PUMP IS NOT CREDITED FOR SIS/SISLOP EVENTS (IE, IS NON-SEISMIC), NOR IS IT SUITABLE FOR LONG-TERM OPERATION FOR NON-SIS/SISLOP EVENTS DUE TO THE POTENTIAL FOR SUCTION STRAINER CLOGGING

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS OPERATOR UNIT 1
TABLE 1-1: SALTWATER COOLING SYSTEM PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.3.03.06.1	G-13C	ISA	PRESSURE LOW	AUX SMC PUMP DISABLED DUE TO LOSS OF SUCTION/PRIME CONTROL	CONTROL ROOM INDICATION	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX SMC PUMP	AUX SMC PUMP IS NOT CREDITED FOR SIS/SISLOP EVENTS (IS, IS NON-SERVIC), NOR IS IT SUITABLE FOR LONG-TERM OPERATION FOR NON-SIS/SISLOP EVENTS DUE TO THE POTENTIAL FOR SUCTION STRAINER CLOGGING
07.3.03.07.1	G-13C	SWGR #3 125VDC CONTROL POWER	VOLTS LOW	AUX SMC PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX SMC	SWGR #3 IS ISOLATED ON SIS/SISLOP IRRESPECTIVE OF TRIP STATUS OF ITS INDIVIDUAL LOADS
07.4.01.01.1			OPEN	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION. INCLUDES: SMC-305
07.4.01.01.2			CLOSED	SMC DISCHARGE TO OUTFALL BLOCED FROM BOTH CCM HI	PERIODIC SURVEILLANCE	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING	INOPERABILITY OF BOTH TRAINS OF SMC/CCW HEAT REMOVAL	
07.4.01.02.1			NONE (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
07.4.02.01.1			OPEN	SMC DISCHARGE FROM BOTH CCM HI PARALLELED WITH CIRC WATER PUMP SUPPLY TO TPCW HI, POTENTIALLY REDUCING SMC FLOW WHEN CIRC WATER PUMPS ON	PERIODIC SURVEILLANCE	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING	POTENTIAL INOPERABILITY OF BOTH TRAINS OF SMC/CCW HEAT REMOVAL FOR SIS EVENTS, NONE FOR SISLOP FAILURE. SEE TABLE 1-2 FOR (IN WHICH CIRC WATER PUMPS ARE TRIPPED AND LOCKED OUT).	POTENTIAL FLOODING BOUNDED BY CIRC WATER EXPANSION JOINT ANALYSIS
07.4.02.01.2			CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	POTENTIAL INTAKE AREA FLOODING
07.4.02.02.1			OPEN	SMC PUMPS PARALLELED AT CCM HI INLETS, POTENTIAL FAILURE OF RUNNING SMC PUMP DUE TO RUNOUT	PERIODIC SURVEILLANCE	FAILURE PRECLUDED BY ADMINISTRATIVELY CONTROLLED VALVE LOCKING	POTENTIAL INOPERABILITY OF BOTH SAFETY RELATED SMC PUMPS DUE TO SEQUENTIAL RUN-OUT/FAILURE OF OPERATING PUMP, AUTO-START OF STANDBY PUMP AND ITS SUBSEQUENT RUN-OUT/FAILURE	
07.4.02.02.2			CLOSED	NONE	PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	NORMAL POSITION
07.4.02.03.1			NORMAL (PASSIVE)					THERE ARE NO VALVES IN THIS CATEGORY
07.4.03.01.1	NOV-9	VALVE/ACTUATOR	OPEN	NONE DURING NORMAL OPERATION. DURING HEAT TREAT WOULD RESULT IN LOSS OF SMC/CCW COOLING CAPACITY DUE TO ELLEVATED SUCTION TEMPERATURE PRIOR TO TURBINE TRIP	LOCAL INDICATION	INACTOR TRIP/TURBINE TRIP OCCURS AUTOMATICALLY ON SIS/SISLOP	POTENTIAL INOPERABILITY OF BOTH TRAINS OF SMC/CCW HEAT REMOVAL PRIOR TO TURBINE TRIP	INTAKE GATE. POSITION FOR NORMAL OPERATION. GATE CLOSED (TO 65) AND INTAKE BECIRC GATE OPENED FOR HEAT TREAT
07.4.03.01.2	NOV-9	VALVE/ACTUATOR	CLOSED	INTAKE GATE DROPS TO BUMP STOPS AT 6X OPEN POSITION. NORMAL FOR HEAT TREATMENT	LOCAL INDICATION	NONE FOR INJECTION, INITIAL RECIRCULATION OR LONG-TERM. AUX SMC PUMP FOR INTERIM SERVICE	LOSS OF SUCTION HEAD TO BOTH TRAINS OF SMC PUMPS, POTENTIALLY CAUSING LOSS OF BOTH PUMPS FOR SIS EVENTS (NO CIRC WATER PUMP TRIP) OR IF PRIOR TO SISLOP	CIRC WATER PUMP SUCTION NOT LOCATED SUFFICIENTLY ABOVE SMC PUMP SUCTION TO PREVENT LOSS OF SMC PP WPSB. AUX SMC PUMP IS NON-SAFETY RELATED AND POWERED FROM SWGR #3, WHICH IS ISOLATED ON SIS/SISLOP

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
TABLE 7-1: SALTWATER COOLING SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.4.03.02.1	NOV-9	86 (N3-3)	CONTACTS CLOSED (OFF)	GATE ACTUATOR POWER NOT LOCKED-OUT ON SISLOP	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. MCC-3 LOCKOUT RELAT. SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELATS
07.4.03.02.2	NOV-9	86 (N3-3)	CONTACTS OPEN (ON)	GATE ACTUATOR POWER LOCKED-OUT, GATE FAILS AS-IS	PERIODIC TESTING	NONE REQUIRED	NONE	
07.4.03.03.1	NOV-9	MCC-3 (42-1367)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.04.01.1	NOV-10	VALVE/ACTUATOR	OPEN	NONE DURING NORMAL OPERATION. DURING HEAT TREAT WOULD RESULT IN LOSS OF SMC/CCW COOLING CAPACITY DUE TO ELEVATED SUCTION TEMPERATURE PRIOR TO TURBINE TRIP	LOCAL INDICATION	REACTOR TRIP/TURBINE TRIP OCCURS AUTOMATICALLY ON SIS/SISLOP	POTENTIAL INOPERABILITY OF BOTH TRAINS OF SMC/CCW HEAT REMOVAL PRIOR TO TURBINE TRIP	OUTFALL GATE. POSITION FOR NORMAL OPERATION. GATE CLOSED AND OUTFALL RECIRC GATE OPENED FOR HEAT TREAT
07.4.04.01.2	NOV-10	VALVE/ACTUATOR	CLOSED	OUTFALL GATE BLOCKS CIRC WATER DISCHARGE FROM CONDENSERS. NO EFFECT ON SMC	LOCAL INDICATION	NONE REQUIRED	NONE	SMC DISCHARGES TO OUTFALL PIPE DOWNSTREAM OF OUTFALL GATE. SQ IS UNAFFECTED BY THIS FAILURE
07.4.04.02.1	NOV-10	LS-2 (NOV-12)	CONTACTS OPEN	OUTFALL GATE CANNOT BE CLOSED TO LESS THAN 20%. DURING HEAT TREAT WOULD RESULT IN LOSS OF SMC/CCW COOLING CAPACITY DUE TO ELEVATED SUCTION TEMPERATURE PRIOR TO TURBINE TRIP	LOCAL INDICATION, PERIODIC TESTING	REACTOR TRIP/TURBINE TRIP OCCURS AUTOMATICALLY ON SIS/SISLOP	POTENTIAL INOPERABILITY OF BOTH TRAINS OF SMC/CCW HEAT REMOVAL PRIOR TO TURBINE TRIP	OUTFALL RECIRC GATE (NOV-12) OPEN LIMIT SWITCH. POSITION FOR NORMAL OPERATION
07.4.04.02.2	NOV-10	LS-2 (NOV-12)	CONTACTS CLOSED	OUTFALL GATE CAN BE FULLY CLOSED WITHOUT OUTFALL RECIRC GATE BEING FULLY OPEN. NO EFFECT ON SMC	PERIODIC TESTING	NONE REQUIRED	NONE	
07.4.04.03.1	NOV-10	86 (N3-3)	CONTACTS CLOSED (OFF)	GATE ACTUATOR POWER NOT LOCKED-OUT ON SISLOP	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. MCC-3 LOCKOUT RELAT. SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELATS
07.4.04.03.2	NOV-10	86 (N3-3)	CONTACTS OPEN (ON)	GATE ACTUATOR POWER LOCKED-OUT, GATE FAILS AS-IS	PERIODIC TESTING	NONE REQUIRED	NONE	
07.4.04.04.1	NOV-10	MCC-3 (42-1370)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.05.01.1	NOV-11	VALVE/ACTUATOR	OPEN	NONE DURING HEAT TREAT. DURING NORMAL OPERATION WOULD RESULT IN LOSS OF SMC/CCW COOLING CAPACITY DUE TO ELEVATED SUCTION TEMPERATURE PRIOR TO TURBINE TRIP	LOCAL INDICATION	REACTOR TRIP/TURBINE TRIP OCCURS AUTOMATICALLY ON SIS/SISLOP	POTENTIAL INOPERABILITY OF BOTH TRAINS OF SMC/CCW HEAT REMOVAL PRIOR TO TURBINE TRIP	INTAKE RECIRCULATION GATE. GATE OPENED AND INTAKE GATE CLOSED FOR HEAT TREAT
07.4.05.01.2	NOV-11	VALVE/ACTUATOR	CLOSED	NONE DURING NORMAL OPERATION. DURING HEAT TREAT, REDUCES INTAKE FLOW TO CIRC WATER AND SMC PUMPS TO THAT THROUGH NOV-9 AT 6% OPEN	LOCAL INDICATION	NONE FOR INJECTION. INITIAL RECIRCULATION OR LONG-TERM. AUX SMC PUMP FOR INTERIM RECIRCULATION SERVICE	LOSS OF SUCTION HEAD TO BOTH TRAINS OF SMC PUMPS, POTENTIALLY CAUSING LOSS OF BOTH PUMPS FOR SIS EVENTS (NO CIRC WATER PUMP TRIP) OR IF PRIOR TO SISLOP	CIRC WATER PUMP SUCTION NOT LOCATED SUFFICIENTLY ABOVE SMC PUMP SUCTION TO PREVENT LOSS OF SMC PUMP UPSH. AUX SMC PUMP IS NON-SAFETY RELATED AND POWERED FROM SWGR #3, WHICH IS ISOLATED ON SIS/SISLOP

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 7-1: SALTWATER COOLING SYSTEM PSHA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.4.05.02.1	NOV-11	86 (H3-3)	CONTACTS CLOSED (OFF)	GATE ACTUATOR POWER NOT LOCKED-OUT ON SISLOP	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. MCC-3 LOCKOUT RELAY. SUCR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS
07.4.05.02.2	NOV-11	86 (H3-3)	CONTACTS OPEN (ON)	GATE ACTUATOR POWER LOCKED-OUT, GATE FAILS AS-IS	PERIODIC TESTING	NONE REQUIRED	NONE	
07.4.05.03.1	NOV-11	MCC-3 (42-1373)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.06.01.1	NOV-12	VALVE/ACTUATOR	OPEN	NONE DURING HEAT TREAT. DURING NORMAL OPERATION WOULD RESULT IN LOSS OF SUC/CCW COOLING CAPACITY DUE TO ELEVATED SUCTION TEMPERATURE PRIOR TO TURBINE TRIP	LOCAL INDICATION	REACTOR TRIP/TURBINE TRIP OCCURS AUTOMATICALLY ON SIS/SISLOP	POTENTIAL INOPERABILITY OF BOTH TRAINS OF SUC/CCW HEAT REMOVAL PRIOR TO TURBINE TRIP	OUTFALL RECIRCULATION GATE. GATE OPENED AND OUTFALL GATE CLOSED FOR HEAT TREAT
07.4.06.01.2	NOV-12	VALVE/ACTUATOR	CLOSED	NONE DURING NORMAL OPERATION. DURING HEAT TREAT WOULD BLOCK CIRC WATER PUMP DISCHARGE FROM CONDENSER, NO EFFECT ON SUC	LOCAL INDICATION	NONE REQUIRED	NONE	POSITION DURING NORMAL OPERATION
07.4.06.02.1	NOV-12	86 (H3-3)	CONTACTS CLOSED (OFF)	GATE ACTUATOR POWER NOT LOCKED-OUT ON SISLOP	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. MCC-3 LOCKOUT RELAY. SUCR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS
07.4.06.02.2	NOV-12	86 (H3-3)	CONTACTS OPEN (ON)	GATE ACTUATOR POWER LOCKED-OUT, GATE FAILS AS-IS	PERIODIC TESTING	NONE REQUIRED	NONE	
07.4.06.03.1	NOV-12	MCC-3 (42-1376)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.07.01.1	NOV-9 NOV-10 NOV-11 NOV-12	VALVE/ACTUATOR	NORMAL	NONE	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.07.01.2	NOV-9 NOV-10 NOV-11 NOV-12	VALVE/ACTUATOR	HEAT TREAT	NOV-9 CLOSED TO 6X, NOV-11 OPENED, NOV-10 CLOSED, NOV-12 OPENED. RESULTS IN LOSS OF SUC/CCW COOLING CAPACITY DUE TO ELEVATED SUCTION TEMPERATURE PRIOR TO TURBINE TRIP	LOCAL INDICATION	REACTOR TRIP/TURBINE TRIP OCCURS AUTOMATICALLY ON SIS/SISLOP	POTENTIAL INOPERABILITY OF BOTH TRAINS OF SUC/CCW HEAT REMOVAL PRIOR TO TURBINE TRIP	
07.4.07.01.3	NOV-9 NOV-10 NOV-11 NOV-12	VALVE ACTUATOR	SEISMIC	GATES NOV-10, 11, 12 FAIL CLOSED, GATE NOV-9 FAILS TO 6X OPEN POSITION ON BURP STOPS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE FOR INJECTION OR RECIRC (NON-SEISMIC AUX SUC PUMP ALSO LOST)	*LOSS OF SUCTION HEAD TO BOTH TRAINS OF SUC PUMPS, POTENTIALLY CAUSING LOSS OF BOTH PUMPS FOR SIS EVENTS (NO CIRC WATER PUMP TRIP) OR IF PRIOR TO SISLOP	*GATE ACTUATORS ARE NON-SEISMIC. CIRC WATER PUMP SUCTION NOT LOCATED SUFFICIENTLY ABOVE SUC PUMP SUCTION TO PREVENT LOSS OF SUC PUMP WPSR

TABLE 7-2: SALTWATER COOLING BOUNDARY VALVE ANALYSIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFR UNIT 1
 BOUNDARY VALVE ANALYSIS

ITEM #	SAFETY RELATED BOUNDARY		SAFETY RELATED BACKUP		NON-SAFETY RELATED BACKUP		REMARKS	
	TAG #	NC/AUTO?	LOCED?	TAG #	NC/AUTO?	TAG #		NC/AUTO?
07.1.01	CWS-526	CLOSED	YES					G-13A DISCHARGE CROSS-CONNECT TO TPCW HI CIRC WATER INLET AND SCREEN WASH PUMPS
07.1.02	UNKNOWN	CLOSED	NO	NONE				G-13A INSTRUMENT (PS-29/PI-73) VENT
07.1.03	SVC-334	CLOSED	NO	NONE				G-13A DISCHARGE HEADER VENT
07.1.04	SVC-336	CLOSED	NO	NONE				G-13A DISCHARGE HEADER DRAIN
07.1.05	SVC-362	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE INLET HEAD VENT
07.1.06	SVC-366	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE INLET HEAD DRAIN
07.1.07	SVC-364	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE OUTLET HEAD VENT
07.1.08	SVC-368	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE OUTLET HEAD DRAIN
07.1.09	SVC-332	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE DP-INDICATOR VENT
07.1.10	UNKNOWN	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE DP-INDICATOR VENT
07.1.11	UNKNOWN	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE DP-INDICATOR VENT
07.1.12	UNKNOWN	CLOSED	NO	NONE				TRAIN A CCW HI TUBE-SIDE DP-INDICATOR EQUALIZATION VALVE. VALVE OPEN COULD RESULT IN PARTIAL BYPASS OF HI FLOW
07.1.13	RV-59	RELIEF		NONE REQUIRED				TRAIN A CCW HI TUBE-SIDE THERMAL RELIEF
07.2.01	CWS-527	CLOSED	YES					G-13B DISCHARGE CROSS-CONNECT TO TPCW HI CIRC WATER INLET AND SCREEN WASH PUMPS
07.2.02	UNKNOWN	CLOSED	NO	NONE				G-13B INSTRUMENT (PS-29/PI-74) VENT
07.2.03	SVC-337	CLOSED	NO	NONE				G-13B DISCHARGE HEADER VENT
07.2.04	SVC-335	CLOSED	NO	NONE				G-13B DISCHARGE HEADER DRAIN
07.2.05	SVC-363	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE INLET HEAD VENT
07.2.06	SVC-367	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE INLET HEAD DRAIN
07.2.07	SVC-365	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE OUTLET HEAD VENT
07.2.08	SVC-369	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE OUTLET HEAD DRAIN
07.2.09	UNKNOWN	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE DP-INDICATOR VENT
07.2.10	UNKNOWN	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE DP-INDICATOR VENT
07.2.11	UNKNOWN	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE DP-INDICATOR VENT
07.2.12	UNKNOWN	CLOSED	NO	NONE				TRAIN B CCW HI TUBE-SIDE DP-INDICATOR EQUALIZATION VALVE. VALVE OPEN COULD RESULT IN PARTIAL BYPASS OF HI FLOW
07.3.13	RV-58	RELIEF		NONE REQUIRED				TRAIN B CCW HI TUBE-SIDE THERMAL RELIEF
07.3.01	SVC-352	CLOSED	NO	NONE				AUX SVC PUMP PRIMING TANK DRAIN
07.3.02	SVC-351	CLOSED	NO	NONE				AUX SVC PUMP PRIMING TANK VENT
07.3.03	UNKNOWN	CLOSED	NO	NONE				AUX SVC PUMP SUCTION GAGE GLASS DRAIN VALVE
07.3.04	SVC-340	CLOSED	NO	NONE				AUX SVC PUMP CASING VENT
07.3.05	SVC-346	CLOSED	NO	NONE				AUX SVC PUMP SERVICE WATER VENT
07.3.06	SVC-353	CLOSED	NO	NONE				AUX SVC PUMP CASING DRAIN
07.3.07	UNKNOWN	CLOSED	NO	CAP				AUX SVC PUMP INSTRUMENTATION VENT
07.3.08	SVC-348	CLOSED	NO	NONE				PRIMING SYSTEM SERVICE WATER ISOLATION. VALVE OPEN WOULD DISABLE PRIMING/SUCTION CONTROL
07.4.01	SVC-317	CLOSED	NO	NONE				CCW HI SVC LOOP SBAL VENT. VALVE OPEN COULD RESULT IN HI AIR BINDING UNDER LOW INTAKE WATER LEVEL CONDITIONS
07.4.02	SVC-308	CLOSED	NO	NONE		CWS-529, 530 POV-7, 8	OPEN	SVC OUTLET HEADER CROSS-CONNECT TO TPCW HI CIRC WATER SUPPLY HEADER. VALVE OPEN MAY REDUCE SVC FLOW DUE TO BACKPRESSURE FROM CIRC WATER PUMP OPERATION. BACKUP VALVES POV-7 AND 8 AUTO-OPEN

SECTION 8: SAFETY INJECTION ACTUATION

SAFETY INJECTION ACTUATION SYSTEM NOTES

1. Item numbers in this section have been assigned as follows:
 - 08.1: Train A actuation instrumentation and logic (including block permissive instrumentation for Train B)
 - 08.2: Train B actuation instrumentation and logic
 - 08.3: Common (4 kV bus undervoltage) instrumentation
2. This section covers the Safeguards Sequencers (SEQs) including input instrumentation and manual actuate, block and reset controls, for both the SIS (Safety Injection Signal only) and SISLOP (SIS with concurrent Loss of Offsite Power) conditions. The failure modes and effects for individual SEQ output relays (ie, individual SEQ controlled loads) are addressed in the applicable FMEA tables for the actuated systems. The SEQ actuated 480V lockout relays are addressed in Section 12 of this analysis.
3. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.

SAFETY INJECTION ACTUATION SYSTEM REFERENCES

One Line Diagrams

5102173	125 VDC System No. 1
5102174	120 VAC Vital Bus System - Train A
5149348	125 VDC System No. 2
5159826	120 VAC Vital Bus System - Train B

Elementary Diagrams

N1546 Sh 3	Station Loss of Voltage Auto Transfer
63715	Safety Injection System (Sh 1, 2)
63716	Reactor Protection System (Sh 1, 2)
449408	FCV-456 and CV-142
455457	FCV-1112 Solenoid Valve
5130351	4.16 kV Busses Undervoltage Relays
5149630	4.16 kV Bus Diesel Generator Breakers
5150874	Safety Injection Sequencer No. 1
5150875	Safety Injection Sequencer No. 2
5150876	4.16 kV Busses Undervoltage and Generator Frequency Relays
5151366	Diesel Generator No. 2 Engine Control System (Sh3)
5159760	Containment Isolation System, PT-1120A, PT-1120B & PT-1120C - Train A
5159776	Containment Isolation System, PT-1121A, PT-1121B & PT-1121C - Train B
5168185	Safety Injection Actuation and High Radiation Alarm System
5180711	Pressurizer Pressure Safety Injection Actuation System, PT-3000A, PT-3000B & PT-3000C - Train B
5202910	FCV-457, FCV-458, CV-142, CV-143, CV-144

Other Drawings

451356	Loop Diagram - Pressurizer Pressure (Train 2)
5149178	Load Sequence Table, Train 1 (Sh 1)
5149179	Load Sequence Table, Train 1 (Sh 2)
5149180	Logic Diagram - Sequencer
5149181	Load Sequence Table, Train 2 (Sh 1)
5149182	Load Sequence Table, Train 2 (Sh 2)
5156589	Block Diagram - Sequencer No. 1 SLSS
5156592	Sequencer Module Data - Relay Driver Outputs (Sh1)
5156593	Sequencer Module Data - Relay Driver Outputs (Sh2)
S6N297	Schematic Logic - Sequencer (CCC Vendor Drawing)

Procedures

SO1-1.0-10	Reactor Trip or Safety Injection
SO1-1.0-12	SI Termination
SO1-1.0-20	Loss of Reactor Coolant
SO1-1.0-23	Transfer to Cold Leg Injection and Recirculation
SO1-1.0-30	Loss of Secondary Coolant
SO1-1.0-32	Loss of RHR Following Loss of Secondary Coolant in Containment

S01-1.0-40 Steam Generator Tube Rupture
S01-12.3-7 Monthly Sequencer Testing

Other Documents

SD-S01-580 System Description: Safety Injection, Recirculation and Containment Spray Systems
SD-S01-590 System Description: Safeguard Load Sequencing System

TABLE 8-1: SAFETY INJECTION ACTUATION FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 8-1: SAFETY INJECTION ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
08.1.01.01.1	PT-430 LOOP	PT-430	SIGNAL HIGH	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 FOR BOTH FUNCTIONS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SI BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 (SIS/SISLOP) AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	INCLUDES PT-430, YE-430, PC-430G, PC-430I AS PZR RPS SINGLE FAILURE ANALYSIS (H39405)
08.1.01.01.2	PT-430 LOOP	PT-430	SIGNAL LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 FOR BOTH FUNCTIONS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
08.1.01.02.1	PT-430 LOOP	PC-430G PC-430GI	INPUT OPEN	(SAME AS 8.1.01.01.2)	(SAME AS 8.1.01.01.2)	(SAME AS 8.1.01.01.2)	(SAME AS 8.1.01.01.2)	SEQ 1 INPUT BISTABLE AND RELAY
08.1.01.02.2	PT-430 LOOP	PC-430G PC-430GI	INPUT SHORT	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP	
08.1.01.02.3	PT-430 LOOP	PC-430G PC-430GI	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP	
08.1.01.02.4	PT-430 LOOP	PC-430G PC-430GI	AS-IS (UNTRIPPED)	(SAME AS 8.1.1.2.2)	(SAME AS 8.1.1.2.2)	(SAME AS 8.1.1.2.2)	(SAME AS 8.1.1.2.2)	
08.1.01.03.1	PT-430 LOOP	PC-430I PC-430II	INPUT OPEN	(SAME AS 8.1.1.1.2)	(SAME AS 8.1.1.1.2)	(SAME AS 8.1.1.1.2)	(SAME AS 8.1.1.1.2)	SI BLOCK PERMISSIVE INPUT BISTABLE AND RELAY
08.1.01.03.2	PT-430 LOOP	PC-430I PC-430II	INPUT SHORT	1/3 PZR PRESSURE INPUTS DISABLED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT PZR PRESSURE CHANNELS	REDUCED RELIABILITY FOR SEQ 1 AND 2 SI BLOCK PERMISSIVE	
08.1.01.03.3	PT-430 LOOP	PC-430I PC-430II	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 AND 2 SI BLOCK PERMISSIVE	
08.1.01.03.4	PT-430 LOOP	PC-430I PC-430II	AS-IS (UNTRIPPED)	(SAME AS 8.1.1.3.2)	(SAME AS 8.1.1.3.2)	(SAME AS 8.1.1.3.2)	(SAME AS 8.1.1.3.2)	
08.1.01.04.1	PT-430 LOOP	VITAL BUS #1 (8-1101V)	VOLTS LOW	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 AND 1/2 RESPECTIVELY ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP AND REDUCED REDUNDANCY AGAINST SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	1/3 SEQ BLOCK PERMISSIVE COULD ALSO RESULT IF VITAL BUS AUTO-TRANSFER OCCURS DURING FAILURE TRANSIENT
08.1.01.05.1	PT-430 LOOP	EEG BUS #1 (8-1184)	VOLTS LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
08.1.02.01.1	PT-431 LOOP	PT-431	SIGNAL HIGH	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 FOR BOTH FUNCTIONS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SI BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 (SIS/SISLOP) AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	INCLUDES PT-431, YE-431, PC-431B, PC-431G AS PZR RPS SINGLE FAILURE ANALYSIS (H39405)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR OPERATOR UNIT 1
TABLE 8-1: SAFETY INJECTION ACTUATION PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.1.02.01.2	PT-431 LOOP	PT-431	SIGNAL LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 FOR BOTH FUNCTIONS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING CHANNELS	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
08.1.02.02.1	PT-431 LOOP	PC-431B PC-431BX	INPUT OPEN	(SAME AS 8.1.02.01.2)	(SAME AS 8.1.02.01.2)	(SAME AS 8.1.02.01.2)	(SAME AS 8.1.02.01.2)	SEQ 1 INPUT BISTABLE AND RELAY
08.1.02.02.2	PT-431 LOOP	PC-431B PC-431BX	INPUT SHORT	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN CHANNELS	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP	
08.1.02.02.3	PT-431 LOOP	PC-431B PC-431BX	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP	
08.1.02.02.4	PT-431 LOOP	PC-431B PC-431BX	AS-IS (UNTRIPPED)	(SAME AS 8.1.2.2.2)	(SAME AS 8.1.2.2.2)	(SAME AS 8.1.2.2.2)	(SAME AS 8.1.2.2.2)	
08.1.02.03.1	PT-431 LOOP	PC-431G PC-430GI	INPUT OPEN	(SAME AS 8.1.2.1.2)	(SAME AS 8.1.2.1.2)	(SAME AS 8.1.2.1.2)	(SAME AS 8.1.2.1.2)	SI BLOCK PERMISSIVE INPUT BISTABLE AND RELAY
08.1.02.03.2	PT-431 LOOP	PC-431G PC-430GI	INPUT SHORT	1/3 PZR PRESSURE INPUTS DISABLED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT PZR PRESSURE CHANNELS	REDUCED RELIABILITY FOR SEQ 1 AND 2 SI BLOCK PERMISSIVE	
08.1.02.03.3	PT-431 LOOP	PC-431G PC-430GI	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 AND 2 SI BLOCK PERMISSIVE	
08.1.02.03.4	PT-431 LOOP	PC-431G PC-431GX	AS-IS (UNTRIPPED)	(SAME AS 8.1.2.3.2)	(SAME AS 8.1.2.3.2)	(SAME AS 8.1.2.3.2)	(SAME AS 8.1.2.3.2)	
08.1.02.04.1	PT-431 LOOP	VITAL BUS #2 (8-1201V)	VOLTS LOW	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 AND 1/2 RESPECTIVELY ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP AND REDUCED REDUNDANCY AGAINST SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	1/3 SEQ BLOCK PERMISSIVE COULD ALSO RESULT IF VITAL BUS AUTO-TRANSFER OCCURS DURING FAILURE TRANSIENT
08.1.02.05.1	PT-431 LOOP	REG BUS #2 (8-12R4)	VOLTS LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
08.1.03.01.1	PT-432 LOOP	PT-432	SIGNAL HIGH	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 FOR BOTH FUNCTIONS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING CHANNELS	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SI BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 (SIS/SISLOP) AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	INCLUDES PT-432, TR-432B, PC-432C, PC-432D AS PER RPS SINGLE FAILURE ANALYSIS (839405)
08.1.03.01.2	PT-432 LOOP	PT-432	SIGNAL LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 FOR BOTH FUNCTIONS	CONTROL ROOM INDICATION, ANNUNCIATION, PERIODIC TESTING CHANNELS	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRR UNIT 1
TABLE 8-1: SAFETY INJECTION ACTUATION PHBA

ITER #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.1.03.02.1	PT-432 LOOP	PC-432C	INPUT OPEN	(SAME AS 8.1.03.01.2)	(SAME AS 8.1.03.01.2)	(SAME AS 8.1.03.01.2)	(SAME AS 8.1.03.01.2)	SEQ 1 INPUT BISTABLE AND RELAY
08.1.03.02.2	PT-432 LOOP	PC-432C PC-432CI	INPUT SHORT	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP	
08.1.03.02.3	PT-432 LOOP	PC-432C PC-432CI	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP	
08.1.03.02.4	PT-432 LOOP	PC-432C PC-432CI	AS-IS (UNTRIPPED)	(SAME AS 8.1.3.2.2)	(SAME AS 8.1.3.2.2)	(SAME AS 8.1.3.2.2)	(SAME AS 8.1.3.2.2)	
08.1.03.03.1	PT-432 LOOP	PC-432D PC-432DI	INPUT OPEN	(SAME AS 8.1.3.1.2)	(SAME AS 8.1.3.1.2)	(SAME AS 8.1.3.1.2)	(SAME AS 8.1.3.1.2)	SI BLOCK PERMISSIVE INPUT BISTABLE AND RELAY
08.1.03.03.2	PT-432 LOOP	PC-432D PC-432DI	INPUT SHORT	1/3 PZR PRESSURE INPUTS DISABLED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT PZR PRESSURE CHANNELS	REDUCED RELIABILITY FOR SEQ 1 AND 2 SI BLOCK PERMISSIVE	
08.1.03.03.3	PT-432 LOOP	PC-432D PC-432DI	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 AND 2 SI BLOCK PERMISSIVE	
08.1.03.03.4	PT-432 LOOP	PC-432D PC-432DI	AS-IS (UNTRIPPED)	(SAME AS 8.1.3.3.2)	(SAME AS 8.1.3.3.2)	(SAME AS 8.1.3.3.2)	(SAME AS 8.1.3.3.2)	
08.1.03.04.1	PT-432 LOOP (8-1301V)	VITAL BUS #3	VOLTS LOW	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 AND 1/2 RESPECTIVELY ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP AND REDUCED REDUNDANCY AGAINST SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	1/3 SEQ BLOCK PERMISSIVE COULD RESULT IF VITAL BUS AUTO-TRANSFER OCCURS DURING FAILURE TRANSIENT
08.1.03.05.1	PT-432 LOOP (8-1384)	REG BUS #3	VOLTS LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
08.1.04.01.1	PT-430 LOOP PT-431 LOOP PT-432 LOOP	SW. PR/430	CONTACTS OPEN	LOW PZR PRESSURE SIGNAL TO RECORDER. NO EFFECTS ON INSTRUMENT LOOPS	NONE REQUIRED	NONE REQUIRED	NONE	SEE RPS SINGLE FAILURE ANALYSIS (H39405)
08.1.04.01.2	PT-430 LOOP PT-431 LOOP PT-432 LOOP	SW. PR/430	CONTACTS CLOSED	PARALLELING OF 1/3 PZR PRESSURE INPUTS TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2	PERIODIC TESTING	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, NONE FOR BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
08.1.04.01.3	PT-430 LOOP PT-431 LOOP PT-432 LOOP	SW. PR/430	CONTACTS GROUNDED	CURRENT LOOP RESISTORS SHORTED CAUSING HIGH LOOP SIGNALS AND DISABLING 1/3 PZR PRESSURE INPUTS TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, NONE FOR LOSS OF BLOCK PERMISSIVE	*SEQ 1 SIS/SISLOP DISABLED, BOTH SEQ 1 AND 2 UNBLOCKED	INABILITY TO UNBLOCK SEQ# RESULTS IN LOSS OF SECONDARY RECIRC VIA INABILITY TO REOPEN CV-142/143/144

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
TABLE 8-1: SAFETY INJECTION ACTUATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.1.05.01.1	PT-1120A LOOP	PT-1120A PA-1120A PC-1120-2 (K1-2)	TRIPPED	1/3 CONTAINMENT PRESSURE INPUTS TRIPPED TO SEQ 1, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTAINMENT PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP	SEQ 1 INPUT BISTABLE AND RELAY
08.1.05.01.2	PT-1120A LOOP	PT-1120A PA-1120A PC-1120-2 (K1-2)	AS-IS (UNTRIPPED)	1/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 1, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP	
08.1.06.01.1	PT-1120B LOOP	PT-1120B PA-1120B PC-1120-2 (K2-2)	TRIPPED	1/3 CONTAINMENT PRESSURE INPUTS TRIPPED TO SEQ 1, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTAINMENT PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP	SEQ 1 INPUT BISTABLE AND RELAY
08.1.06.01.2	PT-1120B LOOP	PT-1120B PA-1120B PC-1120-2 (K2-2)	AS-IS (UNTRIPPED)	1/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 1, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP	
08.1.07.01.1	PT-1120C LOOP	PT-1120C PA-1120C PC-1120-2 (K4-2)	TRIPPED	1/3 CONTAINMENT PRESSURE INPUTS TRIPPED TO SEQ 1, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTAINMENT PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP	SEQ 1 INPUT BISTABLE AND RELAY
08.1.07.01.2	PT-1120C LOOP	PT-1120C PA-1120C PC-1120-2 (K4-2)	AS-IS (UNTRIPPED)	1/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 1, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP	
08.1.08.01.1	PT-1120A PT-1120B PT-1120C LOOPS	VB-1120	OUTPUT VOLTS LOW	3/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 1	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SEQ/TRAIN	SEQ 1 CONTAINMENT HIGH PRESSURE SIS/SISLOP DISABLED	NEST POWER SUPPLY. CONTAINMENT HIGH PRESSURE SIS CREDITED FOR MAIN FEED ISOLATION AND CONTAINMENT SPRAY PERMISSIVE FOR HSLB INSIDE CONTAINMENT
08.1.08.02.1	PT-1120A PT-1120B PT-1120C LOOPS	VITAL BUS #1 (8-1112V)	VOLTS LOW	3/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 1	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	SEQ 1 CONTAINMENT HIGH PRESSURE SIS/SISLOP DISABLED	CONTAINMENT HIGH PRESSURE SIS CREDITED FOR MAIN FEED ISOLATION AND CONTAINMENT SPRAY PERMISSIVE FOR HSLB INSIDE CONTAINMENT
08.1.09.01.1	SEQ 1 SI BLOCK	SW. CS-1	CONTACTS OPEN	RELAY AT SEAL-IN CIRCUIT DISABLED, CAUSING SEQ 1 SI AUTO-BLOCK (VS. PERMISSIVE) ON 2/3 LOW PZR PRESSURE CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	SEQ 1 SIS/SISLOP DISABLED	CONTACTS NORMALLY CLOSED TO ENERGIZE RELAY AT
08.1.09.01.2	SEQ 1 SI BLOCK	SW. CS-1	CONTACTS CLOSED	RELAY AT CANNOT BE DE-ENERGIZED FOR SEQ 1 SI BLOCK	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	SEQ 1 SIS/SISLOP DISABLED	
08.1.09.02.1	SEQ 1 SI BLOCK	AI	INPUT OPEN	SEQ 1 SI BLOCKED	CONTROL ROOM ANNUNCIATION	REDUNDANT SEQ/TRAIN	SEQ 1 SIS/SISLOP DISABLED	RELAY IS DE-ENERGIZE FOR SI BLOCK
08.1.09.02.2	SEQ 1 SI BLOCK	AI	INPUT SHORT	RELAY AT DE-ENERGIZED. FAULT CURRENT CAUSES PC-430IX, PC-431GX, PC-432DX TO FAIL AS-IS (CLOSED) BY CONTACT WELDING IN SEQ 1 SI BLOCK CNT. FAULT WILL OPEN 125 VDC BRKR 72-124 SERVING SEQ 1	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR INJECTION, NONE FOR RECIRCULATION	SEQ 1 AND SI BLOCK FOR SEQ 2 DISABLED	SEQ 1 AND 2 SI BLOCK PERMISSIVE CTS USE ADJACENT CONTACTS FROM SAME PZR PRESSURE RELAYS. 100A BRKR RATING TOO HIGH TO PROTECT RELAYS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1

TABLE 8-1: SAFETY INJECTION ACTUATION PHEN

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.1.09.02.1	SBQ 1 SI BLOCK	AI	ON	(SAME AS 8.1.9.1.2)	(SAME AS 8.1.9.1.2)	(SAME AS 8.1.9.1.2)	(SAME AS 8.1.9.1.2)	
08.1.09.02.4	SBQ 1 SI BLOCK	AI	OFF (BLOCK)	(SAME AS 8.1.9.2.1)	(SAME AS 8.1.9.2.1)	(SAME AS 8.1.9.2.1)	(SAME AS 8.1.9.2.1)	
08.1.10.01.1	DG #1	R-11A (RELAY)	CONTACTS OPEN	LOSS OF DG VOLTS/FREQ INPUT TO SBQ 1, DISABLING SISLOP LOAD SEQUENCING	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	TRAIN A DISABLED FOR SISLOP	DG VOLTS/FREQ RELAY
08.1.10.01.2	DG #1	R-11A (RELAY)	CONTACTS CLOSED	DG VOLTS/FREQ INPUT TO SBQ 1, CAUSING PREMATURE SISLOP LOAD SEQUENCING AND POTENTIAL DG FAILURE	PERIODIC TESTING	(SAME AS 8.1.10.1.1)	(SAME AS 8.1.10.1.1)	
08.1.10.02.1	DG #1	152-11C14 "a" CONTACT	OPEN	LOSS OF DG BRKR CLOSED INPUT TO SBQ 1, DISABLING SISLOP LOAD SEQUENCING	PERIODIC TESTING	(SAME AS 8.1.10.1.1)	(SAME AS 8.1.10.1.1)	
08.1.10.02.2	DG #1	152-11C14 "a" CONTACT	CLOSED	DG BRKR CLOSED INPUT TO SBQ 1, CAUSING SISLOP LOAD SEQUENCING CONCURRENT WITH DG BRKR CLOSE SIGNAL	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	REDUCED RELIABILITY OF TRAIN A FOR SISLOP	
08.1.11.01.1	SBQ 1	BS-2164 (SIS INITIATE)	CONTACTS OPEN	SBQ 1 SIS/SISLOP CANNOT BE MANUALLY INITIATED. NO EFFECT ON AUTO INITIATION	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	REDUCED RELIABILITY OF TRAIN A FOR SIS/SISLOP	
08.1.11.01.2	SBQ 1	BS-2164 (SIS INITIATE)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SBQ 1 MANUAL SIS CKY. TRIP/NORMAL/RESET SWITCH UNAPPECTED	PERIODIC TESTING	REDUNDANT SWITCH	REDUCED REDUNDANCY AGAINST SBQ 1 SIS/SISLOP	
08.1.11.02.1	SBQ 1	BS-2166 (SIS RESET)	CONTACTS OPEN	SBQ 1 SIS/SISLOP CANNOT BE RESET AFTER SI BLOCK, PREVENTING REALIGNMENT/RESTART OF TRAIN A SI/PW PUMPS AND REOPENING OF CV-142/143/144 FOR SECONDARY RECIRCULATION	PERIODIC TESTING	REDUNDANT SBQ/TRAIN FOR SECONDARY RECIRC PUMPING, NONE FOR SECONDARY RECIRC PATH	*TRAIN A SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	CV-142/143/144 ACTUATED CLOSED BY REDUNDANT SOLENOID VALVES (ONE PER SBQ/TRAIN PER CV). CLR AND HLR UNAPPECTED BY THIS FAILURE SINCE PCV-1112 (SV-1112) HAS AN OVERRIDE SWITCH/RELAY TO PERMIT MODULATION/CLOSURE EVEN WITH SIS/SISLOP STILL PRESENT
08.1.11.02.2	SBQ 1	BS-2166 (SIS RESET)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SBQ 1 SIS RESET CKY. TRIP/NORMAL/RESET SWITCH UNAPPECTED	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	REDUCED RELIABILITY OF SBQ 1 SIS/SISLOP FOR SBLOCA, SCTR AND NSLB	
08.1.11.03.1	SBQ 1	SIS TRIP/NORML/RESET (SWITCH)	CONTACTS OPEN	SBQ 1 MANUAL SIS, SIS RESET DISABLED, PREVENTING: REALIGNMENT/RESTART OF TRAIN A SI/PW PUMPS, REOPENING OF CV-142/143/144	PERIODIC TESTING	REDUNDANT SBQ/TRAIN FOR INJECTION AND SECONDARY RECIRC PUMPING, NONE FOR SECONDARY RECIRC PATH	*REDUCED RELIABILITY OF TRAIN A FOR SIS/SISLOP, TRAIN A SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	A ROTARY SWITCH ON SIS SURVEILLANCE PANEL
08.1.11.03.2	SBQ 1	SIS TRIP/NORML/RESET (SWITCH)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SBQ 1 MANUAL SIS, SIS RESET CKYS. BS-2164, 2166 UNAPPECTED	PERIODIC TESTING	REDUNDANT SWITCHES	REDUCED REDUNDANCY AGAINST SBQ 1 SIS/SISLOP AND SIS/SISLOP RESET	
08.1.11.04.1	SBQ 1	BS-2165 (LOP INITIATE)	CONTACTS OPEN	SBQ 1 LOP/SISLOP CANNOT BE MANUALLY INITIATED. NO EFFECT ON AUTO INITIATION	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	REDUCED RELIABILITY OF SBQ 1 LOP/SISLOP	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
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TABLE 8-1: SAFETY INJECTION ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.1.11.04.2	SEQ 1	HS-2165 (LOP INITIATE)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SEQ 1 MANUAL LOP CXT. TRIP/NORMAL/RESET SWITCH UNAFFECTED	PERIODIC TESTING	REDUNDANT SWITCH	REDUCED REDUNDANCY AGAINST SEQ 1 LOP/SISLOP	
08.1.11.05.1	SEQ 1	HS-2167 (LOP RESET)	CONTACTS OPEN	SEQ 1 LOB/LOP CANNOT BE MANUALLY RESET TO PERMIT RESTART OF TRAIN A NON-SAFETY LOADS FOR SECONDARY RECIRCULATION FOLLOWING SISLOP	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	TRAIN A SECONDARY RECIRC DISABLED BY LOCK-OUT OF NON-SAFETY LOADS	
08.1.11.05.2	SEQ 1	HS-2167 (LOP RESET)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SEQ 1 MANUAL LOB/LOP RESET CXT. TRIP/NORMAL/RESET SWITCH UNAFFECTED	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY OF SEQ 1 LOB/LOP/SISLOP	
08.1.11.06.1	SEQ 1	LOP TRIP/NORMAL/RESET (SWITCH)	CONTACTS OPEN	SEQ 1 MANUAL LOP, LOB/LOP RESET DISABLED, PREVENTING RESTART OF TRAIN A NON-SAFETY LOADS FOR SECONDARY RECIRC	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	TRAIN A NON-SAFETY LOADS DISABLED FOR SECONDARY RECIRCULATION	ROTARY SWITCH ON SIS SURVEILLANCE PANEL
08.1.11.06.2	SEQ 1	LOP TRIP/NORMAL/RESET (SWITCH)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SEQ 1 MANUAL LOP AND LOB/LOP RESET CXTS. HS-2165, 2167 UNAFFECTED	PERIODIC TESTING	REDUNDANT SWITCHES	REDUCED REDUNDANCY AGAINST SEQ 1 LOP/SISLOP AND AGAINST RESET OF LOB/LOP/SISLOP	
08.1.11.07.1	SEQ 1	SUBCHANNEL X (LOGIC)	TRIPPED	1/2 REDUNDANT SEQ 1 SUBCHANNELS ACTUATED, LOB/LOP/SIS/SISLOP LOGIC AND TIMING BECOMES 1/2 ON REMAINING SUBCHANNEL	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SUBCHANNEL	REDUCED REDUNDANCY AGAINST SEQ 1 LOB/LOP/SIS/SISLOP	
08.1.11.07.2	SEQ 1	SUBCHANNEL X (LOGIC)	AS-IS (UMTRIPPED)	1/2 REDUNDANT SEQ 1 SUBCHANNELS FAILED, DISABLING 2/2 LOGIC FOR SEQ 1 (SAME AS 8.1.11.7.1)	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	TRAIN A LOB/LOP/SIS/SISLOP DISABLED	
08.1.11.08.1	SEQ 1	SUBCHANNEL Y (LOGIC)	TRIPPED	(SAME AS 8.1.11.7.1)	(SAME AS 8.1.11.7.1)	(SAME AS 8.1.11.7.1)	(SAME AS 8.1.11.7.1)	
08.1.11.08.2	SEQ 1	SUBCHANNEL Y (LOGIC)	AS-IS (UMTRIPPED)	(SAME AS 8.1.11.7.2)	(SAME AS 8.1.11.7.2)	(SAME AS 8.1.11.7.2)	(SAME AS 8.1.11.7.2)	
08.1.12.01.1	SEQ 1	125VDC BUS #1 (72-124)	VOLTS LOW	SEQ 1 DISABLED	CONTROL ROOM INDICATION	REDUNDANT SEQ/TRAIN	TRAIN A LOB/LOP/SIS/SISLOP DISABLED	SEQ OUTPUT RELAYS ARE ENERGIZE TO ACTUATE
08.2.01.01.1	PT-3000A LOOP	PTC-3000A	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 2 SIS/SISLOP	INCLUDES PTV-3000A, PTB-3000A
08.2.01.01.2	PT-3000A LOOP	PTC-3000A	AS-IS (UMTRIPPED)	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 SIS/SISLOP	
08.2.02.01.1	PT-3000B LOOP	PTC-3000B	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 2 SIS/SISLOP	INCLUDES PTV-3000B, PTB-3000B

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TABLE 8-1: SAFETY INJECTION ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.2.02.01.2	PT-3000B LOOP	PTC-3000B	AS-IS (UNTRIPPED)	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 S1S/SISLOP	
08.2.03.01.1	PT-3000C LOOP	PTC-3000C	TRIPPED	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 2 S1S/SISLOP	INCLUDES PTV-3000C, PTB-3000C
08.2.03.01.2	PT-3000C LOOP	PTC-3000C	AS-IS (UNTRIPPED)	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 S1S/SISLOP	
08.2.04.01.1 (NOT USED)								
08.2.05.01.1	PT-1121A LOOP	PT-1121A PA-1121A PC-1121-1 (K1-2)	TRIPPED	1/3 CONTAINMENT PRESSURE INPUTS TRIPPED TO SEQ 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN B CONTAINMENT PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 2 S1S/SISLOP	SEQ 2 INPUT BISTABLE AND RELAY
08.2.05.01.2	PT-1121A LOOP	PT-1121A PA-1121A PC-1121-1 (K1-2)	AS-IS (UNTRIPPED)	1/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 S1S/SISLOP	
08.2.06.01.1	PT-1121B LOOP	PT-1121B PA-1121B PC-1121-1 (K2-2)	TRIPPED	1/3 CONTAINMENT PRESSURE INPUTS TRIPPED TO SEQ 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN B CONTAINMENT PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 2 S1S/SISLOP	SEQ 2 INPUT BISTABLE AND RELAY
08.2.06.01.2	PT-1121B LOOP	PT-1121B PA-1121B PC-1121-1 (K2-2)	AS-IS (UNTRIPPED)	1/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 S1S/SISLOP	
08.2.07.01.1	PT-1121C LOOP	PT-1121C PA-1121C PC-1121-1 (K4-2)	TRIPPED	1/3 CONTAINMENT PRESSURE INPUTS TRIPPED TO SEQ 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN B CONTAINMENT PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 2 S1S/SISLOP	SEQ 2 INPUT BISTABLE AND RELAY
08.2.07.01.2	PT-1121C LOOP	PT-1121C PA-1121C PC-1121-1 (K4-2)	AS-IS (UNTRIPPED)	1/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 2, LOGIC BECOMES 2/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 S1S/SISLOP	
08.2.08.01.1	PT-3000A/B/C LOOPS PT-1121A/B/C LOOPS	VB-1121	OUTPUT VOLTS LOW	3/3 PZR PRESSURE AND CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 2	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SEQ/TRAIN	SEQ 2 S1S/SISLOP DISABLED	NEST POWER SUPPLY
08.2.08.02.1	PT-3000A/B/C LOOPS PT-1121A/B/C LOOPS	VITAL BUS #5 (8-2901V)	VOLTS LOW	3/3 PZR PRESSURE AND CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	SEQ 2 S1S/SISLOP DISABLED	
08.2.09.01.1	SEQ 2 SI BLOCK	SW. CS-2	CONTACTS OPEN	RELAY BI SEAL-IN CIRCUIT DISABLED, CAUSING SEQ 2 SI AUTO-BLOCK (VS. PERMISSIVE) ON 2/3 LOW PZR PRESSURE CHANNELS	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	SEQ 2 S1S/SISLOP DISABLED	CONTACTS NORMALLY CLOSED TO ENERGIZE RELAY PI

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TABLE B-1: SAFETY INJECTION ACTUATION AREA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.2.09.01.2	SEQ 2 SI BLOCK	SW, CS-2	CONTACTS CLOSED	RELAY BI CANNOT BE DE-ENERGIZED FOR SEQ 2 SI BLOCK	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	SEQ 2 SIS/SISLOP DISABLED	
08.2.09.02.1	SEQ 2 SI BLOCK	BI	INPUT OPEN	SEQ 2 SI BLOCKED	CONTROL ROOM ANNUNCIATION	REDUNDANT SEQ/TRAIN	SEQ 2 SIS/SISLOP DISABLED	RELAY IS DE-ENERGIZER FOR SI BLOCK
08.2.09.02.2	SEQ 2 SI BLOCK	BI	INPUT SHORT	RELAY BI DE-ENERGIZED. FAULT CURRENT CAUSES PC-4301X, PC-431GX, PC-432DX TO FAIL AS-IS (CLOSED) BY CONTACT WELDING IN SEQ 2 SI BLOCK CKT. FAULTY WILL OPEN 125 VDC BRER 72-212 SERVING SEQ 2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR INJECTION, NONE FOR RECIRCULATION	*SEQ 2 AND SI BLOCK FOR SEQ 1 DISABLED	SEQ 1 AND 2 SI BLOCK PERMISSIVE CKTS USE ADJACENT CONTACTS FROM SAME PZR PRESSURE RELAYS. 100A BRER RATING TOO HIGH TO PROTECT RELAYS
08.2.09.02.3	SEQ 2 SI BLOCK	BI	ON	(SAME AS 8.2.9.1.2)	(SAME AS 8.2.9.1.2)	(SAME AS 8.2.9.1.2)	(SAME AS 8.2.9.1.2)	
08.2.09.02.4	SEQ 2 SI BLOCK	BI	OFF (BLOCK)	(SAME AS 8.2.9.2.1)	(SAME AS 8.2.9.2.1)	(SAME AS 8.2.9.2.1)	(SAME AS 8.2.9.2.1)	
08.2.10.01.1	DG #2	R-11A (RELAY)	CONTACTS OPEN	LOSS OF DG VOLTS/FREQ INPUT TO SEQ 2, DISABLING SISLOP LOAD SEQUENCING	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	TRAIN B DISABLED FOR SISLOP	DG VOLTS/FREQ RELAY
08.2.10.01.2	DG #2	R-11A (RELAY)	CONTACTS CLOSED	DG VOLTS/FREQ INPUT TO SEQ 2, CAUSING PREMATURE SISLOP LOAD SEQUENCING AND POTENTIAL DG FAILURE	PERIODIC TESTING	(SAME AS 8.2.10.1.1)	(SAME AS 8.2.10.1.1)	
08.2.10.02.1	DG #2	152-12C15 "A" CONTACT	OPEN	LOSS OF DG BRER CLOSED INPUT TO SEQ 2, DISABLING SISLOP LOAD SEQUENCING	PERIODIC TESTING	(SAME AS 8.2.10.1.1)	(SAME AS 8.2.10.1.1)	
08.2.10.02.2	DG #2	152-12C15 "A" CONTACT	CLOSED	DG BRER CLOSED INPUT TO SEQ 2, CAUSING SISLOP LOAD SEQUENCING CONCURRENT WITH DG BRER CLOSE SIGNAL	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY OF TRAIN B FOR SISLOP	
08.2.11.01.1	SEQ 2	HS-3164 (SIS INITIATE)	CONTACTS OPEN	SEQ 2 SIS/SISLOP CANNOT BE MANUALLY INITIATED. NO EFFECT ON AUTO INITIATION	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY OF TRAIN B FOR SIS/SISLOP	
08.2.11.01.2	SEQ 2	HS-3164 (SIS INITIATE)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SEQ 2 MANUAL SIS CKT. TRIP/NORMAL/RESET SWITCH UNAFFECTED	PERIODIC TESTING	REDUNDANT SWITCH	REDUCED REDUNDANCY AGAINST SEQ 2 SIS/SISLOP	
08.2.11.02.1	SEQ 2	HS-3166 (SIS RESET)	CONTACTS OPEN	SEQ 2 SIS/SISLOP CANNOT BE RESET AFTER SI BLOCK, PREVENTING REALIGNMENT/RESTART OF TRAIN B SI/PW PUMPS AND REOPENING OF CV-142/143/144 FOR SECONDARY RECIRCULATION	PERIODIC TESTING	REDUNDANT SEQ/TRAIN FOR SECONDARY RECIRC PUMPING, NONE FOR SECONDARY RECIRC PATH	*TRAIN B SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	CV-142/143/144 ACTUATED CLOSED BY REDUNDANT SOLENOID VALVES (ONE PER SEQ/TRAIN PER CV). CLR AND HLR UNAFFECTED BY THIS FAILURE SINCE PCV-1112 (SV-1112) HAS AN OVERRIDE SWITCH/RELAY TO PERMIT MODULATION/CLOSURE EVEN WITH SIS/SISLOP STILL PRESENT
08.2.11.02.2	SEQ 2	HS-3166 (SIS RESET)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SEQ 2 SIS RESET CKT. TRIP/NORMAL/RESET SWITCH UNAFFECTED	PERIODIC TESTING	REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY OF SEQ 2 SIS/SISLOP FOR SBLOCK, SGR AND MSB	

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TABLE B-1: SAFETY INJECTION ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
08.2.11.03.1	SBQ 2	SIS TRIP/NORML/RESET (SWITCH)	CONTACTS OPEN	SBQ 2 MANUAL SIS, SIS RESET DISABLED, PREVENTING: REALIGNMENT/RESTART OF TRAIN B SI/PW PUMPS, REOPENING OF CV-142/143/144	PERIODIC TESTING	REDUNDANT SBQ/TRAIN FOR INJECTION AND SECONDARY RECIRC PUMPING, NONE FOR SECONDARY RECIRC PATH	*REDUCED RELIABILITY OF TRAIN B ROTARY SWITCH ON SLS5 FOR SIS/SISLOP, TRAIN B SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	SURVEILLANCE PANEL
08.2.11.03.2	SBQ 2	SIS TRIP/NORML/RESET (SWITCH)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SBQ 2 MANUAL SIS, SIS RESET CCTS. BS-3164, 3166 UNAPFFECTED	PERIODIC TESTING	REDUNDANT SWITCHES	REDUCED REDUNDANCY AGAINST SBQ 2 SIS/SISLOP AND SIS/SISLOP RESET	
08.2.11.04.1	SBQ 2	BS-3165 (LOP INITIATE)	CONTACTS OPEN	SBQ 2 LOP/SISLOP CANNOT BE MANUALLY INITIATED. NO EFFECT ON AUTO INITIATION	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	REDUCED RELIABILITY OF SBQ 2 LOP/SISLOP	
08.2.11.04.2	SBQ 2	BS-3165 (LOP INITIATE)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SBQ 2 MANUAL LOP CRT. TRIP/NORMAL/RESET SWITCH UNAPFFECTED	PERIODIC TESTING	REDUNDANT SWITCH	REDUCED REDUNDANCY AGAINST SBQ 2 LOP/SISLOP	
08.2.11.05.1	SBQ 2	BS-3167 (LOP RESET)	CONTACTS OPEN	SBQ 2 LOB/LOP CANNOT BE MANUALLY RESET TO PERMIT RESTART OF TRAIN B NON-SAFETY LOADS FOR SECONDARY RECIRCULATION FOLLOWING SISLOP	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	TRAIN B SECONDARY RECIRC DISABLED BY LOCK-OUT OF NON-SAFETY LOADS	
08.2.11.05.2	SBQ 2	BS-3167 (LOP RESET)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SBQ 2 MANUAL LOB/LOP RESET CRT. TRIP/NORMAL/RESET SWITCH UNAPFFECTED	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	REDUCED RELIABILITY OF SBQ 2 LOB/LOP/SISLOP	
08.2.11.06.1	SBQ 2	LOP TRIP/NORML/RESET (SWITCH)	CONTACTS OPEN	SBQ 2 MANUAL LOP, LOB/LOP RESET DISABLED, PREVENTING RESTART OF TRAIN B NON-SAFETY LOADS FOR SECONDARY RECIRC	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	TRAIN B NON-SAFETY LOADS DISABLED FOR SECONDARY RECIRCULATION	ROTARY SWITCH ON SLS5 SURVEILLANCE PANEL
08.2.11.06.2	SBQ 2	LOP TRIP/NORML/RESET (SWITCH)	CONTACTS CLOSED	1/2 SERIES CONTACTS CLOSED IN SBQ 2 MANUAL LOP AND LOB/LOP RESET CCTS. BS-3165, 3167 UNAPFFECTED	PERIODIC TESTING	REDUNDANT SWITCHES	REDUCED REDUNDANCY AGAINST SBQ 2 LOP/SISLOP AND AGAINST RESET OF LOB/LOP/SISLOP	
08.2.11.07.1	SBQ 2	SUBCHANNEL X (LOGIC)	TRIPPED	1/2 REDUNDANT SBQ 2 SUBCHANNELS ACTUATED, LOB/LOP/SIS/SISLOP LOGIC AND TIMING BECOMES 1/2 ON REMAINING SUBCHANNEL	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SUBCHANNEL	REDUCED REDUNDANCY AGAINST SBQ 2 LOB/LOP/SIS/SISLOP	
08.2.11.07.2	SBQ 2	SUBCHANNEL X (LOGIC)	AS-IS (UNTRIPPED)	1/2 REDUNDANT SBQ 2 SUBCHANNELS FAILED, DISABLING 2/2 LOGIC FOR SBQ 2 (SAME AS 8.2.11.7.1)	PERIODIC TESTING	REDUNDANT SBQ/TRAIN	TRAIN B LOB/LOP/SIS/SISLOP DISABLED	
08.2.11.08.1	SBQ 2	SUBCHANNEL Y (LOGIC)	TRIPPED	(SAME AS 8.2.11.7.1)	(SAME AS 8.2.11.7.1)	(SAME AS 8.2.11.7.1)	(SAME AS 8.2.11.7.1)	
08.2.11.08.2	SBQ 2	SUBCHANNEL Y (LOGIC)	AS-IS (UNTRIPPED)	(SAME AS 8.2.11.7.2)	(SAME AS 8.2.11.7.2)	(SAME AS 8.2.11.7.2)	(SAME AS 8.2.11.7.2)	
08.2.12.01.1	SBQ 2	125VDC BUS #2 (12-212)	VOLTS LOW	SBQ 2 DISABLED	CONTROL ROOM INDICATION	REDUNDANT SBQ/TRAIN	TRAIN B LOB/LOP/SIS/SISLOP DISABLED	SBQ OUTPUT RELAYS ARE ENERGIZE TO ACTUATE

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TABLE 8-1: SAFETY INJECTION ACTUATION PHRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.3.01.01.1	BUS #1C	127-3 (UV RELAY)	AS-IS (UNTRIPPED)	1/2 REDUNDANT BUS 1C UV INPUTS PERIODIC TESTING DISABLED TO SEQ 1 AND 2. SEQ 1 LOB LOGIC AND SEQ 1 AND 2 LOP LOGIC FOR BUS 1C UV BECOMES 1/1 ON REMAINING CHANNELS		REDUNDANT RELAY	REDUCED RELIABILITY FOR SEQ 1 LOB AND SEQ 1 AND 2 LOP	INCLUDES POTENTIAL TRANSFORMER
08.3.01.01.2	BUS #1C	127-3 (UV RELAY)	TRIPPED	1/2 REDUNDANT BUS 1C UV INPUTS PERIODIC TESTING TRIPPED TO SEQ 1 AND 2. SEQ 1 INITIATES LOB AND SEQ 2 LOP LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS		REDUNDANT SEQ/TRAIN	TRAIN A DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A. REDUCED REDUNDANCY AGAINST SEQ 2 LOP/SISLOP	FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RETRIPS DC BREAK DURING SISLOP
08.3.01.02.1	BUS #1C	127-3X (AUX RELAY)	AS-IS (UNTRIPPED)	1/2 REDUNDANT BUS 1C UV INPUTS PERIODIC TESTING DISABLED TO SEQ 1. SEQ 1 LOB AND LOP LOGIC FOR BUS 1C UV BECOME 1/1 ON REMAINING CHANNELS		REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 1 LOB/LOP	
08.3.01.02.2	BUS #1C	127-3X (AUX RELAY)	TRIPPED	1/2 REDUNDANT BUS 1C UV INPUTS PERIODIC TESTING TRIPPED TO SEQ 1. SEQ 1 INITIATES LOB		REDUNDANT SEQ/TRAIN	TRAIN A DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A	FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RETRIPS DC BREAK DURING SISLOP
08.3.01.03.1	BUS #1C	127-7X (AUX RELAY)	AS-IS (UNTRIPPED)	1/2 REDUNDANT BUS 1C UV INPUTS PERIODIC TESTING DISABLED TO SEQ 2. SEQ 2 LOP LOGIC FOR BUS 1C UV BECOMES 1/1 ON REMAINING CHANNELS		REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 LOP	
08.3.01.03.2	BUS #1C	127-7X (AUX RELAY)	TRIPPED	1/2 REDUNDANT BUS 1C UV INPUTS PERIODIC TESTING TRIPPED TO SEQ 2. SEQ 2 LOP LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS		REDUNDANT SEQ/TRAIN	REDUCED REDUNDANCY AGAINST SEQ 2 LOP/SISLOP	
08.3.01.04.1	BUS #1C	127-9 (UV RELAY)	AS-IS (UNTRIPPED)	(SAME AS 8.3.1.1.1)	(SAME AS 8.3.1.1.1)	(SAME AS 8.3.1.1.1)	(SAME AS 8.3.1.1.1)	
08.3.01.04.2	BUS #1C	127-9 (UV RELAY)	TRIPPED	(SAME AS 8.3.1.1.2)	(SAME AS 8.3.1.1.2)	(SAME AS 8.3.1.1.2)	(SAME AS 8.3.1.1.2)	
08.3.01.05.1	BUS #1C	127-9X (AUX RELAY)	AS-IS (UNTRIPPED)	(SAME AS 8.3.1.2.1)	(SAME AS 8.3.1.2.1)	(SAME AS 8.3.1.2.1)	(SAME AS 8.3.1.2.1)	
08.3.01.05.2	BUS #1C	127-9X (AUX RELAY)	TRIPPED	(SAME AS 8.3.1.2.2)	(SAME AS 8.3.1.2.2)	(SAME AS 8.3.1.2.2)	(SAME AS 8.3.1.2.2)	
08.3.01.06.1	BUS #1C	127-11X (AUX RELAY)	AS-IS (UNTRIPPED)	(SAME AS 8.3.1.3.1)	(SAME AS 8.3.1.3.1)	(SAME AS 8.3.1.3.1)	(SAME AS 8.3.1.3.1)	
08.3.01.06.2	BUS #1C	127-11X (AUX RELAY)	TRIPPED	(SAME AS 8.3.1.3.2)	(SAME AS 8.3.1.3.2)	(SAME AS 8.3.1.3.2)	(SAME AS 8.3.1.3.2)	
08.3.01.07.1	BUS #1C	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	AUX RELAYS 127-3X, 127-7X, 127-9X, 127-11X TRIPPED. SEQ 1 INITIATES LOB, SEQ 2 LOP LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS	CONTROL ROOM INDICATION	REDUNDANT SEQ/TRAIN	TRAIN A DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A. REDUCED REDUNDANCY AGAINST SEQ 2 LOP/SISLOP	RELAYS ARE DE-ENERGIZED TO ACTUATE. FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RETRIPS DC BREAKER DURING SISLOP
08.3.02.01.1	BUS #2C	127-4 (UV RELAY)	AS-IS (UNTRIPPED)	1/2 REDUNDANT BUS 2C UV INPUTS PERIODIC TESTING DISABLED TO SEQ 1 AND 2. SEQ 2 LOB LOGIC AND SEQ 1 AND 2 LOP LOGIC FOR BUS 2C UV BECOMES 1/1 ON REMAINING CHANNELS		REDUNDANT RELAY	REDUCED RELIABILITY FOR SEQ 2 LOB AND SEQ 1 AND 2 LOP	INCLUDES POTENTIAL TRANSFORMER

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
TABLE 8-1: SAFETY INJECTION ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
08.3.02.01.2	BUS #2C	127-4 (UV RELAY)	TRIPPED	1/2 REDUNDANT BUS 2C UV INPUTS PERIODIC TESTING TRIPPED TO SEQ 1 AND 2. SEQ 2 INITIATES LOB AND SEQ 1 LOP LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS		REDUNDANT SEQ/TRAIN	TRAIN B DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A. REDUCED REDUNDANCY AGAINST SEQ 1 LOP/SISLOP	FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RETRIPS DC BRKR DURING SISLOP
08.3.02.02.1	BUS #2C	127-4I (AUX RELAY)	AS-IS (UNTRIPPED)	1/2 REDUNDANT BUS 2C UV INPUTS PERIODIC TESTING DISABLED TO SEQ 1. SEQ 1 LOP LOGIC FOR BUS 2C UV BECOMES 1/1 ON REMAINING CHANNELS		REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 1 LOP	
08.3.02.02.2	BUS #2C	127-4I (AUX RELAY)	TRIPPED	1/2 REDUNDANT BUS 2C UV INPUTS PERIODIC TESTING TRIPPED TO SEQ 1. SEQ 1 LOP LOGIC BECOMES 1/2 ON BUS 1C UV INPUTS		REDUNDANT SEQ/TRAIN	REDUCED REDUNDANCY AGAINST SEQ 1 LOP/SISLOP	
08.3.02.03.1	BUS #2C	127-8I (AUX RELAY)	AS-IS (UNTRIPPED)	1/2 REDUNDANT BUS 2C UV INPUTS PERIODIC TESTING DISABLED TO SEQ 2. SEQ 2 LOB AND LOP LOGIC FOR BUS 2C UV BECOME 1/1 ON REMAINING CHANNELS		REDUNDANT SEQ/TRAIN	REDUCED RELIABILITY FOR SEQ 2 LOB/LOP	
08.3.02.03.2	BUS #2C	127-8I (AUX RELAY)	TRIPPED	1/2 REDUNDANT BUS 2C UV INPUTS PERIODIC TESTING TRIPPED TO SEQ 2. SEQ 2 INITIATES LOB		REDUNDANT SEQ/TRAIN	TRAIN B DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A	FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RETRIPS DC BRKR DURING SISLOP
08.3.02.04.1	BUS #2C	127-10 (UV RELAY)	AS-IS (UNTRIPPED)	(SAME AS 8.3.2.1.1)	(SAME AS 8.3.2.1.1)	(SAME AS 8.3.2.1.1)	(SAME AS 8.3.2.1.1)	
08.3.02.04.2	BUS #2C	127-10 (UV RELAY)	TRIPPED	(SAME AS 8.3.2.1.2)	(SAME AS 8.3.2.1.2)	(SAME AS 8.3.2.1.2)	(SAME AS 8.3.2.1.2)	
08.3.02.05.1	BUS #2C	127-10I (AUX RELAY)	AS-IS (UNTRIPPED)	(SAME AS 8.3.2.2.1)	(SAME AS 8.3.2.2.1)	(SAME AS 8.3.2.2.1)	(SAME AS 8.3.2.2.1)	
08.3.02.05.2	BUS #2C	127-10I (AUX RELAY)	TRIPPED	(SAME AS 8.3.2.2.2)	(SAME AS 8.3.2.2.2)	(SAME AS 8.3.2.2.2)	(SAME AS 8.3.2.2.2)	
08.3.02.06.1	BUS #2C	127-12I (AUX RELAY)	AS-IS (UNTRIPPED)	(SAME AS 8.3.2.3.1)	(SAME AS 8.3.2.3.1)	(SAME AS 8.3.2.3.1)	(SAME AS 8.3.2.3.1)	
08.3.02.06.2	BUS #2C	127-12I (AUX RELAY)	TRIPPED	(SAME AS 8.3.2.3.2)	(SAME AS 8.3.2.3.2)	(SAME AS 8.3.2.3.2)	(SAME AS 8.3.2.3.2)	
08.3.02.07.1	BUS #2C 125VDC CONTROL POWER		VOLTS LOW	AUX RELAYS 127-4I, 127-8I, 127-10I, 127-12I TRIPPED. SEQ 2 INITIATES LOB, SEQ 1 LOP LOGIC BECOMES 1/2 ON BUS 1C UV INPUTS	CONTROL ROOM INDICATION	REDUNDANT SEQ/TRAIN	TRAIN B DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A. REDUCED REDUNDANCY AGAINST SEQ 1 LOP/SISLOP	RELAYS ARE DE-ENERGIZE TO ACTUATE. FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RETRIPS DC BRKR DURING SISLOP

SECTION 9: CONTAINMENT SPRAY ACTUATION

CONTAINMENT SPRAY ACTUATION SYSTEM NOTES

1. Item numbers in this section have been assigned as follows:
 - 09.1: Train A actuation instrumentation and logic
 - 09.2: Train B actuation instrumentation and logic
2. This section covers the Containment Spray Actuation System (CSAS) input instrumentation and logic. The failure modes and effects for individual CSAS output relays (ie, individual CSAS controlled loads) are addressed in FMEA Table 5-1.
3. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.

CONTAINMENT SPRAY ACTUATION SYSTEM REFERENCES

One Line Diagrams

64383 CSAS Inverter System

Elementary Diagrams

64354 Containment Spray Actuation System, Train A Power and Control (Sh 1)
64355 Containment Spray Actuation System, Train A Power and Control (Sh 2)
64365 Containment Spray Actuation System, Train B Power and Control (Sh 1)
64366 Containment Spray Actuation System, Train B Power and Control (Sh 2)
5130351 4.16 kV Buses Undervoltage Relays
5130826 Containment Spray and Hydrazine Addition Control System, Train A (Sh 1)
5130827 Containment Spray and Hydrazine Addition Control System, Train A (Sh 2)
5159793 Containment Spray and Hydrazine Addition Control System, Train B (Sh 1)
5180775 Containment Spray and Hydrazine Addition Control System, Train B (Sh 2)

Procedures

S01-1.0-23 Transfer to Cold Leg Injection and Recirculation
S01-1.5.1 Response to High Containment Pressure
S01-12.3-35 Containment Spray and Recirculation Safety Related Alignment
S01-12.8-5 Cold Operability Test of Containment Spray Actuation System

Other Documents

SD-S01-580 System Description: Safety Injection, Recirculation and Containment Spray Systems
SD-S01-590 System Description: Safeguard Load Sequencing System

TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
09.1.01.01.1	PT-501 LOOP	PIS-511 (BISTABLE)	TRIPPED	CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL VIA DE-ENERGIZING RELAY ACIA TO TRAIN A CSAS, AND BCIB TO TRAIN B CSAS. CHANNELS B AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR CSAS INITIATION, REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND TRAIN B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQ	LOOP INCLUDES TRANSMITTER PT-501, TEST SWITCH AND RESISTOR. CSAS LOGIC FOR EACH TRAIN IS SIS/SISLOP PLUS 2/3 HI-HI CONTAINMENT PRESSURE. BISTABLE FAILURE IN TRIPPED STATE BOUNDS COIL SHORT IN OUTPUT RELAYS
09.1.01.01.2	PT-501 LOOP	PIS-511 (BISTABLE)	UNTRIPPED	CHANNEL A HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A AND TRAIN B CSAS VIA RELAYS ACIA AND BCIB REMAINING ENERGIZED. CHANNELS B AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS	TRAIN A AND TRAIN B CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQ	NORMAL POSITION. OUTPUT RELAYS ARE NORMALLY ENERGIZED, AND DE-ENERGIZE TO TRIP
09.1.01.02.1	PT-501 LOOP	LOOP PWR SUPPLY 610	INPUT OPEN	(SAME AS 9.1.1.1.1)	(SAME AS 9.1.1.1.1)	(SAME AS 9.1.1.1.1)	(SAME AS 9.1.1.1.1)	
09.1.01.02.2	PT-501 LOOP	LOOP PWR SUPPLY 610	INPUT SHORT	FUSE BLOWS IN SUPPLY FROM VITAL BUS #1, CAUSING LOSS OF POWER TO PIS-510, -511, LIS-500A, PIS-520, -521, -522 AND OUTPUT RELAYS, RESULTING IN CHNL A HI-HI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC AND DISABLING LOW LEVEL TRIP OF TRAIN A HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCES	
09.1.01.03.1	PT-501 LOOP	ACIA (RELAY)	TRIPPED	CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS LOGIC. CHANNELS B AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS TRAIN A CSAS	TRAIN A CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1. TRAIN B CSAS LOGIC UNAPPECTED	RELAY IS DE-ENERGIZE TO TRIP
09.1.01.03.2	PT-501 LOOP	ACIA (RELAY)	UNTRIPPED	CHANNEL A HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A CSAS LOGIC. CHANNELS B AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1. TRAIN B CSAS LOGIC UNAPPECTED	
09.1.01.04.1	PT-501 LOOP	BCIB (RELAY)	TRIPPED	CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS LOGIC. CHANNELS B AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS TRAIN B CSAS	TRAIN B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2. TRAIN A CSAS LOGIC UNAPPECTED	RELAY IS DE-ENERGIZE TO TRIP
09.1.01.04.2	PT-501 LOOP	BCIB (RELAY)	UNTRIPPED	CHANNEL A HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B CSAS LOGIC. CHANNELS B AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2. TRAIN A CSAS LOGIC UNAPPECTED	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
TABLE 9-1: CONTAINMENT SPBAT ACTUATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.01.05.1	PT-501 LOOP	VITAL BUS #1 (8-1116V)	VOLTS LOW	LOSS OF POWER TO PIS-510, -511, LIS-500A, PIS-520, -521, -522 AND OUTPUT RELAYS, RESULTING IN CHNL A HI-HI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC AND DISABLING LOW LEVEL TRIP OF TRAIN A HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SRQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCES	
09.1.02.01.1 (NOT USED)								
09.1.03.01.1	SRQ 1	SUBCHANNEL X (29-5,6)	CONTACTS OPEN (UNTRIPPED)	LOGIC RELAYS APXA, APXB, AVXA, AVXB REMAIN DE-ENERGIZED, DISABLING 1 OF 2 REQUIRED SRQ 1 INPUTS TO CSAS TRAIN A LOGIC	PERIODIC TESTING	REDUNDANT TRAIN	CSAS TRAIN A DISABLED	CSAS LOGIC REQUIRES 2/2 TRIP OF SRQ 1 SUBCHANNEL X AND Y INPUTS CONCURRENT WITH 2/3 CONTAINMENT HI-HI PRESSURE
09.1.03.01.2	SRQ 1	SUBCHANNEL X (29-5,6)	CONTACTS CLOSED (TRIPPED)	LOGIC RELAYS APXA, APXB, AVXA, AVXB ENERGIZE, PROVIDING 1 OF 2 REQUIRED SRQ 1 INPUTS TO CSAS TRAIN A LOGIC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SRQ SUBCHANNEL AND CONTAINMENT HI-HI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS LOGIC BECOMES 1/1 ON REMAINING SRQ SUBCHANNEL WITH CONCURRENT 2/3 HI-HI CONTAINMENT PRESSURE	
09.1.03.02.1	SRQ 1	SUBCHANNEL Y (29-7,8)	CONTACTS OPEN (UNTRIPPED)	LOGIC RELAYS APYA, APYB, AVYA, AVYB REMAIN DE-ENERGIZED, DISABLING 1 OF 2 REQUIRED SRQ 1 INPUTS TO CSAS TRAIN A LOGIC	PERIODIC TESTING	REDUNDANT TRAIN	CSAS TRAIN A DISABLED	CSAS LOGIC REQUIRES 2/2 TRIP OF SRQ 1 SUBCHANNEL X AND Y INPUTS CONCURRENT WITH 2/3 CONTAINMENT HI-HI PRESSURE
09.1.03.02.2	SRQ 1	SUBCHANNEL Y (29-7,8)	CONTACTS CLOSED (TRIPPED)	LOGIC RELAYS APYA, APYB, AVYA, AVYB ENERGIZE, PROVIDING 1 OF 2 REQUIRED SRQ 1 INPUTS TO CSAS TRAIN A LOGIC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SRQ SUBCHANNEL AND CONTAINMENT HI-HI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS LOGIC BECOMES 1/1 ON REMAINING SRQ SUBCHANNEL WITH CONCURRENT 2/3 HI-HI CONTAINMENT PRESSURE	
09.1.04.01.1	BUS #1C, 2C UNDERVOLTAGE	127-3X (RELAY)	CONTACTS OPEN (ON)	1 OF 2 REDUNDANT BUS 1C UNDERVOLTAGE INPUTS DISABLED TO TRAIN A CSAS TIME DELAY RELAYS APDR, AVDR	PERIODIC TESTING	REDUNDANT RELAY, REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS FOR SISLOP CONDITIONS	UV AUXILIARY RELAYS ARE DE-ENERGIZE TO TRIP
09.1.04.01.2	BUS #1C, 2C UNDERVOLTAGE	127-3X (RELAY)	CONTACTS CLOSED (OFF)	BUS 1C UNDERVOLTAGE SIGNAL TO TRAIN A CSAS TIME DELAY RELAYS APDR, AVDR. DELAY LOGIC BECOMES 1/2 ON BUS 2C UNDERVOLTAGE INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN A CSAS LOADING WILL FOLLOW BUS 2C (TRAIN B) VOLTAGE RECOVERY AND SRQ 1 LOAD GROUP D DELAY. THIS FAILURE WITH A CONCURRENT BUS 2C LOW WOULD CONSTITUTE A DOUBLE FAILURE SCENARIO, WHICH IS NOT CREDIBLE
09.1.04.02.1	BUS #1C, 2C UNDERVOLTAGE	127-4X (RELAY)	CONTACTS OPEN (ON)	1 OF 2 REDUNDANT BUS 2C UNDERVOLTAGE INPUTS DISABLED TO TRAIN A CSAS TIME DELAY RELAYS APDR, AVDR	PERIODIC TESTING	REDUNDANT RELAY, REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS FOR SISLOP CONDITIONS	UV AUXILIARY RELAYS ARE DE-ENERGIZE TO TRIP
09.1.04.02.2	BUS #1C, 2C UNDERVOLTAGE	127-4X (RELAY)	CONTACTS CLOSED (OFF)	BUS 2C UNDERVOLTAGE SIGNAL TO TRAIN A CSAS TIME DELAY RELAYS APDR, AVDR. DELAY LOGIC BECOMES 1/2 ON BUS 1C UNDERVOLTAGE INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.04.03.1	BUS #1C, 2C UNDERVOLTAGE	127-9X (RELAY)	CONTACTS OPEN (ON)	(SAME AS 9.1.4.1.1)	(SAME AS 9.1.4.1.1)	(SAME AS 9.1.4.1.1)	(SAME AS 9.1.4.1.1)	(SAME AS 9.1.4.1.1)
09.1.04.03.2	BUS #1C, 2C UNDERVOLTAGE	127-9X (RELAY)	CONTACTS CLOSED (OFF)	(SAME AS 9.1.4.1.2)	(SAME AS 9.1.4.1.2)	(SAME AS 9.1.4.1.2)	(SAME AS 9.1.4.1.2)	(SAME AS 9.1.4.1.2)
09.1.04.04.1	BUS #1C, 2C UNDERVOLTAGE	127-10X (RELAY)	CONTACTS OPEN (ON)	(SAME AS 9.1.4.2.1)	(SAME AS 9.1.4.2.1)	(SAME AS 9.1.4.2.1)	(SAME AS 9.1.4.2.1)	(SAME AS 9.1.4.2.1)
09.1.04.04.2	BUS #1C, 2C UNDERVOLTAGE	127-10X (RELAY)	CONTACTS CLOSED (OFF)	(SAME AS 9.1.4.2.2)	(SAME AS 9.1.4.2.2)	(SAME AS 9.1.4.2.2)	(SAME AS 9.1.4.2.2)	(SAME AS 9.1.4.2.2)
09.1.04.05.1	BUS #1C, 2C UNDERVOLTAGE	BUS #1C	VOLTS LOW	RELAYS 127-3X AND 127-9X DE-ENERGIZE. TRAIN A CSAS TIME DELAY RELAY APDR, AVDR LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN A CSAS LOADING WILL FOLLOW BUS 2C (TRAIN B) VOLTAGE RECOVERY AND SEQ 1 LOAD GROUP D DELAY. THIS FAILURE IS NOT CREDIBLE WITH CONCURRENT BUS 2C LOB, SINCE THAT WOULD BE A DOUBLE FAILURE SCENARIO
09.1.04.06.1	BUS #1C, 2C UNDERVOLTAGE	BUS #2C	VOLTS LOW	RELAYS 127-4X AND 127-10X DE-ENERGIZE. TRAIN A CSAS TIME DELAY RELAY APDR, AVDR LOGIC BECOMES 1/2 ON BUS 1C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN A CSAS LOADING WILL FOLLOW BUS 1C (TRAIN A) VOLTAGE RECOVERY AND SEQ 1 LOAD GROUP D DELAY
09.1.05.01.1	CSAS TRAIN A (CHANNEL A TEST) (RELAYS)	APC1A, APC1B	ON (UNTRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A PUMP MATRIX. CHANNEL A VALVE MATRIX, CHANNELS B, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS PUMP LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	NORMAL POSITION. TRAIN A CHANNEL A PUMP MATRIX RELAYS. PARALLEL RELAY APC1C PROVIDES CONTROL ROOM INDICATION
09.1.05.01.2	CSAS TRAIN A (CHANNEL A TEST) (RELAYS)	APC1A, APC1B	OFF (TRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A PUMP MATRIX. CHANNEL A VALVE MATRIX, CHANNELS B, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	
09.1.05.01.3	CSAS TRAIN A (CHANNEL A TEST) (RELAYS)	APC1A, APC1B	INPUT OPEN	(SAME AS 9.1.5.1.2)	(SAME AS 9.1.5.1.2)	(SAME AS 9.1.5.1.2)	(SAME AS 9.1.5.1.2)	(SAME AS 9.1.5.1.2)
09.1.05.01.4	CSAS TRAIN A (CHANNEL A TEST) (RELAYS)	APC1A, APC1B	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES APSA AND APDB, CAUSING TRIP OF 3/3 HI-HI CONTAINMENT PRESSURE CHANNELS, DISABLING 2/2 SEQUENCER SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN A CSAS LOGIC	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN A CSAS LOGIC DISABLED	BOUNDARY FAILURE OF ANNUNCIATOR RELAY APC1C. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APSA AND APDB OUTPUTS ARE PARALLELLED
09.1.05.02.1	CSAS TRAIN A (CHANNEL A TEST) (TEST SWITCH)	APC1S	CONTACTS OPEN	RELAYS APC1A, APC1B DE-ENERGIZE, CAUSING CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS PUMP MATRIX. CHANNELS B, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.05.02.2	CSAS TRAIN A (CHANNEL A TEST)	APC19 (TEST SWITCH)	CONTACTS CLOSED	CHANNEL A HI-HI CONTAINMENT PRESSURE MATRIX RELAYS APC1A, APC1B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.1.05.03.1	CSAS TRAIN A (CHANNEL A TEST)	AVC1A, AVC1B (RELAYS)	ON (UNTRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A VALVE MATRIX. CHANNEL A PUMP MATRIX, CHANNELS B, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS VALVE LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS	NORMAL POSITION. TRAIN A CHANNEL A VALVE MATRIX RELAYS. PARALLEL RELAY AVCIC PROVIDES CONTROL ROOM INDICATION
09.1.05.03.2	CSAS TRAIN A (CHANNEL A TEST)	AVC1A, AVC1B (RELAYS)	OFF (TRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A VALVE MATRIX. CHANNEL A PUMP MATRIX, CHANNELS B, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	
09.1.05.03.3	CSAS TRAIN A (CHANNEL A TEST)	AVC1A, AVC1B (RELAYS)	INPUT OPEN	(SAME AS 9.1.5.3.2)	(SAME AS 9.1.5.3.2)	(SAME AS 9.1.5.3.2)	(SAME AS 9.1.5.3.2)	
09.1.05.03.4	CSAS TRAIN A (CHANNEL A TEST)	AVC1A, AVC1B (RELAYS)	INPUT SHORT	(SAME AS 9.1.5.1.4)	(SAME AS 9.1.5.1.4)	(SAME AS 9.1.5.1.4)	(SAME AS 9.1.5.1.4)	BOUNDS FAILURE OF ANNUNCIATOR RELAY AVCIC. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APSA AND APSB OUTPUTS ARE PARALLELED
09.1.05.04.1	CSAS TRAIN A (CHANNEL A TEST)	AVC19 (TEST SWITCH)	CONTACTS OPEN	RELAYS AVC1A, AVC1B DE-ENERGIZE, CAUSING CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS VALVE MATRIX. CHANNEL B, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	
09.1.05.04.2	CSAS TRAIN A (CHANNEL A TEST)	AVC19 (TEST SWITCH)	CONTACTS CLOSED	CHANNEL A HI-HI CONTAINMENT PRESSURE MATRIX RELAYS AVC1A, AVC1B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.1.06.01.1	CSAS TRAIN A (CHANNEL B TEST)	APC2A, APC2B (RELAYS)	ON (UNTRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A PUMP MATRIX. CHANNEL B VALVE MATRIX, CHANNELS A, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS PUMP LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	NORMAL POSITION. TRAIN A CHANNEL B PUMP MATRIX RELAYS. PARALLEL RELAY APC2C PROVIDES CONTROL ROOM INDICATION
09.1.06.01.2	CSAS TRAIN A (CHANNEL B TEST)	APC2A, APC2B (RELAYS)	OFF (TRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A PUMP MATRIX. CHANNEL B VALVE MATRIX, CHANNELS A, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	
09.1.06.01.3	CSAS TRAIN A (CHANNEL B TEST)	APC2A, APC2B (RELAYS)	INPUT OPEN	(SAME AS 9.1.6.1.2)	(SAME AS 9.1.6.1.2)	(SAME AS 9.1.6.1.2)	(SAME AS 9.1.6.1.2)	
09.1.06.01.4	CSAS TRAIN A (CHANNEL B TEST)	APC2A, APC2B (RELAYS)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES APSA AND APSB, CAUSING TRIP OF 3/3 HI-HI CONTAINMENT PRESSURE CHANNELS, DISABLING 2/2 SEQUENCER SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN A CSAS LOGIC	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN A CSAS LOGIC DISABLED	BOUNDS FAILURE OF ANNUNCIATOR RELAY APC2C. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APSA AND APSB OUTPUTS ARE PARALLELED

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.06.02.1	CSAS TRAIN A (CHANNEL B TEST)	APC2S (TEST SWITCH)	CONTACTS OPEN	RELAYS APC2A, APC2B DE-ENERGIZE, CAUSING CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS PUMP MATRIX. CHANNELS A, C AND SEQ1 (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	
09.1.06.02.2	CSAS TRAIN A (CHANNEL B TEST)	APC2S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL B HI-HI CONTAINMENT PRESSURE MATRIX RELAYS APC2A, APC2B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.1.06.03.1	CSAS TRAIN A (CHANNEL B TEST)	AVC2A, AVC2B (RELAYS)	ON (UNTRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A VALVE MATRIX. CHANNEL B PUMP MATRIX, CHANNELS A, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS VALVE LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS	NORMAL POSITION. TRAIN A CHANNEL B VALVE MATRIX RELAYS. PARALLEL RELAY AVC2C PROVIDES CONTROL ROOM INDICATION
09.1.06.03.2	CSAS TRAIN A (CHANNEL B TEST)	AVC2A, AVC2B (RELAYS)	OFF (TRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A VALVE MATRIX. CHANNEL B PUMP MATRIX, CHANNELS A, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	
09.1.06.03.3	CSAS TRAIN A (CHANNEL B TEST)	AVC2A, AVC2B (RELAYS)	INPUT OPEN	(SAME AS 9.1.6.3.2)	(SAME AS 9.1.6.3.2)	(SAME AS 9.1.6.3.2)	(SAME AS 9.1.6.3.2)	
09.1.06.03.4	CSAS TRAIN A (CHANNEL B TEST)	AVC2A, AVC2B (RELAYS)	INPUT SHORT	(SAME AS 9.1.6.1.4)	(SAME AS 9.1.6.1.4)	(SAME AS 9.1.6.1.4)	(SAME AS 9.1.6.1.4)	BOUNDS FAILURE OF ANNUNCIATOR RELAY AVC2C. CSAS OUTPUT RELAYS ARE ENERGIZED TO ACTUATE APSA AND APSE OUTPUTS ARE PARALLELED
09.1.06.04.1	CSAS TRAIN A (CHANNEL B TEST)	AVC2S (TEST SWITCH)	CONTACTS OPEN	RELAYS AVC2A, AVC2B DE-ENERGIZE, CAUSING CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS VALVE MATRIX. CHANNEL A, C AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	
09.1.06.04.2	CSAS TRAIN A (CHANNEL B TEST)	AVC2S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL B HI-HI CONTAINMENT PRESSURE MATRIX RELAYS AVC2A, AVC2B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.1.07.01.1	CSAS TRAIN A (CHANNEL C TEST)	APC3A, APC3B (RELAYS)	ON (UNTRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A PUMP MATRIX. CHANNEL C VALVE MATRIX, CHANNELS A, B AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS PUMP LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	NORMAL POSITION. TRAIN A CHANNEL C PUMP MATRIX RELAYS. PARALLEL RELAY APC3C PROVIDES CONTROL ROOM INDICATION
09.1.07.01.2	CSAS TRAIN A (CHANNEL C TEST)	APC3A, APC3B (RELAYS)	OFF (TRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A PUMP MATRIX. CHANNEL C VALVE MATRIX, CHANNELS A, B AND SEQ 1 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.07.01.3	CSAS TRAIN A (CHANNEL C TEST)	APC3A, APC3B (RELAYS)	INPUT OPEN	(SAME AS 9.1.7.1.2)	(SAME AS 9.1.7.1.2)	(SAME AS 9.1.7.1.2)	(SAME AS 9.1.7.1.2)	
09.1.07.01.4	CSAS TRAIN A (CHANNEL C TEST)	APC3A, APC3B (RELAYS)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES APSA AND APSB, CAUSING TRIP OF 3/3 HI-HI CONTAINMENT PRESSURE CHANNELS, DISABLING 2/2 SEQUENCER SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN A CSAS LOGIC	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN A CSAS LOGIC DISABLED	BOUNDS FAILURE OF ANNUNCIATOR RELAY APC3C. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE APSA AND APSB OUTPUTS ARE PARALLELED
09.1.07.02.1	CSAS TRAIN A (CHANNEL C TEST)	APC3B (TEST SWITCH)	CONTACTS OPEN	RELAYS APC3A, APC3B DE-ENERGIZE, CAUSING CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS PUMP MATRIX. CHANNELS A, B AND SRQ1 (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SRQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SRQ 1	
09.1.07.02.2	CSAS TRAIN A (CHANNEL C TEST)	APC3B (TEST SWITCH)	CONTACTS CLOSED	CHANNEL C HI-HI CONTAINMENT PRESSURE MATRIX RELAYS APC3A, APC3B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.1.07.03.1	CSAS TRAIN A (CHANNEL C TEST)	AVC3A, AVC3B (RELAYS)	ON (UNTRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A VALVE MATRIX. CHANNEL C PUMP MATRIX, CHANNELS A, B AND SRQ 1 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS VALVE LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS	NORMAL POSITION. TRAIN A CHANNEL C VALVE MATRIX RELAYS. PARALLEL RELAY AVC3C PROVIDES CONTROL ROOM INDICATION
09.1.07.03.2	CSAS TRAIN A (CHANNEL C TEST)	AVC3A, AVC3B (RELAYS)	OFF (TRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A VALVE MATRIX. CHANNEL C PUMP MATRIX, CHANNELS A, B AND SRQ 1 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SRQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SRQ 1	
09.1.07.03.3	CSAS TRAIN A (CHANNEL C TEST)	AVC3A, AVC3B (RELAYS)	INPUT OPEN	(SAME AS 9.1.7.3.2)	(SAME AS 9.1.7.3.2)	(SAME AS 9.1.7.3.2)	(SAME AS 9.1.7.3.2)	
09.1.07.03.4	CSAS TRAIN A (CHANNEL C TEST)	AVC3A, AVC3B (RELAYS)	INPUT SHORT	(SAME AS 9.1.7.1.4)	(SAME AS 9.1.7.1.4)	(SAME AS 9.1.7.1.4)	(SAME AS 9.1.7.1.4)	BOUNDS FAILURE OF ANNUNCIATOR RELAY AVC3C. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE APSA AND APSB OUTPUTS ARE PARALLELED
09.1.07.04.1	CSAS TRAIN A (CHANNEL C TEST)	AVC3B (TEST SWITCH)	CONTACTS OPEN	RELAYS AVC3A, AVC3B DE-ENERGIZE, CAUSING CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS VALVE MATRIX. CHANNEL A, B AND SRQ 1 (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SRQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SRQ 1	
09.1.07.04.2	CSAS TRAIN A (CHANNEL C TEST)	AVC3B (TEST SWITCH)	CONTACTS CLOSED	CHANNEL C HI-HI CONTAINMENT PRESSURE MATRIX RELAYS AVC3A, AVC3B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.08.01.1	CSAS TRAIN A (SRQ 1 TEST)	APIA (RBLAT)	TRIPPED (ON)	RELAY PROVIDES 1 OF 2 REQUIRED SRQ 1 INPUTS TO CSAS TRAIN A PUMP LOGIC	PERIODIC TESTING	REDUNDANT SRQ SUBCHANNEL AND CONTAINMENT HI-HI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS ACTUATION OF TRAIN A PUMP	CSAS LOGIC FOR TRAIN A PUMPS BECOMES 1/1 ON REMAINING SRQ SUBCHANNEL WITH CONCURRENT 2/3 HI-HI CONTAINMENT PRESSURE, TRAIN A VALVE LOGIC AND TRAIN B UNAFFECTED	
09.1.08.01.2	CSAS TRAIN A (SRQ 1 TEST)	APIA (RBLAT)	UNTRIPPED (OFF)	1 OF 2 REQUIRED SRQ 1 INPUTS DISABLED TO TRAIN A PUMP LOGIC, VALVE LOGIC (INCLUDING REDUNDANT INPUT FROM RELAY AVS3) AND TRAIN B UNAFFECTED	PERIODIC TESTING	REDUNDANT RELAY INPUT FROM VALVE LOGIC (AVS3), REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS PUMP ACTUATION	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APXB
09.1.08.01.3	CSAS TRAIN A (SRQ 1 TEST)	APIA (RBLAT)	INPUT OPEN	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APXB
09.1.08.01.4	CSAS TRAIN A (SRQ 1 TEST)	APIA (RBLAT)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES APXA AND APXB ON RELAY TEST OR SRQ 1 SIS/SISLOP SIGNAL, CAUSING TRIP OF 2/3 CONTAINMENT HI-HI PRESSURE CHANNELS, DISABLING 2/2 SRQ SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN A CSAS LOGIC	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A CSAS INOPERABLE	APXB BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY APXB. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APXA AND APXB OUTPUTS ARE PARALLELED
09.1.08.02.1	CSAS TRAIN A (SRQ 1 TEST)	APIS (TEST SWITCH)	NORMAL	RELAY APIA CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.1.08.02.2	CSAS TRAIN A (SRQ 1 TEST)	APIS (TEST SWITCH)	TEST	(SAME AS 9.1.8.1.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.1.8.1.1)	(SAME AS 9.1.8.1.1)	
09.1.08.03.1	CSAS TRAIN A (SRQ 1 TEST)	AVIA (RBLAT)	TRIPPED (ON)	RELAY PROVIDES 1 OF 2 REQUIRED SRQ 1 INPUTS TO CSAS TRAIN A VALVE LOGIC	PERIODIC TESTING	REDUNDANT SRQ SUBCHANNEL AND CONTAINMENT HI-HI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS ACTUATION OF TRAIN A VALVES	CSAS LOGIC FOR TRAIN A VALVES BECOMES 1/1 ON REMAINING SRQ SUBCHANNEL WITH CONCURRENT 2/3 HI-HI CONTAINMENT PRESSURE, TRAIN A VALVE LOGIC AND TRAIN B UNAFFECTED	
09.1.08.03.2	CSAS TRAIN A (SRQ 1 TEST)	AVIA (RBLAT)	UNTRIPPED (OFF)	1 OF 2 REQUIRED SRQ 1 INPUTS DISABLED TO CSAS TRAIN A VALVE LOGIC, PUMP LOGIC UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A CSAS VALVE ACTUATION INOPERABLE	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVXB
09.1.08.03.3	CSAS TRAIN A (SRQ 1 TEST)	AVIA (RBLAT)	INPUT OPEN	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	*FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVXB
09.1.08.03.4	CSAS TRAIN A (SRQ 1 TEST)	AVIA (RBLAT)	INPUT SHORT	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	AVIB BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY AVIB. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APXA AND APXB OUTPUTS ARE PARALLELED

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM OPERATOR UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.08.04.1	CSAS TRAIN A (SEQ 1 TEST)	AVIS (TEST SWITCH)	NORMAL	RELAY AVIA CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL
09.1.08.04.2	CSAS TRAIN A (SEQ 1 TEST)	AVIS (TEST SWITCH)	TEST	(SAME AS 9.1.8.3.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.1.8.3.1)	(SAME AS 9.1.8.3.1)	
09.1.08.05.1	CSAS TRAIN A (SEQ 1 TEST)	APYA (RELAY)	TRIPPED (ON)	(SAME AS 9.1.8.1.1)	(SAME AS 9.1.8.1.1)	(SAME AS 9.1.8.1.1)	(SAME AS 9.1.8.1.1)	
09.1.08.05.2	CSAS TRAIN A (SEQ 1 TEST)	APYA (RELAY)	UNTRIPPED (OFF)	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APYB
09.1.08.05.3	CSAS TRAIN A (SEQ 1 TEST)	APYA (RELAY)	INPUT OPEN	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	(SAME AS 9.1.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APYB
09.1.08.05.4	CSAS TRAIN A (SEQ 1 TEST)	APYA (RELAY)	INPUT SHORT	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY APYB. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APSA AND AP5B OUTPUTS ARE PARALLELED
09.1.08.06.1	CSAS TRAIN A (SEQ 1 TEST)	APYS (TEST SWITCH)	NORMAL	RELAY APYA CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.1.08.06.2	CSAS TRAIN A (SEQ 1 TEST)	APYS (TEST SWITCH)	TEST	(SAME AS 9.1.8.1.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.1.8.1.1)	(SAME AS 9.1.8.1.1)	
09.1.08.07.1	CSAS TRAIN A (SEQ 1 TEST)	AVYA (RELAY)	TRIPPED (ON)	(SAME AS 9.1.8.3.1)	(SAME AS 9.1.8.3.1)	(SAME AS 9.1.8.3.1)	(SAME AS 9.1.8.3.1)	(SAME AS 9.1.8.3.1)
09.1.08.07.2	CSAS TRAIN A (SEQ 1 TEST)	AVYA (RELAY)	UNTRIPPED (OFF)	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVYB
09.1.08.07.3	CSAS TRAIN A (SEQ 1 TEST)	AVYA (RELAY)	INPUT OPEN	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	(SAME AS 9.1.8.3.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVYB
09.1.08.07.4	CSAS TRAIN A (SEQ 1 TEST)	AVYA (RELAY)	INPUT SHORT	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	(SAME AS 9.1.8.1.4)	BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY AVYB. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APSA AND AP5B OUTPUTS ARE PARALLELED
09.1.08.08.1	CSAS TRAIN A (SEQ 1 TEST)	AVYS (TEST SWITCH)	NORMAL	RELAY AVYB CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.1.08.08.2	CSAS TRAIN A (SEQ 1 TEST)	AVYS (TEST SWITCH)	TEST	(SAME AS 9.1.8.3.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.1.8.3.1)	(SAME AS 9.1.8.3.1)	
09.1.09.01.1	CSAS TRAIN A (UV TEST)	APDR (TOR RELAY)	OFF	CSAS TRAIN A PUMP LOGIC DELAY DISABLED, VALVE LOGIC DELAY AND SEQ LOAD GROUP D TIMERS UNAPPROCTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. NO EFFECT FOR SIS. FOR SISLOP, RELAY IS DE-ENERGIZED FOR CSAS PERMISSIVE 10 SEC FOLLOWING 4 LV BUS VOLTAGE RECOVERY SO THAT SEQ LOAD GROUP D 11 SEC TIME DELAY CONTROLS START TIME FOR CSAS LOADS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.09.01.2	CSAS TRAIN A (UV TEST)	APDR (TDR RELAY)	ON	CSAS TRAIN A PUMP LOGIC DISABLED, OUTPUT RELAYS APS1 THROUGH APS9 CANNOT BE ENERGIZED (SAME AS 9.1.9.1.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A CSAS PUMP ACTUATION INOPERABLE	
09.1.09.01.3	CSAS TRAIN A (UV TEST)	APDR (TDR RELAY)	INPUT OPEN		(SAME AS 9.1.9.1.1)	(SAME AS 9.1.9.1.1)	(SAME AS 9.1.9.1.1)	
09.1.09.01.4	CSAS TRAIN A (UV TEST)	APDR (TDR RELAY)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES APSA AND APSB, DE-ENERGIZING TRAIN A CSAS LOGIC AND POTENTIALLY IMPACTING VITAL BUS #1 (8-1115V FOR APSA) AND VITAL BUS #3A (8-1314V FOR APSB)	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR CSAS, NONE FOR VITAL BUSES	*TRAIN A CSAS INOPERABLE, POTENTIAL IMPACT TO REDUNDANT VITAL BUSES #1 AND #3A	BREAKERS COORDINATED WITH VITAL BUS FEEDERS, HOWEVER FAILURE (SHORT OF BOTH +15VDC AND -15VDC ON APSA AND APSB) MAY CAUSE AUTO-TRANSFER OF BOTH VITAL BUSES PRIOR TO TRIP OF APSA/APS8 LOAD BREAKERS
09.1.09.02.1	CSAS TRAIN A (UV TEST)	APDS (TEST SWITCH)	NORMAL	RELAY APDR CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.1.09.02.2	CSAS TRAIN A (UV TEST)	APDS (TEST SWITCH)	TEST	(SAME AS 9.1.9.1.2)	(SAME AS 9.1.9.1.2)	(SAME AS 9.1.9.1.2)	(SAME AS 9.1.9.1.2)	
09.1.09.03.1	CSAS TRAIN A (UV TEST)	AVDR (TDR RELAY)	OFF	CSAS TRAIN A VALVE LOGIC DELAY DISABLED, PUMP LOGIC DELAY AND SEQ LOAD GROUP D TIMERS UNAFFECTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.1.09.03.2	CSAS TRAIN A (UV TEST)	AVDR (TDR RELAY)	ON	CSAS TRAIN A PUMP LOGIC DISABLED, OUTPUT RELAYS AVS1 THRU AVS9 CANNOT BE ENERGIZED (SAME AS 9.1.9.3.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A CSAS VALVE ACTUATION INOPERABLE	
09.1.09.03.3	CSAS TRAIN A (UV TEST)	AVDR (TDR RELAY)	INPUT OPEN		(SAME AS 9.1.9.3.1)	(SAME AS 9.1.9.3.1)	(SAME AS 9.1.9.3.1)	
09.1.09.03.4	CSAS TRAIN A (UV TEST)	AVDR (TDR RELAY)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES APSA AND APSB, DE-ENERGIZING TRAIN A CSAS LOGIC AND POTENTIALLY IMPACTING VITAL BUS #1 (8-1115V FOR APSA) AND VITAL BUS #3A (8-1314V FOR APSB)	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR CSAS, NONE FOR VITAL BUSES	*TRAIN A CSAS INOPERABLE, POTENTIAL IMPACT TO REDUNDANT VITAL BUSES #1 AND #3A	BREAKERS COORDINATED WITH VITAL BUS FEEDERS, HOWEVER FAILURE (SHORT OF BOTH +15VDC AND -15VDC ON APSA AND APSB) MAY CAUSE AUTO-TRANSFER OF BOTH VITAL BUSES PRIOR TO TRIP OF APSA/APS8 LOAD BREAKERS
09.1.09.04.1	CSAS TRAIN A (UV TEST)	AVDS (TEST SWITCH)	NORMAL	RELAY AVDR CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.1.09.04.2	CSAS TRAIN A (UV TEST)	AVDS (TEST SWITCH)	TEST	(SAME AS 9.1.9.3.2)	(SAME AS 9.1.9.3.2)	(SAME AS 9.1.9.3.2)	(SAME AS 9.1.9.3.2)	
09.1.10.01.1	CSAS TRAIN A (LOGIC)	APH1A, APH2A (RELAYS)	TRIPPED (ONE RELAY)	RELAY PROVIDES 1 OF 2 REQUIRED MATRIX SIGNALS TO TRAIN A CSAS PUMP OUTPUT RELAYS	PERIODIC TESTING	REDUNDANT MATRIX OUTPUT RELAY AND REDUNDANT VALVE LOGIC TO PREVENT SPURIOUS CSAS	CSAS LOGIC FOR TRAIN A PUMPS BECOMES 1/1 ON REMAINING MATRIX OUTPUT RELAY	*RELAYS ARE DE-ENERGIZE TO ACTUATE. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAYS APH1B OR APH2B NORMAL POSITION (ENERGIZED)
09.1.10.01.2	CSAS TRAIN A (LOGIC)	APH1A, APH2A (RELAYS)	UNTRIPPED (ONE RELAY)	1 OF 2 REQUIRED MATRIX OUTPUT RELAYS DISABLED FOR CSAS TRAIN A PUMPS	PERIODIC TESTING	REDUNDANT TRAIN	CSAS TRAIN A PUMP ACTUATION INOPERABLE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.10.01.3	CSAS TRAIN A (LOGIC)	APH1A, APH2A (RELAYS)	INPUT OPEN (ONE RELAY)	(SAME AS 9.1.10.1.1)	(SAME AS 9.1.10.1.1)	(SAME AS 9.1.10.1.1)	(SAME AS 9.1.10.1.1)	*(SAME AS 9.1.10.1.1)
09.1.10.01.4	CSAS TRAIN A (LOGIC)	APH1A, APH2A (RELAYS)	INPUT SHORT (ONE RELAY)	LOSS OF 15VDC POWER SUPPLIES APSA AND APSE, PREVENTING ENERGIZATION OF CSAS TRAIN A OUTPUT RELAYS	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A CSAS INOPERABLE	BOUNDS SHORT OF ANY OUTPUT RELAY APS1 THRU APS9 OR AVS1 THRU AVS9. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APSA AND APSE OUTPUTS ARE PARALLELED
09.1.10.02.1	CSAS TRAIN A (LOGIC)	RMS-2020A (INITIATE PUMPS)	CONTACTS OPEN	TRAIN A CSAS PUMPS ACTUATED, SIGNAL RESET CANNOT BE SEALED-IN. TRAIN A CSAS VALVE LOGIC UNAFFECTED	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT LOGIC FOR TRAIN A VALVES TO PREVENT SPURIOUS CSAS	REDUCED REDUNDANCY AGAINST SPURIOUS CSAS	
09.1.10.02.2	CSAS TRAIN A (LOGIC)	RMS-2020A (INITIATE PUMPS)	CONTACTS CLOSED	TRAIN A CSAS PUMPS CANNOT BE ACTUATED MANUALLY AT SYSTEM LEVEL. NO EFFECT ON AUTOMATIC ACTUATION	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	NORMAL POSITION
09.1.10.03.1	CSAS TRAIN A (LOGIC)	AVH1A, AVH2A (RELAYS)	TRIPPED (ONE RELAY)	RELAY PROVIDES 1 OF 2 REQUIRED MATRIX SIGNALS TO CSAS TRAIN A VALVE OUTPUT RELAYS	PERIODIC TESTING	REDUNDANT MATRIX OUTPUT RELAY TO PREVENT SPURIOUS CSAS	CSAS LOGIC FOR TRAIN A VALVES BECOMES 1/1 ON REMAINING MATRIX OUTPUT RELAY	*RELAYS ARE DE-ENERGIZE TO ACTUATE. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAYS AVH1B OR AVH2B
09.1.10.03.2	CSAS TRAIN A (LOGIC)	AVH1A, AVH2A (RELAYS)	UNTRIPPED (ONE RELAY)	1 OF 2 REQUIRED MATRIX OUTPUT RELAYS DISABLED FOR CSAS TRAIN A VALVES	PERIODIC TESTING	REDUNDANT TRAIN	CSAS TRAIN A VALVE ACTUATION INOPERABLE	NORMAL POSITION
09.1.10.03.3	CSAS TRAIN A (LOGIC)	AVH1A, AVH2A (RELAYS)	INPUT OPEN (ONE RELAY)	(SAME AS 9.1.10.3.1)	(SAME AS 9.1.10.3.1)	(SAME AS 9.1.10.3.1)	(SAME AS 9.1.10.3.1)	*(SAME AS 9.1.10.3.1)
09.1.10.03.4	CSAS TRAIN A (LOGIC)	AVH1A, AVH2A (RELAYS)	INPUT SHORT (ONE RELAY)	LOSS OF 15VDC POWER SUPPLIES APSA AND APSE, PREVENTING ENERGIZATION OF CSAS TRAIN A OUTPUT RELAYS	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	CSAS TRAIN A INOPERABLE	BOUNDS SHORT OF ANY OUTPUT RELAY APS1 THRU APS9 OR AVS1 THRU AVS9. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. APSA AND APSE OUTPUTS ARE PARALLELED
09.1.10.04.1	CSAS TRAIN A (LOGIC)	RMS-2060A (INITIATE VALVES)	CONTACTS OPEN	CSAS TRAIN A VALVES ACTUATED, SIGNAL RESET CANNOT BE SEALED-IN. TRAIN A PUMPS UNAFFECTED	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT LOGIC FOR TRAIN A PUMPS TO PREVENT SPURIOUS CSAS	REDUCED REDUNDANCY AGAINST SPURIOUS CSAS	
09.1.10.04.2	CSAS TRAIN A (LOGIC)	RMS-2060A (INITIATE VALVES)	CONTACTS CLOSED	TRAIN A CSAS VALVES CANNOT BE ACTUATED MANUALLY AT SYSTEM LEVEL. NO EFFECT ON AUTOMATIC ACTUATION	PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	NORMAL POSITION
09.1.10.05.1	CSAS TRAIN A (LOGIC)	RMS-2070A, -2080A (MANUAL RESET)	CONTACTS OPEN (NORMAL)	TRAIN A CSAS PUMP AND VALVE SIGNALS CANNOT BE RESET AFTER TEST OR ACTUATION	PERIODIC TESTING	EQUIPMENT LEVEL OVERRIDES FOR TRAIN A VALVE REALIGNMENT IN RECIRC, REDUNDANT TRAIN FOR AUTO-REINITIATION IN SMALL BREAK EVENTS	TRAIN A CSAS CANNOT BE RESET FOR VALVE REALIGNMENT IN RECIRC, REQUIRING USE OF OVERRIDES WHICH BLOCK AUTO-REINITIATION	NORMAL POSITION
09.1.10.05.2	CSAS TRAIN A (LOGIC)	RMS-2070A, -2080A (MANUAL RESET)	CONTACTS CLOSED (RESET)	TRAIN A CSAS PUMPS AND VALVES CANNOT BE ACTUATED MANUALLY OR AUTOMATICALLY AT SYSTEM LEVEL	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A CSAS INOPERABLE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRR UNIT 1
 TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.1.11.01.1	CSAS TRAIN A (POWER)	APSA (15VDC PWR SUPL)	OUTPUT VOLTS LOW	POWER LOST FROM APSA. NO EFFECT ON TRAIN A CSAS LOGIC DUE TO REDUNDANT SUPPLY APSB (SAME AS 9.1.11.1.1)	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	DOES NOT INCLUDE OUTPUT SHORT, WHICH IS BOUNDED BY INPUT SHORT OF CONNECTED RELAYS
09.1.11.01.2	CSAS TRAIN A (POWER)	APSA (15VDC PWR SUPL)	INPUT OPEN		(SAME AS 9.1.11.1.1)	(SAME AS 9.1.11.1.1)	(SAME AS 9.1.11.1.1)	
09.1.11.01.3	CSAS TRAIN A (POWER)	APSA (15VDC PWR SUPL)	INPUT SHORT	VITAL BUS #1 (8-1115V) BREAKER TRIPS OPEN AND DE-ENERGIZES APSA. NO EFFECT ON TRAIN A CSAS LOGIC DUE TO REDUNDANT SUPPLY APSB	CONTROL ROOM INDICATION	(SAME AS 9.1.11.1.1)	(SAME AS 9.1.11.1.1)	FAILURE MAY ALSO RESULT IN AUTO-TRANSFER OF VITAL BUS #1 TO BACKUP SOURCE PRIOR TO ISOLATION OF FAULT BY LOAD BREAKER
09.1.11.02.1	CSAS TRAIN A (POWER)	APSB (15VDC PWR SUPL)	OUTPUT VOLTS LOW	POWER LOST FROM APSB. NO EFFECT ON TRAIN A CSAS LOGIC DUE TO REDUNDANT SUPPLY APSA (SAME AS 9.1.11.2.1)	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	DOES NOT INCLUDE OUTPUT SHORT, WHICH IS BOUNDED BY INPUT SHORT OF CONNECTED RELAYS
09.1.11.02.2	CSAS TRAIN A (POWER)	APSB (15VDC PWR SUPL)	INPUT OPEN		(SAME AS 9.1.11.2.1)	(SAME AS 9.1.11.2.1)	(SAME AS 9.1.11.2.1)	
09.1.11.02.3	CSAS TRAIN A (POWER)	APSB (15VDC PWR SUPL)	INPUT SHORT	VITAL BUS #3 (8-1314V) BREAKER TRIPS OPEN AND DE-ENERGIZES APSB	CONTROL ROOM INDICATION	(SAME AS 9.1.11.2.1)	(SAME AS 9.1.11.2.1)	
09.1.11.03.1	CSAS TRAIN A (POWER)	VITAL BUS #1 (8-1115V)	VOLTS LOW	15VDC POWER SUPPLY APSA DE-ENERGIZED. NO EFFECT ON TRAIN A CSAS LOGIC DUE TO REDUNDANT SUPPLY APSB	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	
09.1.11.04.1	CSAS TRAIN A (POWER)	VITAL BUS #3 (8-1314V)	VOLTS LOW	15VDC POWER SUPPLY APSB DE-ENERGIZED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	APSA AND APSB OUTPUTS ARE PARALLELED
09.2.01.01.1	PT-502 LOOP	PIS-512 (BISTABLE)	TRIPPED	CHANNEL B HI-BI CONTAINMENT PRESSURE SIGNAL VIA DE-ENERGIZING RELAY AC2A TO TRAIN A CSAS, AND BC2B TO TRAIN B CSAS. CHANNELS A AND C HI-BI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR CSAS INITIATION, REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	BECOMES 1/2 ON REMAINING CONTAINMENT PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQ	LOOP INCLUDES TRANSMITTER PT-502, TEST SWITCH AND RESISTOR. CSAS LOGIC FOR EACH TRAIN IS SIS/SISLOP PLUS 2/3 HI-BI CONTAINMENT PRESSURE. BISTABLE FAILURE IN TRIPPED STATE BOUNDS COIL SHORT IN OUTPUT RELAYS
09.2.01.01.2	PT-502 LOOP	PIS-512 (BISTABLE)	UNTRIPPED	CHANNEL B HI-BI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A AND TRAIN B CSAS VIA RELAYS AC2A AND BC2B REMAINING ENERGIZED. CHANNELS A AND C HI-BI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS	BECOMES 2/2 ON REMAINING CONTAINMENT PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQ	NORMAL POSITION. OUTPUT RELAYS ARE NORMALLY ENERGIZED, AND DE-ENERGIZE TO TRIP
09.2.01.02.1	PT-502 LOOP	LOOP PWR SUPPLY 610	INPUT OPEN	(SAME AS 9.2.1.1.1)	(SAME AS 9.2.1.1.1)	(SAME AS 9.2.1.1.1)	(SAME AS 9.2.1.1.1)	
09.2.01.02.2	PT-502 LOOP	LOOP PWR SUPPLY 610	INPUT SHORT	PUSH BLOWS IN SUPPLY FROM CSAS INVERTER, CAUSING LOSS OF POWER TO PIS-512, LIS-500B, PIS-501 AND OUTPUT RELAYS, RESULTING IN CHNL B HI-BI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC AND DISABLING LOW LEVEL TRIP OF TRAIN B HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	BECOMES 1/2 ON REMAINING CONTAINMENT HI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCER	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 9-1: CONTAINMENT SPRAY ACTUATION FAILURE

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.01.03.1	PT-502 LOOP	AC2A (RELAY)	TRIPPED	CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS LOGIC. CHANNELS A AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS TRAIN A CSAS	TRAIN A CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1. TRAIN B CSAS LOGIC UNAFFECTED	RELAY IS DE-ENERGIZE TO TRIP
09.2.01.03.2	PT-502 LOOP	AC2A (RELAY)	UNTRIPPED	CHANNEL B HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A CSAS LOGIC. CHANNELS A AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 1. TRAIN B CSAS LOGIC UNAFFECTED	
09.2.01.04.1	PT-502 LOOP	BC2B (RELAY)	TRIPPED	CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS LOGIC. CHANNELS A AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS TRAIN B CSAS	TRAIN B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2. TRAIN A CSAS LOGIC UNAFFECTED	RELAY IS DE-ENERGIZE TO TRIP
09.2.01.04.2	PT-502 LOOP	BC2B (RELAY)	UNTRIPPED	CHANNEL B HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B CSAS LOGIC. CHANNELS A AND C HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2. TRAIN A CSAS LOGIC UNAFFECTED	
09.2.01.05.1	PT-502 LOOP	CSAS INVERTER (V02-2)	VOLTS LOW	LOSS OF POWER TO PIS-512, LIS-500B, PIS-501 AND OUTPUT RELAYS, RESULTING IN COMB HI-HI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC AND DISABLING LOW LEVEL TRIP OF TRAIN B HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCES	
09.2.02.01.1	PT-503 LOOP	PIS-513 (BISTABLE)	TRIPPED	CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL VIA DE-ENERGIZING RELAY AC3A TO TRAIN A CSAS, AND BC3B TO TRAIN B CSAS. CHANNELS A AND B HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR CSAS INITIATION, REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND TRAIN B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQ	LOOP INCLUDES TRANSMITTER PT-503, TEST SWITCH AND RESISTOR. CSAS LOGIC FOR EACH TRAIN IS SIS/SISLOP PLUS 2/3 HI-HI CONTAINMENT PRESSURE. BISTABLE FAILURE IN TRIPPED STATE BOUNDS COIL SHORT IN OUTPUT RELAYS
09.2.02.01.2	PT-503 LOOP	PIS-513 (BISTABLE)	UNTRIPPED	CHANNEL C HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A AND TRAIN B CSAS VIA RELAYS AC3A AND BC3B REMAINING ENERGIZED. CHANNELS A AND B HI-HI CONTAINMENT PRESSURE AND SEQ (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS	TRAIN A AND TRAIN B CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQ	NORMAL POSITION. OUTPUT RELAYS ARE NORMALLY ENERGIZED, AND DE-ENERGIZE TO TRIP

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.02.02.1	PT-503 LOOP	LOOP PWR SUPPLY	INPUT OPEN	(SAME AS 9.2.2.1.1)	(SAME AS 9.2.2.1.1)	(SAME AS 9.2.2.1.1)	(SAME AS 9.2.2.1.1)	
		610						
09.2.02.02.2	PT-503 LOOP	LOOP PWR SUPPLY	INPUT SHORT	FUSE BLOWS IN SUPPLY FROM CSAS INVERTER, CAUSING LOSS OF POWER TO PIS-513, NOV-883 POSITION INDICATION AND PIS-513 OUTPUT RELAYS, RESULTING IN CTRL C HI-BI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SBQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCE	
09.2.02.03.1	PT-503 LOOP	AC3A (RELAY)	TRIPPED	CHANNEL C HI-BI CONTAINMENT PRESSURE SIGNAL TO TRAIN A CSAS LOGIC. CHANNELS A AND B HI-BI CONTAINMENT PRESSURE AND SBQ (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SBQ INPUTS TO PREVENT SPURIOUS TRAIN A CSAS	TRAIN A CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SBQ 1. TRAIN B CSAS LOGIC UNAFFECTED	RELAY IS DE-ENERGIZE TO TRIP
09.2.02.03.2	PT-503 LOOP	AC3A (RELAY)	UNTRIPPED	CHANNEL C HI-BI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN A CSAS LOGIC. CHANNELS A AND B HI-BI CONTAINMENT PRESSURE AND SBQ (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN A CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SBQ 1. TRAIN B CSAS LOGIC UNAFFECTED	
09.2.02.04.1	PT-503 LOOP	BC3B (RELAY)	TRIPPED	CHANNEL C HI-BI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS LOGIC. CHANNELS A AND B HI-BI CONTAINMENT PRESSURE AND SBQ (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SBQ INPUTS TO PREVENT SPURIOUS TRAIN B CSAS	TRAIN B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SBQ 2. TRAIN A CSAS LOGIC UNAFFECTED	RELAY IS DE-ENERGIZE TO TRIP
09.2.02.04.2	PT-503 LOOP	BC3B (RELAY)	UNTRIPPED	CHANNEL C HI-BI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B CSAS LOGIC. CHANNELS A AND B HI-BI CONTAINMENT PRESSURE AND SBQ (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SBQ 2. TRAIN A CSAS LOGIC UNAFFECTED	
09.2.02.05.1	PT-503 LOOP	CSAS INVERTER (T02-3)	VOLTS LOW	LOSS OF POWER TO PIS-513, NOV-883 POSITION INDICATION, AND PIS-513 OUTPUT RELAYS, RESULTING IN CTRL C HI-BI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SBQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCE	
09.2.03.01.1	9BQ 2	SUBCHANNEL X (29-5,6)	CONTACTS OPEN (UNTRIPPED)	LOGIC RELAYS BPIA, BPIB, BVIA, BVIB REMAIN DE-ENERGIZED, DISABLING 1 OF 2 REQUIRED SBQ 2 INPUTS TO CSAS TRAIN B LOGIC	PERIODIC TESTING	REDUNDANT TRAIN	CSAS TRAIN B DISABLED	CSAS LOGIC REQUIRES 2/2 TRIP OF SBQ 2 SUBCHANNEL X AND Y INPUTS CONCURRENT WITH 2/3 CONTAINMENT HI-BI PRESSURE
09.2.03.01.2	9BQ 2	SUBCHANNEL X (29-5,6)	CONTACTS CLOSED (TRIPPED)	LOGIC RELAYS BPIA, BPIB, BVIA, BVIB ENERGIZE, PROVIDING 1 OF 2 REQUIRED SBQ 2 INPUTS TO CSAS TRAIN B LOGIC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT SBQ SUBCHANNEL AND CONTAINMENT HI-BI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS LOGIC BECOMES 1/1 ON REMAINING SBQ SUBCHANNEL WITH CONCURRENT 2/3 HI-BI CONTAINMENT PRESSURE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
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TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON SCS	REMARKS
09.2.03.02.1	SEQ 2	SUBCHANNEL Y (29-7,8)	CONTACTS OPEN (UNTRIPPED)	LOGIC RELAYS BPTA, BPTY, BVTA, BVTB REMAIN DE-ENERGIZED, DISABLING 1 OF 2 REQUIRED SRQ 2 INPUTS TO CSAS TRAIN B LOGIC	PERIODIC TESTING	REDUNDANT TRAIN	CSAS TRAIN B DISABLED	CSAS LOGIC REQUIRES 2/2 TRIP OF SEQ 2 SUBCHANNEL I AND Y INPUTS CONCURRENT WITH 2/3 CONTAINMENT HI-HI PRESSURE
09.2.03.02.2	SEQ 2	SUBCHANNEL Y (29-7,8)	CONTACTS CLOSED (TRIPPED)	LOGIC RELAYS BPTA, BPTY, BVTA, BVTB ENERGIZE, PROVIDING 1 OF 2 REQUIRED SRQ 2 INPUTS TO CSAS TRAIN B LOGIC	PERIODIC TESTING	REDUNDANT SEQ SUBCHANNEL AND CONTAINMENT HI-HI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS LOGIC BECOMES 1/1 ON REMAINING SEQ SUBCHANNEL WITH CONCURRENT 2/3 HI-HI CONTAINMENT PRESSURE	
09.2.04.01.1	BUS #1C, 2C UNDERVOLTAGE	127-7X (RBLAY)	CONTACTS OPEN (ON)	1 OF 2 REDUNDANT BUS 1C UNDERVOLTAGE INPUTS DISABLED TO TRAIN B CSAS TIME DELAY RELAYS BPDR, BVDR	PERIODIC TESTING	REDUNDANT RELAY, REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B CSAS FOR SISLOP CONDITIONS	UV AUXILIARY RELAYS ARE DE-ENERGIZED TO TRIP
09.2.04.01.2	BUS #1C, 2C UNDERVOLTAGE	127-7X (RBLAY)	CONTACTS CLOSED (OFF)	BUS 1C UNDERVOLTAGE SIGNAL TO TRAIN B CSAS TIME DELAY RELAYS BPDR, BVDR. DELAY LOGIC BECOMES 1/2 ON BUS 2C UNDERVOLTAGE INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN B CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN B CSAS LOADING WILL FOLLOW BUS 2C VOLTAGE RECOVERY AND SEQ 2 LOAD GROUP D DELAY
09.2.04.02.1	BUS #1C, 2C UNDERVOLTAGE	127-8X (RBLAY)	CONTACTS OPEN (ON)	1 OF 2 REDUNDANT BUS 2C UNDERVOLTAGE INPUTS DISABLED TO TRAIN B CSAS TIME DELAY RELAYS BPDR, BVDR	PERIODIC TESTING	REDUNDANT RELAY, REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B CSAS FOR SISLOP CONDITIONS	UV AUXILIARY RELAYS ARE DE-ENERGIZED TO TRIP
09.2.04.02.2	BUS #1C, 2C UNDERVOLTAGE	127-8X (RBLAY)	CONTACTS CLOSED (OFF)	BUS 2C UNDERVOLTAGE SIGNAL TO TRAIN B CSAS TIME DELAY RELAYS BPDR, BVDR. DELAY LOGIC BECOMES 1/2 ON BUS 1C UNDERVOLTAGE INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN B CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN B CSAS LOADING WILL FOLLOW BUS 1C (TRAIN A) VOLTAGE RECOVERY AND SEQ 2 LOAD GROUP D DELAY. THIS FAILURE WITH A CONCURRENT BUS 1C LOB WOULD CONSTITUTE A DOUBLE FAILURE SCENARIO, WHICH IS NOT CREDIBLE
09.2.04.03.1	BUS #1C, 2C UNDERVOLTAGE	127-11X (RBLAY)	CONTACTS OPEN (ON)	(SAME AS 9.2.4.1.1)	(SAME AS 9.2.4.1.1)	(SAME AS 9.2.4.1.1)	(SAME AS 9.2.4.1.1)	(SAME AS 9.2.4.1.1)
09.2.04.03.2	BUS #1C, 2C UNDERVOLTAGE	127-11X (RBLAY)	CONTACTS CLOSED (OFF)	(SAME AS 9.2.4.1.2)	(SAME AS 9.2.4.1.2)	(SAME AS 9.2.4.1.2)	(SAME AS 9.2.4.1.2)	(SAME AS 9.2.4.1.2)
09.2.04.04.1	BUS #1C, 2C UNDERVOLTAGE	127-12X (RBLAY)	CONTACTS OPEN (ON)	(SAME AS 9.2.4.2.1)	(SAME AS 9.2.4.2.1)	(SAME AS 9.2.4.2.1)	(SAME AS 9.2.4.2.1)	(SAME AS 9.2.4.2.1)
09.2.04.04.2	BUS #1C, 2C UNDERVOLTAGE	127-12X (RBLAY)	CONTACTS CLOSED (OFF)	(SAME AS 9.2.4.2.2)	(SAME AS 9.2.4.2.2)	(SAME AS 9.2.4.2.2)	(SAME AS 9.2.4.2.2)	(SAME AS 9.2.4.2.2)
09.2.04.05.1	BUS #1C, 2C UNDERVOLTAGE	BUS #1C	VOLTS LOW	RELAYS 127-7X AND 127-11X DE-ENERGIZE. TRAIN B CSAS TIME DELAY RELAY BPDR, BVDR LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN B CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN B CSAS LOADING WILL FOLLOW BUS 2C VOLTAGE RECOVERY AND SEQ 2 LOAD GROUP D DELAY
09.2.04.06.1	BUS #1C, 2C UNDERVOLTAGE	BUS #2C	VOLTS LOW	RELAYS 127-8X AND 127-12X DE-ENERGIZE. TRAIN B CSAS TIME DELAY RELAY BPDR, BVDR LOGIC BECOMES 1/2 ON BUS 1C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN B CSAS LOADING WILL FOLLOW BUS 1C (TRAIN A) VOLTAGE RECOVERY AND SEQ 2 LOAD GROUP D DELAY. THIS FAILURE IS NOT CREDIBLE WITH CONCURRENT BUS 1C LOB, SINCE THAT WOULD BE A DOUBLE FAILURE SCENARIO

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TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.05.01.1	CSAS TRAIN B (CHANNEL A TEST)	BPC1A, BPC1B (RELAYS)	ON (UNTRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B PUMP MATRIX. CHANNEL A VALVE MATRIX, CHANNELS B, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS PUMP LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	NORMAL POSITION. TRAIN B CHANNEL A PUMP MATRIX RELAYS. PARALLEL RELAY BPC1C PROVIDES CONTROL ROOM INDICATION
09.2.05.01.2	CSAS TRAIN B (CHANNEL A TEST)	BPC1A, BPC1B (RELAYS)	OFF (TRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN A PUMP MATRIX. CHANNEL A VALVE MATRIX, CHANNELS B, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.05.01.3	CSAS TRAIN B (CHANNEL A TEST)	BPC1A, BPC1B (RELAYS)	INPUT OPEN	(SAME AS 9.2.5.1.2)	(SAME AS 9.2.5.1.2)	(SAME AS 9.2.5.1.2)	(SAME AS 9.2.5.1.2)	
09.2.05.01.4	CSAS TRAIN B (CHANNEL A TEST)	BPC1A, BPC1B (RELAYS)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES BPSA AND BPSB, CAUSING TRIP OF 1/3 HI-HI CONTAINMENT PRESSURE CHANNELS, DISABLING 2/2 SEQUENCER SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN B CSAS LOGIC	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN A CSAS LOGIC DISABLED	BOUNDS FAILURE OF ANNUNCIATOR RELAY BPC1C. CSAS OUTPUT RELAYS ARE EMERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED
09.2.05.02.1	CSAS TRAIN B (CHANNEL A TEST)	BPC1S (TEST SWITCH)	CONTACTS OPEN	RELAYS BPC1A, BPC1B DE-EMERGIZE, CAUSING CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS PUMP MATRIX. CHANNELS B, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.05.02.2	CSAS TRAIN B (CHANNEL A TEST)	BPC1S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL A HI-HI CONTAINMENT PRESSURE MATRIX RELAYS BPC1A, BPC1B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.2.05.03.1	CSAS TRAIN B (CHANNEL A TEST)	BVC1A, BVC1B (RELAYS)	ON (UNTRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B VALVE MATRIX. CHANNEL A PUMP MATRIX, CHANNELS B, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS VALVE LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	NORMAL POSITION. TRAIN B CHANNEL A VALVE MATRIX RELAYS. PARALLEL RELAY BVC1C PROVIDES CONTROL ROOM INDICATION
09.2.05.03.2	CSAS TRAIN B (CHANNEL A TEST)	BVC1A, BVC1B (RELAYS)	OFF (TRIPPED)	CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B VALVE MATRIX. CHANNEL A PUMP MATRIX, CHANNELS B, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.05.03.3	CSAS TRAIN B (CHANNEL A TEST)	BVC1A, BVC1B (RELAYS)	INPUT OPEN	(SAME AS 9.2.5.3.2)	(SAME AS 9.2.5.3.2)	(SAME AS 9.2.5.3.2)	(SAME AS 9.2.5.3.2)	
09.2.05.03.4	CSAS TRAIN B (CHANNEL A TEST)	BVC1A, BVC1B (RELAYS)	INPUT SHORT	(SAME AS 9.2.5.1.4)	(SAME AS 9.2.5.1.4)	(SAME AS 9.2.5.1.4)	(SAME AS 9.2.5.1.4)	BOUNDS FAILURE OF ANNUNCIATOR RELAY BVC1C. CSAS OUTPUT RELAYS ARE EMERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
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TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.05.04.1	CSAS TRAIN B (CHANNEL A TEST)	BVC1S (TEST SWITCH)	CONTACTS OPEN	RELAYS BVC1A, BVC1B DE-ENERGIZE, CAUSING CHANNEL A HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS VALVE MATRIX. CHANNEL B, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.05.04.2	CSAS TRAIN B (CHANNEL A TEST)	BVC1S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL A HI-HI CONTAINMENT PRESSURE MATRIX RELAYS BVC1A, BVC1B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.2.06.01.1	CSAS TRAIN B (CHANNEL B TEST)	BPC2A, BPC2B (RELAYS)	ON (UNTRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B PUMP MATRIX. CHANNEL B VALVE MATRIX, CHANNELS A, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS PUMP LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	NORMAL POSITION. TRAIN B CHANNEL B PUMP MATRIX RELAYS. PARALLEL RELAY BPC2C PROVIDES CONTROL ROOM INDICATION
09.2.06.01.2	CSAS TRAIN B (CHANNEL B TEST)	BPC2A, BPC2B (RELAYS)	OFF (TRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B PUMP MATRIX. CHANNEL B VALVE MATRIX, CHANNELS A, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.06.01.3	CSAS TRAIN B (CHANNEL B TEST)	BPC2A, BPC2B (RELAYS)	INPUT OPEN	(SAME AS 9.2.6.1.2)	(SAME AS 9.2.6.1.2)	(SAME AS 9.2.6.1.2)	(SAME AS 9.2.6.1.2)	
09.2.06.01.4	CSAS TRAIN B (CHANNEL B TEST)	BPC2A, BPC2B (RELAYS)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES BPSA AND BPSB, CAUSING TRIP OF 1/3 HI-HI CONTAINMENT PRESSURE CHANNELS, DISABLING 2/2 SEQUENCER SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN B CSAS LOGIC	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN B CSAS LOGIC DISABLED	BOUNDARY FAILURE OF ANNUNCIATOR RELAY BPC2C. CSAS OUTPUTS RELAYS ARE ENERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED
09.2.06.02.1	CSAS TRAIN B (CHANNEL B TEST)	BPC2S (TEST SWITCH)	CONTACTS OPEN	RELAYS BPC2A, BPC2B DE-ENERGIZE, CAUSING CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS PUMP MATRIX. CHANNELS A, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.06.02.2	CSAS TRAIN B (CHANNEL B TEST)	BPC2S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL B HI-HI CONTAINMENT PRESSURE MATRIX RELAYS BPC2A, BPC2B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.2.06.03.1	CSAS TRAIN B (CHANNEL B TEST)	BVC2A, BVC2B (RELAYS)	ON (UNTRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B VALVE MATRIX. CHANNEL B PUMP MATRIX, CHANNELS A, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS VALVE LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS	NORMAL POSITION. TRAIN B CHANNEL B VALVE MATRIX RELAYS. PARALLEL RELAY BVC2C PROVIDES CONTROL ROOM INDICATION

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SAN ONOPFER UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.06.03.2	CSAS TRAIN B (CHANNEL B TEST)	BVC2A, BVC2B (RELAYS)	OFF (TRIPPED)	CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B VALVE MATRIX. CHANNEL B PUMP MATRIX, CHANNELS A, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.06.03.3	CSAS TRAIN B (CHANNEL B TEST)	BVC2A, BVC2B (RELAYS)	INPUT OPEN	(SAME AS 9.2.6.3.2)	(SAME AS 9.2.6.3.2)	(SAME AS 9.2.6.3.2)	(SAME AS 9.2.6.3.2)	
09.2.06.03.4	CSAS TRAIN B (CHANNEL B TEST)	BVC2A, BVC2B (RELAYS)	INPUT SHORT	(SAME AS 9.2.6.1.4)	(SAME AS 9.2.6.1.4)	(SAME AS 9.2.6.1.4)	(SAME AS 9.2.6.1.4)	BOUNDS FAILURE OF ANNUNCIATOR RELAY BVC2C. CSAS OUTPUT RELAYS ARE EMERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELLED
09.2.06.04.1	CSAS TRAIN B (CHANNEL B TEST)	BVC2S (TEST SWITCH)	CONTACTS OPEN	RELAYS BVC2A, BVC2B DE-EMERGIZE, CAUSING CHANNEL B HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS VALVE MATRIX. CHANNEL A, C AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.06.04.2	CSAS TRAIN B (CHANNEL B TEST)	BVC2S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL B HI-HI CONTAINMENT PRESSURE MATRIX RELAYS BVC2A, BVC2B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.2.07.01.1	CSAS TRAIN B (CHANNEL C TEST)	BPC3A, BPC3B (RELAYS)	ON (UNTRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B PUMP MATRIX. CHANNEL C VALVE MATRIX, CHANNELS A, B AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS PUMP LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	NORMAL POSITION. TRAIN B CHANNEL C PUMP MATRIX RELAYS. PARALLEL RELAY BPC3C PROVIDES CONTROL ROOM INDICATION
09.2.07.01.2	CSAS TRAIN B (CHANNEL C TEST)	BPC3A, BPC3B (RELAYS)	OFF (TRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B PUMP MATRIX. CHANNEL C VALVE MATRIX, CHANNELS A, B AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.07.01.3	CSAS TRAIN B (CHANNEL C TEST)	BPC3A, BPC3B (RELAYS)	INPUT OPEN	(SAME AS 9.2.7.1.2)	(SAME AS 9.2.7.1.2)	(SAME AS 9.2.7.1.2)	(SAME AS 9.2.7.1.2)	
09.2.07.01.4	CSAS TRAIN B (CHANNEL C TEST)	BPC3A, BPC3B (RELAYS)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES BPSA AND BPSB, CAUSING TRIP OF 3/3 HI-HI CONTAINMENT PRESSURE CHANNELS, DISABLING 2/2 SEQUENCER SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN B CSAS LOGIC	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN B CSAS LOGIC DISABLED	BOUNDS FAILURE OF ANNUNCIATOR RELAY BPC3C. CSAS OUTPUT RELAYS ARE EMERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELLED
09.2.07.02.1	CSAS TRAIN B (CHANNEL C TEST)	BPC3S (TEST SWITCH)	CONTACTS OPEN	RELAYS BPC3A, BPC3B DE-EMERGIZE, CAUSING CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS PUMP MATRIX. CHANNELS A, B AND SEQ 2 (SIS/SISLOP) INPUTS UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS PUMP LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM ONOPER UNIT 1
 TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.07.02.2	CSAS TRAIN B (CHANNEL C TEST)	BPC3S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL C HI-HI CONTAINMENT PRESSURE MATRIX RELAYS BPC3A, BPC3B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.2.07.03.1	CSAS TRAIN B (CHANNEL C TEST)	BVC3A, BVC3B (RELAYS)	ON (UNTRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE INPUT DISABLED TO TRAIN B VALVE MATRIX. CHANNEL C PUMP MATRIX, CHANNELS A, B AND SEQ 2 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS, REDUNDANT TRAIN	TRAIN B CSAS VALVE LOGIC BECOMES 2/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS	NORMAL POSITION. TRAIN B CHANNEL C VALVE MATRIX RELAYS. PARALLEL RELAY BVC3C PROVIDES CONTROL ROOM INDICATION
09.2.07.03.2	CSAS TRAIN B (CHANNEL C TEST)	BVC3A, BVC3B (RELAYS)	OFF (TRIPPED)	CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B VALVE MATRIX. CHANNEL C PUMP MATRIX, CHANNELS A, B AND SEQ 2 (SIS/SISLOP) INPUTS UNAFFECTED	PERIODIC TESTING	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.07.03.3	CSAS TRAIN B (CHANNEL C TEST)	BVC3A, BVC3B (RELAYS)	INPUT OPEN	(SAME AS 9.2.7.3.2)	(SAME AS 9.2.7.3.2)	(SAME AS 9.2.7.3.2)	(SAME AS 9.2.7.3.2)	
09.2.07.03.4	CSAS TRAIN B (CHANNEL C TEST)	BVC3A, BVC3B (RELAYS)	INPUT SHORT	(SAME AS 9.2.7.1.4)	(SAME AS 9.2.7.1.4)	(SAME AS 9.2.7.1.4)	(SAME AS 9.2.7.1.4)	BOUNDS FAILURE OF ANNUNCIATOR RELAY BVC3C. CSAS OUTPUT RELAYS ARE ENERGIZED TO ACTUATE BPSA AND BPSB OUTPUTS ARE PARALLELLED
09.2.07.04.1	CSAS TRAIN B (CHANNEL C TEST)	BVC3S (TEST SWITCH)	CONTACTS OPEN	RELAYS BVC3A, BVC3B DE-ENERGIZED, CAUSING CHANNEL C HI-HI CONTAINMENT PRESSURE SIGNAL TO TRAIN B CSAS VALVE MATRIX. CHANNEL A, B AND SEQ 2 (SIS/SISLOP) INPUTS UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN B CSAS VALVE LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM SEQ 2	
09.2.07.04.2	CSAS TRAIN B (CHANNEL C TEST)	BVC3S (TEST SWITCH)	CONTACTS CLOSED	CHANNEL C HI-HI CONTAINMENT PRESSURE MATRIX RELAYS BVC3A, BVC3B CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
09.2.08.01.1	CSAS TRAIN B (SEQ 2 TEST)	BP1A (RELAY)	TRIPPED (ON)	RELAY PROVIDES 1 OF 2 REQUIRED SEQ 2 INPUTS TO CSAS TRAIN B PUMP LOGIC	PERIODIC TESTING	REDUNDANT SEQ SUBCHANNEL AND CONTAINMENT HI-HI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS ACTUATION OF TRAIN B PUMP	CSAS LOGIC FOR TRAIN B PUMPS BECOMES 1/1 ON REMAINING SEQ SUBCHANNEL WITH CONCURRENT HI-HI CONTAINMENT PRESSURE, TRAIN B VALVE LOGIC AND TRAIN A UNAFFECTED	
09.2.08.01.2	CSAS TRAIN B (SEQ 2 TEST)	BP1A (RELAY)	UNTRIPPED (OFF)	1 OF 2 REQUIRED SEQ 2 INPUTS DISABLED TO TRAIN B PUMP LOGIC, VALVE LOGIC (INCLUDING REDUNDANT INPUT FROM RELAY BVC3) AND TRAIN A UNAFFECTED	PERIODIC TESTING	REDUNDANT RELAY INPUT FROM VALVE LOGIC (BVC3), REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN B CSAS PUMP ACTUATION	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BP1B
09.2.08.01.3	CSAS TRAIN B (SEQ 2 TEST)	BP1A (RELAY)	INPUT OPEN	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BP1B

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.08.01.4	CSAS TRAIN B (SBQ 2 TEST)	BPIA (RELAY)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES BPSA AND BPSB ON RELAY TEST OR SBQ 2 SIS/SISLOP SIGNAL, CAUSING TRIP OE 3/3 CONTAINMENT HI-HI PRESSURE CHANNELS, DISABLING 2/2 SBQ SUBCHANNEL INPUTS AND ALL CSAS OUTPUTS IN TRAIN B CSAS LOGIC	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN B CSAS INOPERABLE	BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY BPIB. CSAS OUTPUT RELAYS ARE ENERGIZED TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED
09.2.08.02.1	CSAS TRAIN B (SBQ 2 TEST)	BPIB (TEST SWITCH)	NORMAL	RELAY BPIA CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.2.08.02.2	CSAS TRAIN B (SBQ 2 TEST)	BPIB (TEST SWITCH)	TEST	(SAME AS 9.2.8.1.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.2.8.1.1)	(SAME AS 9.2.8.1.1)	
09.2.08.03.1	CSAS TRAIN B (SBQ 2 TEST)	BVIA (RELAY)	TRIPPED (ON)	RELAY PROVIDES 1 OF 2 REQUIRED SBQ 2 INPUTS TO CSAS TRAIN B VALVE LOGIC	PERIODIC TESTING	REDUNDANT SBQ SUBCHANNEL AND CONTAINMENT HI-HI PRESSURE INPUTS TO PREVENT SPURIOUS CSAS ACTUATION OF TRAIN B VALVES	CSAS LOGIC FOR TRAIN B VALVES BECOMES 1/1 ON REMAINING SBQ SUBCHANNEL WITH CONCURRENT 2/3 HI-HI CONTAINMENT PRESSURE, TRAIN B VALVE LOGIC AND TRAIN A UNAPPECTED	
09.2.08.03.2	CSAS TRAIN B (SBQ 2 TEST)	BVIA (RELAY)	UNTRIPPED (OFF)	1 OF 2 REQUIRED SBQ 1 INPUTS DISABLED TO CSAS TRAIN B VALVE LOGIC, PUMP LOGIC UNAPPECTED	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN B CSAS VALVE ACTUATION INOPERABLE	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BVIB
09.2.08.03.3	CSAS TRAIN B (SBQ 2 TEST)	BVIA (RELAY)	INPUT OPEN	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	*FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BVIB
09.2.08.03.4	CSAS TRAIN B (SBQ 2 TEST)	BVIA (RELAY)	INPUT SHORT	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY BVIB. CSAS OUTPUT RELAYS ARE ENERGIZED TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED
09.2.08.04.1	CSAS TRAIN B (SBQ 2 TEST)	BVIS (TEST SWITCH)	NORMAL	RELAY BVIA CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL
09.2.08.04.2	CSAS TRAIN B (SBQ 2 TEST)	BVIS (TEST SWITCH)	TEST	(SAME AS 9.2.8.3.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.2.8.3.1)	(SAME AS 9.2.8.3.1)	
09.2.08.05.1	CSAS TRAIN B (SBQ 2 TEST)	BPIA (RELAY)	TRIPPED (ON)	(SAME AS 9.2.8.1.1)	(SAME AS 9.2.8.1.1)	(SAME AS 9.2.8.1.1)	(SAME AS 9.2.8.1.1)	
09.2.08.05.2	CSAS TRAIN B (SBQ 2 TEST)	BPIA (RELAY)	UNTRIPPED (OFF)	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BPIB
09.2.08.05.3	CSAS TRAIN B (SBQ 2 TEST)	BPIA (RELAY)	INPUT OPEN	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	(SAME AS 9.2.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BPIB

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOFFER UNIT 1
TABLE 9-1: CONTAINMENT SPRAY ACTUATION FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
09.2.08.05.4	CSAS TRAIN B (SEQ 2 TEST)	BPTA (RELAY)	INPUT SHORT	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY BPTB. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED
09.2.08.06.1	CSAS TRAIN B (SEQ 2 TEST)	BPTS (TEST SWITCH)	NORMAL	RELAY BPTA CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.2.08.06.2	CSAS TRAIN B (SEQ 2 TEST)	BPTS (TEST SWITCH)	TEST	(SAME AS 9.2.8.1.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.2.8.1.1)	(SAME AS 9.2.8.1.1)	
09.2.08.07.1	CSAS TRAIN B (SEQ 2 TEST)	BVTA (RELAY)	TRIPPED (ON)	(SAME AS 9.2.8.3.1)	(SAME AS 9.2.8.3.1)	(SAME AS 9.2.8.3.1)	(SAME AS 9.2.8.3.1)	(SAME AS 9.2.8.3.1)
09.2.08.07.2	CSAS TRAIN B (SEQ 2 TEST)	BVTA (RELAY)	UNTRIPPED (OFF)	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BVTB
09.2.08.07.3	CSAS TRAIN B (SEQ 2 TEST)	BVTA (RELAY)	INPUT OPEN	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	(SAME AS 9.2.8.3.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BVTB
09.2.08.07.4	CSAS TRAIN B (SEQ 2 TEST)	BVTA (RELAY)	INPUT SHORT	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	(SAME AS 9.2.8.1.4)	BOUNDS FAILURE OF ANNUNCIATOR/TEST RELAY BVTB. CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED
09.2.08.08.1	CSAS TRAIN B (SEQ 2 TEST)	BVTS (TEST SWITCH)	NORMAL	RELAY BVTB CANNOT BE TESTED	PERIODIC TESTING	NONE REQUIRED	NONE	
09.2.08.08.2	CSAS TRAIN B (SEQ 2 TEST)	BVTS (TEST SWITCH)	TEST	(SAME AS 9.2.8.3.1)	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 9.2.8.3.1)	(SAME AS 9.2.8.3.1)	
09.2.09.01.1	CSAS TRAIN B (UV TEST)	BPDR (TDR RELAY)	OFF	CSAS TRAIN B PUMP LOGIC DISABLED, VALVE LOGIC DELAY AND SEQ LOAD GROUP D TIMERS UNAFFECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. NO EFFECT FOR SIG. FOR SIGLOP. RELAY IS DE-ENERGIZED FOR CSAS PERMISSIVE 10 SEC FOLLOWING 4 BY BUS VOLTAGE RECOVERY SO THAT SEQ LOAD GROUP D 11 SEC TIME DELAY CONTROLS START TIME FOR CSAS LOADS
09.2.09.01.2	CSAS TRAIN B (UV TEST)	BPDR (TDR RELAY)	ON	CSAS TRAIN B PUMP LOGIC DISABLED, OUTPUT RELAYS BPS1 THROUGH BPS9 CANNOT BE ENERGIZED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	TRAIN B CSAS PUMP ACTUATION INOPERABLE	
09.2.09.01.3	CSAS TRAIN B (UV TEST)	BPDR (TDR RELAY)	INPUT OPEN	(SAME AS 9.2.9.1.1)	(SAME AS 9.2.9.1.1)	(SAME AS 9.2.9.1.1)	(SAME AS 9.2.9.1.1)	
09.2.09.01.4	CSAS TRAIN B (UV TEST)	BPDR (TDR RELAY)	INPUT SHORT	LOSS OF 15VDC POWER SUPPLIES BPSA AND BPSB, DE-ENERGIZING TRAIN B CSAS LOGIC AND POTENTIALLY IMPACTING CSAS INVERTER (T02-1)	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR CSAS	TRAIN B CSAS INOPERABLE	CSAS OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. BPSA AND BPSB OUTPUTS ARE PARALLELED

SECTION 10: STANDBY POWER

STANDBY POWER SYSTEM NOTES

1. Item numbers in this section have been assigned as follows:
 - 10.1: Train A Emergency Diesel Generator, 4 kV breaker and dependencies
 - 10.2: Train B Emergency Diesel Generator, 4 kV breaker and dependencies
2. This section covers the Emergency Diesel Generators (EDGs), their 4kV breakers and control/power dependencies. Failures of EDG auxiliaries are bounded by the engine/generator or control/power failures, since each EDG is provided with a separate train-aligned auxiliary system.
3. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.

STANDBY POWER SYSTEM REFERENCES

Piping and Instrumentation Diagrams

5178800	Diesel Generator #1 Fuel Oil System
5178805	Diesel Generator #1 Lube Oil System (Sh 1)
5178806	Diesel Generator #1 Lube Oil System (Sh 2)
5178810	Diesel Generator #1 Cooling Water System
5178815	Diesel Generator #1 Starting Air System (Sh 1)
5178816	Diesel Generator #1 Starting Air System (Sh 2)
5178820	Diesel Generator #1 Combustion Air Intake-Exhaust
5178825	Diesel Generator #1 Instrument and Control Air
5178830	Diesel Generator #2 Fuel Oil System
5178835	Diesel Generator #2 Lube Oil System (Sh 1)
5178836	Diesel Generator #2 Lube Oil System (Sh 2)
5178840	Diesel Generator #2 Cooling Water System
5178845	Diesel Generator #2 Starting Air System (Sh 1)
5178846	Diesel Generator #2 Starting Air System (Sh 2)
5178850	Diesel Generator #2 Combustion Air Intake-Exhaust
5178855	Diesel Generator #2 Instrument and Control Air

One Line Diagrams

5102173	125 VDC System #1
5146828	Main One Line Diagram
5149348	125 VDC System #2
5149306	MCC-1B
5149307	MCC-2B

Elementary Diagrams

5149630	4 kV Bus Diesel Generator Breakers
5151363	Diesel Generator #1 Engine Control
5151364	Diesel Generator #2 Engine Control

Other Drawings

5149178	Load Sequence Table, Train 1 (Sh 1)
5149179	Load Sequence Table, Train 1 (Sh 2)
5149181	Load Sequence Table, Train 2 (Sh 1)
5149182	Load Sequence Table, Train 2 (Sh 2)
5149957	Emergency Operating Condition, Train 1
5149958	Emergency Operating Condition, Train 2

Procedures

S01-1.0-10	Reactor Trip or Safety Injection
S01-1.0-60	Loss of All AC Power
S01-1.0-61	Loss of All AC Power Recovery
S01-2.6-4	Loss of DC Bus
S01-9-2	4160 V System Operations
S01-10-1	Diesel Generator Operations
S01-10-2	Diesel Generator Starting Air System
S01-10-3	Diesel Generator Control and Instrument Air System
S01-10-4	Diesel Generator Cooling Water System
S01-10-5	Diesel Generator Fuel System
S01-10-6	Diesel Generator Lube Oil System
S01-12.2-6	Electrical Distribution Weekly Surveillances

SO1-12.3-10 Diesel Generator Load Test
SO1-12.3-37 Diesel Generator #1 Safety Related Alignment
SO1-12.3-38 Diesel Generator #2 Safety Related Alignment

Other Documents

SD-SO1-120 System Description: 4160 V System
SD-SO1-590 System Description: Safeguard Load Sequencing
System
SD-SO1-600 System Description: Diesel Generator System
M89048 Response to Generic Letter 88-14, "Instrument Air
Supply System Problems Affecting Safety Related
Systems", dated July 5, 1989

TABLE 10-1: STANDBY POWER FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 10-1: STANDBY POWER SYSTEM (DIESEL GENERATORS) FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
10.1.01.01.1 DG #1		ENGINE/GENERATOR	FAIL TO START/RUN	NONE FOR SIS. LOSS OF TRAIN A 4 kV AND 480 V POWER FOR LOB, LOP AND SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS. REDUNDANT TRAIN/DC FOR LOB, LOP AND SISLOP	NONE FOR SIS. FOR LOB, LOP AND SISLOP, IMMEDIATE LOSS OF 4 kV AND 480 V AC POWER, WITH DELAYED LOSS OF 125 VDC BUS #1 AFTER BATTERY DISCHARGE (SAME AS 10.1.1.1.1)	INCLUDES STARTING, GOVERNOR, FUEL, COOLING AND RELATED SUPPORT SYSTEMS
10.1.01.01.2 DG #1		ENGINE/GENERATOR	OUTPUT VOLTS/FREQ LOW	(SAME AS 10.1.1.1.1)	(SAME AS 10.1.1.1.1)	(SAME AS 10.1.1.1.1)	(SAME AS 10.1.1.1.1)	
10.1.01.02.1 DG #1	SBQ 1 (15-5, 7)		CONTACTS OPEN (OFF)	LOSS OF DC FIELD, CAUSING INOPERABILITY OF TRAIN A 4kV AND 480 V BUS POWER DURING LOB, LOP AND SISLOP	PERIODIC TESTING	(SAME AS 10.1.1.1.1)	(SAME AS 10.1.1.1.1)	NORMAL POSITION. DC FIELD RESET CONTACTS
10.1.01.02.2 DG #1	SBQ 1 (15-5, 7)		CONTACTS CLOSED (ON)	(SAME AS 10.1.1.1.1)	(SAME AS 10.1.1.1.1)	(SAME AS 10.1.1.1.1)	(SAME AS 10.1.1.1.1)	NORMAL SBQ OUTPUT IS MOMENTARY. MAINTAINED CLOSED CONDITION PREVENTS NORMAL FIELD RESPONSE
10.1.01.03.1 DG #1	SBQ 1 (22-1, 3)		CONTACTS OPEN (OFF)	START CIRCUIT #1 DISABLED FOR DC. DC WILL START AS NEEDED FOR LOB, LOP AND SISLOP ON START CIRCUIT #2	PERIODIC TESTING	REDUNDANT TRAIN/DC	REDUCED RELIABILITY FOR TRAIN A FOR LOB, LOP AND SISLOP	NORMAL POSITION. DC START CIRCUIT #1
10.1.01.03.2 DG #1	SBQ 1 (22-1, 3)		CONTACTS CLOSED	START SIGNAL TO START CIRCUIT #1 OF DC, CAUSING DC ENGINE START BUT NO FIELD RESET	CONTROL ROOM INDICATION	NONE REQUIRED	TRAIN A DC STARTS, REMAINS AVAILABLE FOR LOB, LOP AND SISLOP	
10.1.01.04.1 DG #1	SBQ 1 (22-5, 7)		CONTACTS OPEN (OFF)	START CIRCUIT #2 DISABLED. DC WILL START AS NEEDED FOR LOB, LOP AND SISLOP ON START CIRCUIT #1	PERIODIC TESTING	REDUNDANT TRAIN/DC	REDUCED RELIABILITY FOR TRAIN A FOR LOB, LOP AND SISLOP	NORMAL POSITION. DC START CIRCUIT #2
10.1.01.04.2 DG #1	SBQ 1 (22-5, 7)		CONTACTS CLOSED	START SIGNAL TO START CIRCUIT #2 OF DC, CAUSING DC ENGINE START BUT NO FIELD RESET	CONTROL ROOM INDICATION	NONE REQUIRED	TRAIN A DC STARTS, REMAINS AVAILABLE FOR LOB, LOP AND SISLOP	
10.1.01.05.1 DG #1	SBQ 1 (14-1, 3)		CONTACTS OPEN (ON)	DC EMERGENCY SHUTDOWN COIL BLOCKED. NORMAL FOR LOB, LOP, SIS AND SISLOP	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE. NORMAL FOR LOB/LOP/SIS/SISLOP RESPONSE OF TRAIN A DC	EXCITATION SHUTDOWN CRY BLOCK CONTACTS
10.1.01.05.2 DG #1	SBQ 1 (14-1, 3)		CONTACTS CLOSED (OFF)	DC EMERGENCY SHUTDOWN COIL CANNOT BE BLOCKED	PERIODIC TESTING	REDUNDANT TRAIN/DC	REDUCED RELIABILITY OF TRAIN A DC	NORMAL POSITION
10.1.01.06.1 DG #1	R-11A (RELAY)		OFF	LOSS OF DC VOLTS/FREQ SIGNAL TO SBQ 1	PERIODIC TESTING	REDUNDANT TRAIN/DC	TRAIN A DC BREAKER WILL NOT CLOSE AUTOMATICALLY FOLLOWING SISLOP	NORMAL POSITION
10.1.01.06.2 DG #1	R-11A (RELAY)		ON	DC VOLTS/FREQ SIGNAL TO SBQ 1, RESULTING IN PREMATURE DG BRKR CLOSING DURING SISLOP	PERIODIC TESTING	REDUNDANT TRAIN/DC	POTENTIAL TRAIN A FAILURE DURING SISLOP DUE TO PREMATURE LOAD SEQUENCING	
10.1.01.07.1 DG #1	ECC-1B		VOLTS LOW	LOSS OF ESSENTIAL ENGINE/GENERATOR AUXILIARIES CAUSING DELAYED DC TRIP	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DC	DELAYED LOSS OF TRAIN A DC FOR LOB, LOP AND SISLOP	
10.1.01.08.1 DG #1	125VDC BUS #1 (72-105)		VOLTS LOW	LOSS OF DC FIELD FLASH AND GOVERNOR CONTROL POWER	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DC	LOSS OF TRAIN A DC FOR LOB, LOP AND SISLOP	
10.1.02.01.1 DG #1 BREAKER	BUS #1C (11C14)		OPEN	DC CANNOT ENERGIZE BUS #1C FOR LOB, LOP AND SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN/DC	LOSS OF TRAIN A 4kV AND 480V POWER FOR LOB, LOP AND SISLOP	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 10-1: STANDBY POWER SYSTEM (DIRSEL GENERATORS) PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
10.1.02.01.2	DG #1 BREAKER	BUS #1C (11C14)	CLOSED	DG BREAKER WILL NOT TRIP ON LOB/LOP/SIS/SISLOP, CAUSING DEGRADED TRAIN A RESPONSE DUE TO SIS BLOCK LOADING AND FAILURE OF TRAIN B DUE TO DELAYED OR PREVENTED BUS #1C UNDERVOLTAGE SIGNAL	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE	*DEGRADED TRAIN A RESPONSE AND FAILURE OF TRAIN B FOR SIS WITH LOSS OF OPPOSITE POWER	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOP LOGIC CHANGED TO SISLOP
10.1.02.02.1	DG #1 BREAKER	SBQ 1 (21-9, 11)	CONTACTS OPEN (OFF)	DG BREAKER WILL NOT CLOSE AUTOMATICALLY ON SISLOP	PERIODIC TESTING	REDUNDANT TRAIN/DG	INOPERABILITY OF TRAIN A FOR SISLOP	NORMAL POSITION
10.1.02.02.2	DG #1 BREAKER	SBQ 1 (21-9, 11)	CONTACTS CLOSED (ON)	DG BREAKER CLOSE SIGNAL, PARALLELING DG TO OPPOSITE SYSTEM PREMATURELY DURING SIS AND DG TESTING. MAY CAUSE DG DAMAGE DUE TO MOTORING AND/OR BUS DEGRADATION	CONTROL ROOM INDICATION	REDUNDANT TRAIN/DG	INOPERABILITY OF TRAIN A FOR LOB/LOP/SIS/SISLOP	
10.1.02.03.1	DG #1 BREAKER	SBQ 1 (14-5, 7)	CONTACTS OPEN (OFF)	(SAME AS 10.1.2.1.2)	(SAME AS 10.1.2.1.2)	(SAME AS 10.1.2.1.2)	*(SAME AS 10.1.2.1.2)	*NORMAL POSITION. (SAME AS 10.1.2.1.2)
10.1.02.03.2	DG #1 BREAKER	SBQ 1 (14-5, 7)	CONTACTS CLOSED (ON)	(SAME AS 10.1.2.1.1)	PERIODIC TESTING	(SAME AS 10.1.2.1.1)	(SAME AS 10.1.2.1.1)	NORMAL MOMENTARY SIGNAL. MAINTAINED SIGNAL PREVENTS DG BRKR ENCLOSURE
10.1.02.04.1	DG #1 BREAKER	152-11C14 "a" CONTACT	OPEN	LOSS OF DG BRKR CLOSED SIGNAL TO SBQ 1, PREVENTING AUTOMATIC LOADING ON SISLOP	PERIODIC TESTING	REDUNDANT TRAIN/DG	INOPERABILITY OF TRAIN A FOR SISLOP	NORMAL POSITION WITH DG BRKR OPEN
10.1.02.04.2	DG #1 BREAKER	152-11C14 "a" CONTACT	CLOSED	DG BRKR CLOSED SIGNAL TO SBQ 1, CAUSING SISLOP LOADING CONCURRENT WITH SBQ SIGNAL TO CLOSE BRKR	PERIODIC TESTING	REDUNDANT TRAIN/DG	REDUCED RELIABILITY OF TRAIN A FOR SISLOP	
10.1.02.05.1	DG #1 BREAKER	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	INABILITY TO TRIP DG BRKR IF CLOSED OR TO CLOSE DG BRKR IF OPEN	PERIODIC TESTING	NONE FOR BRKR CLOSED, REDUNDANT TRAIN/DG FOR BRKR OPEN	*INOPERABILITY OF TRAIN A FOR SIS AND SISLOP, WITH CONCURRENT INOPERABILITY OF TRAIN B DUE TO DELAYED OR PREVENTED BUS #1C UNDERVOLTAGE, IF BRKR INITIALLY CLOSED. TRAIN B UNAFFECTED FOR SIS	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOP LOGIC CHANGED TO SISLOP
10.2.01.01.1	DG #2	ENGINE/GENERATOR	FAIL TO START/RUN	NONE FOR SIS. LOSS OF TRAIN B 4 kV AND 480 V POWER FOR LOB, LOP AND SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS. REDUNDANT TRAIN/DG FOR LOB, LOP AND SISLOP	NONE FOR SIS. FOR LOB, LOP AND SISLOP, IMMEDIATE LOSS OF TRAIN B 4 kV AND 480 V AC POWER, WITH SUPPORT SYSTEMS DELAYED LOSS OF 125 VDC BUS #2 AFTER BATTERY DISCHARGE	INCLUDES STARTING, GOVERNOR, COOLING AND RELATED SYSTEMS (SAME AS 10.2.1.1.1)
10.2.01.01.2	DG #2	ENGINE/GENERATOR	OUTPUT VOLTS/FREQ LOW	(SAME AS 10.2.1.1.1)	(SAME AS 10.2.1.1.1)	(SAME AS 10.2.1.1.1)	(SAME AS 10.2.1.1.1)	
10.2.01.02.1	DG #2	SBQ 2 (15-5, 7)	CONTACTS OPEN (OFF)	LOSS OF DG FIELD, CAUSING INOPERABILITY OF TRAIN B 4kV AND 480 V BUS POWER DURING LOB, LOP AND SISLOP	PERIODIC TESTING	(SAME AS 10.2.1.1.1)	(SAME AS 10.2.1.1.1)	NORMAL POSITION. DG FIELD RESET CONTACTS
10.2.01.02.2	DG #2	SBQ 2 (15-5, 7)	CONTACTS CLOSED (ON)	(SAME AS 10.2.1.2.1)	(SAME AS 10.2.1.1.1)	(SAME AS 10.2.1.1.1)	(SAME AS 10.2.1.1.1)	NORMAL SBQ OUTPUT IS MOMENTARY. MAINTAINED CLOSED CONDITION PREVENTS NORMAL FIELD RESPONSE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 10-1: STANDBY POWER SYSTEM (DIESEL GENERATORS) FERA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
10.2.01.01.1 DG #2		SRQ 2 (22-1, 3)	CONTACTS OPEN (OFF)	START CIRCUIT #1 DISABLED. DG WILL START AS NEEDED FOR LOB, LOP AND SISLOP ON START CIRCUIT #2	PERIODIC TESTING	REDUNDANT TRAIN/DG	REDUCED RELIABILITY FOR TRAIN B NORMAL POSITION. DG START FOR LOB, LOP AND SISLOP	CIRCUIT #1
10.2.01.03.2 DG #2		SRQ 2 (22-1, 3)	CONTACTS CLOSED	START SIGNAL TO START CIRCUIT #1 OF DG, CAUSING DG ENGINE START BUT NO FIELD RESET	CONTROL ROOM INDICATION	NONE REQUIRED	TRAIN B DG STARTS, REMAINS AVAILABLE FOR LOB, LOP AND SISLOP	
10.2.01.04.1 DG #2		SRQ 2 (22-5, 7)	CONTACTS OPEN (OFF)	START CIRCUIT #2 DISABLED. DG WILL START AS NEEDED FOR LOB, LOP AND SISLOP ON START CIRCUIT #1	PERIODIC TESTING	REDUNDANT TRAIN/DG	REDUCED RELIABILITY FOR TRAIN B NORMAL POSITION. DG START FOR LOB, LOP AND SISLOP	CIRCUIT #2
10.2.01.04.2 DG #2		SRQ 2 (22-5, 7)	CONTACTS CLOSED	START SIGNAL TO START CIRCUIT #2 OF DG, CAUSING DG ENGINE START BUT NO FIELD RESET	CONTROL ROOM INDICATION	NONE REQUIRED	TRAIN B DG STARTS, REMAINS AVAILABLE FOR LOB, LOP AND SISLOP	
10.2.01.05.1 DG #2		SRQ 2 (14-1, 3)	CONTACTS OPEN (ON)	DG EMERGENCY SHUTDOWN COIL BLOCKED. NORMAL FOR LOB/LOP/SIS/SISLOP	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE. NORMAL FOR LOB/LOP/SIS/SISLOP RESPONSE OF TRAIN B DG	EXCITATION SHUTDOWN CKT BLOCK CONTACTS
10.2.01.05.2 DG #2		SRQ 2 (14-1, 3)	CONTACTS CLOSED (OFF)	DG EMERGENCY SHUTDOWN COIL CANNOT BE BLOCKED	PERIODIC TESTING	REDUNDANT TRAIN/DG	REDUCED RELIABILITY OF TRAIN B NORMAL POSITION DG	
10.2.01.06.1 DG #2		R-11A (RELAY)	OFF	LOSS OF DG VOLTS/FREQ SIGNAL TO SRQ 2	PERIODIC TESTING	REDUNDANT TRAIN/DG	TRAIN B DG BREAKER WILL NOT CLOSE AUTOMATICALLY FOLLOWING SISLOP	NORMAL POSITION
10.2.01.06.2 DG #2		R-11A (RELAY)	ON	DG VOLTS/FREQ SIGNAL TO SRQ 2, RESULTING IN PREMATURE DG BRKR CLOSING DURING SISLOP	PERIODIC TESTING	REDUNDANT TRAIN/DG	POTENTIAL TRAIN B FAILURE DURING SISLOP DUE TO PREMATURE LOAD SEQUENCING	
10.2.01.07.1 DG #2		MCC-2B	VOLTS LOW	LOSS OF ESSENTIAL ENGINE/GENERATOR AUXILIARIES CAUSING DELAYED DG TRIP	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DG	LOSS OF TRAIN B DG FOR LOB, LOP AND SISLOP	
10.2.01.08.1 DG #2		125VDC BUS #2 (72-210)	VOLTS LOW	LOSS OF DG FIELD FLASH AND GOVERNOR CONTROL POWER	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DG	LOSS OF TRAIN B DG FOR LOB, LOP AND SISLOP	
10.2.02.01.1 DG #2 BREAKER		BUS #2C (12C15)	OPEN	DG CANNOT ENERGIZE BUS #2C FOR LOB, LOP AND SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN/DG	LOSS OF TRAIN B 48V AND 480 V POWER FOR LOB, LOP AND SISLOP	NORMAL POSITION
10.2.02.01.2 DG #2 BREAKER		BUS #2C (12C15)	CLOSED	DG BREAKER WILL NOT TRIP ON LOB/LOP/SIS/SISLOP, CAUSING DEGRADED TRAIN B RESPONSE DUE TO SIS BLOCK LOADING AND FAILURE OF TRAIN A DUE TO DELAYED OR PREVENTED BUS #2C UNDERVOLTAGE SIGNAL	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE	DEGRADED TRAIN B RESPONSE AND FAILURE OF TRAIN A FOR SIS WITH LOSS OF OPPOSITE POWER	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE UNLESS SISLOP LOGIC CHANGED TO SISLOP
10.2.02.02.1 DG #2 BREAKER		SRQ 2 (21-9, 11)	CONTACTS OPEN (OFF)	DG BREAKER WILL NOT CLOSE AUTOMATICALLY ON SISLOP	PERIODIC TESTING	REDUNDANT TRAIN/DG	INOPERABILITY OF TRAIN B FOR SISLOP	NORMAL POSITION
10.2.02.02.2 DG #2 BREAKER		SRQ 2 (21-9, 11)	CONTACTS CLOSED (ON)	DG BREAKER CLOSE SIGNAL, PARALLELING DG TO OPPOSITE SYSTEM PREMATURELY DURING SIS AND DG TESTING. MAY CAUSE DG DAMAGE DUE TO MOTORING AND/OR BUS DEGRADATION	CONTROL ROOM INDICATION	REDUNDANT TRAIN/DG	INOPERABILITY OF TRAIN B FOR LOB/LOP/SIS/SISLOP	

EMERGENCY COBB COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 10-1: STANDBY POWER SYSTEM (DIESEL GENERATORS) PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
10.2.02.03.1	DC #2 BREAKER	SRQ 2 (14-5, 7)	CONTACTS OPEN (OFF)	(SAME AS 10.2.2.1.2)	(SAME AS 10.2.2.1.2)	(SAME AS 10.2.2.1.2)	*(SAME AS 10.2.2.1.2)	*NORMAL POSITION. (SAME AS 10.2.2.1.2)
10.2.02.03.2	DC #2 BREAKER	SRQ 2 (14-5, 7)	CONTACTS CLOSED (ON)	(SAME AS 10.2.2.1.1)	PERIODIC TESTING	(SAME AS 10.2.2.1.1)	(SAME AS 10.2.2.1.1)	NORMAL MONITARY SIGNAL. MAINTAINED SIGNAL PREVENTS DG BREE RECLOSURE
10.2.02.04.1	DC #2 BREAKER	152-12C14 "A" CONTACT	OPEN	LOSS OF DG BREE CLOSED SIGNAL TO SRQ 2, PREVENTING AUTOMATIC LOADING ON SISLOP	PERIODIC TESTING	REDUNDANT TRAIN/DG	INOPERABILITY OF TRAIN B FOR SISLOP	NORMAL POSITION WITH DG BREE OPEN
10.2.02.04.2	DC #2 BREAKER	152-12C14 "A" CONTACT	CLOSED	DG BREE CLOSED SIGNAL TO SRQ 2, CAUSING SISLOP LOADING CONCURRENT WITH SRQ SIGNAL TO CLOSE BREE	PERIODIC TESTING	REDUNDANT TRAIN/DG	REDUCED RELIABILITY OF TRAIN B FOR SISLOP	
10.2.02.05.1	DC #2 BREAKER	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	INABILITY TO TRIP DG BREE IF CLOSED OR CLOSE DG BREE IF OPEN	PERIODIC TESTING	NONE FOR BREE CLOSED, REDUNDANT TRAIN/DG FOR BREE OPEN	*INOPERABILITY OF TRAIN B FOR SIS AND SISLOP, WITH CONCURRENT INOPERABILITY OF TRAIN A DUE TO DELAYED OR PREVENTED BUS #2C UNDERVOLTAGE, IF BREE INITIALLY CLOSED. TRAIN A UNAFFECTED FOR SIS	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE DURING DC TESTING UNLESS SISLOP LOGIC CHANGED TO

SECTION 11: VITAL AND REGULATED POWER

VITAL POWER SYSTEM NOTES

1. To facilitate possible future changes to the SONGS 1 electrical system, Item numbers in this section have been assigned as follows:

<u>Train A</u>	<u>Train B</u>
11.1: Vital/Reg Bus #1	11.5: Utility Bus
11.2: Vital/Reg Bus #2	11.6: Vital Bus #5/6
11.3: Vital/Reg Bus #3/3A	11.7: CSAS Inverters
11.4: Vital/Reg Bus #4	

This does not affect the automated sorts for electrical and other dependencies, as the ITEM_NO field is not used as the sorting key.

2. An automated sort of vital power dependencies (COMP_ID = 'CSAS INV', 'REG BUS', 'UTILITY BUS', OR 'VITAL BUS', AND (ITEM_NO <> '11' AND FAIL_MODE = 'VOLTS LOW')) is provided in Table 11-2 as an aid to the reviewer.
3. Cross-references to the Reactor Protection System Single Failure Analysis (M39405), Section 8 have been provided where applicable.
4. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.

VITAL AND REGULATED POWER SYSTEM REFERENCES

One Line Diagrams

64383	CSAS Inverter System
5102174	120VAC Vital Power System, Train A
5159826	120VAC Vital Power System, Train B

Procedures

S01-2.6-3	Loss of Vital or Utility Bus
S01-9-13	Inverter and Vital Bus Operation
S01-12.2-6	Electrical Distribution Surveillance
S01-12.3-17	Electrical Transfer Switches Alignment Check

Other Documents

SD-S01-150	System Description: Maintained 120VAC System
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TABLE 11-1: VITAL/REGULATED POWER FMEA

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONOPRE UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.1.01.01.1	VITAL BUS #1	INVERTER #1	INPUT OPEN	INTERRUPTION OF POWER TO VITAL CONTROL ROOM ANNUNCIATION, BUS #1 AND REG BUS #1 ECCS AND LOCAL INDICATION OTHER LOADS DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC PLUS TRANSFER SW DELAY TIME DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP AND SPRAY, REDUNDANT PRZ PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	INOPERABILITY OF 1/2 HI-FLOW CONTAINMENT SPRAY VALVES AND SEQ #1 (HI CONTAINMENT PRESSURE), REDUCED REDUNDANCY AGAINST SEQ #1 AND 2 BLOCK PERMISSIVE	SEE ITEMS 1.4.6.5.3, 1.4.6.5.4, 1.4.12.5.1, 2.4.8.3.1, 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1, 3.2.10.2.1, 5.1.4.5.1, 5.1.5.4.1, 5.1.6.6.1, 6.1.5.2.1, 8.1.1.4.1, 8.1.1.5.1, 8.1.8.2.1, 9.1.1.5.1, 9.1.11.3.1. SEE SECTION 8 OF H39405 FOR RPS EFFECTS. CV-517 SHUTS (SAME AS 11.1.1.1.1)
11.1.01.01.2	VITAL BUS #1	INVERTER #1	INPUT SHORT	125VDC BREAKER 72-135 TRIPS, INTERRUPTING POWER TO VITAL BUS #1 AND REGULATED BUS #1 DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC PLUS TRANSFER SWITCH DELAY TIME DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.1.1.1.1)	(SAME AS 11.1.1.1.1)	(SAME AS 11.1.1.1.1)
11.1.01.01.3	VITAL BUS #1	INVERTER #1	OUTPUT VOLTS LOW	(SAME AS 11.1.1.1.1)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.1.1.1.1)	(SAME AS 11.1.1.1.1)	(SAME AS 11.1.1.1.1)
11.1.01.01.4	VITAL BUS #1	INVERTER #1	OUTPUT SHORT OR GROUND	(SAME AS 11.1.1.1.2)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.1.1.1.1)	(SAME AS 11.1.1.1.1)	(SAME AS 11.1.1.1.1)
11.1.01.02.1	VITAL BUS #1	AUTO XFER SW #1	NORMAL	VITAL BUS #1 AND REG BUS #1 CANNOT BE TRANSFERRED TO THE MCC-2 POWERED BACKUP SOURCE	PERIODIC TESTING	REDUNDANT TRAIN AND CHANNELS FOR AFFECTED ECCS FUNCTIONS	REDUCED RELIABILITY OF VITAL BUS #1 AND REGULATED BUS #1 ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE
11.1.01.02.2	VITAL BUS #1	AUTO XFER SW #1	ALTERNATE	VITAL BUS #1 AND REGULATED BUS #1 CANNOT BE POWERED FROM INVERTER #1, RESULTING IN UP TO 10 SEC INTERRUPTION OF POWER TO VITAL BUS #1 AND REG BUS #1 POWERED ECCS LOADS DURING SISLOP (IE, TIME FOR DG #2 TO START AND RE-ENERGIZE MCC-2 FOLLOWING LOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP AND SPRAY, REDUNDANT PRZ PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	INOPERABILITY OF 1/2 HI-FLOW CONTAINMENT SPRAY VALVES AND SEQ #1 (HI CONTAINMENT PRESSURE), REDUCED REDUNDANCY AGAINST SEQ #1 AND 2 BLOCK PERMISSIVE	SEE ITEMS 1.4.6.5.3, 1.4.6.5.4, 1.4.12.5.1, 2.4.8.3.1, 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1, 3.2.10.2.1, 5.1.4.5.1, 5.1.5.4.1, 5.1.6.6.1, 6.1.5.2.1, 8.1.1.4.1, 8.1.1.5.1, 8.1.8.2.1, 9.1.1.5.1. 1/3 SEQ BLOCK PERM B/G A OVERFILL RELAY ACT IF AUTO-XFER OCCURS (SAME AS 11.1.1.2.2) PORV NOT CREDITED FOR NSLB OR LOCA
11.1.01.02.3	VITAL BUS #1	AUTO XFER SW #1	CONTACTS OPEN	LOSS OF POWER TO VITAL BUS #1 AND REGULATED BUS #1 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT TRAIN FOR CSAS AND SIS/SISLOP, ALT PATH FOR HLR, PRZ PRESS CHNLS FOR SEQ #2 BLOCK PERMISSIVE, PORV FOR SGTR. NOV-1100C CLOSERS FOR INJECTION	INOP OF 1/2 HI-FLOW CONTAINMENT SPRAY VALVS, SEQ #1 (HI CONTAINMENT PRESSURE), HLR PRIMARY PATH, REDUCED RELIABILITY OF TRAIN A CSAS AND AGAINST SEQ #2 BLOCK PERMISSIVE. POTENTIAL OPERATION OF BOTH CBG PPS DURING INJECTION. 1/2 PORV/BLOCK VV INOP	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPR UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEMS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.1.01.02.4	VITAL BUS #1	AUTO IPBR SW #1	CONTACTS CLOSED	INVERTER #1 AND 37.5 kVA ALTERNATE SOURCE FROM MCC-2 PARALLELED. IF OUT OF PHASE, INVERTER MAY CURRENT-LIMIT AND TRIP INTERNALLY, LEAVING VITAL BUS #1 AND REG BUS #1 ON BACKUP SOURCE FROM MCC-2	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION, PERIODIC TESTING	(SAME AS 11.1.1.2.2)	(SAME AS 11.1.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
11.1.01.02.5	VITAL BUS #1	AUTO IPBR SW #1	CONTACTS GROUNDING	LOSS OF VITAL BUS #1, REGULATED BUS #1 AND 37.5kVA BACKUP SOURCE FROM MCC-2, INCLUDING LOSS OF UTILITY BUS. INVERTER #1 OUTPUT BREAKER TRIPS	CONTROL ROOM INDICATION AND ANNUNCIATION	NONE FOR SI/BCS INVENTORY OR SBLOCA CLR, REDUND VLV/TRAIN FOR SPRAY AND SIS/SISLOP, ALT PATH FOR HLR, PZR PRESS CHNLS FOR SI BLOCK, ROV-1100C CLOSURE	*POTENTIAL UNISOL DIVERSION OF SI/BCS INVENTORY TO BCDY AND LOSS OF CLR CAPABILITY FOR SBLOCA. INOP OF 1/2 HI-FLOW CONTAINMENT SPRAY VALVES, SEQ #1, HLR PRIMARY PATH. REDUCED REDUNDANCY AGAINST SI BLOCK PERM, OP OF 2 CHG PP DURING INJ	(SAME AS 11.1.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.21.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1. 1/2 PORVs AND ITS BLOCK VALVE ALSO INOP FOR SCTR. PORVs NOT CREDITED FOR NSIB OR LOCA (SAME AS 11.1.1.2.3)
11.1.01.03.1	VITAL BUS #1	VITAL BUS #1 ACB OPEN	ACB OPEN	LOSS OF POWER TO VITAL BUS #1 AND REG BUS #1 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.1.1.2.3)	(SAME AS 11.1.1.2.3)	(SAME AS 11.1.1.2.3)
11.1.01.03.2	VITAL BUS #1	VITAL BUS #1 ACB CLOSED	ACB CLOSED	VITAL BUS #1 BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SAFETY RELATED LOADS HAVE 10CFR50.49(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS (SAME AS 11.1.1.2.5). FAULT WILL CAUSE UNDERVOLTAGE CONDITION AT TRANSFER SWITCH, WHICH THEN AUTO-TRANSFERS FAULT TO MCC-2 POWERED 37.5 kVA BACKUP SOURCE, CAUSING CONCURRENT LOSS OF UTILITY BUS
11.1.01.03.3	VITAL BUS #1	VITAL BUS #1 ACB INPUT SHORT OR GROUND	INPUT SHORT OR GROUND	(SAME AS 11.1.1.2.5)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.1.1.2.5)	(SAME AS 11.1.1.2.5)	(SAME AS 11.1.1.2.5)
11.1.01.04.1	VITAL BUS #1	8-1101V (BREAKER)	OPEN	LOSS OF VITAL BUS #1 POWER TO INSTRUMENT RACK R3/R4, INCLUDING 1/3 PZR PRESSURE INPUTS TO SEQ #1 AND BLOCK PERMISSIVE FOR SEQ #1 AND SEQ #2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SI BLOCK PERMISSIVE FOR SEQ #1 AND SEQ #2	SEE ITEM 8.1.1.4.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.1.01.05.1	VITAL BUS #1	8-1102V (BREAKER)	OPEN	LOSS OF VITAL BUS #1 POWER TO 1/3 STM GEN WIDE RANGE LEVEL INDICATION (NON-PANI) AND SPHERE FIRE LOOP VALVE CV-92	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEM 5.3.5.4.1. CV-92 SAFETY FUNCTION IS FAIL-CLOSED FOR ECCS
11.1.01.06.1	VITAL BUS #1	8-1103V (BREAKER)	OPEN	LOSS OF VITAL BUS #1 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.1.01.07.1	VITAL BUS #1	8-1104V (BREAKER)	OPEN	LOSS OF VITAL BUS #1 POWER TO SYSTEM FREQUENCY RECORDER AND BUS UNDERVOLTAGE	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.1.01.08.1	VITAL BUS #1 (BREAKER)	8-1105V	OPEN	LOSS OF VITAL BUS #1 POWER TO INSTRUMENT RACK R10/R11, INCLUDING S/G OVERFILL PROTECTION RELAY	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	SEE ITEM 1.4.6.5.4. SEE SECTION 8 OF H39405 FOR RPS EFFECTS
11.1.01.09.1	VITAL BUS #1 (BREAKER)	8-1106V	OPEN	LOSS OF VITAL BUS #1 POWER TO INSTRUMENT RACK R5	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF H39405 FOR RPS EFFECTS
11.1.01.10.1	VITAL BUS #1 (BREAKER)	8-1107V	OPEN	LOSS OF REG BUS #1 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	ALTERNATE PATH FOR HLR, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #1 AND #2 BLOCK PERMISSIVE, REDUNDANT S/Gs FOR SECONDARY RECIRC	INOPERABILITY OF HLR PRIMARY PATH, REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G A	SEE ITEMS 1.4.5.5.3, 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1, 8.1.1.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS
11.1.01.11.1	VITAL BUS #1 (BREAKER)	8-1108V	OPEN	LOSS OF VITAL BUS #1 POWER TO BORON MONITOR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.1.01.12.1	VITAL BUS #1 (BREAKER)	8-1109V	OPEN	LOSS OF VITAL BUS #1 POWER TO INSTRUMENT RACK R7, INCLUDING PIC-1111	CONTROL ROOM INDICATION, ANNUNCIATION	NOV-1100C CLOSERS AS REQUIRED FOR INJECTION. NONE REQUIRED PRIOR TO SEQ BLOCK/RESET OR DURING RECIRC	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION (AFTER SEQ BLOCK/RESET)	SEE ITEM 2.1.8.3.1
11.1.01.13.1	VITAL BUS #1 (BREAKER)	8-1110V	OPEN	NONE				(THIS BREAKER IS CURRENTLY A SPARE)
11.1.01.14.1	VITAL BUS #1 (BREAKER)	8-1111V	OPEN	LOSS OF VITAL BUS #1 POWER TO CVCS AND CONTAINMENT SPRAY SYSTEMS, INCLUDING CV-525 AND CV-82	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	SEE ITEMS 3.2.10.2.1 AND 5.1.5.4.1. CV-82 FAILS OPEN FOR CONTAINMENT SPRAY SAFETY FUNCTION, CV-525 FAILS CLOSED FOR CONTAINMENT ISOLATION SAFETY FUNCTION
11.1.01.15.1	VITAL BUS #1 (BREAKER)	8-1112V	OPEN	LOSS OF VITAL BUS #1 POWER TO 1/2 PORVs AND ITS BLOCK VALVE, SI HEADER VENT VALVES SV-702B/D AND 3/3 CONTAINMENT PRESSURE INPUTS TO SEQ #1	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN/SEQUENCER FOR SIS/SISLOP, REDUNDANT PORV FOR SCTR	SEQ #1 INOPERABLE (SI CONTAINMENT PRESSURE), 1/2 PORVs AND ITS BLOCK VALVE INOPERABLE	SEE ITEMS 1.4.12.5.1, 8.1.8.2.1. SV-702B/D SAFETY FUNCTION IS FAIL-CLOSED. PORVs NOT CREDITED FOR HSLD OR LOCA
11.1.01.16.1	VITAL BUS #1 (BREAKER)	8-1113V	OPEN	LOSS OF VITAL BUS #1 POWER TO CONTAINMENT SPRAY SYSTEM, INCLUDING 1/2 SPRAY FLOW LIMITER VALVES (CV-517)	CONTROL ROOM INDICATION	REDUNDANT HI-FLOW PATH THROUGH CV-518 FOR INJECTION, NONE REQUIRED FOR RECIRC	1/2 REDUNDANT HI-FLOW CONTAINMENT SPRAY PATHS INOPERABLE FOR INJECTION, NO EFFECT FOR RECIRC	SEE ITEM 5.1.4.5.1. VALVE SAFETY FUNCTION IS TO REMAIN OPEN FOR INJECTION, FAIL CLOSED FOR RECIRCULATION
11.1.01.17.1	VITAL BUS #1 (BREAKER)	8-1114V	OPEN	LOSS OF VITAL BUS #1 POWER TO CCW SYSTEM, INCLUDING 1/2 RECIRC HI VALVES (CV-731A)	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEM 6.1.5.2.1. VALVE SAFETY FUNCTION IS FAIL-OPEN
11.1.01.18.1	VITAL BUS #1 (BREAKER)	8-1115V	OPEN	LOSS OF VITAL BUS #1 POWER TO CSAS TRAIN A	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	SEE ITEM 9.1.11.3.1
11.1.01.19.1	VITAL BUS #1 (BREAKER)	8-1116V	OPEN	LOSS OF VITAL BUS #1 POWER TO CONTAINMENT SPRAY, INCLUDING 1/3 CONTAINMENT PRESSURE INPUTS TO TRAIN A/B, AND G-200A LOW LEVEL TRIP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT HI-HI CONTAINMENT PRESSURE CHANNELS AND SEQ TO PREVENT SPURIOUS CSAS, REDUNDANT HYDRAZINE PUMP	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING HI-HI CONTAINMENT PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP, REDUCED RELIABILITY OF TRAIN A HYDRAZINE PUMP	SEE ITEMS 5.1.6.6.1 AND 9.1.1.5.1. SEE SECTION 8 OF H39405 FOR RPS EFFECTS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRE UNIT 1
 TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.1.02.01.1	REGULATED BUS #1	REGULATOR #1 (TWINCO)	INPUT OPEN	LOSS OF REGULATED BUS #1 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	ALTERNATE PATH FOR HLR, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #1 AND SEQ #2 AGAINST SEQ #1 SI BLOCK PERMISSIVE, REDUNDANT S/Gs FOR SECONDARY RECIRC	INOPERABILITY OF HLR PRIMARY PATH, REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G A	SEE ITEMS 1.4.6.5.3, 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1, 8.1.1.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS
11.1.02.01.2	REGULATED BUS #1	REGULATOR #1 (TWINCO)	INPUT SHORT	REGULATOR #1 FEEDER BREAKER 8-1107V TRIPS, CAUSING LOSS OF REG BUS #1 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.1.2.1.1)	(SAME AS 11.1.2.1.1)	(SAME AS 11.1.2.1.1)
11.1.02.01.3	REGULATED BUS #1	REGULATOR #1 (TWINCO)	OUTPUT VOLTS LOW	(SAME AS 11.1.2.1.1)	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.1.2.1.1)	(SAME AS 11.1.2.1.1)	(SAME AS 11.1.2.1.1)
11.1.02.02.1	REGULATED BUS #1	8-1181 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO INSTRUMENT RACK R10/R11, INCLUDING S/G A OVERFILL PROTECTION INPUT CHANNEL	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A	SEE ITEM 1.4.6.5.3. NO ECCS EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS. SEE SECTION 8 OF H39405 FOR RPS EFFECTS
11.1.02.03.1	REGULATED BUS #1	8-1182 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF H39405 FOR RPS EFFECTS
11.1.02.04.1	REGULATED BUS #1	8-1183 (FUSE)	OPEN	NONE				[THIS POSITION CURRENTLY A SPARE]
11.1.02.05.1	REGULATED BUS #1	8-1184 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO INST RACK R3/R4, INCLUDING 1/3 PZR PRESSURE INPUTS TO SEQ #1 AND BLOCK PERMISSIVE FOR SEQ #1 AND #2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2	SEE ITEM 8.1.1.5.1. SEE SECTION 8 OF H39405 FOR RPS EFFECTS
11.1.02.06.1	REGULATED BUS #1	8-1185 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO INST RACK R7 (CVCS)	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.1.02.07.1	REGULATED BUS #1	8-1186 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO INST RACK R5	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF H39405 FOR RPS EFFECTS
11.1.02.08.1	REGULATED BUS #1	8-1187 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO REACTOR INSTRUMENTATION IN PANEL C03, INCLUDING PCV-1112, PCV-430C/B	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF PRIMARY HLR PATH	SEE ITEMS 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1. PCV-430C/B SAFETY FUNCTION IS FAIL-CLOSED. PCV-1112 SAFETY FUNCTION IS FAIL-CLOSED FOR CLR, MODULATE FOR HLR
11.1.02.09.1	REGULATED BUS #1	8-1188 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO MISCELLANEOUS MIS LOADS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.1.02.10.1	REGULATED BUS #1	8-1189 (FUSE)	OPEN	LOSS OF REG BUS #1 POWER TO BUS UNDERVOLTAGE RELAY	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE

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SAS ONOFFER UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.1.02.11.1	REGULATED BUS #1 8-11R10		OPEN	NONE				(THIS FUSE CURRENTLY A SPARE)
11.2.01.01.1	VITAL BUS #2	INVERTER #2	INPUT OPEN	INTERRUPTION OF POWER TO VITAL CONTROL ROOM ANNUNCIATION, BUS #2 AND REG BUS #2 ECCS AND LOCAL INDICATION OTHER LOADS DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC PLUS TRANSFER SWITCH DELAY DURING SISLOP)		REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE	SEE ITEMS 1.4.7.5.3, 1.4.7.5.4, 5.2.5.4.1, 6.2.5.2.1, 6.4.7.2.1, 8.1.2.4.1, 8.1.2.5.1. INTERRUPTION OF POWER TO PORV AND ITS BLOCK VALVE HAS NO EFFECT DUE TO AVAILABILITY OF BACKUP NITROGEN FOR REPOSITIONING. CV-114 AND CV-137B FAIL OPEN AS REQUIRED (SAME AS 11.2.1.1.1)
11.2.01.01.2	VITAL BUS #2	INVERTER #2	INPUT SHORT	125VDC BREAKER 72-136 TRIPS, INTERRUPTING POWER TO VITAL BUS #2 AND REGULATED BUS #2 DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.2.1.1.1)	(SAME AS 11.2.1.1.1)	(SAME AS 11.2.1.1.1)
11.2.01.01.3	VITAL BUS #2	INVERTER #2	OUTPUT VOLTS LOW	(SAME AS 11.2.1.1.1)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.2.1.1.1)	(SAME AS 11.2.1.1.1)	(SAME AS 11.2.1.1.1)
11.2.01.01.4	VITAL BUS #2	INVERTER #2	OUTPUT SHORT OR GROUND	(SAME AS 11.2.1.1.2)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.2.1.1.1)	(SAME AS 11.2.1.1.1)	(SAME AS 11.2.1.1.1)
11.2.01.02.1	VITAL BUS #2	AUTO XFER SW #2	NORMAL	VITAL BUS #2 AND REG BUS #2 CANNOT BE TRANSFERRED TO THE MCC-2 POWERED BACKUP SOURCE	PERIODIC TESTING	REDUNDANT TRAIN AND CHANNELS FOR AFFECTED ECCS FUNCTIONS	REDUCED RELIABILITY OF VITAL BUS #2 AND REGULATED BUS #2 ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE
11.2.01.02.2	VITAL BUS #2	AUTO XFER SW #2	ALTERNATE	VITAL BUS #2 AND REGULATED BUS #2 CANNOT BE POWERED FROM INVERTER #2, RESULTING IN UP TO 10 SEC INTERRUPTION OF POWER TO VITAL BUS #2 AND REG BUS #2 POWERED ECCS LOADS DURING SISLOP (IE, TIME FOR DG #2 TO START AND RE-ENERGIZE MCC-2 FOLLOWING LOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE	SEE ITEMS 1.4.7.5.3, 1.4.7.5.4, 5.2.5.4.1, 6.2.5.2.1, 6.4.7.2.1, 8.1.2.4.1, 8.1.2.5.1. 1/3 SEQ BLOCK PERMISSIVE AND 8/G 8 OVERFILL PROTECTION RELAY ACTUATION IF AUTO-TRANSFER OCCURS
11.2.01.02.3	VITAL BUS #2	AUTO XFER SW #2	CONTACTS OPEN	LOSS OF POWER TO VITAL BUS #2 AND REGULATED BUS #2 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE, REDUNDANT PORV/BLOCK VALVE FOR SCTR	REDUCED RELIABILITY OF SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE. 1/2 PORVs AND ITS BLOCK VALVE INOPERABLE FOR SCTR	(SAME AS 11.2.1.2.2). PORVs NOT CREDITED FOR MSLB OR LOCA. CV-114 AND CV-137B FAIL OPEN AS REQUIRED
11.2.01.02.4	VITAL BUS #2	AUTO XFER SW #2	CONTACTS CLOSED	INVERTER #2 AND 37.5 kVA ALTERNATE SOURCE FROM MCC-2 PARALLELED. IF OUT OF PHASE, INVERTER MAY CURRENT-LIMIT AND TRIP INTERNALLY, LEAVING VITAL BUS #2 AND REG BUS #2 ON BACKUP SOURCE FROM MCC-2	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION, PERIODIC TESTING	(SAME AS 11.2.1.2.2)	(SAME AS 11.2.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE

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TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.2.01.02.5	VITAL BUS #2	AUTO IPBR SW #2	CONTACTS GROUNDED	LOSS OF VITAL BUS #2, REGULATED BUS #2 AND 37.5LVA BACKUP SOURCE FROM MCC-2, INCLUDING LOSS OF UTILITY BUS. INVERTER #2 OUTPUT BREAKER TRIPS	CONTROL ROOM INDICATION AND ANNUNCIATION	NONE FOR SI/RCS INVENTORY OR SBLOCA CLR, REDUNDANT SEQ/TRAIN FOR SI/SISLOP AND PZR PRESS CHNLS FOR SEQ #2 BLOCK PERMISSIVE, REDUNDANT PORV FOR SGTR	*POTENTIAL UNISOL DIVERSION OF SI/RCS INVENTORY TO ECBY AND LOSS OF CLR CAPABILITY FOR SBLOCA. REDUCED RELIABILITY FOR SEQ #1 AND #2 BLOCK PERMISSIVE. 1/2 PORVs AND ITS BLOCK VALVE INOPERABLE	(SAME AS 11.2.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.18.11.1, 2.4.12.1.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1 PORVs NOT CREDITED FOR NSLD OR LOCA
11.2.01.03.1	VITAL BUS #2	VITAL BUS #2 ACB OPEN		LOSS OF POWER TO VITAL BUS #2 AND REG BUS #2 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.2.1.2.3)	(SAME AS 11.2.1.2.3)	(SAME AS 11.2.1.2.3)
11.2.01.03.2	VITAL BUS #2	VITAL BUS #2 ACB CLOSED		VITAL BUS #2 BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SR LOADS HAVE 10CFR50.49(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS (SAME AS 11.2.1.2.5). FAULT WILL CAUSE UNDERVOLTAGE CONDITION AT TRANSFER SWITCH, WHICH THEN AUTO-TRANSFERS FAULT TO MCC-2 POWERED 37.5 LVA BACKUP SOURCE, CAUSING CONCURRENT LOSS OF UTILITY BUS
11.2.01.03.3	VITAL BUS #2	VITAL BUS #2 ACB INPUT SHORT OR GROUND		(SAME AS 11.2.1.2.5)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.2.1.2.5)	(SAME AS 11.2.1.2.5)	SEE ITEM 8.1.2.4.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.01.04.1	VITAL BUS #2	8-1201V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO INSTRUMENT RACK R3/R4, INCLUDING 1/3 PZR PRESSURE INPUTS TO SEQ #1 AND BLOCK PERMISSIVE FOR SEQ #1 AND SEQ #2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST 1/2 BLOCK PERMISSIVE FOR SEQ #1 AND SEQ #2	SEE ITEM 8.1.2.4.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.01.05.1	VITAL BUS #2	8-1202V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO 1/3 5TH GEN WIDE RANGE LEVEL INDICATION (NON-PAMI)	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.2.01.06.1	VITAL BUS #2	8-1203V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.01.07.1	VITAL BUS #2	8-1204V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO RCP THERMAL BARRIER ISOLATION VALVES TO CV-122A, B AND C	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	SEE ITEM 8.1.2.4.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.01.08.1	VITAL BUS #2	8-1205V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO INSTRUMENT RACK R10/R11, INCLUDING S/G B OVERFILL PROTECTION RELAY	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	SEE ITEM 1.4.7.5.4. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.01.09.1	VITAL BUS #2	8-1206V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO INSTRUMENT RACK R5	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS

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TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.2.01.10.1	VITAL BUS #2	8-1207V (BREAKER)	OPEN	LOSS OF REG BUS #2 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS FOR SEQs, REDUNDANT S/Gs FOR SECONDARY RECIRC	REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G B	*SEE ITEMS 1.4.7.5.3, 8.1.2.3.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS
11.2.01.11.1	VITAL BUS #2	8-1208V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO CONTROL ROD POSITION INDICATION SYSTEM	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.2.01.12.1	VITAL BUS #2	8-1209V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO INSTRUMENT RACK #7	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.2.01.13.1	VITAL BUS #2	8-1210V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO S/G HIGH LEVEL TRIP RELAY	PERIODIC TESTING	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.2.01.14.1	VITAL BUS #2	8-1211V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO DG BUILDING FIRE PROTECTION SYSTEM	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.2.01.15.1	VITAL BUS #2	8-1212V (BREAKER)	OPEN	(SAME AS 11.2.1.14.1)	CONTROL ROOM INDICATION	(SAME AS 11.2.1.14.1)	(SAME AS 11.2.1.14.1)	(SAME AS 11.2.1.14.1)
11.2.01.16.1	VITAL BUS #2	8-1213V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO PH TRANSMITTER	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.2.01.17.1	VITAL BUS #2	8-1214V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO CCW AND CONTAINMENT SPRAY SYSTEMS, INCLUDING CV-737B AND CV-114	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEMS 5.2.5.4.1 AND 6.2.5.2.1. SAFETY FUNCTION IS FAIL-OPEN FOR BOTH VALVES
11.2.01.18.1	VITAL BUS #2	8-1215V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO 1/2 PORVs AND ITS BLOCK VALVE	CONTROL ROOM INDICATION	REDUNDANT PORV/BLOCK VALVE FOR SGTs	INOPERABILITY OF 1/2 PORVs AND ITS BLOCK VALVE FOR SGTs	PORVs NOT CREDITED FOR MSLB OR LOCA
11.2.01.19.1	VITAL BUS #2	8-1216V (BREAKER)	OPEN	LOSS OF VITAL BUS #2 POWER TO WIS AND BUS UNDERVOLTAGE RELAY	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF H39405 FOR RPS EFFECTS
11.2.02.01.1	REGULATED BUS #2	REGULATOR #2 (TWINCO)	INPUT OPEN	LOSS OF REGULATED BUS #2 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS FOR SEQs, REDUNDANT S/Gs FOR SECONDARY RECIRC	REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G B	*SEE ITEMS 1.4.7.5.3, 8.1.2.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS
11.2.02.01.2	REGULATED BUS #2	REGULATOR #2 (TWINCO)	INPUT SHORT	REGULATOR #2 FREDER BREAKER 8-1207V TRIPS, CAUSING LOSS OF REG BUS #2 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.2.2.1.1)	(SAME AS 11.2.2.1.1)	(SAME AS 11.2.2.1.1)
11.2.02.01.3	REGULATED BUS #2	REGULATOR #2 (TWINCO)	OUTPUT VOLTS LOW	(SAME AS 11.2.2.1.1)	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.2.2.1.1)	(SAME AS 11.2.2.1.1)	(SAME AS 11.2.2.1.1)
11.2.02.02.1	REGULATED BUS #2	8-12R1 (PUSH)	OPEN	LOSS OF REG BUS #2 POWER TO INSTRUMENT RACK R10/R11, INCLUDING S/G B OVERFILL PROTECTION INPUT CHANNEL	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G B	*SEE ITEM 1.4.7.5.3. NO ECCS EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS. SEE SECTION 8 OF H39405 FOR RPS EFFECTS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.2.02.03.1	REGULATED BUS #2	8-1282 (FUSE)	OPEN	LOSS OF REG BUS #2 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.02.04.1	REGULATED BUS #2	8-1283 (FUSE)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.2.02.05.1	REGULATED BUS #2	8-1284 (FUSE)	OPEN	LOSS OF REG BUS #2 POWER TO INST RACK R3/R4, INCLUDING 1/3 PZR PRESSURE INPUTS TO SEQ #1 AND BLOCK PERMISSIVE FOR SEQ #1 AND #2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2	SEE ITEM 8.1.2.5.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.02.06.1	REGULATED BUS #2	8-1285 (FUSE)	OPEN	NONE				[THIS FUSE CURRENTLY SPARE]
11.2.02.07.1	REGULATED BUS #2	8-1286 (FUSE)	OPEN	LOSS OF REG BUS #2 POWER TO INST RACK R5	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.2.02.08.1	REGULATED BUS #2	8-1287 (FUSE)	OPEN	NONE				[THIS FUSE CURRENTLY SPARE]
11.2.02.09.1	REGULATED BUS #2	8-1288 (FUSE)	OPEN	NONE				[THIS FUSE CURRENTLY SPARE]
11.2.02.10.1	REGULATED BUS #2	8-1289 (FUSE)	OPEN	LOSS OF REG BUS #2 POWER TO BUS UNDERVOLTAGE RELAY	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.2.02.11.1	REGULATED BUS #2	8-12810 (FUSE)	OPEN	NONE				[THIS FUSE CURRENTLY SPARE]
11.3.01.01.1	VITAL BUS #3	INVERTER #3	INPUT OPEN	INTERRUPTION OF POWER TO VITAL BUS #3, 3A AND REG BUS #3 LOCAL INDICATION AND OTHER LOADS DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC PLUS TRANSFER SWITCH DELAY TIME DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE	SEE ITEMS 1.4.8.5.3, 1.4.9.10.1, 1.4.18.3.1, 2.4.25.4.1, 3.1-12.4.1, 3.2-16.2.1, 4.1.3.2.1, 8.1.3.4.1, 9.1.11.4.1
11.3.01.01.2	VITAL BUS #3	INVERTER #3	INPUT SHORT	125VDC BREAKER 72-137 TRIPS, INTERRUPTING POWER TO VITAL BUS #3, 3A AND REGULATED BUS #3 DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC PLUS TRANSFER SWITCH DELAY TIME DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.3.1.1.1)	(SAME AS 11.3.1.1.1)	(SAME AS 11.3.1.1.1)
11.3.01.01.3	VITAL BUS #3	INVERTER #3	OUTPUT VOLTS LOW	(SAME AS 11.3.1.1.1)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.3.1.1.1)	(SAME AS 11.3.1.1.1)	(SAME AS 11.3.1.1.1)
11.3.01.01.4	VITAL BUS #3	INVERTER #3	OUTPUT SHORT OR GROUND	(SAME AS 11.3.1.1.2)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.3.1.1.1)	(SAME AS 11.3.1.1.1)	(SAME AS 11.3.1.1.1)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRE UNIT 1

TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
11.3.01.02.1	VITAL BUS #3	AUTO IPBR SW #3	NORMAL	VITAL BUS #3, 3A AND REG BUS #3 CANNOT BE TRANSFERRED TO THE MCC-2 POWERED BACKUP SOURCE	PERIODIC TESTING	REDUNDANT TRAIN AND CHANNELS FOR AFFECTED RCCS FUNCTIONS	REDUCED RELIABILITY OF VITAL BUS #3, 3A AND REGULATED BUS #3	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE RCCS LOADS
11.3.01.02.2	VITAL BUS #3	AUTO IPBR SW #3	ALTERNATE	VITAL BUS #3, 3A AND REGULATED BUS #3 CANNOT BE POWERED FROM INVERTER #3, RESULTING IN UP TO 10 SEC INTERRUPT OF POWER TO VITAL BUS #3, 3A AND REG BUS #3 POWERED RCCS LOADS DURING SISLOP (18. TIME FOR DG #2 TO START AND RE-EMERGIZE MCC-2 AFTER LOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE	SEE ITEMS 1.4.8.5.3, 1.4.8.5.4, 1.4.9.10.1, 1.4.18.3.1, 2.4.25.4.1, 3.1.12.4.1, 3.2.16.2.1, 4.1.3.2.1, 8.1.3.4.1, 9.1.11.4.1. 1/3 SEQ BLOCK PERMISSIVE AND S/G/C OVERFILL PROTECTION RELAY ACTUATION IF AUTO-IPBR OCCURS
11.3.01.02.3	VITAL BUS #3	AUTO IPBR SW #3	CONTACTS OPEN	LOSS OF POWER TO VITAL BUS #3, 3A AND REGULATED BUS #3 RCCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	NONE FOR CLR OR CLR/HLR FLOW BALANCE, REDUND SEQ/TRAIN FOR SIS/SISLOP, REDUND PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISS, NONE FOR SECONDARY RECIRC	*LOSS OF CLR AND CLR/HLR FLOW BALANCE CAPABILITY, REDUCED RELIABILITY OF SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2 FOR RCCS) FOR S.G. 1.97 AND THE SYSTEMS, REDUNDANT TRAIN B SYSTEMS PROVIDE SAFETY FUNCTION
11.3.01.02.4	VITAL BUS #3	AUTO IPBR SW #3	CONTACTS CLOSED	INVERTER #3 AND 37.5 MVA ALTERNATE SOURCE FROM MCC-2 PARALLELED. IF OUT OF PHASE, INVERTER MAY CURRENT-LIMIT AND TRIP INTERNALLY, LEAVING VITAL BUS #3, 3A AND REG BUS #3 ON BACKUP SOURCE FROM MCC-2	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION, PERIODIC TESTING	(SAME AS 11.3.1.2.2)	(SAME AS 11.3.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
11.3.01.02.5	VITAL BUS #3	AUTO IPBR SW #3	CONTACTS GROUNDED	LOSS OF VITAL BUS #3, 3A AND REGULATED BUS #3 AND 37.5MVA BACKUP SOURCE FROM MCC-2, INCLUDING LOSS OF UTILITY BUS. INVERTER #3 OUTPUT BREAKER TRIPS.	CONTROL ROOM INDICATION AND ANNUNCIATION	NONE FOR SI/RCS INVENTRY, CLR AND CLR/HLR FLO BAL, REDUND SEQ/TRAIN FOR SIS/SISLOP AND PZR PRESS CHNLS FOR SEQ #2 BLOCK PERM, NONE FOR SECONDARY RECIRC	*POTENTIAL UNISOL DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR AND CLR/HLR FLOW BALANCE, AND (FOR SBLOCA) CLR PUMPING. REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1
11.3.01.03.1	VITAL BUS #3	VITAL BUS #3 ACB OPEN		LOSS OF POWER TO VITAL BUS #3 AND REG BUS #3 RCCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP AND CBAS, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE AND TRAIN A CBAS	SEE ITEMS 1.4.8.5.3, 1.4.8.5.4, 8.1.3.4.1, 9.1.11.4.1
11.3.01.03.2	VITAL BUS #3	VITAL BUS #3 ACB CLOSED		VITAL BUS #3 BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SR LOADS HAVE 10CFR50.49(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS

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TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.3.01.03.3	VITAL BUS #3	VITAL BUS #3 ACB	INPUT SHORT OR GROUND	(SAME AS 11.3.1.2.5)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.3.1.2.5)	(SAME AS 11.3.1.2.5)	(SAME AS 11.3.1.2.5). FAULT WILL CAUSE UNDERVOLTAGE CONDITION AT TRANSFER SWITCH, WHICH THEN AUTO-TRANSFERS FAULT TO MCC-2 POWERED 37.5 KVA BACKUP SOURCE, CAUSING CONCURRENT LOSS OF UTILITY BUS
11.3.01.04.1	VITAL BUS #3	8-1301V (BREAKER)	OPEN	LOSS OF VITAL BUS #3 POWER TO INSTRUMENT RACK R3/R4, INCLUDING 1/3 PZR PRESSURE INPUTS TO SEQ #1 AND BLOCK PERMISSIVE FOR SEQ #1 AND SEQ #2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR SEQ #2 BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST B1 BLOCK PERMISSIVE FOR SEQ #1 AND SEQ #2	SEE ITEM 8.1.3.4.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.01.05.1	VITAL BUS #3	8-1302V (BREAKER)	OPEN	LOSS OF VITAL BUS #3 POWER TO 1/3 STM GEN WIDE RANGE LEVEL INDICATION (NON-PANI)	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.3.01.06.1	VITAL BUS #3	8-1303V (BREAKER)	OPEN	LOSS OF VITAL BUS #3 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.01.07.1	VITAL BUS #3	8-1304V (BREAKER)	OPEN	LOSS OF VITAL BUS #3 POWER TO RCP EMERGENCY THERMAL BARRIER PUMP PRESSURE TRANSMITTER	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. RCP EMERGENCY THERMAL BARRIER PUMP NOT CREDITED FOR SIS/SISLOP EVENTS
11.3.01.08.1	VITAL BUS #3	8-1305V (BREAKER)	OPEN	LOSS OF VITAL BUS #3 POWER TO INSTRUMENT RACK R10/R11, INCLUDING S/G C OVERFILL PROTECTION RELAY	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	SEE ITEM 1.4.8.5.4. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.01.09.1	VITAL BUS #3	8-1306V (BREAKER)	OPEN	LOSS OF VITAL BUS #3 POWER TO INSTRUMENT RACK R5	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.01.10.1	VITAL BUS #3	8-1307V (BREAKER)	OPEN	LOSS OF REG BUS #3 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS FOR SEQ, REDUNDANT S/G FOR SECONDARY RECIRC	REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND B1 BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G C	SEE ITEMS 1.4.8.5.3, 8.1.3.5.1
11.3.01.11.1	VITAL BUS #3	8-1308V (BREAKER)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.3.01.12.1	VITAL BUS #3	8-1309V (BREAKER)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.3.01.13.1	VITAL BUS #3	8-1310V (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.3.01.14.1	VITAL BUS #3	8-1311V (BREAKER)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.3.01.15.1	VITAL BUS #3	8-1312V (BREAKER)	OPEN	LOSS OF VITAL BUS #3 POWER TO 1/3 STM GEN WIDE RANGE LEVEL INDICATION (NON-PANI) AND BUS UNDERVOLTAGE RELAY	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE

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SAM ONOPRR UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.3.01.16.1	VITAL BUS #3	8-1313V (BRKBRK)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.3.01.17.1	VITAL BUS #3	8-1314V (BRKBRK)	OPEN	LOSS OF VITAL BUS #3 POWER TO CONTAINMENT SPRAY SYSTEM	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	SEE ITEM 9.1.11.4.1
11.3.01.18.1	VITAL BUS #3	8-1315V (BRKBRK)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.3.01.19.1	VITAL BUS #3	8-1316V (BRKBRK)	OPEN	LOSS OF VITAL BUS #3 POWER TO MIS	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.02.01.1	REGULATED BUS #3	REGULATOR #3 (TWINCO)	INPUT OPEN	LOSS OF REGULATED BUS #3 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS FOR SEQ#; REDUNDANT S/G# FOR SECONDARY RECIRC	REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G C	SEE ITEMS 1.4.8.5.3, 1.1.3.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS (SAME AS 11.3.2.1.1)
11.3.02.01.2	REGULATED BUS #3	REGULATOR #3 (TWINCO)	INPUT SHORT	REGULATOR #3 FINDER BREAKER 8-1307V TRIPS, CAUSING LOSS OF REG BUS #3 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.3.2.1.1)	(SAME AS 11.3.2.1.1)	(SAME AS 11.3.2.1.1)
11.3.02.01.3	REGULATED BUS #3	REGULATOR #3 (TWINCO)	OUTPUT VOLTS LOW	(SAME AS 11.3.2.1.1)	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.3.2.1.1)	(SAME AS 11.3.2.1.1)	(SAME AS 11.3.2.1.1)
11.3.02.02.1	REGULATED BUS #3	(FUSE)	OPEN	LOSS OF REG BUS #3 POWER TO INSTRUMENT RACK R10/R11, INCLUDING S/G C OVERFILL PROTECTION INPUT CHANNEL	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/G# FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G C	SEE ITEM 1.4.8.5.3. NO ECCS EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.02.03.1	REGULATED BUS #3	8-1382 (FUSE)	OPEN	LOSS OF REG BUS #3 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.02.04.1	REGULATED BUS #3	8-1383 (FUSE)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.3.02.05.1	REGULATED BUS #3	8-1384 (FUSE)	OPEN	LOSS OF REG BUS #3 POWER TO INST RACK R3/R4, INCLUDING 1/3 PZR PRESSURE INPUTS TO SEQ #1 AND BLOCK PERMISSIVE FOR SEQ #1 AND #2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2	SEE ITEM 8.1.3.5.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.3.02.06.1	REGULATED BUS #3	8-1385 (FUSE)	OPEN	NONE				[THIS FUSE CURRENTLY SPARE]
11.3.02.07.1	REGULATED BUS #3	8-1386 (FUSE)	OPEN	LOSS OF REG BUS #3 POWER TO INST RACK R5	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS

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TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.3.02.08.1	REGULATED BUS #3	8-1387	OPEN	NONE				(THIS FUSE CURRENTLY SPARE)
		(FUSE)						
11.3.02.09.1	REGULATED BUS #3	8-1388	OPEN	NONE				(THIS FUSE CURRENTLY SPARE)
		(FUSE)						
11.3.02.10.1	REGULATED BUS #3	8-1389	OPEN	LOSS OF REG BUS #3 POWER TO BUS UNDERVOLTAGE RELAY	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.3.02.11.1	REGULATED BUS #3	8-13810	OPEN	NONE				(THIS FUSE CURRENTLY SPARE)
		(FUSE)						
11.3.03.01.1	VITAL BUS #3A	VITAL BUS #3A ACB	OPEN	LOSS OF POWER TO VITAL BUS #3A AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	NONE AVAILABLE FOR CLR OR CLR/HLR FLOW BALANCE	*CLR FLOW TO 2/3 RCS LOOPS WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING ELECTRIC PUMP LIMITATIONS	SEE ITEMS 1.4.9.10.1, 1.7.19.3.1, 2.7.25.4.1, 3.1.12.4.1, 3.2.16.2.1, 4.1.3.2.1 FOR ECCS LOADS. FOR E.G. 1.97 AND THI SYSTEMS, REDUNDANT TRAIN B SYSTEM PROVIDES SAFETY FUNCTION
11.3.03.01.2	VITAL BUS #3A	VITAL BUS #3A ACB	CLOSED	VITAL BUS #3A BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT		NONE REQUIRED	NONE	NON-BE LOADS HAVE 10CFR50.49(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS (SAME AS 11.3.1.2.5). FAULT WILL CAUSE UNDERVOLTAGE CONDITION AT TRANSFER SWITCH, WHICH THEN AUTO-TRANSFERS FAULT TO MCC-2 POWERED BY LVA BACKUP SOURCE, CAUSING CONCURRENT LOSS OF UTILITY BUS (THIS BREAKER CURRENTLY SPARE)
11.3.03.01.3	VITAL BUS #3A	VITAL BUS #3A ACB	INPUT SHORT OR GROUND	(SAME AS 11.3.1.2.5)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.3.1.2.5)	(SAME AS 11.3.1.2.5)	(THIS BREAKER CURRENTLY SPARE)
11.3.03.02.1	VITAL BUS #3A	8-3301 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.03.1	VITAL BUS #3A	8-3302 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.04.1	VITAL BUS #3A	8-3303 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.05.1	VITAL BUS #3A	8-3304 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.06.1	VITAL BUS #3A	8-3305 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.07.1	VITAL BUS #3A	8-3306 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.08.1	VITAL BUS #3A	8-3307 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO HI RADIATION AUTO-ALERT SYSTEM	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.3.03.09.1	VITAL BUS #3A	8-3308 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO TRAIN A CONTAINMENT AND MAIN STEAM LINE HI RAD MONITORS	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 AND THI REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN B

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRR UNIT 1
 TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.3.03.10.1	VITAL BUS #3A	8-3309 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM ANNUNCIATION TRAIN A SUBCOOLED MARGIN MONITOR		NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. R.G. 1.37 AND THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN B
11.3.03.11.1	VITAL BUS #3A	8-3310 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM ANNUNCIATION TRAIN A CONTAINMENT WIDE RANGE PRESSURE, HYDROGEN AND WATER LEVEL MONITORS		NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. R.G. 1.37 AND THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN B
11.3.03.12.1	VITAL BUS #3A	8-3311 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM ANNUNCIATION CONTAINMENT ISOLATION VALVES, INCLUDING CV-962		NONE REQUIRED	NONE	SEE ITEM 3.2.16.2.1. VALVE SAFETY FUNCTION IS FAIL-CLOSED
11.3.03.13.1	VITAL BUS #3A	8-3312 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM ANNUNCIATION TRAIN A RCS HIGH-POINT VENT SYSTEM		NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT SYSTEM AVAILABLE ON TRAIN B
11.3.03.14.1	VITAL BUS #3A	8-3313 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM INDICATION, CLR FLOW INDICATION FOR 2/3 RCS LOOPS	PERIODIC TEST	NONE AVAILABLE	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	SEE ITEMS 2.4.25.4.1 AND 3.1.12.4.1
11.3.03.15.1	VITAL BUS #3A	8-3314 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM INDICATION CONTAINMENT ISOLATION VALVES, INCLUDING CV-955 AND CV-956		NONE REQUIRED	NONE	SEE ITEM 1.4.19.3.1. VALVE SAFETY FUNCTION IS FAIL-CLOSED
11.3.03.16.1	VITAL BUS #3A	8-3315 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM INDICATION, TRAIN A APW, INCLUDING BLOWDOWN ISOLATION AND MPW CHECK VALVE BACKUP MODE RELAYS FOR S/G A/B/C	ANNUNCIATION	REDUNDANT APW TRAIN TO PROVIDE STM GEN NR LEVEL INDICATION AND FLOW, NONE REQUIRED FOR AUTOMATIC BLOWDOWN ISOLATION, NONE FOR SECONDARY RECIRC	*TRAIN A NR LEVEL INDICATION AND APW FLOW DISABLED, BLOWDOWN ISOLATED, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER MPW PUMPS TRIPPED	SEE ITEMS 1.4.9.10.1, 4.1.3.2.1. STM GEN BLOWDOWN ISOLATION VALVE SAFETY FUNCTION IS FAIL-CLOSED
11.3.03.17.1	VITAL BUS #3A	8-3316 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM INDICATION, TURBINE DRIVEN APW PUMP G-10	ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. REDUNDANT TRAIN B APW WILL PROVIDE APW FLOW AS REQUIRED FOR S/G HEAT REMOVAL (THIS BREAKER CURRENTLY SPARE)
11.3.03.18.1	VITAL BUS #3A	8-3317 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.19.1	VITAL BUS #3A	8-3318 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.20.1	VITAL BUS #3A	8-3319 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.21.1	VITAL BUS #3A	8-3320 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.22.1	VITAL BUS #3A	8-3321 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)

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11.3.03.23.1	VITAL BUS #3A	8-3322 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.24.1	VITAL BUS #3A	8-3322 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.3.03.25.1	VITAL BUS #3A	8-3324 (BREAKER)	OPEN	LOSS OF VITAL BUS #3A POWER TO CONTROL ROOM ANNUNCIATION BUS UNDERVOLTAGE RELAY		NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.01.01.1	VITAL BUS #4	INVERTER #4	INPUT OPEN	POTENTIAL INTERRUPTION OF POWER TO VITAL BUS #4 AND REG BUS #4 ECCS AND OTHER LOADS DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE FOR SISLOP	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS RESULTING FROM PC-605	SEE ITEMS 1.4.9.9.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1. FAILURE MODE CONSERVATIVELY ASSUMED. NORMAL OPERATION OF STATIC IPR SWITCH DOES NOT RESULT IN INTERRUPTION
11.4.01.01.2	VITAL BUS #4	INVERTER #4	INPUT SHORT	125VDC BREAKER 72-131 TRIPS, INTERRUPTING POWER TO VITAL BUS #4 AND REGULATED BUS #4 DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.4.1.1.1)	*(SAME AS 11.4.1.1.1)	(SAME AS 11.4.1.1.1)
11.4.01.01.3	VITAL BUS #4	INVERTER #4	OUTPUT VOLTS LOW	(SAME AS 11.4.1.1.1)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.4.1.1.1)	*(SAME AS 11.4.1.1.1)	(SAME AS 11.4.1.1.1)
11.4.01.01.4	VITAL BUS #4	INVERTER #4	OUTPUT SHORT OR GROUND	(SAME AS 11.4.1.1.2)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.4.1.1.1)	*(SAME AS 11.4.1.1.1)	(SAME AS 11.4.1.1.1)
11.4.01.02.1	VITAL BUS #4	AUTO IPR SW (INVERTER #4)	NORMAL	VITAL BUS #4 AND REG BUS #4 CANNOT BE TRANSFERRED TO THE MCC-2 POWERED 7.5 kVA BACKUP SOURCE	PERIODIC TESTING	REDUNDANT TRAIN AND CHANNELS FOR AFFECTED ECCS FUNCTIONS	REDUCED RELIABILITY OF VITAL BUS #4 AND REGULATED BUS #4 ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE
11.4.01.02.2	VITAL BUS #4	AUTO IPR SW (INVERTER #4)	ALTERNATE	VITAL BUS #4 AND REGULATED BUS #4 CANNOT BE POWERED FROM INVERTER #4, RESULTING IN UP TO 10 SEC INTERRUPT OF POWER TO VITAL BUS #4 AND REG BUS #4 POWERED ECCS LOADS DURING SISLOP (IE, TIME FOR DG #2 TO START AND RE-ENERGIZE MCC-2 AFTER LOP)	LOCAL INDICATION	NONE FOR SISLOP	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS RESULTING FROM PC-605	SEE ITEMS 1.4.9.9.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1
11.4.01.02.3	VITAL BUS #4	AUTO IPR SW (INVERTER #4)	CONTACTS OPEN	LOSS OF POWER TO VITAL BUS #4 AND REGULATED BUS #4 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	NONE FOR SISLOP OR HLR	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST	*(SAME AS 11.4.1.2.2) - ROI REV REQD FOR BACKUP PRIMARY PATH FLO DETERMINATION OR JUMPER ACROSS PT-425I CONTACTS IN NOV-813 CONTROLS TO MITIGATE LOSS OF HLR FUNCTION. ROI CHANGE REQD IRRESPECTIVE OF THIS FAILURE DUE TO INADEQUACY OF PIT(PT)-1112 RANGE

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11.4.01.02.4	VITAL BUS #4	AUTO IPBR SW (INVERTER #4)	CONTACTS CLOSED	INVERTER #4 AND 7.5 kVA ALTERNATE SOURCE FROM MCC-2 PARALLELED. IF OUT OF PHASE, INVERTER MAY CURRENT-LIMIT AND TRIP INTERNALLY, LEAVING VITAL BUS #4 AND RRG BUS #4 ON MCC-2 POWERED 7.5 kVA BACKUP SOURCE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 11.4.1.2.2)	*(SAME AS 11.4.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
11.4.01.02.5	VITAL BUS #4	AUTO IPBR SW (INVERTER #4)	CONTACTS GROUNDED	LOSS OF VITAL BUS #4, REGULATED BUS #4 AND MCC-2 POWERED 7.5kVA BACKUP SOURCE	CONTROL ROOM INDICATION AND ANNUNCIATION	NONE FOR SISLOP OR HLR, TCV-601A/B BLOCK VALVES/FLOW LIMITING COLLARS FOR CCW FLOW TO MCC LOADS	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCW FLOW REDUCED TO MINIMUM FOR ECCS LOADS	*(SAME AS 11.4.1.2.3). UTILITY BUS LOADS NOT AFFECTED DUE TO SEPARATE FUSE FOR 7.5 kVA IPBR PRIMARY, WHICH PROTECTS 37.5 kVA IPBR SERVING UTILITY BUS AND BACKUP FOR VITAL/REGULATED BUSES #1, 2, 3/3A
11.4.01.03.1	VITAL BUS #4	MAN IPBR SW #4	NORMAL	VITAL BUS #4 AND RRG BUS #4 CANNOT BE TRANSFERRED FROM INVERTER OR MCC-2 POWERED 7.5 kVA BACKUP SOURCE TO MCC-2 POWERED 37.5 kVA BACKUP SOURCE	PERIODIC TESTING	NONE REQUIRED	NONE	INVERTER STATIC TRANSFER SWITCH WILL AUTO-TRANSFER VITAL BUS #4 AND REGULATED BUS #4 TO MCC-2 POWERED 7.5 kVA SOURCE AND BACK AS REQUIRED. MCC-2 POWERED 37.5 kVA BACKUP VIA MANUAL TRANSFER SWITCH NOT REQUIRED FOR THESE BUSES
11.4.01.03.2	VITAL BUS #4	MAN IPBR SW #4	ALTERNATE	VITAL BUS #4 AND RRG BUS #4 CANNOT BE POWERED FROM INVERTER #4 OR MCC-2 POWERED 7.5 kVA BACKUP SOURCE, RESULTING IN UP TO 10 SEC INTERRUPT OF POWER TO VITAL BUS #4 AND RRG BUS #4 POWERED ECCS LOADS DURING SISLOP (18, TIME TO START AND LOAD DG #2)	LOCAL INDICATION	NONE FOR SISLOP	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS RESULTING FROM PC-605	SEE ITEMS 1.4.9.9.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.16.4.1, 6.4.5.1.1, 6.4.6.3.1
11.4.01.03.3	VITAL BUS #4	MAN IPBR SW #4	CONTACTS OPEN	LOSS OF POWER TO VITAL BUS #4 AND REGULATED BUS #4 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	NONE FOR SISLOP OR HLR	*POTENTIAL LOSS OF TRAIN A/B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST	*(SAME AS 11.4.1.3.2). ROI REV REQD FOR BACKUP PRIMARY PATH FLO DETERMINATION OR JUMPER ACROSS PT-425X CONTACTS IN NOV-813 CONTROLS TO MITIGATE LOSS OF HLR FUNCTION. ROI CHANGE REQD IRRESPECTIVE OF THIS FAILURE DUE TO INADEQUATE FIT(PT)=1112 RANGE
11.4.01.03.4	VITAL BUS #4	MAN IPBR SW #4	CONTACTS CLOSED	INVERTER #4 AND MCC-2 POWERED 37.5 kVA BACKUP SOURCE PARALLELED. IF OUT OF PHASE, INVERTER MAY CURRENT LIMIT WITH INTERNAL TRIP AND AUTO-TRANSFER TO MCC-2 POWERED 7.5 kVA BACKUP SOURCE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 11.4.1.3.2)	*(SAME AS 11.4.1.3.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE

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11.4.01.03.5	VITAL BUS #4	MAN IPBR SW #4	CONTACTS GROUNDED	LOSS OF VITAL BUS #4 AND REGULATED BUS #4, MCC-2 POWERED 7.5 kVA AND 37.5 kVA BACKUP SOURCES, INCLUDING LOSS OF UTILITY BUS	CONTROL ROOM INDICATION AND ANNUNCIATION	NONE FOR SISLOP, HLR OR SI/RCS INVENTORY, TCV-601A/B BLOCK VALVES/COLLARS FOR CCW FLOW TO ECCS LOADS	*POTENTIAL LOSS OF TRAIN A AND ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS, UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCW FLOW REDUCED TO MINIMUM FOR ECCS LOADS	*(SAME AS 11.4.1.3.2 AND 11.4.1.3.3.) ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1
11.4.01.04.1	VITAL BUS #4	VITAL BUS #4 ACB OPEN		LOSS OF POWER TO VITAL BUS #4 AND REG BUS #4 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE FOR SISLOP OR HLR, TCV-601A/B BLOCK VALVES/COLLARS FOR CCW FLOW TO ECCS LOADS	*POTENTIAL LOSS OF TRAIN A AND ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCW PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCW FLOW REDUCED TO MINIMUM FOR ECCS LOADS	*(SEE ITEMS 1.4.9.9.1, 3.2.9.2.1, 3.2.9.3.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1. NOT REV REQD AS PER ITEM 11.4.1.3.3)
11.4.01.04.2	VITAL BUS #4	VITAL BUS #4 ACB CLOSED		VITAL BUS #4 BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SP LOADS HAVE 10CFR50.79(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS
11.4.01.04.3	VITAL BUS #4	VITAL BUS #4 ACB INPUT SHORT OR GROUND		(SAME AS 11.4.1.4.1)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.4.1.4.1)	*(SAME AS 11.4.1.4.1)	*(SAME AS 11.4.1.4.1). FAULT WILL CAUSE UNDERVOLTAGE CONDITION AT INVERTER AUTO-TRANSFER SWITCH, WHICH THEN AUTO-TRANSFERS FAULT TO MCC-2 POWERED 7.5 kVA BACKUP SOURCE. SEPARATE PUSH ON 7.5 kVA IPBR PRIMARY PROTECTS 37.5 kVA IPBR SUPPLYING UTILITY BUS
11.4.01.05.1	VITAL BUS #4	8-1401V (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE. LOAD DELETED BY HNP 3548]. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.4.01.06.1	VITAL BUS #4	8-1402V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO VERTICAL BOARD CO9, INCLUDING CV-410, 411, 412, 413 AND TCV-601A/B	CONTROL ROOM INDICATION	TCV-601A/B ISOLATED BLOCK VALVES OR FLOW LIMITED BY COLLAR	CCW FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH REDUCED SPENT PUEL PIT HEAT LOAD	SEE ITEMS 2.4.7.1.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1. VALVES CV-410, 411, 412, 413 SAFETY FUNCTION IS FAIL-CLOSED
11.4.01.07.1	VITAL BUS #4	8-1403V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS

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11.4.01.08.1	VITAL BUS #4	8-1404V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO PANEL COJ	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.01.09.1	VITAL BUS #4	8-1405V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO BUS UNDERVOLTAGE RELAY	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.01.10.1	VITAL BUS #4	8-1406V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO INSTRUMENT RACK R5, INCLUDING PRESSURIZER PRESSURE INTERLOCK FOR MOV-813	CONTROL ROOM INDICATION	PRIMARY PATH FOR HLR	INOPERABILITY OF HLR ALTERNATE PATH	SEE ITEM 3.2.9.3.1. SEE SECTION 8 OF N39405 FOR RPS EFFECTS
11.4.01.11.1	VITAL BUS #4	8-1407V (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE. LOAD DELETED BY NMF 3584]
11.4.01.12.1	VITAL BUS #4	8-1408V (BREAKER)	OPEN	LOSS OF REGULATED BUS #4 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	*SEE ITEMS 3.1.3.2.1, 3.2.9.2.1. SEE SECTION 8 OF N39405 FOR RPS EFFECTS
11.4.01.13.1	VITAL BUS #4	8-1409V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO CONTROL ROD DEVIATION RACK R15	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.01.14.1	VITAL BUS #4	8-1410V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO RAD MONITOR RACK	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.01.15.1	VITAL BUS #4	8-1411V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO BORIC ACID BLENDING	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS
11.4.01.16.1	VITAL BUS #4	8-1412V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO RCP SEAL INJECTION FLOW INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.01.17.1	VITAL BUS #4	8-1413V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO STEAM DUMP CONTROL SYSTEM	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. STEAM DUMP NOT REQUIRED FOR SAFE HOT SHUTDOWN FOLLOWING SIS/SISLOP EVENTS
11.4.01.18.1	VITAL BUS #4	8-1414V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO RELAY RACK R11, INCLUDING NFW CHECK VALVE BACKUP MODE RELAYS	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	SEE ITEM 1.4.9.9.1
11.4.01.19.1	VITAL BUS #4	8-1415V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO RELAY RACK R12, INCLUDING PC-605	CONTROL ROOM ANNUNCIATION	NONE FOR SISLOP, NONE REQUIRED FOR SIS	*POTENTIAL LOSS OF TRAIN A/B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING OF CCV PUMPS	SEE ITEM 6.4.6.3.1
11.4.01.20.1	VITAL BUS #4	8-1416V (BREAKER)	OPEN	LOSS OF VITAL BUS #4 POWER TO CVCS, INCLUDING LC-1100B, PIC-1111, PCV-1115A/D, B/E, C/F AND LO-LO-LO TRIP OF G-8A	CONTROL ROOM INDICATION, ANNUNCIATION	REDDUNDANT TRAIN B CONTROLLERS FOR CLR FLOW CONTROL VALVES PCV-1115D/E/F, MOV-1100C CLOSERS AS REQD TO PREVENT LOSS OF CHARGING PUMPS PRIOR TO RECIRC	LOSS OF TRAIN A CONTROL FOR CLR FLOW CONTROL VALVES PCV-1115A/D, B/E, C/F, TRIP OF TRAIN B CHARGING PUMP DURING INJECTION, POTENTIAL AUTO-START OF SECOND CHARGING PUMP PRIOR TO SIS/SISLOP AND AFTER SBQ BLOCK/RESET	SEE ITEMS 2.4.4.2.1, 2.4.6.3.2, 2.4.22.1.1
11.4.01.21.1	VITAL BUS #4	8-1417V (BREAKER)	OPEN	LOSS OF REGULATED BUS #4 POWER TO M19 AND ROD STEP CONTROL	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF N39405 FOR RPS EFFECTS

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11.4.01.22.1	VITAL BUS #4	8-1418V (BRKBR)	OPEN	LOSS OF REGULATED BUS #4 POWER TO RCP SHAL BYPASS FLOW INDICATION	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.02.01.1	REGULATED BUS #4	REGULATOR #4 (TWINCO)	INPUT OPEN	LOSS OF REGULATED BUS #4 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	ALTERNATE PATH FOR HLR	LOSS OF HLR PRIMARY PATH	SEE ITEMS 3.1.3.2.1, 3.2.9.2.1
11.4.02.01.2	REGULATED BUS #4	REGULATOR #4 (TWINCO)	INPUT SHORT	REGULATOR #4 FREDER BRKBR 8-1408V TRIPS, CAUSING LOSS OF REG BUS #4 POWER TO ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.4.2.1.1)	(SAME AS 11.4.2.1.1)	(SAME AS 11.4.2.1.1) FAILURE MAY ALSO CAUSE INVERTER AUTO-TRANSFER SWITCH TO TRANSFER TO (AND, DEPENDING ON FAULT CLEARING TIME, REMAIN ON) BACKUP SOURCE
11.4.02.01.3	REGULATED BUS #4	REGULATOR #4 (TWINCO)	OUTPUT VOLTS LOW	(SAME AS 11.4.2.1.1)	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.4.2.1.1)	(SAME AS 11.4.2.1.1)	(SAME AS 11.4.2.1.1)
11.4.02.02.1	REGULATED BUS #4	8-1481 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO BUS UNDERVOLTAGE RELAY	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.02.03.1	REGULATED BUS #4	8-1482 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO INSTRUMENT RACK R1/R2	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.4.02.04.1	REGULATED BUS #4	8-1483 (FUSE)	OPEN	NONE				(THIS POSITION CURRENTLY SPARE)
11.4.02.05.1	REGULATED BUS #4	8-1484 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO INST RACK R3/R4	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.4.02.06.1	REGULATED BUS #4	8-1485 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO CW21, CC	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.02.07.1	REGULATED BUS #4	8-1486 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO INST RACK R5	CONTROL ROOM INDICATION, ANNUNCIATION	PRIMARY HLR PATH	INOPERABILITY OF ALTERNATE HLR PATH, DUE TO INABILITY TO CLEAR PC-425X INTERLOCK TO NOV-813	SEE ITEM 3.2.9.2.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS
11.4.02.08.1	REGULATED BUS #4	8-1487 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO PWR1 C05	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.02.09.1	REGULATED BUS #4	8-1488 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO VERTICAL BOARD C09	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.4.02.10.1	REGULATED BUS #4	8-1489 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO INSTRUMENT RACK R6 (CVCS) INCLUDING PIT-1112	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH DUE TO LOSS OF FLOW INDICATION	SEE ITEM 3.1.3.2.1
11.4.02.11.1	REGULATED BUS #4	8-14810 (FUSE)	OPEN	LOSS OF REG BUS #4 POWER TO ROD DEVIATION AND AXIAL OFFSET SYSTEMS	ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.01.01.1	UTILITY BUS	MAN IPBR SW #7	NORMAL (MCC-2)	UTILITY BUS IS ALIGNED TO BACKUP SOURCE FOR VITAL BUSES #1, 2, 3/3A AND 4 FROM MCC-2, CANNOT BE REALIGNED TO TRAIN A (MCC-1)	PERIODIC TESTING	TRAIN B POWER TO HLR PRIMARY AND ALTERNATE PATH VALVES	REDUCED RELIABILITY OF HLR PRIMARY PATH (CV-305 POWER CANNOT BE BEING ALIGNED TO SAFETY RELATED POWER)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMBUEENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.5.01.01.2	UTILITY BUS	HAN IPBR SW #7	ALTERNATE (NCC-1)	LOSS OF POWER TO UTILITY BUS AND BACKUP SOURCE FOR VITAL BUSES #1, 2, 3/3A	LOCAL INDICATION	NONE FOR SI/RCS INVENTORY DIVERSION OR FOR CLR PUMPING CAPABILITY FOR SBLOCA. ALTERNATE PATH FOR HLR	*POTENTIALLY UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, LOSS OF HLR PRIMARY PATH	SEE ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1. FUSES REMOVED PER TECH SPEC 4.1.1.1 PREVENT POWER VIA NCC-1 EVEN WITH TRANSFER SWITCH IN THIS POSITION
11.5.01.01.4	UTILITY BUS	HAN IPBR SW #7	CONTACTS CLOSED	TRAIN A (NCC-1) AND TRAIN B (NCC-2) FEEDS PARALLELED	PERIODIC TESTING	FUSES FOR ALTERNATE FEED FROM NCC-1 REMOVED PER TECH SPEC 4.1.1 (SAME AS 11.5.1.1.2)	*POTENTIAL LOSS OF TRAIN A/B DUE TO PARALLELING THROUGH MANUAL TRANSFER SWITCH	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
11.5.01.01.5	UTILITY BUS	HAN IPBR SW #7	CONTACTS GROUNDED	LOSS OF UTILITY BUS AND NCC-2 POWERED BACKUP SOURCE FOR VITAL BUSES #1, 2, 3/3A AND 4. POWER ALSO LOST TO ROD CONTROL SYSTEM	CONTROL ROOM INDICATION AND ANNUNCIATION	(SAME AS 11.5.1.1.2)	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)
11.5.01.02.1	UTILITY BUS	AUTO IPBR SW #6	NORMAL	UTILITY BUS IS ALIGNED TO NCC-2 POWERED 37.5 kVA BACKUP SOURCE FOR VITAL BUSES #1, 2, 3/3A. WILL NOT AUTO-TRANSFER TO NON-SAFETY RELATED BACKUP SOURCE FROM TRAIN A LIGHTING SWGR	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SAFETY RELATED SOURCE CANNOT BE CREDITED IN MODES 1-4
11.5.01.02.2	UTILITY BUS	AUTO IPBR SW #6	ALTERNATE	UTILITY BUS CONNECTED TO NON-SAFETY RELATED TRAIN A LIGHTING SWGR, WHICH MAY BE A COMMON-CAUSE FAILURE AND IS ISOLATED ON SISLOP	LOCAL INDICATION	(SAME AS 11.5.1.1.2)	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)
11.5.01.02.3	UTILITY BUS	AUTO IPBR SW #6	CONTACTS OPEN	LOSS OF POWER TO UTILITY BUS, ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 11.5.1.1.2)	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)
11.5.01.02.4	UTILITY BUS	AUTO IPBR SW #6	CONTACTS CLOSED	TRAIN B (NCC-2) AND NON-SAFETY RELATED ALTERNATE SOURCE FROM TRAIN A (LIGHTING SWGR) PARALLELED, RESULTING IN DEGRADATION OF TRAIN B (NCC-2) OR FAILURE OF 37.5 kVA IPBR PRIMARY FEED AND LOSS OF UTILITY BUS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 11.5.1.1.2)	*(SAME AS 11.5.1.1.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
11.5.01.02.5	UTILITY BUS	AUTO IPBR SW #6	CONTACTS GROUNDED	LOSS OF UTILITY BUS AND NCC-2 POWERED BACKUP 37.5 kVA BACKUP SOURCE FOR VITAL BUSES #1, 2, 3/3A	CONTROL ROOM INDICATION AND ANNUNCIATION	(SAME AS 11.5.1.1.2)	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)
11.5.01.03.1	UTILITY BUS	NCC-1 (8-1181)	VOLTS LOW	LOSS OF BACKUP SOURCE FROM NCC-1 TO UTILITY BUS AND VITAL BUSES 1, 2, 3/3A AND 4	LOCAL INDICATION, PERIODIC TESTING	TRAIN B POWER TO HLR PRIMARY AND ALTERNATE PATH VALVES	REDUCED RELIABILITY OF HLR PRIMARY PATH (CV-305 CANNOT BE SWING ALIGNED TO SAFETY RELATED POWER)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.5.01.03.2	UTILITY BUS	HCC-2 (8-1238)	VOLTS LOW	LOSS OF POWER TO UTILITY BUS AND BACKUP SOURCE FOR VITAL BUSES #1, 2, 3/3A AND 4 FROM HCC-2	LOCAL INDICATION, PERIODIC TESTING	NONE FOR SI/ECS INVENTORY DIVERSION OR FOR CLR PUMPING FOR SBLOCA. ALTERNATE FEED FROM HCC-1 AVAILABLE FOR HLR PRIMARY PATH	*POTENTIAL UNISOLABLE DIVERSION OF SI/ECS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA. REDUCED RELIABILITY OF HLR PRIMARY PATH	*ROI REVISION REQUIRED TO SPECIFY LOCAL OPERATOR ACTION TO REALIGN MANUAL TRANSFER SWITCH #7 TO RESTORE SAFETY RELATED POWER FROM REDUNDANT TRAIN TO UTILITY BUS IN SUPPORT OF HLR PRIMARY PATH NON-SAFETY RELATED SOURCE CANNOT BE CREDITED IN MODES 1-4
11.5.01.03.3	UTILITY BUS	LIGHTING SWGR (MSR)	VOLTS LOW	LOSS OF AUTOMATIC BACKUP SOURCE FOR UTILITY BUS FROM TRAIN A	LOCAL INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NON-SAFETY RELATED SOURCE CANNOT BE CREDITED IN MODES 1-4
11.5.02.01.1	UTILITY BUS	UTILITY BUS ACB	OPEN	LOSS OF POWER TO UTILITY BUS ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR SI/ECS INVENTORY DIVERSION OR FOR CLR PUMPING FOR SBLOCA, ALTERNATE PATH FOR HLR	*POTENTIAL UNISOLABLE DIVERSION OF SI/ECS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, AND LOSS OF HLR PRIMARY PATH	SEE ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1
11.5.02.01.2	UTILITY BUS	UTILITY BUS ACB	CLOSED	UTILITY BUS BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SAFETY RELATED LOADS HAVE 10CFR50.49(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS (SAME AS 11.5.1.1.2). FAULT WILL RESULT IN UNDERVOLTAGE CONDITION, CAUSING IFRB SW #6 TO AUTO-TRANSFER TO NON-SAFETY RELATED LIGHTING SWGR
11.5.02.01.3	UTILITY BUS	UTILITY BUS ACB	INPUT SHORT OR GROUND	(SAME AS 11.5.1.1.2)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.5.1.1.2)	*(SAME AS 11.5.1.1.2)	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.02.1	UTILITY BUS	8-1501 (BREAKER)	OPEN	LOSS OF UTILITY BUS POWER TO IMCORE FLUX WAPPING DE-HUMIDIFIERS	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.03.1	UTILITY BUS	8-1502 (BREAKER)	OPEN	LOSS OF UTILITY BUS POWER TO VAPOR SEAL HEAD TANK SYSTEM, INCLUDING HCV-427A/B/C CONTROL RELAYS	CONTROL ROOM INDICATION	NONE FOR SI/ECS INVENTORY DIVERSION, NONE REQUIRED FOR INJECTION OR CLR FLOW	*POTENTIAL UNISOLABLE DIVERSION OF SI/ECS INVENTORY TO RCDT, NONE FOR INJECTION OR CLR FLOW DUE TO CONTINUED FUNCTIONING OF RCP SEALS	SEE ITEM 2.4.28.4.1
11.5.02.04.1	UTILITY BUS	8-1503 (BREAKER)	OPEN	NONE				[THIS POSITION CURRENTLY SPARE]
11.5.02.05.1	UTILITY BUS	8-1504 (BREAKER)	OPEN	LOSS OF UTILITY BUS POWER TO CONTRACT POWER SYSTEM	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.06.1	UTILITY BUS	8-1505 (BREAKER)	OPEN	LOSS OF UTILITY BUS POWER TO BUS UNDERVOLTAGE RELAT	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.07.1	UTILITY BUS	8-1506 (BREAKER)	OPEN	LOSS OF UTILITY BUS POWER TO STEAM DUMP SYSTEM (CONDENSER) INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.08.1	UTILITY BUS	8-1507 (BREAKER)	OPEN	LOSS OF UTILITY BUS POWER TO MAIN STEAM BYPASS INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPR UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.5.02.09.1	UTILITY BUS (BREAKER)	8-1508	OPEN	LOSS OF UTILITY BUS POWER TO VERTICAL BOARD CO9, INCLUDING CV-304/305, CV-288	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	INOPERABILITY OF HLR PRIMARY PATH	SEE ITEMS 2.4.12.1.1, 3.1.7.1.1, 3.2.15.2.1. VALVES FAIL CLOSED ON LOSS OF POWER. CV-305 SAFETY FUNCTION FOR HLR IS TO OPEN
11.5.02.10.1	UTILITY BUS (BREAKER)	8-1509	OPEN	LOSS OF UTILITY BUS POWER TO VERTICAL BOARD RECORDERS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.11.1	UTILITY BUS (BREAKER)	8-1510	OPEN	LOSS OF UTILITY BUS POWER TO PERMISSIVE INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.12.1	UTILITY BUS (BREAKER)	8-1511	OPEN	LOSS OF UTILITY BUS POWER TO MAIN GENERATOR MONITORING	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.13.1	UTILITY BUS (BREAKER)	8-1512	OPEN	LOSS OF UTILITY BUS POWER TO RECITER LIMITER	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.14.1	UTILITY BUS (BREAKER)	8-1513	OPEN	LOSS OF UTILITY BUS POWER TO SPHERE PUMP ALTERNATOR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.15.1	UTILITY BUS (BREAKER)	8-1514	OPEN	LOSS OF UTILITY BUS POWER TO OSCILLOGRAPH	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.16.1	UTILITY BUS (BREAKER)	8-1515	OPEN	LOSS OF UTILITY BUS POWER TO FIRE DETECTION SYSTEM	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.17.1	UTILITY BUS (BREAKER)	8-1516	OPEN	LOSS OF UTILITY BUS POWER TO ANNUNCIATOR LOSS OF POWER	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.18.1	UTILITY BUS (BREAKER)	8-1517	OPEN	LOSS OF UTILITY BUS POWER TO FW HEATER LEVEL ALARM	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.19.1	UTILITY BUS (BREAKER)	8-1518	OPEN	LOSS OF UTILITY BUS POWER TO VERTICAL BOARD CO9, INCLUDING CV-202/203/204 AND CV-406A/B	CONTROL ROOM INDICATION	NONE FOR SBLOCA	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA	SEE ITEMS 1.4.16.11.1, 2.4.27.4.1, 3.2.12.11.1
11.5.02.20.1	UTILITY BUS (BREAKER)	8-1519	OPEN	LOSS OF UTILITY BUS POWER TO VITAL ARBA ALARMS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.21.1	UTILITY BUS (BREAKER)	8-1520	OPEN	LOSS OF UTILITY BUS POWER TO VERTICAL BOARD CO9	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.22.1	UTILITY BUS (BREAKER)	8-1521	OPEN	LOSS OF UTILITY BUS POWER TO PH TRANSMITTER	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.5.02.23.1	UTILITY BUS (BREAKER)	8-1522	OPEN	LOSS OF UTILITY BUS POWER TO RCP VIBRATION MONITOR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. LOAD ADDED BY HNP 3584
11.6.01.01.1	VITAL BUS #5/6	INVERTER #5	INPUT OPEN	POTENTIAL INTERRUPTION OF POWER TO VITAL BUS #5/6 ECCS AND OTHER LOADS DURING AUTO-TRANSFER TO BACKUP SOURCE FROM MCC-2 (UP TO 10 SEC DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B (SEQUENCE) FOR SISLOP, NONE FOR SIS	SEE ITEM 8.2.8.2.1. FAILURE NONE CONSERVATIVELY ASSUMED. NORMAL OPERATION OF STATIC IFR SWITCH DOES NOT RESULT IN INTERRUPTION
11.6.01.01.2	VITAL BUS #5/6	INVERTER #5	INPUT SHORT	125VDC BREAKER T2-217 TRIPS, INTERRUPTING POWER TO VITAL BUSES #5/6 DURING AUTO-TRANSFER TO MCC-2 POWERED BACKUP SOURCE (UP TO 10 SEC DURING SISLOP)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.6.1.1.1)	(SAME AS 11.6.1.1.1)	(SAME AS 11.6.1.1.1)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFER UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.6.01.01.3	VITAL BUS #5/6	INVERTER #5	OUTPUT VOLTS LOW	(SAME AS 11.6.1.1.1)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.6.1.1.1)	(SAME AS 11.6.1.1.1)	(SAME AS 11.6.1.1.1)
11.6.01.01.4	VITAL BUS #5/6	INVERTER #5	OUTPUT SHORT OR GROUND	(SAME AS 11.6.1.1.2)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	(SAME AS 11.6.1.1.1)	(SAME AS 11.6.1.1.1)	(SAME AS 11.6.1.1.1)
11.6.01.02.1	VITAL BUS #5/6	AUTO IPBR SW (INVERTER #5)	NORMAL	VITAL BUSES #5/6 CANNOT BE TRANSFERRED TO THE MCC-2 POWERED 15 kVA BACKUP SOURCE	PERIODIC TESTING	REDUNDANT TRAIN FOR AFFECTED ECCS FUNCTIONS	REDUCED RELIABILITY OF VITAL BUSES #5/6 ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. MANUAL TRANSFER SWITCH AVAILABLE BUT NOT CREDITED
11.6.01.02.2	VITAL BUS #5/6	AUTO IPBR SW (INVERTER #5)	ALTERNATE	VITAL BUSES #5/6 CANNOT BE POWERED FROM INVERTER #5, RESULTING IN UP TO 10 SEC INTERRUPT OF POWER TO VITAL BUS #5/6 POWERED ECCS LOADS DURING SISLOP (18, TIME FOR DG #2 TO START AND RE-ENERGIZE MCC-2 AFTER LOP)	LOCAL INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	IMPROBABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	SEE ITEM 8.2.8.2.1
11.6.01.02.3	VITAL BUS #5/6	AUTO IPBR SW (INVERTER #5)	CONTACTS OPEN	LOSS OF POWER TO VITAL BUS #5/6 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	NONE FOR CLR, CLR/HLR FLOW BALANCE OR SECONDARY RECIRC, REDUNDANT TRAIN FOR SIS/SISLOP AND APVAs	*CLR FLOW TO 1/3 RCH LOOPS WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS. TRAIN B SEQUENCE AND APV IMPROPERABLE, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER HPV PP TRIPPED	SEE ITEMS 1.4.9.11.1, 1.4.11.5.1, 2.4.24.3.1, 3.1.11.3.1, 3.2.17.3.1, 4.2.3.2.1, 8.2.8.2.1
11.6.01.02.4	VITAL BUS #5/6	AUTO IPBR SW (INVERTER #5)	CONTACTS CLOSED	INVERTER #5 AND MCC-2 POWERED 15 kVA BACKUP SOURCE PARALLELED. IF OUT OF PHASE, INVERTER MAY CURRENT-LIMIT AND TRIP INTERNALLY, LEAVING VITAL BUSES #5/6 ON MCC-2 POWERED 15 kVA BACKUP SOURCE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 11.6.1.2.2)	(SAME AS 11.6.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
11.6.01.02.5	VITAL BUS #5/6	AUTO IPBR SW (INVERTER #5)	CONTACTS GROUNDED	LOSS OF VITAL BUSES #5/6 AND MCC-2 POWERED 15 kVA BACKUP SOURCE	CONTROL ROOM INDICATION AND ANNUNCIATION	(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)
11.6.01.03.1	VITAL BUS #5/6	MANUAL IPBR SW (INVERTER #5)	NORMAL	VITAL BUSES #5/6 CANNOT BE MANUALLY TRANSFERRED FROM INVERTER #5 TO MCC-2 POWERED 15 kVA BACKUP SOURCE	PERIODIC TESTING	NONE REQUIRED	NONE	INVERTER STATIC TRANSFER SWITCH WILL AUTO-TRANSFER VITAL BUSES #5/6 TO MCC-2 POWERED 15 kVA BACKUP SOURCE AS REQUIRED
11.6.01.03.2	VITAL BUS #5/6	MANUAL IPBR SW (INVERTER #5)	ALTERNATE	VITAL BUSES #5/6 CANNOT BE POWERED FROM INVERTER #5, RESULTING IN UP TO 10 SEC INTERRUPT OF POWER TO VITAL BUS #5/6 POWERED ECCS LOADS DURING SISLOP (18, TIME TO START AND LOAD DG #2)	LOCAL INDICATION	(SAME AS 11.6.1.2.2)	(SAME AS 11.6.1.2.2)	(SAME AS 11.6.1.2.2)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR OPERATOR UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.6.01.03.3	VITAL BUS #5/6	MANUAL IPER SW (INVERTER #5)	CONTACTS OPEN	LOSS OF POWER TO VITAL BUS #5/6 ECCS AND OTHER LOADS	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 11.6.1.2.3)	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)
11.6.01.03.4	VITAL BUS #5/6	MANUAL IPER SW (INVERTER #5)	CONTACTS CLOSED	INVERTER #5 AND MCC-2 POWERED 15 kVA BACKUP SOURCE PARALLELED. IF OUT OF PHASE, INVERTER MAY CURRENT LIMIT AND TRIP INTERNALLY, LEAVING VITAL BUSES #5/6 ON MCC-2 POWERED 15 kVA BACKUP SOURCE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	(SAME AS 11.6.1.2.2)	(SAME AS 11.6.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
11.6.01.03.5	VITAL BUS #5/6	MANUAL IPER SW (INVERTER #5)	CONTACTS GROUNDED	LOSS OF VITAL BUSES #5/6 AND MCC-2 POWERED 15 kVA BACKUP SOURCE	CONTROL ROOM INDICATION AND ANNUNCIATION	(SAME AS 11.6.1.2.3)	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)
11.6.01.04.1	VITAL BUS #5/6	MCC-2 (8-1268A)	VOLTS LOW	LOSS OF BACKUP SOURCE FROM MCC-2 TO VITAL BUSES #5/6	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR AFFECTED ECCS FUNCTIONS	REDUCED RELIABILITY OF VITAL BUS #5/6 ECCS LOADS	
11.6.02.01.1	VITAL BUS #5	VITAL BUS #5 ACB OPEN		LOSS OF POWER TO VITAL BUS #5 ECCS AND OTHER LOADS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN FOR SIS/SISLOP AND APWAS, NONE FOR CLR AND CLR/HLR FLOW BALANCE	ACLR FLOW TO 1/3 RCS LOOPS WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS. TRAIN-B SEQUENCES AND APWAS ALSO INOPERABLE	SEE ITEMS 1.4.9.11.1, 2.4.24.3.1, 3.1.11.3.1, 3.2.11.2.1, 4.2.3.2.1, 8.2.8.2.1
11.6.02.01.2	VITAL BUS #5	VITAL BUS #5 ACB CLOSED		VITAL BUS #5 BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SAFETY RELATED LOADS HAVE 10CFR50.49(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS (SAME AS 11.6.2.1.1). FAULT WILL CAUSE CONCURRENT LOSS OF VITAL BUS #5
11.6.02.01.3	VITAL BUS #5	VITAL BUS #5 ACB INPUT SHORT OR GROUND		(SAME AS 11.6.1.2.3)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.6.1.2.3)	*(SAME AS 11.6.1.2.3)	
11.6.02.02.1	VITAL BUS #5	8-2901 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO TRAIN B APW, INCLUDING BLOWDOWN ISOLATION AND HPW CHECK VALVE BACKUP MODE RELAYS, AND 3/3 SEQ #2 PZR PRESSURE AND CONTAINMENT PRESSURE CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN FOR SIS/SISLOP, REDUNDANT S/G NR AND NR LEVEL INDICATION FOR APW, NONE REQUIRED FOR BLOWDOWN ISOLATION, NONE FOR SECONDARY RECIRC	INOPERABILITY OF TRAIN-B SEQ AND APW, BLOWDOWN ISOLATED, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER HPW PUMPS TRIPPED	SEE ITEMS 1.4.9.11.1, 4.2.3.2.1, 8.2.8.2.1
11.6.02.03.1	VITAL BUS #5	8-2902 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.04.1	VITAL BUS #5	8-2903 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO CLR FLOW INDICATION FOR 1/3 RCS LOOPS	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE AVAILABLE	ACLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	SEE ITEMS 2.4.24.3.1, 3.1.11.3.1

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRE UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.6.02.05.1	VITAL BUS #5	8-2904 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO TRAIN B SUBCOOLED MARGIN MONITOR	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 AND THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN A
11.6.02.06.1	VITAL BUS #5	8-2905 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO TRAIN B CONTAINMENT WIDE RANGE PRESSURE, HYDROGEN AND WATER LEVEL MONITORS	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 AND THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN A
11.6.02.07.1	VITAL BUS #5	8-2906 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.02.08.1	VITAL BUS #5	8-2907 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO TRAIN B CONTAINMENT AND MAIN STEAM LINE HI RAD MONITORS	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 AND THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN A
11.6.02.09.1	VITAL BUS #5	8-2908 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO TRAIN B PZR SAFETY VALVE POSITION INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 AND THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN A
11.6.02.10.1	VITAL BUS #5	8-2909 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO MISCELLANEOUS CONTAINMENT ISOLATION VALVES, INCLUDING CV-526	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEM J.E.T.L. VALVE SAFETY FUNCTION IS FAIL-CLOSED
11.6.02.11.1	VITAL BUS #5	8-2910 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO MAIN FW BYPASS CONTROL VALVE FLOW INDICATION	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 AND THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT MONITORS AVAILABLE ON TRAIN A
11.6.02.12.1	VITAL BUS #5	8-2911 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.02.13.1	VITAL BUS #5	8-2912 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.02.14.1	VITAL BUS #5	8-2913 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.02.15.1	VITAL BUS #5	8-2914 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.02.16.1	VITAL BUS #5	8-2915 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.02.17.1	VITAL BUS #5	8-2916 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRE UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.6.02.18.1	VITAL BUS #5	8-2917 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.19.1	VITAL BUS #5	8-2918 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.20.1	VITAL BUS #5	8-2919 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.21.1	VITAL BUS #5	8-2920 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.22.1	VITAL BUS #5	8-2921 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.23.1	VITAL BUS #5	8-2922 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.24.1	VITAL BUS #5	8-2923 (BREAKER)	OPEN	NONE				[THIS BREAKER CURRENTLY SPARE]
11.6.02.25.1	VITAL BUS #5	8-2924 (BREAKER)	OPEN	LOSS OF VITAL BUS #5 POWER TO BUS UNDERVOLTAGE RELAY	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.6.03.01.1	VITAL BUS #6	VITAL BUS #6 ACB	OPEN	LOSS OF POWER TO VITAL BUS #6	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	SEE ITEMS 1.4.11.5.1 AND 3.2.17.3.1
11.6.03.01.2	VITAL BUS #6	VITAL BUS #6 ACB	CLOSED	VITAL BUS #6 BREAKER WILL NOT OPEN IF NEEDED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NON-SAFETY RELATED LOADS HAVE 10CFR50.49(b)(2) ISOLATION WHICH COORDINATES WITH LOAD BREAKERS. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS OUTSIDE THE PLANT DESIGN BASIS (SAME AS 11.6.1.2.3). FAULT WILL CAUSE CONCURRENT LOSS OF VITAL BUS #5
11.6.03.01.3	VITAL BUS #6	VITAL BUS #6 ACB	INPUT SHORT OR GROUND	(SAME AS 11.6.1.2.3)	CONTROL ROOM ANNUNCIATION	(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	SEE ITEM 3.2.17.3.1. VALVE SAFETY FUNCTION IS FAIL-CLOSED
11.6.03.02.1	VITAL BUS #6	8-3001 (BREAKER)	OPEN	LOSS OF VITAL BUS #6 POWER TO CONTAINMENT ISOLATION VALVES, INCLUDING CV-957	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEM 3.2.17.3.1. VALVE SAFETY FUNCTION IS FAIL-CLOSED
11.6.03.03.1	VITAL BUS #6	8-3002 (BREAKER)	OPEN	LOSS OF VITAL BUS #6 POWER TO TRAIN B SI HEADER VENT ISOLATION VALVES SV-702A/C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEM 1.4.11.5.1
11.6.03.04.1	VITAL BUS #6	8-3003 (BREAKER)	OPEN	LOSS OF VITAL BUS #6 POWER TO PASS ISOLATION VALVE SV-3303	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 OR THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS
11.6.03.05.1	VITAL BUS #6	8-3004 (BREAKER)	OPEN	LOSS OF VITAL BUS #6 POWER TO PASS RCS SAMPLER ISOLATION VALVES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 OR THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS
11.6.03.06.1	VITAL BUS #6	8-3005 (BREAKER)	OPEN	LOSS OF VITAL BUS #6 POWER TO TRAIN B RCS HIGH-POINT VENT SYSTEM	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE. E.G. 1.97 OR THE REQUIRED EQUIPMENT, NOT REQUIRED FOR ECCS. REDUNDANT SYSTEM ON TRAIN A

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS OPERATOR UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.6.03.07.1	VITAL BUS #6	8-3006 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.08.1	VITAL BUS #6	8-3007 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.09.1	VITAL BUS #6	8-3008 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.10.1	VITAL BUS #6	8-3009 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.11.1	VITAL BUS #6	8-3010 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.12.1	VITAL BUS #6	8-3011 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.13.1	VITAL BUS #6	8-3012 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.14.1	VITAL BUS #6	8-3013 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.15.1	VITAL BUS #6	8-3014 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.16.1	VITAL BUS #6	8-3015 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.17.1	VITAL BUS #6	8-3016 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.18.1	VITAL BUS #6	8-3017 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.19.1	VITAL BUS #6	8-3018 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.20.1	VITAL BUS #6	8-3019 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.21.1	VITAL BUS #6	8-3020 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.22.1	VITAL BUS #6	8-3021 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.23.1	VITAL BUS #6	8-3022 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.24.1	VITAL BUS #6	8-3023 (BREAKER)	OPEN	NONE				(THIS BREAKER CURRENTLY SPARE)
11.6.03.25.1	VITAL BUS #6	8-3024 (BREAKER)	OPEN	LOSS OF VITAL BUS #6 POWER TO CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	NO ECCS EQUIPMENT ON THIS SOURCE	
11.7.01.01.1	CSAS INVERTER	INVERTERS A/B	INPUT OPEN	LOSS OF CSAS INVERTER POWER TO CONTROL ROOM INDICATION, TRAIN B CSAS LOGIC, 2/3 CONTAINMENT PRESSURE OUTPUT RELAYS TO TRAIN A AND B CSAS, TRAIN B CONTROLLERS FOR 3/3 CLR FLOW CONTROL VALVES	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN AND SEQ INPUTS, REDUNDANT TRAIN A CONTROLLERS FOR PCV-1115A/D, B/E, C/F	TRAIN B CSAS INOPERABLE, TRAIN A CSAS WILL ACTUATE UPON SEQ #1 SIS/SISLOP (DUE TO 2/3 HI-HI CONTAINMENT PRESSURE INPUT SIGNALS FROM FAILED RELAYS), TRAIN B CLR FLOW CONTROL INOPERABLE	#01 REV REQUIRED TO WARN OPERATORS THAT CONTAINMENT SPRAY WILL ACTUATE PREMATURELY WITH THIS FAILURE. SEE ITEMS 2.4.23.1.1, 5.2.4.5.1, 5.2.6.6.1, 9.2.1.5.1, 9.2.2.5.1, 9.2.11.3.1 (SAME AS 11.7.1.1.1).
11.7.01.01.2	CSAS INVERTER	INVERTERS A/B	INPUT SHORT	125VDC BREAKER 72-223 TRIPS, INTERRUPTING POWER TO TRAIN B CSAS LOGIC, 2/3 CONTAINMENT PRESSURE OUTPUT RELAYS TO TRAIN A AND B CSAS, TRAIN B CONTROLLERS FOR 3/3 CLR FLOW CONTROL VALVES	CONTROL ROOM ANNUNCIATION	(SAME AS 11.7.1.1.1)	INVERTER CABINET CONTAINS 2 REDUNDANT INVERTERS. HOWEVER, THE SECOND INVERTER IS NOT TECH SPEC REQUIRED, AND MUST BE ASSUMED A PRE-EXISTING FAILURE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
TABLE 11-1: VITAL AND REGULATED POWER SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
11.7.01.01.3	CSAS INVERTER	INVERTERS A/B	OUTPUT VOLTS LOW	(SAME AS 11.7.1.1.1)	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.7.1.1.1)	(SAME AS 11.7.1.1.1)	(SAME AS 11.7.1.1.2)
11.7.01.01.4	CSAS INVERTER	INVERTERS A/B	OUTPUT SHORT OR GROUND	(SAME AS 11.7.1.1.2)	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 11.7.1.1.1)	(SAME AS 11.7.1.1.1)	(SAME AS 11.7.1.1.2)
11.7.02.01.1	CSAS INVERTER	Y02-1 (FUSE)	OPEN	LOSS OF CSAS INVERTER POWER TO TRAIN B CSAS LOGIC, 1/3 CONTAINMENT PRESSURE TRANSMITTERS TO TRAIN A AND B CSAS. LOW LEVEL TRIP OF TRAIN B HYDRAZINE PUMP ALSO DISABLED	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN, REDUNDANT CONTAINMENT PRESSURE CHANNELS	INOPERABILITY OF TRAIN B CSAS, LOSS OF 1/3 CONTAINMENT PRESSURE INPUTS TO TRAIN A AND B CSAS, REDUCED RELIABILITY OF TRAIN B HYDRAZINE PUMP	SEE ITEMS 5.2.6.6.1 AND 9.2.11.3.1
11.7.02.02.1	CSAS INVERTER	Y02-2 (FUSE)	OPEN	LOSS OF CSAS INVERTER POWER TO 1/3 CONTAINMENT PRESSURE TRANSMITTERS TO TRAIN A AND B CSAS. LOW LEVEL TRIP OF TRAIN B HYDRAZINE PUMP ALSO DISABLED	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN, REDUNDANT CONTAINMENT PRESSURE CHANNELS	LOSS OF 1/3 CONTAINMENT PRESSURE INPUTS TO TRAIN A AND B CSAS, REDUCED RELIABILITY OF TRAIN B HYDRAZINE PUMP	SEE ITEM 9.2.1.5.1
11.7.02.03.1	CSAS INVERTER	Y02-3 (FUSE)	OPEN	LOSS OF CSAS INVERTER POWER TO 1/3 CONTAINMENT PRESSURE CHANNEL OUTPUT RELAYS FOR TRAIN A AND B CSAS, MOV-883 POSITION INDICATION ON CSAS PANEL	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	1/3 CONTAINMENT PRESSURE CHANNELS TRIPPED TO TRAIN A AND B CSAS, LOGIC BECOMES 1/2 ON REMAINING CHANNELS WITH CONCURRENT BIS/DISLOP FROM RESPECTIVE SEQUENCER	SEE ITEM 9.2.2.5.1
11.7.02.04.1	CSAS INVERTER	Y02-4 (FUSE)	OPEN	LOSS OF CSAS INVERTER POWER TO TRAIN B CONTAINMENT SPRAY FLOW LIMITER VALVE CV-518	CONTROL ROOM INDICATION	REDUNDANT BI-FLOW PATH THROUGH REDUNDANT TRAIN A VALVE CV-518 FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	1 OF 2 REDUNDANT BI-FLOW CONTAINMENT SPRAY PATHS INOPERABLE FOR INJECTION. NO EFFECT ON RECIRCULATION	SEE ITEM 5.2.4.5.1. VALVE SAFETY FUNCTION IS OPEN (EMERGIZED) FOR INJECTION MODE, CLOSED (DE-EMERGIZED) FOR RECIRCULATION
11.7.02.05.1	CSAS INVERTER	Y02-5 (FUSE)	OPEN	LOSS OF CSAS INVERTER POWER TO PERIODIC TESTING ALARM CONTROL	NONE REQUIRED	NONE	NONE	NO ECCS EQUIPMENT ON THIS SOURCE
11.7.02.06.1	CSAS INVERTER	Y02-6 (FUSE)	OPEN	LOSS OF CSAS INVERTER POWER TO TRAIN B CONTROLLERS FOR CLR FLOW CONTROL VALVES FCV-1115D/B/F	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTROLLERS FOR FCV-1115A/D, B/B, C/P	LOSS OF 1/2 REDUNDANT CONTROLLERS FOR EACH CLR PATH	SEE ITEM 2.4.23.1.1

TABLE 11-2: SORT OF VITAL/REGULATED POWER DEPENDENCIES

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPR UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
05.2.06.06.1	G-2008	CSAS INVERTER (Y02-1)	VOLTS LOW	LOSS OF POWER TO PT-502, PIS-512, PIS-501 AND LIS-500A LOOPS, CAUSING LOW CH. B CONTAINMENT PRESSURE SIGNAL TO CSAS A/B LOGIC, AND DEPRATING LOW LEVEL TRIP OF TRAIN B HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CHANNELS FOR CSAS, REDUNDANT HYDRAZINE PUMP	LOSS OF 1 OF 3 REDUNDANT CONTAINMENT HI-HI PRESSURE INPUTS TO CSAS TRAIN A/B LOGIC AND REDUCED RELIABILITY OF TRAIN B HYDRAZINE PUMP	
09.2.11.03.1	CSAS TRAIN B (POWER)	CSAS INVERTER (Y02-1)	VOLTS LOW	15VDC POWER SUPPLIES BPSA AND BPSB DE-ENERGIZED, DISABLING OUTPUT RELAYS FOR CSAS TRAIN B	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CSAS	OUTPUT RELAYS ARE ENERGIZE TO ACTUATE
09.2.01.05.1	PT-502 LOOP	CSAS INVERTER (Y02-2)	VOLTS LOW	LOSS OF POWER TO PIS-512, LIS-500B, PIS-501 AND OUTPUT RELAYS, RESULTING IN COMB B HI-HI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC AND DISABLING LOW LEVEL TRIP OF TRAIN B HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCER	
09.2.02.05.1	PT-503 LOOP	CSAS INVERTER (Y02-3)	VOLTS LOW	LOSS OF POWER TO PIS-513, MOV-883 POSITION INDICATION, AND PIS-513 OUTPUT RELAYS RESULTING IN COMB C HI-HI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT HI-HI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCER	
05.2.04.05.1	CV-518	CSAS INVERTER (Y02-4)	VOLTS LOW	CV-518 FAILS CLOSED, CANNOT BE REOPENED	CONTROL INDICATION	REDUNDANT HI-FLOW PATH THROUGH CV-517 FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS INOPERABLE FOR INJECTION, NO EFFECT ON RECIRCULATION	
02.4.23.01.1	PCV-1115D PCV-1115E PCV-1115F	CSAS INVERTER (Y02-6)	VOLTS LOW	TRAIN B CONTROLLERS DISABLED FOR PCV-1115D/E/F	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTROLLERS	LOSS OF 1 OF 2 REDUNDANT CONTROLLERS FOR EACH OF PCV-1115D/E/F FOR CLR FLOW CONTROL	
01.4.06.05.3	PCV-456 CV-142	RBC BUS #1 (8-11R1)	VOLTS LOW	S/G A OVERFILL PROTECTION SIGNAL CLOSSES PCV-456 AND CV-142	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/GA FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/GA OR CONTROL CHANNEL, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. LT-453 LOOP FAILS HIGH ON LOSS OF POWER
08.1.01.05.1	PT-430 LOOP	RBC BUS #1 (8-11R1)	VOLTS LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
02.4.09.06.1	PCV-1112	RBC BUS #1 (8-11R7)	VOLTS LOW	PCV-1112 FAILS CLOSED AFTER SV-1112 DE-ENERGIZED (BY OVERRIDE OR SEQ BLOCK/RESET)	CONTROL ROOM INDICATION	ALTERNATE BLR PATH	LOSS OF BLR PRIMARY PATH	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.1.04.06.1	PCV-1112	RBG BUS #1 (8-11R7)	VOLTS LOW	PCV-1112 FAILS CLOSED AFTER BY-1112 DE-ENERGIZED (BY OVERRIDE OR SEQ BLOCK/RESET)	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	
03.1.10.02.1	PCV-430C PCV-430R	RBG BUS #1 (8-11R7)	VOLTS LOW	DIVERSION OF PRIMARY PATH HLR FLOW TO LOOP A AND B COLD LINES	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	
01.4.07.05.3	PCV-457 CV-144	RBG BUS #2 (8-12R1)	VOLTS LOW	S/G B OVERFILL PROTECTION SIGNAL CLOSSES PCV-457 AND CV-144	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G B	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. LT-454 LOOP FAILS HIGH ON LOSS OF POWER
08.1.02.05.1	PT-431 LOOP	RBG BUS #2 (8-12R4)	VOLTS LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
01.4.08.05.3	PCV-458 CV-143	RBG BUS #3 (8-13R1)	VOLTS LOW	S/G C OVERFILL PROTECTION SIGNAL CLOSSES PCV-458 AND CV-143	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT S/Gs FOR SECONDARY RECIRC	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G C	RELAY ACTUATED ON HIGH INDICATED LEVEL BY S/G NR CONTROL CHANNEL, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. LT-455 LOOP FAILS HIGH ON LOSS OF POWER
08.1.03.05.1	PT-432 LOOP	RBG BUS #3 (8-13R4)	VOLTS LOW	1/3 PZR PRESSURE INPUTS TRIPPED TO SEQ 1 AND BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 1/2 ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT PZR PRESSURE CHANNELS	REDUCED REDUNDANCY AGAINST SEQ 1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ 1 AND 2	
03.2.09.02.1	MOV-813 MOV-834	RBG BUS #4 (8-14R6)	VOLTS LOW	PRESSURIZER PRESSURE INTERLOCK CLEARS, PERMITTING RENOTE-MANUAL OPENING OF MOV-813 AND MOV-834	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR ALTERNATE HLR	NONE FOR ALTERNATE HLR	REDUNDANT VALVES MOV-814 AND MOV-833 PROVIDE RCS INTEGRITY. LOSS OF POWER TO PT-425 LOOP CAUSES PC-425 TO DE-ENERGIZE OUTPUT RELAY PC-425I, CLOSING PERMISSIVE CONTACTS IN MOV-813/834 OPENING CIRCUITS *RANGE INADEQUATE FOR HLR PRIMARY PATH FUNCTION, BACKUP FLOW DETERMINATION METHOD REQUIRED IN BOI, IRRESPECTIVE OF FIT-1112 FAILURE
03.1.03.02.1	FIT-1112 LOOP	RBG BUS #4 (8-14R9)	VOLTS LOW	DOWNSCALE FAILURE OF HLR PRIMARY PATH FLOW INDICATION	CONTROL ROOM INDICATION	ALTERNATE HLR PATH	LOSS OF HLR PRIMARY PATH	
02.4.28.04.1	BCV-427A BCV-427B BCV-427C	UTILITY BUS (8-1502)	VOLTS LOW	VALVES FAIL AS-IS, CONTROL RELAY OPERATE AND RESET COILS CANNOT BE DE-ENERGIZED TO CHANGE STATE OF CONTACTS IN SOLENOID VALVE POWER CIRCUITS	CONTROL ROOM INDICATION	NONE FOR SI/RCS INVENTORY, NONE REQUIRED FOR INJECTION OR CLR FLOW	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, NONE FOR INJECTION OR CLR FLOW DUE TO CONTINUED FUNCTIONING OF RCP SEALS	*RWS INVENTORY AND SI/PW LO-LO RWS LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT

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02.4.12.01.1	CV-304 CV-305	UTILITY BUS (8-1508)	VOLTS LOW	CV-304 AND CV-305 CLOSE, CANNOT BE OPENED, ISOLATING CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH. VALVES FAIL TO CLR POSITION	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, REDUNDANT PATH FOR HLR, NONE REQUIRED FOR CLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH, NONE FOR CLR	CHARGING NOT CREDITED FOR INJECTION
03.1.07.01.1	CV-304 CV-305	UTILITY BUS (8-1508)	VOLTS LOW	CV-304 AND CV-305 CLOSE, CANNOT BE OPENED, ISOLATING CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH. VALVES FAIL TO CLR POSITION	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, REDUNDANT PATH FOR HLR, NONE REQUIRED FOR CLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH, NONE FOR CLR	*CHARGING NOT CREDITED FOR INJECTION. REALIGNMENT OF UTILITY BUS VIA TRANSFER SW #7 REQUIRED TO PRECLUDE COMMON-MODE FAILURE OF HLR (DUE TO LOSS OF TRAIN B POWER) BY RESTORING SAFETY-RELATED POWER TO UTILITY BUS
03.2.15.02.1	CV-288	UTILITY BUS (8-1508)	VOLTS LOW	VALVE FAILS TO NORMAL POSITION	CONTROL ROOM INDICATION	REDUNDANT VALVES CV-287 AND HCV-1117 PREVENT DIVERSION OF ALTERNATE HLR FLOW TO LOOP B COLD LEG	NONE	
01.4.16.11.1	CV-202, 203, 204, 287	UTILITY BUS (8-1518)	VOLTS LOW	SOLENOID VALVES FOR CV-202, 203, 204, 287 AND SEQ RELAYS 83-10, 83-12 DE-ENERGIZE, ISOLATING LRTDOWN AND RECESS LRTDOWN	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
02.4.27.04.1	CV-406A CV-406B	UTILITY BUS (8-1518)	VOLTS LOW	CV-406A AND CV-406B OPEN, BYPASSING NOV-1100C, POTENTIALLY GAS-BINDING BOTH CHARGING PUMPS DURING VCT LEVEL TRANSIENT PRECEDING SIS/SISLOP IN SBLOCA, AND PRESELECTED PUMP DURING LBLOCA, NSLB, SCTR INJECTION. NO EFFECT IF DURING RECIRC	CONTROL ROOM INDICATION	NONE FOR SBLOCA, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR RECIRC IN OTHER EVENTS	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	*AT LEAST ONE OF CV-406A/B MUST BE FAIL CLOSED AND/OR LOCKED CLOSED. NOTE MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP SIMILAR TO NOV-1100C FAILURE TO CLOSE
03.2.12.11.1	CV-202, 203, 204	UTILITY BUS (8-1518)	VOLTS LOW	SOLENOID VALVES FOR CV-202, 203, 204 AND SEQ RELAYS 83-10, 83-12 DE-ENERGIZE, ISOLATING LRTDOWN FROM LOOP A COLD LEG	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
08.1.01.04.1	PT-430 LOOP	VITAL BUS #1 (8-1101V)	VOLTS LOW	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 AND 1/2 RESPECTIVELY ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP AND REDUCED REDUNDANCY AGAINST #1 BLOCK PERMISSIVE FOR SEQ 1 AND 2	1/3 SEQ BLOCK PERMISSIVE COULD ALSO RESULT IF VITAL BUS AUTO-TRANSFER OCCURS DURING FAILURE TRANSIENT
05.3.05.04.1	CV-92	VITAL BUS #1 (8-1102V)	VOLTS LOW	VALVE FAILS IN CLOSED POSITION, CANNOT BE OPENED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.06.05.4	PCV-456 CV-142	VITAL BUS #1 (8-1105V)	VOLTS LOW	S/G A OVERFILL PROTECTION SIGNAL DISABLED TO PCV-456 AND CV-142	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	RELAY IS ENERGIZE TO ACTUATE AND FAILS OFF ON LOSS OF VITAL BUS POWER, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. ANNUNCIATION OCCURS ON MISMATCH CHANNEL TRIP

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02.4.08.03.1	PIC-1111 LOOP	VITAL BUS #1 (8-1109V)	VOLTS LOW	LOW DISCHARGE PRESSURE AUTO-START SIGNAL TO BOTH CHARGING PUMPS, CAUSING START OF IDLE PUMP DURING NORMAL OPERATION AND AFTER SEQ BLOCK/RSBT	CONTROL ROOM INDICATION, ANNUNCIATION	MOV-1100C CLOSURE AS REQUIRED FOR INJECTION. NONE REQUIRED PRIOR TO SEQ BLOCK/RSBT OR DURING CLR/HLB	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION (AFTER SEQ BLOCK/RSBT)	
03.2.10.02.1	CV-525	VITAL BUS #1 (8-1111V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	INTERNAL DUMP VALVE IS DE-ENERGIZED TO ACTUATE *BOT PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION
05.1.05.04.1	CV-82	VITAL BUS #1 (8-1111V)	VOLTS LOW	CV-82 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP HEAD FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	POST-LOCA. NOT CONSISTENT WITH SRP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF CONTAINMENT ISOLATION CONFIGURATION FOR THE SPRAY PENETRATION
01.4.12.05.1	SV-702B SV-702D	VITAL BUS #1 (8-1112V)	VOLTS LOW	TRAIN A BI LOOP B AND C VENT ISOLATION VALVES CLOSED IRRESPECTIVE OF CIS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
08.1.08.02.1	PT-1120A PT-1120B PT-1120C LOOPS	VITAL BUS #1 (8-1112V)	VOLTS LOW	3/3 CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 1	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	SEQ 1 CONTAINMENT HIGH PRESSURE SIS/SISLOP DISABLED	CONTAINMENT HIGH PRESSURE SIS CREDITED FOR MAIN FEED ISOLATION AND CONTAINMENT SPRAY PERMISSIVE FOR HSLB INSIDE CONTAINMENT
05.1.04.05.1	CV-517	VITAL BUS #1 (8-1113V)	VOLTS LOW	CV-517 FAILS CLOSED, CANNOT BE REOPENED	CONTROL INDICATION	REDUNDANT BI-FLOW PATH THROUGH CV-518 FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	1 OF 2 REDUNDANT BI-FLOW SPRAY PATHS IMPROPER FOR INJECTION, NO EFFECT ON RECIRCULATION	
06.1.05.02.1	CV-737A	VITAL BUS #1 (8-1114V)	VOLTS LOW	VALVE FAILS OPEN, ALIGNING CCW FLOW TO RECIRC BI	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
09.1.11.03.1	CSAS TRAIN A (POWER)	VITAL BUS #1 (8-1115V)	VOLTS LOW	15VDC POWER SUPPLY AP5A DE-ENERGIZED. NO EFFECT ON TRAIN A CSAS LOGIC DUE TO REDUNDANT SUPPLY AP5B	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	
05.1.06.06.1	G-200A	VITAL BUS #1 (8-1116V)	VOLTS LOW	LOSS OF POWER TO PT-501, PIS-511, PIS-500, LIS-500A, PIS-510 AND PIS-520 AND -521 LOOPS, CAUSING LOW CR. A CONTAINMENT PRESSURE SIGNAL TO CSAS A/B LOGIC, AND OPERATING LOW LEVEL TRIP OF TRAIN A HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CHANNELS FOR CSAS, REDUNDANT HYDRAZINE PUMP	LOSS OF 1 OF 3 REDUNDANT CONTAINMENT BI-BI PRESSURE INPUTS TO CSAS TRAIN A/B LOGIC AND REDUCED RELIABILITY OF TRAIN A HYDRAZINE PUMP	
09.1.01.05.1	PT-501 LOOP	VITAL BUS #1 (8-1116V)	VOLTS LOW	LOSS OF POWER TO PIS-510, -511, LIS-500A, PIS-520, -521, -522 AND OUTPUT RELAYS, RESULTING IN COME A BI-BI PRESS SIGNAL TO TRAIN A AND B CSAS LOGIC AND DISABLING LOW LEVEL TRIP OF TRAIN A HYDRAZINE PUMP	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT CONTAINMENT PRESSURE CHANNELS AND SEQ INPUTS TO PREVENT SPURIOUS CSAS	TRAIN A AND B CSAS LOGIC BECOMES 1/2 ON REMAINING CONTAINMENT BI-BI PRESSURE CHANNELS WITH CONCURRENT SIS/SISLOP FROM RESPECTIVE SEQUENCE	

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08.1.02.04.1	PT-431 LOOP	VITAL BUS #2 (8-1201V)	VOLTS LOW	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 AND 1/2 RESPECTIVELY ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP AND REDUCED REDUNDANCY AGAINST S1 BLOCK PERMISSIVE FOR SEQ 1 AND 2	1/3 SEQ BLOCK PERMISSIVE COULD ALSO RESULT IF VITAL BUS AUTO-TRANSFER OCCURS DURING FAILURE TRANSIENT
06.4.07.02.1	CV-722A CV-722B CV-722C	VITAL BUS #2 (8-1204V)	VOLTS LOW	CV-722A, B AND C FAIL OPEN, ALIGNING CW FLOW THROUGH THERMAL BARRIER COILS FOR RCP-A, B AND C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVES NORMALLY OPEN, REMOTE-MANUALLY CLOSED FOR THERMAL BARRIER COIL FAILURE ONLY
01.4.07.05.4	PCV-457 CV-144	VITAL BUS #2 (8-1205V)	VOLTS LOW	S/G B OVERFILL PROTECTION SIGNAL DISABLED TO PCV-457 AND CV-144	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	RELAY IS ENERGIZE TO ACTUATE AND FAILS OFF ON LOSS OF VITAL BUS POWER, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. ANNUNCIATION OCCURS ON MISMATCH CHANNEL TRIP
05.2.05.04.1	CV-114	VITAL BUS #2 (8-1214V)	VOLTS LOW	CV-114 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RBCIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION POST-LOCA. NOT CONSISTENT WITH SEP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF CONTAINMENT ISOLATION CONFIGURATION FOR THE SPRAY PENETRATION
06.2.05.02.1	CV-137B	VITAL BUS #2 (8-1214V)	VOLTS LOW	VALVE FAILS OPEN, ALIGNING CCW FLOW TO RBCIRC BY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
08.1.03.04.1	PT-432 LOOP	VITAL BUS #3 (8-1301V)	VOLTS LOW	1/3 PZR PRESSURE INPUTS DISABLED TO SEQ 1 AND TRIPPED TO BLOCK PERMISSIVE FOR SEQ 1 AND 2, LOGIC BECOMES 2/2 AND 1/2 RESPECTIVELY ON REMAINING CHANNELS	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN FOR SIS/SISLOP, REDUNDANT PZR PRESSURE CHANNELS FOR BLOCK PERMISSIVE	REDUCED RELIABILITY FOR SEQ 1 SIS/SISLOP AND REDUCED REDUNDANCY AGAINST S1 BLOCK PERMISSIVE FOR SEQ 1 AND 2	1/3 SEQ BLOCK PERMISSIVE COULD RESULT IF VITAL BUS AUTO-TRANSFER OCCURS DURING FAILURE TRANSIENT
01.4.08.05.4	PCV-458 CV-143	VITAL BUS #3 (8-1305V)	VOLTS LOW	S/G C OVERFILL PROTECTION SIGNAL DISABLED TO PCV-458 AND CV-143	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	RELAY IS ENERGIZE TO ACTUATE AND FAILS OFF ON LOSS OF VITAL BUS POWER, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS. ANNUNCIATION OCCURS ON MISMATCH CHANNEL TRIP
09.1.11.04.1	CSAS TRAIN A (POMBB)	VITAL BUS #3 (8-1314V)	VOLTS LOW	15VDC POWER SUPPLY AP5B DE-ENERGIZED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED RELIABILITY OF TRAIN A CSAS	AP5A AND AP5B OUTPUTS ARE PARALLELED
03.2.16.02.1	CV-962	VITAL BUS #3A (8-3311V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
02.4.25.04.1	PT-2114B LOOP PT-2114C LOOP	VITAL BUS #3A (8-3313V)	VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOPS B AND C	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE AVAILABLE	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/BLR FLOW IMBALANCE, AND POTENTIALLY EXCEEDING RBCIRC PUMP LIMITATIONS	*PCV-1115B/F FAILURE AND FI-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/BLR WITHOUT EQ FI-1112 LOOP. CHARGING PUMP ANMSTER USED TO DETERMINE TOTAL CHARGING PUMP FLOW

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03.1.12.04.1	PT-2114B LOOP PT-2114C LOOP	VITAL BUS #3A (8-3313V)	VOLTS LOW	LOW CLR FLOW INDICATION FOR BCS LOOPS B AND C	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE AVAILABLE	*CLR FLOW TO BCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/BLR FLOW IMBALANCE, AND POTENTIALLY EXCEEDING REFCIRC PUMP LIMITATIONS	*PCV-1115R/F FAILURE AND PT-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/BLR WITHOUT HQ PIT-1112 LOOP. CHARGING PUMP ARRHYTHM USED TO DETERMINE TOTAL CHARGING PUMP FLOW
01.4.19.03.1	CV-955	VITAL BUS #3A (8-3314V)	VOLTS LOW	LOOP B, C RCS SAMPLE FLOW ISOLATED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE SAFETY FUNCTION IS TO FAIL CLOSED
01.4.09.10.1	PCV-456, 457, 458 CV-142, 143, 144	VITAL BUS #3A (8-3315V)	VOLTS LOW	NFW CHECK VALVE BACKUP MODE IS ARMED FOR W/C A/B/C. PCVs AND CVs WILL CLOSE VIA RESPECTIVE SOLENOIDS IF TURBINE IS TRIPPED (TT12 CONTACTS CLOSED) AND BOTH NFW PUMPS ARE TRIPPED ("b" CONTACTS CLOSED)	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, NONE FOR SECONDARY REFCIRC	*NONE FOR SI, LOSS OF SECONDARY REFCIRC TO W/C A/B/C AFTER NFW PUMPS TRIPPED	RE-EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR NFW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY REFCIRC. ANNUNCIATION OCCURS FROM APNAS-A ACTUATION OR TROUBLE
04.1.03.02.1	LT-2400A LT-2400B LT-2400C LOOPS	VITAL BUS #3A (8-3315V)	VOLTS LOW	TRAIN A NARROW RANGE LEVEL INDICATION AND APW AUTO-ACTUATION DISABLED, BLOWDOWN ISOLATED ON TRAIN A APW RELAY DE-ENERGIZING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT APW TRAIN TO PROVIDE NR LEVEL INDICATION AND FLOW, NONE REQUIRED FOR AUTOMATIC BLOWDOWN ISOLATION	TRAIN A NARROW RANGE LEVEL INDICATION AND APW FLOW DISABLED, BLOWDOWN ISOLATED	
02.4.07.01.1	CV-410 CV-411	VITAL BUS #4 (8-1402V)	VOLTS LOW	CV-410 AND CV-411 CLOSE, ISOLATING SEAL WATER RETURN TO VCT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.13.02.1	CV-413	VITAL BUS #4 (8-1402V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.14.04.1	CV-412	VITAL BUS #4 (8-1402V)	VOLTS LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
06.4.05.01.1	TCV-601A TCV-601B	VITAL BUS #4 (8-1402V)	VOLTS LOW	TCV-601A/B FAIL OPEN, CAUSING EXCESS CCW FLOW TO RHR BY B-21A/B AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION	VALVES ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*NONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 RESPONDING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
03.2.09.03.1	MOV-813 MOV-834	VITAL BUS #4 (8-1406V)	VOLTS LOW	PRESSURIZER PRESSURE INTERLOCK WILL NOT CLEAR, PREVENTING OPENING OF MOV-813 AND MOV-834	CONTROL ROOM INDICATION, PERIODIC TESTING	PRIMARY BLR PATH	INOPERABILITY OF ALTERNATE BLR	VALVE MOV-813 REQUIRED TO OPEN FOR ALTERNATE BLR FLOW PATH. PC-425I RELAY IS ENERGIZE-TO-ACTUATE FOR CONTACT CLOSURE IN VALVE OPENING CIRCUIT
01.4.09.09.1	PCV-456, 457, 458 CV-142, 143, 144	VITAL BUS #4 (8-1411V)	VOLTS LOW	NFW CHECK VALVE BACKUP MODE DISABLED FOR RESPECTIVE PCV/CV SOLENOID VALVE CIRCUITS (TT12: PCV-456; CV-142/143/144 TRAIN A SVs, TT12-ISO: PCV-457/458, CV-143/144 TRAIN B SVs, TT13-ISO: CV-142 TRAIN B SV)	PERIODIC TESTING	NONE REQUIRED FOR SI OR SECONDARY REFCIRC	NONE FOR SI AND SECONDARY REFCIRC	OUTPUT/ISOLATION RELAYS ARE ENERGIZE TO ACTUATE

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06.4.06.03.1	PC-605 LOOP	VITAL BUS #4 (8-1415V)	VOLTS LOW	AUTOSTART SIGNAL TO CCW AND EMERGENCY THERMAL BARRIER PUMPS, CAUSING PUMPS TO START AS SOON AS RESPECTIVE BUS VOLTAGE AVAILABLE	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE FOR SIS/LOP, NONE REQUIRED FOR SIS	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER BUS TO OUT OF SEQUENCE BUS LOADING DURING SIS/LOP, NONE FOR SIS	
02.4.04.02.1	LC-1100B LOOP	VITAL BUS #4 (8-1416V)	VOLTS LOW	LOW VCT LEVEL SIGNAL TO NOV-1100B/C/D, CAUSING NOV-1100B/D OPENING AND NOV-1100C CLOSING IF IN AUTO. ALSO CAUSES LO-LO-LO TRIP OF C-8A. NO EFFECT ON SRQ	CONTROL ROOM INDICATION	NONE REQUIRED	TRAIN B CHARGING PUMP WILL NOT AUTO-START DURING INJECTION, BUT AVAILABLE FOR RECIRC WITH LEVEL TRIP OVERRIDE	CHARGING PUMPS NOT CREDITED FOR INJECTION
02.4.08.03.2	PIC-1111 LOOP	VITAL BUS #4 (8-1416V)	VOLTS LOW	ACTUATION OR POST-SIS/SIS/LOP LOW CHARGING PUMP DISCHARGE PRESSURE SIGNAL TO AUTO-START CRT OF BOTH CHARGING PUMPS, CAUSING START OF IDLE PUMP DURING NORMAL OPS AND FOLLOWING SRQ BLOCK/RESBT. DOES NOT AFFECT SIS/SIS/LOP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED DURING SIS/SIS/LOP. NOV-1100C CLOSING AS REQUIRED TO PREVENT GAS BINDING OF DE-SELECTED PUMP FOLLOWING SRQ BLOCK/RESBT	NONE. START OF ONE CHARGING PUMP AND TRIP/LOCKOUT OF OTHER ON SIS/SIS/LOP IS UNAFFECTED, AND RESTART OF DE-SELECTED PUMP FOLLOWING SRQ BLOCK/RESBT IS ACCEPTABLE AS LONG AS NOV-1100C HAS CLOSED	
02.4.22.01.1	PCV-1115A/D PCV-1115B/R PCV-1115C/F	VITAL BUS #4 (8-1416V)	VOLTS LOW	TRIP OF DE-SELECTED PUMP PCV-1115A/B/C FAIL OPEN AND PCV-1115D/R/F FAIL CLOSED IF TRAIN A CONTROLLERS ALIGNED. CLR FLOW CANNOT BE THROTTLED BELOW ABOUT 80 GPM PER RCS LOOP	CONTROL ROOM INDICATION	REDUNDANT CONTROLLERS	LOSS OF TRAIN A CLR FLOW CONTROL TO RCS LOOPS A, B AND C, AND INABILITY TO THROTTLE CLR FLOW BELOW ABOUT 80 GPM PER LOOP FOR COMBINED CLR/HLR	*HYDRAULIC CALC REQUIRED TO VERIFY FLOW THROUGH WIDE OPEN PCV-1115A/B/C AND UPPER LIMIT FOR PRIMARY PATH HLR FLOW TO REMAIN WITHIN RECIRC PUMP FLOW CAPABILITIES
01.4.09.11.1	PCV-456, 457, 458 CV-142, 143, 144	VITAL BUS #5 (8-2901V)	VOLTS LOW	HPW CHECK VALVE BACKUP MODE IS ARMED FOR S/G A/B/C. PCVs AND CVs WILL CLOSE VIA RESPECTIVE SOLENOIDS IF TURBINE IS TRIPPED (TTR2 CONTACTS CLOSED) AND BOTH HPW PUMPS ARE TRIPPED ("b" CONTACTS CLOSED)	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER HPW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES ON HPW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY RECIRC. ANNUNCIATION OCCURS ON APWAS-B ACTUATION OR TROUBLE
04.2.03.02.1	LT-3400A LT-3400B LT-3400C LOOPS	VITAL BUS #5 (8-2901V)	VOLTS LOW	TRAIN B NARROW RANGE LEVEL INDICATION AND APW AUTO-ACTUATION DISABLED, BLOWDOWN ISOLATED ON TRAIN B APW RELAY DE-ENERGIZING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT APW TRAIN TO PROVIDE NE LEVEL INDICATION, NONE REQUIRED FOR AUTOMATIC BLOWDOWN ISOLATION	TRAIN B NARROW RANGE LEVEL INDICATION DISABLED, BLOWDOWN ISOLATED	
08.2.08.02.1	PT-3000A/B/C LOOPS PT-1121A/B/C LOOPS	VITAL BUS #5 (8-2901V)	VOLTS LOW	3/3 PZR PRESSURE AND CONTAINMENT PRESSURE INPUTS DISABLED TO SEQ 2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT SEQ/TRAIN	SEQ 2 SIS/SIS/LOP DISABLED	
02.4.24.03.1	PT-3114A LOOP	VITAL BUS #5 (8-2903V)	VOLTS LOW	LOW CLR FLOW INDICATION FOR RCS LOOP A	CONTROL ROOM INDICATION	NONE AVAILABLE	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECIRCULATING RECIRC PUMP LIMITATIONS	*PCV-1115D FAILURE AND PT-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP ANNUNCIATION USED TO DETERMINE TOTAL CHARGING PUMP FLOW

SECTION 12: AUXILIARY POWER

AUXILIARY POWER SYSTEM NOTES

1. The Auxiliary Power System FMEA, Table 12-1, is printed in several parts, due to the size of this database section:
 - a. 4 kV System
 - b. 480 V System
 - c. 125 VDC System
 - d. Common
2. To facilitate anticipated changes to the SONGS 1 electrical system, Item numbers in this section have been assigned as follows:

<u>Train A</u>	<u>Train B</u>
12.1: 4 kV Bus 1A, 1B	12.2: 4 kV Bus 1B, 2C
12.3: 480 V Bus #1	12.4: 480 V Bus #2
12.5: [future]	12.6: 480 V Bus #3
12.7: 125 VDC Bus #1	12.8: 125 VDC Bus #2
12.9: Common	

This does not affect the automated sorts for electrical and other dependencies, as the ITEM_NO field is not used as the sorting key.

3. Because long-term ECCS operation could be required beyond the capacity of the on-site Diesel Generator fuel storage tanks, the ability to retransfer ECCS loads from the Diesel Generators to an offsite source (normal or alternate), is conservatively considered to be a required ECCS function for SISLOP events. For purposes of this evaluation, repairs of common-cause failures of the non-seismic switchyard and transformer equipment are assumed, but repairs to mitigate single active failures are not.
4. An automated sort of auxiliary power dependencies (COMP_ID = 'BUS', 'MCC', 'SWGR', OR '125VDC BUS') is provided in Table 12.2 as an aid to the reviewer.
5. Potential single failure susceptibilities in the FMEA table are flagged with "*" as the first character of the associated ECCS EFFECTS field. Other open items (eg. required procedure or calculation changes) are flagged with "*" as the first character of the REMARKS field.

AUXILIARY POWER SYSTEM REFERENCES

I. 4kV SYSTEM AND COMMON:

One Line Diagrams

5145331 220 kV Switchyard (Positions 1 - 6)
5146828 Main One Line Diagram

Elementary Diagrams

N1545 Sh 20 Main Transformer Protection, 220 kV Circuit
Breaker Position Relays
N1545 Sh 21 Auxiliary Transformer C Loss of Voltage Relays
N1545 Sh 28 Auxiliary Transformer C Differential and Sudden
Pressure Relays
N1545 Sh 34 Generator Disconnect Switch
N1546 Sh 1 Auxiliary Transformer A and B 4.16 kV ACBs
N1546 Sh 2 Auxiliary Transformer C 4.16 kV ACB
N1546 Sh 13 Station Loss of Voltage Auto-Transfer Sh 1
N1546 Sh 14 Station Loss of Voltage Auto-Transfer Sh 2
5130351 4.16 kV Bus Undervoltage Relays
5145385 220 kV PCB 1 - 6 Breaker Failure Protection
5145395 Auxiliary Transformer C 220 kV PCB Protection
5149630 4.16 kV Diesel Generator Breakers
5150335 Reactor Coolant Pumps
5150356 Exciter 4.16 kV ACB
5150876 4.16 kV Bus Undervoltage and Underfrequency
Relays
5151031 Station Service Transformer #1 and 2 4.16 kV ACBs
5151224 4.16 kV Bus Reactor Bypass Breakers RX1 and RY1
5151922 Station Service Transformer #3 4.16 kV ACB
5152239 4.16 kV Bus Tie 1A-1C and 1B-2C ACBs
5156238 220 kV PCB 1 Control
5156239 220 kV PCB 2 Control
5156249 220 kV PCB 5 and 6 Breaker Failure Protection

Other Drawings

5149178 Load Sequence Table, Train 1 (Sh 1)
5149179 Load Sequence Table, Train 1 (Sh 2)
5149181 Load Sequence Table, Train 2 (Sh 1)
5149182 Load Sequence Table, Train 2 (Sh 2)

Procedures

S01-1.0-10 Reactor Trip or Safety Injection
S01-1.0-40 Steam Generator Tube Rupture
S01-1.0-60 Loss of All AC Power
S01-1.0-61 Loss of All AC Power Recovery
S01-2.6-4 Loss of DC Bus
S01-9-2 4160 V System Operations
S01-10-1 Diesel Generator Operations
S01-12.2-6 Electrical Distribution Weekly Surveillances
S01-12.3-10 Diesel Generator Load Test

Other Documents

SD-S01-110 System Description: 220 kV Switchyard

SD-S01-120

System Description: 4160 V System

SD-S01-590

System Description: Safeguard Load Sequencing
System

SD-S01-600

System Description: Diesel Generator System

AUXILIARY POWER SYSTEM REFERENCES (continued)

II. 480V SYSTEM:

One Line Diagrams

5146828 Main One Line Diagram
5148062 480V Bus #1
5148063 480V Bus #2 and 3

Elementary Diagrams

450528 Bus #2 Emergency Power 480V ACB
455417 Motor Control Center 480V ACB
455429 Station Service Transformer #3 480V ACB
455430 Bus #1-3 Tie 480V ACB
455431 Bus #2-3 Tie 480V ACB
5150158 SIS/SISLOP Lockout Relays
5150408 Station Service Transformer #1 480V ACB
5150409 Station Service Transformer #2 480V ACB
5150885 480V Bus #1, 2 and 3 Undervoltage Relays
5151904 480V Bus #1 125VDC Control
5151905 480V Bus #2 125VDC Control
5151906 480V Bus #3 125VDC Control

Other Drawings

449227 Schematic, Main Transformer (incl. cooling)
5149178 Load Sequence Table, Train 1 (Sh 1)
5149179 Load Sequence Table, Train 1 (Sh 2)
5149181 Load Sequence Table, Train 2 (Sh 1)
5149182 Load Sequence Table, Train 2 (Sh 2)
5149955 SIS/SISLOP Lockout Relays, Train 2 (Sh 1)
5149957 Emergency Operating Condition, Train 1
5149958 Emergency Operating Condition, Train 2
5149974 SIS/SISLOP Lockout Relays, Train 1
5149975 SIS/SISLOP Lockout Relays, Train 2 (Sh 2)

Procedures

SO1-1.0-10 Reactor Trip or Safety Injection
SO1-1.0-40 Steam Generator Tube Rupture
SO1-1.0-60 Loss of All AC Power
SO1-1.0-61 Loss of All AC Power Recovery
SO1-2.6-4 Loss of DC Bus
SO1-2.6-7 480V System Grounds or Faults
SO1-9-2 4160V System Operations
SO1-9-3 480V System Operations
SO1-9-4 12kV / 480V Transformer Operations
SO1-12.2-6 Electrical Distribution Weekly Surveillances

Other Documents

SD-SO1-120 System Description: 4160V System
SD-SO1-130 System Description: 480V and 12kV System
SD-SO1-590 System Description: Safeguard Load Sequencing System

AUXILIARY POWER SYSTEM REFERENCES (continued)

III. 125VDC SYSTEM:

One Line Diagrams

5102173 125VDC System No. 1
5149348 125VDC System No. 2

Procedures

S01-1.0-60 Loss of All AC Power
S01-1.0-61 Loss of All AC Power Recovery
S01-2.6-4 Loss of DC Bus
S01-9-12 Battery Charger Operation
S01-12.2-6 Electrical Distribution Weekly Surveillances

Other Documents

SD-S01-140 System Description: 125VDC System
SD-S01-590 System Description: Safeguard Load Sequencing System

TABLE 12-1: AUXILIARY POWER FMEA

PART I: 4 kV SYSTEM

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.1.01.01.1	X-WINDING CURRENT LIMITING REACTOR		OPEN	LOSS OF POWER IN ONE OR MORE PHASES OF TRAIN A DURING DG TESTING WITH NORMAL OFF-SITE SOURCE ALIGNED. NONE WITH BYPASS BREAKER CLOSED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS DURING DG TESTING, NONE REQUIRED FOR SIS DURING NORMAL OPERATION OR FOR SISLOP	INOPERABILITY OF TRAIN A FOR SIS DURING DG TESTING, NONE FOR NORMAL OPERATION	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.1.01.01.2	X-WINDING CURRENT LIMITING REACTOR		SHORT	LOSS OF FAULT PROTECTION FOR ONE OR MORE PHASES OF TRAIN A DURING DG TESTING WITH NORMAL OFF-SITE SOURCE ALIGNED	PERIODIC TESTING	REDUNDANT TRAIN FOR DG TESTING, NONE REQUIRED FOR NORMAL OPERATION	POTENTIAL INOPERABILITY OF TRAIN A DURING DG TESTING, NONE FOR NORMAL OPERATION	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.1.01.01.3	X-WINDING CURRENT LIMITING REACTOR		GROUND	LOSS OF NORMAL OFF-SITE SOURCE CONTROL ROOM INDICATION (C-IPMR X-WINDING) FOR TRAIN A WITH GROUND OF MORE THAN ONE PHASE		REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	INOPERABILITY OF TRAIN A FOR SIS	GROUND OF 2 OR MORE PHASES REQUIRED FOR THIS FAILURE IN UNGROUNDED DELTA-CONNECTED SYSTEM. TRIP OF FEEDER BRKR 11C02 ISOLATES GROUND FAULT ON SISLOP
12.1.02.01.1	152-1B11 (BBBKR)	BBBKR	OPEN	C-IPMR X-WINDING REACTANCE CANNOT BE BYPASSED, RESULTING IN DEGRADED TRAIN A VOLTAGE CONDITIONS DURING SIS LOADING TRANSIENT WITH NORMAL OFF-SITE SOURCE ALIGNED. NO EFFECT DURING SISLOP DUE TO 11C02 TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	INOPERABILITY OF TRAIN A FOR SIS. NO EFFECT FOR SISLOP	*INCLUDES CONTROL ROOM HANDSWITCH HS-123. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION (EG. DURING DG SURVEILLANCE) BECAUSE OF BUS VOLTAGE DEGRADATION WHICH WOULD OCCUR ON SIS
12.1.02.01.2	152-1B11 (BBBKR)	BBBKR	CLOSED	C-IPMR X-WINDING REACTANCE BYPASSED, RESULTING IN POTENTIAL FOR EXCESSIVE FAULT CURRENTS DURING DG TESTING WITH NORMAL OFF-SITE SOURCE ALIGNED. NO EFFECT ON SIS LOADING TRANSIENT	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR NORMAL OPERATION OR SIS/SISLOP	POTENTIAL INOPERABILITY OF TRAIN A DURING DG LOAD TESTING, NONE FOR NORMAL OPERATION OR SIS/SISLOP	NORMAL POSITION. DG BREAKER TRIPPED ON SIS/SISLOP IF CLOSED
12.1.02.02.1	152-1B11 (BBBKR)	152-11C14 "b" CONTACT	OPEN	(SAME AS 12.1.2.1.1)	PERIODIC TESTING	(SAME AS 12.1.2.1.1)	(SAME AS 12.1.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.1.02.02.2	152-1B11 (BBBKR)	152-11C14 "b" CONTACT	CLOSED	INTERLOCK FROM DG BREAKER DEFEATED, PERMITTING REACTANCE TO BE BYPASSED DURING DG LOAD TESTING	PERIODIC TESTING	(SAME AS 12.1.2.1.2)	(SAME AS 12.1.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.1.02.03.1	152-1B11 (BBBKR)	152-11C14 CELL SWITCH	OPEN	C-IPMR X-WINDING REACTANCE CANNOT BE BYPASSED WITH DG BREAKER CLOSED, EVEN IN DG BRKR TEST POSITION	PERIODIC TESTING	(SAME AS 12.1.2.1.1)	(SAME AS 12.1.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.1.02.03.2	152-1B11 (BBBKR)	152-11C14 CELL SWITCH	CLOSED	INTERLOCK FROM DG BREAKER DEFEATED, PERMITTING REACTANCE TO BE BYPASSED DURING DG BREAKER TESTING	PERIODIC TESTING	(SAME AS 12.1.2.1.2)	(SAME AS 12.1.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.1.02.04.1	152-1B11 (BBBKR)	BUS #1C 125VDC CONTROL POWER (#11C14)	VOLTS LOW	C-IPMR X-WINDING REACTANCE BYPASS BREAKER CANNOT BE REPOSITIONED. IF OPEN, DEGRADES TRAIN A VOLTAGE CONDITION DURING SIS LOADING TRANSIENT. IF CLOSED, RESULTS IN POTENTIAL FOR EXCESSIVE FAULT CURRENTS DURING DG TESTING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A WITH BYPASS BREAKER MISPOSITIONED	*TECH SPEC ACTION ENTRY REQUIRED WITH BYPASS BREAKER MISPOSITIONED

EMERGENCY CORE SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
12.1.03.01.1	152-11C02 (BRBAKBR)	BRBAKBR	OPEN	LOSS OF NORMAL OFF-SITE SOURCE CONTROL ROOM INDICATION FOR TRAIN A. NORMAL FOLLOWING SISLOP. NO EFFECT IF BUS #1C EMERGIZED FROM ALTERNATE SOURCE VIA TIE BRBAKBR 11C01		REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	INOPERABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP	*NORMAL FEEDER BREAKER FOR BUS #1C. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OFFSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT
12.1.03.01.2	152-11C02 (BRBAKBR)	BRBAKBR	CLOSED	NORMAL OFF-SITE SOURCE CANNOT BE ISOLATED FROM BUS #1C, DEGRADING TRAIN A SISLOP RESPONSE BY EMERGIZING C-IPMR VIA X-SECONDARY. ALSO PREVENTS TRAIN B SISLOP FOR DEGRADED GRID CONDITIONS DUE TO INABILITY TO OBTAIN TRAIN A	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE FOR SISLOP WITH DEGRADED GRID CONDITIONS, NONE REQUIRED FOR SIS	*INOPERABILITY OF TRAIN A FOR SISLOP, INOPERABILITY OF TRAIN B FOR SISLOP WITH DEGRADED GRID CONDITIONS, NONE FOR SIS	NORMAL POSITION
12.1.03.02.1	152-11C02 (BRBAKBR)	194 (RELAY)	CONTACTS OPEN (OFF)	BRBAKBR WILL NOT TRIP ON SEQ (LOB, LOP, SISLOP) OR BUS UNDERVOLTAGE SIGNALS	PERIODIC TESTING	(SAME AS 12.1.3.1.2)	*(SAME AS 12.1.3.1.2)	RELAY ACTUATED BY SEQ 1 OR BUS #1C UV RELAY 127-511
12.1.03.02.2	152-11C02 (BRBAKBR)	194 (RELAY)	CONTACTS CLOSED (ON)	BRBAKBR TRIPS, BUT CAN BE RECLOSED AFTER 2 SECOND TIME DELAY	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 12.1.3.1.1)	(SAME AS 12.1.3.1.1)	*SURVEILLANCE TESTING MUST SPECIFICALLY CHECK FOR RELAY CONTACT FAILURE, SINCE TDR PREVENTS RETRIP IF BRER SUBSEQUENTLY RECLOSED
12.1.03.03.1	152-11C02 (BRBAKBR)	C-IPMR PROTECTIVE TRIPS	CONTACTS OPEN	BRBAKBR WILL NOT TRIP IN EVENT OF C-IPMR DIFFERENTIAL, SUDDEN PRESSURE OR OTHER TROUBLE. REMAINING C-IPMR TRIPS TO 11C02 UNAPPECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION OF CONTACTS. FAILURE ADDRESSES ONE TRIP FUNCTION (CONTACT SET) AT A TIME. REMAINING PROTECTIVE TRIPS PREVENT FAULT PROPAGATION TO 4 LV BUGE RM
12.1.03.03.2	152-11C02 (BRBAKBR)	C-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED	BRBAKBR TRIPS IF CLOSED, CAUSING LOB FOR TRAIN A. NORMAL FOR SISLOP WITH C-IPMR TROUBLE. NO EFFECT IF BUS #1C EMERGIZED FROM ALTERNATE SOURCE VIA TIE BRBAKBR 11C01	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP OR IF BUS #1C EMERGIZED FROM ALTERNATE SOURCE	INOPERABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP OR IF BUS #1C EMERGIZED FROM ALTERNATE SOURCE VIA TIE BRBAKBR 11C01	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION
12.1.03.04.1	152-11C02 (BRBAKBR)	BRBR 11C01, 11A04, 11C14, 1811 "a" CONTACTS	CONTACTS OPEN	BUS #1C PARALLELED ALARM INOPERABLE. NO EFFECT ON BRER OPERATION	PERIODIC TESTING	NONE REQUIRED	NONE	BUSB PROTECT BRER CONTROL SCHEME FROM ALARM CBT FAILURE. ALARM ACTUATED IF DG PARALLELED TO C-IPMR W/RII CLOSED OR IF DG OR C-IPMR PARALLELED TO ALTERNATE SOURCE (HATW/A-IPMR)
12.1.03.04.2	152-11C02 (BRBAKBR)	BRBR 11C01, 11A04, 11C14, 1811 "a" CONTACTS	CONTACTS CLOSED	BUS #1C PARALLELED ALARM CANNOT BE CLEARED. NO EFFECT ON BRER OPERATION	PERIODIC TESTING	NONE REQUIRED	NONE	

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.03.05.1	152-11C02 (BBBAAA)	"a" CONTACTS	CONTACTS OPEN	BUS #1C PARALLELED ALARM AND DG DROOP CITS DISABLED. RESULTS IN ISOCHRONOUS DG MODE WHICH CAN CAUSE DG OVERLOAD TRIP DURING PARALLELED OPERATION FOR TESTING OR FOLLOWING OFF-SITE POWER RESTORATION POST-SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A DG DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO ALTERNATE OR NORMAL OFFSITE SOURCE WITHOUT LOSS OF ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. DROOP MODE REQUIRED FOR PARALLELED OPERATION TO PERMIT CONTROL OF DG LOADING. DROOP AND PICKUP OTHERWISE REQUIRED
12.1.03.05.2	152-11C02 (BBBAAA)	"a" CONTACTS	CONTACTS CLOSED	BUS #1C PARALLELED ALARM WILL OCCUR W/ BUS ENERGIZED FROM OTHER SOURCES. DG DROOP CIT ALSO ENABLED, RESULTING IN LOSS OF DG FREQUENCY CONTROL FOR SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN A DG	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. NORMAL POSITION. ISOCHRONOUS MODE REQUIRED FOR LOB, LOP OR SISLOP OPERATION TO ENSURE PROPER FREQUENCY FOR LOAD MOTOR PERFORMANCE
12.1.03.06.1	152-11C02 (BBBAAA)	"b" CONTACTS	CONTACTS OPEN	BUS #1C CANNOT BE RE-ENERGIZED FROM ALTERNATE SOURCE POST-TRIP EXCEPT BY DROP AND PICKUP OF BUS #1A	PERIODIC TESTING	NONE REQUIRED	NONE. NO INTERRUPTION OF BUS #1C ECCS LOADS WILL OCCUR DURING DROP AND PICKUP OF BUS #1A	NORMAL POSITION. DROP AND PICKUP WILL RESULT IN INTERRUPTION OF RCP OPERATION, IF RESTARTED, FOR SGTB EVENTS
12.1.03.06.2	152-11C02 (BBBAAA)	"b" CONTACTS	CONTACTS CLOSED	INTERLOCK TO BUS #1B BREAKER 11C01 DEPARTED, PERMITTING NORMAL OFFSITE SOURCE AND MAIN GENERATOR TO BE PARALLELED MANUALLY THROUGH BUS #1C DURING MAIN GENERATOR COAST-DOWN	PERIODIC TESTING	NONE REQUIRED	NONE	BBBAAA AUXILIARY CONTACT FAILURE AND CONCURRENT OPERATOR ERROR REQUIRED TO PARALLEL MAIN GENERATOR THROUGH BUS #1C. THIS IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS OF PLANT
12.1.03.07.1	152-11C02 (BBBAAA)	186, 1861 (RELAYS)	ON	BREAKER TRIPS AND SENDS OVERLOAD LOCK-OUT SIGNAL TO BLOCK CLOSING OF DG BRKR AND BUS #1B BRKR TO PREVENT RE-ENERGIZING POTENTIALLY FAULTED BUS. NO EFFECT IF DG OR BUS #1B BREAKER ALREADY CLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	OVERLOAD LOCK-OUT PREVENTS CLOSING BRKR TO A FAULTED BUS
12.1.03.07.2	152-11C02 (BBBAAA)	186, 1861 (RELAYS)	OFF	BREAKER OVERLOAD TRIP DISABLED. IF A FAULT OCCURS, POTENTIALLY RESULTS IN 4KV ROOM ELECTRICAL FIRE	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. BUS FAULT PLUS BRKR OVERLOAD RELAY FAILURE IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS OF PLANT
12.1.03.08.1	152-11C02 (BBBAAA)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN A SISLOP RESPONSE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN A FOR SISLOP, NONE FOR SIS	FAILURE TO TRIP 11C02 WOULD RESULT IN RE-ENERGIZING C-1PWR FROM DG #1 VIA BUS #1C
12.1.04.01.1	152-11A04 (BBBAAA)	BBBAAA	OPEN	LOSS OF POWER TO RCPs A AND C IF DURING POWER OPERATION. BUS #1A AND #1C CANNOT BE PBD FROM ALTERNATE OFFSITE SOURCE (MAIN/A 1PWRs)	CONTROL ROOM INDICATION	NORMAL OFFSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN A ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE WITH C-1PWR RELATED LOP	*NORMAL POSITION DURING PLANT S/U PRIOR TO SYNCHRONIZING MAIN GEN TO GRID. SGTB DOSE CALC REV (TO PRECLUDE CREDIT FOR RCPs) AND BOI REV REQD SINCE CANNOT START RCPs FROM BUS #1C/2C POST-SIS/SISLOP WITHOUT INTERRUPTION OF ECCS LOADS DUE TO VOLT TRANSIENT

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 12-1: POWER DISTRIBUTION SYSTEM PMBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.04.01.2	152-11A04 (888A888)	BREAKER	CLOSED	BUS #1A CANNOT BE ISOLATED FROM A-IPMR AND MAIN GENERATOR PERIODIC TESTING FOR STARTUP OR LOVATS. INTERLOCKS PREVENT CLOSURE OF BUS #1C TIE BREAKER WITH MAIN GENERATOR TRIPPED (VOLTS LOW) AND BUS #1C ENERGIZED FROM C-IPMR. NO EFFECT IF BUS #1C ENERGIZED FROM DC	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION DURING POWER OPS. SWD BRKR TRIPS AND RCP OVERCURRENT TRIPS ISOLATE ENERGY SOURCES FROM POTENTIAL MAIN GENERATOR FAULTS
12.1.04.02.1	152-11A04 (888A888)	BB1 (RBLAT)	CONTACTS OPEN (OFF)	AUTOMATIC RECLOSURE OF BRKR FOR LOVATS IS DISABLED. MANUAL BREAKER RECLOSURE FOR ALIGNMENT OFF ALTERNATE OFFSITE SOURCE UNAFFECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OFFSITE SOURCE EVEN IF LOVATS FUNCTIONS AS DESIGNED
12.1.04.02.2	152-11A04 (888A888)	BB1 (RBLAT)	CONTACTS CLOSED (ON)	LOVATS RECLOSURE SIGNAL TO BRKR, PERIODIC TESTING CAUSING PREMATURE RECLOSING BEFORE 18KV ISOLATION COMPLETE	PERIODIC TESTING	NONE REQUIRED	NONE	VERIFICATION REQUIRED THAT MAIN GENERATOR UNDERVOLTAGE RELAY 227E SETPOINT (40%) IS LOW ENOUGH TO PREVENT MOTOR-OPERATED DISCONNECT FAILURE DUE TO FLASHOVER BY RESIDUAL OUTPUT OF GENERATOR
12.1.04.03.1	152-11A04 (888A888)	186-1, 186-2, 186-2A (RBLAYS)	OFF	AUTOMATIC TRIP OR LOCKOUT OF BREAKER OR INTERLOCK TO BUS TIE BRKR 11C01 TO ISOLATE FAULT ON A-IPMR 4 LV OVERCURRENT IS DISABLED	PERIODIC TESTING	NONE REQUIRED	NONE	BACKUP TRIP FROM A-IPMR IS LV OVERCURRENT ISOLATES FAULT FROM MAIN GENERATOR AND TRANSFORMER. FAULT CANNOT BE (RE)ENERGIZED WITHOUT A SECOND FAILURE (EG. BACKUP TRIP FAILURE OR OPERATOR IN-CLOSING BUS TIE BRKR), WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.1.04.03.2	152-11A04 (888A888)	186-1, 186-2, 186-2A (RBLAYS)	ON	BREAKER TRIPS, CANNOT BE RECLOSURE TO ALIGN ALTERNATE OFFSITE SOURCE TO BUS #1C	CONTROL ROOM INDICATION	NORMAL OFFSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN A ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION
12.1.04.04.1	152-11A04 (888A888)	OTHER MAIN GEN MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS OPEN (OFF)	BREAKER WILL NOT TRIP IN EVENT OF IPMR DIFFERENTIAL, SUDDEN PRESSURE OR OTHER MAIN GENERATOR, MAIN IPMR OR A/B IPMR TROUBLE	PERIODIC TESTING	NONE REQUIRED	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DC TO OFFSITE SOURCE WITH C-IPMR RELATED LOP	
12.1.04.04.2	152-11A04 (888A888)	OTHER MAIN GEN MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED (ON)	(SAME AS 12.1.4.3.2)	CONTROL ROOM INDICATION	(SAME AS 12.1.4.3.2)	(SAME AS 12.1.4.3.2)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. CONTACTS CLOSED ON OUT-OF-STEP, OVERSPEED, LOSS OF FIELD, DIFFERENTIAL, NEGATIVE PHASE SEQUENCE, STATOR GROUND, SUDDEN PRESSURE, OR OVERCURRENT

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
FOR ONE OF THE UNITS
TABLE 12-1: POWER DISTRIBUTION SYSTEM EMBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
12.1.04.05.1	152-11A04 (BRBAKBR)	194-2 (BRLAY)	CONTACTS OPEN (GFP)	BRBAKBR WILL NOT AUTOMATICALLY PERIODIC TESTING TRIP ON LOVATS SIGNAL (MAIN GEN TRIPPED, MOTOR OPERATED DISCONNECT CLOSED AND BUS #1C/2C UNDERVOLTAGE). MANUAL TRIP AND RECLOSURE UNAFFECTED (SAME AS 12.1.4.3.2)	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	NORMAL POSITION. OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OFFSITE SOURCE EVEN IF LOVATS FUNCTIONS AS DESIGNED
12.1.04.05.2	152-11A04 (BRBAKBR)	194-2 (BRLAY)	CONTACTS CLOSED (ON)	LOSS OF BRER CLOSED INTERLOCK TO RCP SLOW COASTDOWN ENABLE, SOURCES PARALLELED ALARM AND LOVATS END-OF-SEQUENCE INDICATION. LOSS OF DROOP ENABLE INPUT PREVENTS TRANSFER OF BUS #1C FROM DC TO ALTERNATE OFFSITE SOURCE WITHOUT DROP AND PICKUP	CONTROL ROOM INDICATION	(SAME AS 12.1.4.3.2)	(SAME AS 12.1.4.3.2)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION
12.1.04.06.1	152-11A04 (BRBAKBR)	"a" CONTACTS	CONTACTS OPEN	LOSS OF BRER CLOSED INTERLOCK TO RCP SLOW COASTDOWN ENABLE, SOURCES PARALLELED ALARM AND LOVATS END-OF-SEQUENCE INDICATION. LOSS OF DROOP ENABLE INPUT PREVENTS TRANSFER OF BUS #1C FROM DC TO ALTERNATE OFFSITE SOURCE WITHOUT DROP AND PICKUP	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, REDUNDANT TRAIN FOR SISLOP	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DC TO OFFSITE SOURCE FOR C-IPNR RELATED LOP, WITHOUT LOSS OF BECS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. LOVATS AND RCP SLOW COASTDOWN NOT CREDITED IN SIS/SISLOP EVENTS
12.1.04.06.2	152-11A04 (BRBAKBR)	"a" CONTACTS	CONTACTS CLOSED	RCP SLOW COASTDOWN ENABLED, DC #1 DROOP ENABLED WITH BUS #1A/1C TIE BRBAKBR CLOSED. LOVATS MAY INDICATE END-OF-SEQUENCE PRIOR TO 11A04 RECLOSURE. DROOP ENABLED PREVENTS ISOCRONOUS OPERATION OF DC WITH BUS #1A-1C TIE-BRER CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	*BOI REV REQ: IPNR FROM DC TO ALT OFFSITE SOURCE MUST OCCUR WITH BUS #1B ENERGIZED BEFORE TIE BRER CLOSED, WITH THIS FAILURE
12.1.04.07.1	152-11A04 (BRBAKBR)	"b" CONTACTS	CONTACTS OPEN	LOSS OF BRER OPEN INTERLOCK TO LOVATS AND BUS #1A-1C TIE BRER. LOVATS AUTO-OPEN OF MOTOR OPERATED DISCONNECT AND RECLOSURE OF 11A04/11B04 DISABLED. TIE BRER CANNOT BE CLOSED TO RE-ENERGIZE BUS #1A FROM OFFSITE RECEIPT BY DROP AND PICKUP OF BUS #1C	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	
12.1.04.07.2	152-11A04 (BRBAKBR)	"b" CONTACTS	CONTACTS CLOSED	INTERLOCK DISABLED TO BUS #1A-1C TIE BRER (11C01), PERMITTING PARALLELING OF MAIN GENERATOR TO NORMAL OFFSITE SOURCE THROUGH BUS #1C. NO EFFECT ON MOD DUE TO SEPARATE GENERATOR VOLTS OPEN PERMISSIVE AND TRIP OF BUS LOAD BRBAKBR	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	SECOND FAILURE (OR OPERATOR ERROR) NEEDED FOR PARALLELING OR MOD FAILURE TO OCCUR, WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.1.04.08.1	152-11A04 (BRBAKBR)	BUS #1A 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED IF CLOSED OR RECLOSURE IF OPEN, RESULTING IN LOSS OF ALTERNATE OFFSITE SOURCE TO BUS #1C	CONTROL ROOM INDICATION	NORMAL OFFSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN A ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DC TO OFFSITE SOURCE WITH C-IPNR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.1.05.01.1	BUS #1A NSR LOADS	BREAKER(S)	OPEN	ONE RCP (A OR C) TRIPS AND CANNOT BE RESTARTED FOR SCTR. NO EFFECT ON BCCS LOADS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	INCLUDES RCP-A, RCP-C BREAKERS 152-11A03, 152-11A01 RESPECTIVELY
12.1.05.01.2	BUS #1A NSR LOADS	BREAKER(S)	CLOSED	RCP A OR C CANNOT BE TRIPPED TO CLEAR BUS #1A	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS DURING PLANT STARTUP, OR SISLOP. NORMAL OPPOSITE SOURCE FOR SIS DURING NORMAL OPERATION	REDUCED BLEC MARGIN ON TRAIN A FOR SIS DURING PLANT S/U (W/ TIE BRKR 11C01 CLOSED). TRAIN A ALT OPPOSITE SOURCE ALSO INOP, RESULTING IN POTENTIAL LONG-TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE W/C-IFNR LOP	NORMAL POSITION DURING POWER OPERATION. TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE. FAILURE TO TRIP RCPs SHOWN FOR SIS BY BUS VOLTAGE CALC DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)
12.1.05.02.1	BUS #1A NSR LOADS	127-1X (RELAY)	CONTACTS OPEN (OFF)	RCPs A AND C WILL NOT TRIP AUTOMATICALLY ON BUS #1A UNDERVOLTAGE DURING NORMAL MAIN GENERATOR OPERATION. RCP SLOW COASTDOWN UNDERVOLTAGE TRIP, SIS/SISLOP TRIP AND MANUAL TRIPS UNAFFECTED	PERIODIC TESTING	SIS TRIP OF RCPs, DG AND SISLOP TRIP OF TIE BRKR DURING PLANT STARTUP, NONE REQUIRED FOR SIS/SISLOP DURING NORMAL OPERATION	REDUCED RELIABILITY OF TRAIN A FOR SIS/SISLOP DURING PLANT STARTUP (WITH BUS #1A-1C TIE BRKR CLOSED). NONE FOR SIS/SISLOP DURING NORMAL OPERATION	NORMAL POSITION. BUS #1A UNDERVOLTAGE RELAY
12.1.05.02.2	BUS #1A NSR LOADS	127-1X (RELAY)	CONTACTS CLOSED (ON)	RCPs A AND C TRIP, CANNOT BE RESTARTED WITH MAIN GENERATOR OPERATING. NO EFFECT ON RESTART AFTER MAIN GENERATOR TRIP	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	
12.1.05.03.1	BUS #1A NSR LOADS	281-X 281-Y	ON (281-X CLOSED, 281-Y OPEN)	RCP SLOW COASTDOWN UNDERVOLTAGE TRIP ENABLED, NORMAL UNDERVOLTAGE TRIP DISABLED	PERIODIC TESTING	SIS TRIP OF RCPs, DG AND SISLOP TRIP OF TIE BRKR DURING PLANT STARTUP, NONE REQUIRED FOR SIS/SISLOP DURING NORMAL OPERATION	REDUCED RELIABILITY OF TRAIN A FOR SIS/SISLOP DURING PLANT STARTUP (WITH BUS #1A-1C TIE BRKR CLOSED), NONE FOR NORMAL OPERATION OR AFTER MAIN GENERATOR VOLTS < 40%	RELAYS ENERGIZED WHEN MAIN GENERATOR FREQUENCY < 58 HZ TO SELECT RCP SLOW COASTDOWN VS. NORMAL AT-POWER UNDERVOLTAGE TRIPS. NO EFFECT ON MANUAL TRIP/RESTART OF RCPs FOR SCTR OR ALIGNMENT OF ALTERNATE OPPOSITE SOURCE
12.1.05.03.2	BUS #1A NSR LOADS	281-X 281-Y	OFF (281-X OPEN, 281-Y CLOSED)	RCP SLOW COASTDOWN UNDERVOLTAGE TRIP DISABLED, NORMAL UNDERVOLTAGE TRIP ENABLED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION DURING POWER OPERATION
12.1.05.04.1	BUS #1A NSR LOADS	227X (RELAY)	CONTACTS OPEN (OFF)	RCP A AND C SLOW COASTDOWN TRIP DISABLED (TRIP WILL NOT OCCUR WITH MAIN GEN VOLTS < 40%); NORMAL UNDERVOLTAGE, SIS/SISLOP AND MANUAL TRIPS UNAFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. MAIN GENERATOR UNDERVOLTAGE RELAY. SLOW COASTDOWN TRIP ENABLED ONLY IF BRKR 11A04 OR 11B04 IS CLOSED AND MAIN GENERATOR FREQUENCY IS < 58 HZ.
12.1.05.04.2	BUS #1A NSR LOADS	227X (RELAY)	CONTACTS CLOSED (ON)	RCP COASTDOWN TRIP WILL OCCUR AS SOON AS MAIN GENERATOR FREQUENCY < 58 HZ, IRRESPECTIVE OF VOLTAGE. NORMAL UNDERVOLTAGE TRIP, SIS/SISLOP AND MANUAL TRIPS UNAFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	RELAY DE-ENERGIZED WHEN MAIN GENERATOR VOLTS < 40% AS PART OF RCP SLOW COASTDOWN SEQUENCE

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPFB UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
12.1.05.05.1	BUS #1A MSR LOADS	194-2 (RELAY)	CONTACTS OPEN (OFF)	LOVATS TRIP OF RCPS A AND C DISABLED. NORMAL UNDERVOLTAGE, SIS/SISLOP AND MANUAL TRIPS UNAPPECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. LOVATS NOT CREDITED FOR SIS/SISLOP EVENTS
12.1.05.05.2	BUS #1A MSR LOADS	194-2 (RELAY)	CONTACTS CLOSED (ON)	LOVATS TRIP OF RCPS A AND C. PUMPS CANNOT BE RESTARTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	*SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPS. BOI REVISION REQUIRED TO ADDRESS POTENTIAL INABILITY TO RESTART RCPS IN UNAPPECTED LOOPS
12.1.05.06.1	BUS #1A MSR LOADS	186-SIS (RELAY)	CONTACTS OPEN (OFF)	SIS/SISLOP TRIP OF RCPS A AND C DISABLED. SISLOP TRIP OF BUS #1A-1C TIE BREAKER I1C01 UNAPPECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS DURING PLANT STARTUP, TRIP OF BUS #1A-1C TIE BREAKER FOR SISLOP. NONE REQUIRED FOR SIS DURING NORMAL OPERATION	REDUCED TRAIN A ELECTRICAL MARGIN FOR SIS AND REDUCED RELIABILITY FOR SISLOP, DURING PLANT STARTUP (WITH BUS #1A-1C TIE BREAKER I1C01 CLOSED)	NORMAL POSITION. FAILURE TO TRIP RCPS DUE TO THIS SINGLE FAILURE SHOWN ACCEPTABLE FOR SIS BY BUS VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)
12.1.05.06.2	BUS #1A MSR LOADS	186-SIS (RELAY)	CONTACTS CLOSED (ON)	RCPS A AND C TRIP, CANNOT BE RESTARTED	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	*SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPS
12.1.05.07.1	BUS #1A MSR LOADS	BUS #1A 125VDC CONTROL POWER	VOLTS LOW	RCPS A AND C CANNOT BE TRIPPED OR RESTARTED. TIE BRKR TRIP UNAPPECTED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS DURING PLANT STARTUP OR FOR SISLOP, NONE REQUIRED FOR SIS DURING NORMAL OPERATION	REDUCED TRAIN A ELECTRICAL MARGIN FOR SIS DURING PLANT STARTUP (W/ TIE BRKR I1C01 CLOSED). TRAIN A ALT OPPOSITE SOURCE ALSO INOP, CAUSING POTENTIAL LONG TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE W/ C-1PFR LOP	*TRCH SPEC ACTION ENTRY REQUIRED FOR INOP ALTERNATE OPPOSITE SOURCE ON TRAIN A. FAILURE TO TRIP RCPS SHOWN ACCEPTABLE FOR SIS BY VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)
12.1.06.01.1	BUS #1A CONTROLS	194-2 (RELAY)	CONTACTS OPEN (OFF)	BUS #1A FEEDER BRKR 11A04 AND RCPS A AND C WILL NOT AUTOMATICALLY TRIP ON LOVATS SIGNAL, CAUSING SLOW RCP COASTDOWN ON MAIN GENERATOR VS. PLYWHEEL COASTDOWN. MANUAL TRIPS UNAPPECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OPPOSITE SOURCE EVEN IF LOVATS FUNCTIONS AS DESIGNED
12.1.06.01.2	BUS #1A CONTROLS	194-2 (RELAY)	CONTACTS CLOSED (ON)	UNDERVOLTAGE TRIP OF ALL RCPS, EXCITER AND BUS #1A/1B FEEDER BRKRS 11A04 AND 11B04 FOR ANY MAIN GENERATOR TRIP WITH MOTOR OPERATED DISCONNECT CLOSED. TRIP SIGNALS TO BUS #1B, RCP B AND EXCITER RESET WHEN MOTOR OPERATED DISCONNECT IS OPENED	PERIODIC TESTING	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN A ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-1PFR RELATED LOP. NONE FOR SIS WITH NORMAL OPPOSITE SOURCE ALIGNED	*TRCH SPEC ACTION ENTRY REQUIRED WHENEVER BUS #1C OR 2C ENERGIZED FROM ALTERNATE OPPOSITE SOURCE
12.1.07.01.1	152-11C01 (BREAKER)	BREAKER	OPEN	LOSS OF POWER TO RCPS A AND C DURING PLANT STARTUP, INABILITY TO ALIGN BUS #1C TO ALTERNATE SOURCE	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN A ALTERNATE OPPOSITE SOURCE INOP, RESULTING IN POTENTIAL LONG-TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE FOR C-1PFR RELATED LOP. RCPS A AND C CANNOT BE RE-ENERGIZED FROM MAIN/A-1PFR POST-SGTR	*BOI REVISION REQUIRED TO PRECLUDE RCP RESTART FROM BUS #1C/2C POST-SIS/SISLOP TO PREVENT LOSS OF BECS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT. SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCP OPERATION

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.07.01.2	152-11C01 (BBBAERB)	BBBAERB	CLOSED	BUS #1A CANNOT BE ISOLATED FROM BUS #1C	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, RCP TRIP FOR SIS	TRAIN A INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	*NORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OFFSITE SOURCE TO BUS #1C. NO CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT
12.1.07.02.1	152-11C01 (BBBAERB)	186 (11C02)	CONTACTS OPEN (ON)	BREAKER CANNOT BE CLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN A INOPERABLE	11C02-186 RELAY ALSO TRIPS 11C02 AND BLOCKS CLOSING OF DG BRKR 11C14, RESULTING IN LOSS OF BUS #1C
12.1.07.02.2	152-11C01 (BBBAERB)	186 (11C02)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM BUS #1C NORMAL FEEDER 11C02 DISABLED, PERMITTING PARALLELING OF BUS #1A TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. C-IPNR X-WDOG OVERCURRENT LOCKOUT RELAY. SECOND FAILURE (EG. OPERATOR ERROR) NEEDED FOR PARALLELING TO OCCUR, WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.1.07.03.1	152-11C01 (BBBAERB)	186-2A (11A04)	CONTACTS OPEN (ON)	BREAKER CANNOT BE CLOSED	CONTROL ROOM INDICATION	NORMAL OFFSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	INOPERABILITY OF TRAIN A ALTERNATE OFFSITE SOURCE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE WITH C-IPNR RELATED LOP	11A04 186-2A RELAY ALSO TRIPS 11A04. RCPs A AND C UNAVAILABLE POST-SGTR AS A RESULT OF THIS FAILURE
12.1.07.03.2	152-11C01 (BBBAERB)	186-2A (11A04)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM BUS #1A NORMAL FEEDER 11A04 DISABLED, PERMITTING PARALLELING OF BUS #1C TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. SECOND FAILURE (EG. OPERATOR ERROR) NEEDED FOR PARALLELING TO OCCUR, WHICH IS OUTSIDE THE SIS/SISLOP DESIGN BASIS
12.1.07.04.1	152-11C01 (BBBAERB)	152-11C02 "b" CONTACTS	CONTACTS OPEN	BREAKER CANNOT BE CLOSED TO ENERGIZE BUS #1C FROM ALTERNATE OFFSITE SOURCE POST-TRIP RECEIPT BY DROP AND PICKUP OF BUS #1A	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP. NO INTERRUPTION OF ECCS LOADS WILL OCCUR DURING DROP AND PICKUP OF BUS #1A	INTERRUPTION OF RCPs A AND C COULD OCCUR POST-SGTR WITH LOSS OF NORMAL OFFSITE SOURCE. CONTACTS PARALLELED WITH 227-Y RELAY CONTACTS (WHICH OPEN ON LOW MAIN GENERATOR VOLTAGE) IN BREAKER CONTROL CIRCUIT
12.1.07.04.2	152-11C01 (BBBAERB)	152-11C02 "b" CONTACTS	CONTACTS CLOSED	INTERLOCK FROM 11C02 DEBATED, PERMITTING NORMAL OFFSITE SOURCE AND MAIN GENERATOR TO BE PARALLELED MANUALLY THROUGH BUS #1C DURING MAIN GENERATOR COASTDOWN	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	CONCURRENT OPERATOR ERROR IS REQUIRED FOR PARALLELING TO OCCUR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE THE SIS/SISLOP DESIGN BASIS
12.1.07.05.1	152-11C01 (BBBAERB)	152-11A04 "b" CONTACTS	CONTACTS OPEN	BREAKER CANNOT BE CLOSED POST-TRIP UNLESS BUS #1C FEEDER BRKR 11C02 IS OPEN. REQUIRES TRANSFER BY DROP AND PICKUP FOR SIS. NO EFFECT FOR SISLOP OR WITH MAIN GENERATOR ON LINE	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	TRANSFER TO ALTERNATE OFFSITE SOURCE NOT REQUIRED FOR SIS, UNAFFECTED FOR SISLOP. FAILURE DOES NOT PREVENT RCPs A AND C RESTART FOR SGTR FROM ALTERNATE OFFSITE SOURCE, IF NEEDED

TABLE 12-1: POWER DISTRIBUTION SYSTEM PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.07.05.2	152-11C01 (BRKARBB)	152-11A04 "b" CONTACTS	CONTACTS CLOSED	INTERLOCK FROM 11A04 DEPRATED, PERMITTING NORMAL OPPOSITE SOURCE AND MAIN GENERATOR TO BE PARALLELED MANUALLY THROUGH BUS #1C DURING MAIN GENERATOR COASTDOWN. NO EFFECT WITH MAIN GENERATOR ON LINE	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	THIS SINGLE FAILURE PLUS CONCURRENT OPERATOR ERROR REQUIRED FOR PARALLELING, WHICH IS A DOUBLE FAILURE OUTSIDE SIS/SISLOP DESIGN BASIS
12.1.07.06.1	152-11C01 (BRKARBB)	227T (RELAY)	CONTACTS OPEN (ON)	BUS #1A AND 1C CANNOT BE PARALLELED DURING NORMAL POWER OPERATION EXCEPT BY DROP AND PICKUP OF EITHER BUS. NO EFFECT ON BUS OPERATIONS	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION FOLLOWING PLANT TRIP AND MAIN GENERATOR/RCP COASTDOWN
12.1.07.06.2	152-11C01 (BRKARBB)	227T (RELAY)	CONTACTS CLOSED (OFF)	INTERLOCK FROM MAIN GENERATOR VOLTAGE DEPRATED, PERMITTING NORMAL OPPOSITE SOURCE TO BE PARALLELED MANUALLY WITH MAIN GENERATOR THROUGH BUS #1C DURING MAIN GENERATOR COASTDOWN	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION DURING POWER OPERATION. THIS FAILURE PLUS CONCURRENT OPERATOR ERROR DURING SIS/SISLOP EVENT IS A DOUBLE FAILURE WHICH IS OUTSIDE PLANT DESIGN BASIS
12.1.07.07.1	152-11C01 (BRKARBB)	SRQ 1 (13-9,11)	CONTACTS OPEN (OFF)	BREAKER WILL NOT TRIP ON SISLOP	PERIODIC TESTING	NONE REQUIRED FOR SIS OR FOR SISLOP DURING NORMAL POWER OPERATION. REDUNDANT TRAIN FOR SISLOP DURING PLANT STARTUP	NONE FOR SIS, POTENTIAL INOPERABILITY OF TRAIN A FOR SISLOP DURING PLANT STARTUP (WITH BUS #1A/1C TIE BREAKER 11C01 CLOSED)	NORMAL POSITION. TRIP ENSURES THAT DG DOES NOT ATTEMPT TO EMERGIZE RCP. POST-SISLOP
12.1.07.07.2	152-11C01 (BRKARBB)	SRQ 1 (13-9,11)	CONTACTS CLOSED (ON)	BREAKER TRIPS AND CANNOT BE RECLOSUD, PREVENTING BUS #1A AND 1C FROM BEING PARALLELED	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	INOPERABILITY OF TRAIN A ALTERNATE OPPOSITE SOURCE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-IPNR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
12.1.07.08.1	152-11C01 (BRKARBB)	194 (RELAY)	CONTACTS OPEN (OFF)	BREAKER WILL NOT TRIP ON BUS #1C UNDERVOLTAGE. SEPARATE SRQ 1 SISLOP SIGNAL TO BREAKER NOT AFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN A FOR SIS DURING PLANT STARTUP (WITH BUS #1A/1C TIE BRKR CLOSED). NONE FOR SISLOP DUE TO SEPARATE SISLOP TRIP OF TIE BRKR	NORMAL POSITION. RELAY ACTUATED BY SRQ 1 (SISLOP ONLY) OR BUS #1C UNDERVOLTAGE. UNDERVOLTAGE INPUT IS BLOCKED AFTER 1 SECOND BY TIME DELAY RELAY
12.1.07.08.2	152-11C01 (BRKARBB)	194 (RELAY)	CONTACTS CLOSED (ON)	BREAKER TRIPS, CAN BE RECLOSUD IF NEEDED AFTER 2 SEC. IF FAILURE OCCURS WHEN BREAKER OPEN (EG. NORMAL POWER OPERATION), WILL NOT SUBSEQUENTLY TRIP IF NEEDED. SISLOP TRIP OF BRKR UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN A FOR SIS DURING PLANT STARTUP (WITH BUS #1A/1C TIE BRKR CLOSED). NONE FOR SISLOP DUE TO SEPARATE SISLOP TRIP OF TIE BRKR	*TECH SPEC ACTION ENTRY REQUIRED WITH BUS #1C EMERGIZED FROM ALTERNATE OPPOSITE SOURCE

EMERGENCY CORRECTING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRES UNIT 1
 TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
12.1.07.09.1	152-11C01 (BBBAKBB)	"a" CONTACTS	OPEN	SOURCES PARALLELED ALARM AND DC DROOP CIRCUIT INPUT DISABLED. RESULTS IN ISOCHRONOUS DC MODE IP BRKR 11A04 CLOSED (EG. TO RESTART RCPS), WHICH CAN CAUSE DC OVERLOAD TRIP DURING TRANSFER BACK TO OPPOSITE POWER FOR SISLOP RECOVERY	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DC TO OPPOSITE SOURCE WITH C-IPMR RELATED LOP. NONE FOR SIS	*NORMAL POSITION DURING POWER OPERATION. TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. DROOP MODE REQUIRED TO CONTROL DC LOAD WHEN PARALLELED TO OPPOSITE SOURCE. OTHERWISE DROP AND PICKUP REQUIRED
12.1.07.09.2	152-11C01 (BBBAKBB)	"a" CONTACTS	CLOSED	SOURCES PARALLELED ALARM WILL OCCUR WITH BRKRS 11A04 AND 11C02 CLOSED (EG. DURING NORMAL OPERATION). DC DROOP CIRCUIT ENABLED IF BRKR 11A04 CLOSED (EG. TO RESTART RCPS POST-SIS/SISLOP), RESULTING IN LOSS OF DC FREQ CONTROL FOR SISLOP	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN A DC FOR SISLOP, NONE FOR SIS	NORMAL POSITION DURING PLANT STARTUP. ISOCHRONOUS MODE REQUIRED FOR LOB, LOP OR SISLOP OPERATION TO ENSURE PROPER FREQUENCY FOR LOAD MOTOR OPERATION
12.1.07.10.1	152-11C01 (BBBAKBB)	"b" CONTACTS	OPEN	DC BREAKER CANNOT BE CLOSED	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN A FOR SISLOP, NONE FOR SIS	NORMAL POSITION DURING PLANT STARTUP. INTERLOCKS DO NOT BLOCK CLOSING OF BUS TIE BRKR 11C01 IF DC BRKR ALREADY CLOSED
12.1.07.10.2	152-11C01 (BBBAKBB)	"b" CONTACTS	CLOSED	INTERLOCK TO DC BREAKER DISABLED, PERMITTING DC BRKR TO CLOSE WHEN BUS #1A PARALLELED TO BUS #1C (EG. DURING PLANT STARTUP)	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION DURING POWER OPERATION. SEPARATE SISLOP TRIP OF BRKR PREVENTS AUTOMATIC PARALLELING FOR SISLOP EVENT. SECOND FAILURE OR OPERATOR ERROR REQUIRED TO INADVERTANTLY PARALLEL FOR SIS
12.1.07.11.1	152-11C01 (BBBAKBB)	186 (11C01)	ON	BREAKER TRIPS AND SENDS OVERLOAD LOCK-OUT SIGNAL TO BLOCK CLOSING OF DC BRKR, TO PREVENT RE-ENERGIZING POTENTIALLY FAULTED BUS	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	INOPERABILITY OF TRAIN A ALTERNATE OPPOSITE SOURCE AND DC	
12.1.07.11.2	152-11C01 (BBBAKBB)	186 (11C01)	OFF	BREAKER OVERLOAD TRIP DISABLED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. SEPARATE BUS #1A/1C FREQ BRKR OVERCURRENT TRIPS WOULD CLEAR FAULTS WITH THIS FAILURE
12.1.07.12.1	152-11C01 (BBBAKBB)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN A SISLOP RESPONSE AND PREVENTING TRAIN B SISLOP IF BREAKER INITIALLY CLOSED TO ALIGN BUS #1C TO ALTERNATE OPPOSITE SOURCE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP FROM NORMAL ALIGNMENT, NONE FOR TRAIN A INITIALLY ALIGNED TO ALTERNATE OPPOSITE SOURCE	*INOPERABILITY OF TRAIN A FOR SISLOP, AND TRAIN B FOR SISLOP WITH TRAIN A ALIGNED TO ALTERNATE OPPOSITE SOURCE	*SINCE MAIN GENERATOR COASTDOWN ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ACTION ENTRY IS REQUIRED WHENEVER BUS #1C OR 2C IS ALIGNED TO THE ALTERNATE OPPOSITE SOURCE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 12-1: POWER DISTRIBUTION SYSTEM PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
12.1.09.01.1	[NOT USED]							[THIS BLOCK OF RECORDS RESERVED FOR DUPLICATION OF DC BREAKER RECORDS FROM SECTION 10, IF REQUIRED]
12.1.09.01.1	152-11C10 (BRBAER)	BRBAER	OPEN	LOSS OF TRAIN A 480V LOADS ON SWGR #1 AND MCCS, INCLUDING IMMEDIATE LOSS OF REP WTR PP, RECIRC, CCW, SVC, 2 MPW ISOLATION HOVS, 1 SI/CLR FLOW PATH, AND DELAYED FAILURE OF MPW PP, CRG PP, DG AND DC BUS #1 DUE TO LOSS OF COOLING AND BATTERY CHARGING	CONTROL ROOM INDICATION	REDUNDANT TRAIN AND FLOW PATHS, FAIL-CLOSED BV-851B (W/ BACKUP M2) AND BV-3900 FOR CONTAINMENT ISOLATION. NONE FOR REDUCED CLR HEAT REMOVAL	*TRAIN A BECS INOPERABLE, TRAIN B CLR HEAT REMOVAL DEGRADED DUE TO UNISOLABLE BYPASS THROUGH IDLE CCW BI	*SST #1 4kV FEEDER BRKR. SEE ITEMS 6.1.4.3.1 AND 7.1.3.2.1. ADDITIONALLY, NO REVISION REQUIRED TO TRIP TRAIN A SI/PW PUMPS PRIOR TO LOSS OF 125VDC BUS #1 FOR THIS FAILURE, TO ENSURE BI TERMINATION AT LO-LO HIGHEST LEVEL SETPOINT
12.1.09.01.2	152-11C10 (BRBAER)	BRBAER	CLOSED	NONE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF 480V SWGR #1 ENERGIZED FROM BUS 1-3 TIE BRBAER IN LIEU OF SST #1 VIA THIS BRBAER
12.1.09.02.1	152-11C10 (BRBAER)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BRBAER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
12.1.10.01.1	152-11C11 (BRBAER)	BRBAER	OPEN	LOSS OF POWER TO LOADS ON 480V SWGR #3 AND MCCS, INCLUDING MOV-883 AND DMOV-358/850C UPS BATTERY CHARGER	CONTROL ROOM INDICATION	UPS FOR LOADS REQUIRED IN (30 MIN, OP ACTION TO RESTORE POWER >30 MIN FROM SWGR #1-3 OR 2-3 TIE BRKR	LOSS OF NORMAL POWER SOURCE TO SWGR #3 LOADS	SST #3 4kV FEEDER BRBAER. INCLUDES CONTROL ROOM HANDSWITCH AND LOCAL/REMOTE INDICATION. NORMAL POSITION POST-SIS/SISLOP
12.1.10.01.2	152-11C11 (BRBAER)	BRBAER	CLOSED	BRBAER WILL NOT TRIP ON SEQ 1 SIS/SISLOP OR BUS #1C UNDERVOLTAGE. SWGR #3 480V BRKR 52-1303 TRIP ON SEQ 2 SISLOP UNAPPECTED	PERIODIC TESTING	REDUNDANT TRAIN (SIS/SISLOP) AND TRAIN B TRIP OF BRKR 52-1303 (SISLOP)	INOPERABILITY OF TRAIN A FOR SIS, REDUCED RELIABILITY FOR SISLOP	NORMAL POSITION DURING POWER OPERATION. SWGR #3 POWERED LOADS NOT ASSUMED IN DG LOADING OR BUS VOLTAGE CALCS, AND MUST ALSO BE LOCKED OUT ON SISLOP TO PRECLUDE FAILURE PROPAGATION FROM UNQUALIFIED MCC-3 IN TURBTW BLOC FOR HSLB ONLY ONE BRKR (11C11 OR 12C11) RACKED IN AT ONE TIME TO PRECLUDE PARALLELING REDUNDANT 4kV BUS #1C AND 2C
12.1.10.02.1	152-11C11 (BRBAER)	152-12C11 "b" CONTACTS	OPEN	BRKR CANNOT BE RECLOSED IF TRIPPED (EG. ON SIS/SISLOP)	PERIODIC TESTING	(SAME AS 12.1.10.1.1)	(SAME AS 12.1.10.1.1)	11C11 NORMALLY RACKED IN AND 12C11 NORMALLY TRIPPED AND RACKED OUT (IE, "b" CONTACTS CLOSED)
12.1.10.02.2	152-11C11 (BRBAER)	152-12C11 "b" CONTACTS	CLOSED	BRKR CAN RECEIVE CLOSE SIGNAL WITH 12C11 RACKED IN	PERIODIC TESTING	CELL SWITCH FROM 12C11 PROVIDES TRIP SIGNAL TO BRBAER WHENEVER 12C11 IS NOT RACKED OUT	REDUCED REDUNDANCY AGAINST PARALLELING BUS #1C AND 2C	11C11 NORMALLY RACKED IN AND 12C11 NORMALLY TRIPPED AND RACKED OUT (IE, "b" CONTACTS CLOSED)
12.1.10.03.1	152-11C11 (BRBAER)	152-12C11 CELL SWITCH CONTACTS	OPEN	BRBAER WILL NOT TRIP OPEN WHEN 12C11 RACKED IN	PERIODIC TESTING	"b" CONTACTS AND CELL SWITCH CONTACTS FROM 11C11 PROVIDE TRIP AND PREVENT CLOSING OF 12C11 EVEN IF RACKED IN	REDUCED REDUNDANCY AGAINST PARALLELING BUS #1C AND 2C	NORMAL POSITION WITH 12C11 RACKED OUT

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.10.03.2	152-11C11 (BRKBR)	152-12C11 CBLL SWITCH CONTACTS	CLOSED	BRKBR WILL TRIP AND CANNOT BE RECLOSED, CAUSING LOSS OF POWER TO LOADS ON 480V SWGR #3 AND MCCS, INCLUDING NOV-883 AND NOV-358/850C UPS BATTERY CHARGER	CONTROL ROOM INDICATION	UPS FOR LOADS REQUIRED IN < 30 MIN, OR ACTION TO RESTORE POWER > 30 MIN FROM SWGR #1-3 OR 2-3 TIE BRK	LOSS OF NORMAL POWER SOURCE TO SWGR #3 LOADS	
12.1.10.04.1	152-11C11 (BRKBR)	SEQ 1 (18-2,4)	CONTACTS OPEN (OFF)	BRKBR WILL NOT TRIP ON SIS/SISLOP. SWGR #3 480V BRK 52-1301 TRIP ON SEQ 2 SISLOP UNEXPECTED	PERIODIC TESTING	(SAME AS 12.1.10.1.2)	(SAME AS 12.1.10.1.2)	NORMAL POSITION
12.1.10.04.2	152-11C11 (BRKBR)	SEQ 1 (18-2,4)	CONTACTS CLOSED (ON)	BRKBR WILL TRIP, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	(SAME AS 12.1.10.1.1)	(SAME AS 12.1.10.1.1)	SEQ INPUT TO BRKBR IS A MOMENTARY TRIP. RELAY FAILURE SIGNAL
12.1.10.05.1	152-11C11 (BRKBR)	127-511 (RELAY)	CONTACTS OPEN (OFF)	BRKBR WILL NOT TRIP ON BUS #1C UNDERVOLTAGE. SIS/SISLOP TRIP UNEXPECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. UNDERVOLTAGE TRIP AT 11.5 SEC IS NOT CREDITED FOR SISLOP EVENTS
12.1.10.05.2	152-11C11 (BRKBR)	127-511 (RELAY)	CONTACTS CLOSED (ON)	BRKBR WILL TRIP, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	(SAME AS 12.1.10.1.1)	(SAME AS 12.1.10.1.1)	
12.1.10.06.1	152-11C11 (BRKBR)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BRKBR CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS, TRAIN INOPERABILITY OF TRAIN A FOR B TRIP OF BRK 52-1301 FOR SISLOP, UPS FOR REQUIRED LOADS SISLOP, POTENTIAL LOSS OF < 30 MIN, OPERATOR ACTION > 30 MINUTES TO CLOSE 480 V TIE BRK	DC LOADING AND BUS VOLTAGE CALCULATIONS DO NOT INCLUDE SWGR #3 LOADS, AND ISOLATION OF SWGR #3 IS REQUIRED FOR NSLB OUTSIDE CONTAINMENT DUE TO UNQUALIFIED MCC-3 IN TURBINE BLDG	
12.1.11.01.1	BUS #1C NSR LOADS	BRKBR	OPEN	TRAIN A MAIN CIRC PUMP, TPCW PUMP, CONDENSATE PUMP(S), HEATER DRAIN PUMP OR NORMAL LIGHTING TRANSFORMER TRIPS AND CANNOT BE RE-ENERGIZED	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	INCLUDES BRKBR 11C03, 11C06, 11C08, 11C09, 11C12, 11C13
12.1.11.01.2	BUS #1C NSR LOADS	BRKBR	CLOSED	TRAIN A MAIN CIRC PUMP, TPCW PUMP, CONDENSATE PUMP(S), HEATER DRAIN PUMP OR NORMAL LIGHTING TRANSFORMER CANNOT BE TRIPPED ON BUS UNDERVOLTAGE OR SEQ (AS APPLICABLE)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A FOR SISLOP, REDUCED RELIABILITY FOR SIS	CONDENSATE AND HEATER DRAIN PUMPS RECEIVE DIRECT SEQ SIS/SISLOP SIGNALS TO TRIP AS PART OF RFW ISOLATION. VALVES AND INTERLOCKS PREVENT UNANALYZED CONDENSATE INJECTION EVEN IF PUMPS DO NOT TRIP
12.1.12.01.1	BUS #1C UNDERVOLTAGE AND CONTROL	127-3	ON (VOLTS NORMAL)	UV AUXILIARY RELAYS 127-3X AND 127-7X WILL NOT DE-ENERGIZE AS REQUIRED ON BUS UNDERVOLTAGE OR (SIS)LOP, REDUCING REDUNDANCY OF BUS #1C UV INPUTS TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B	PERIODIC TESTING	REDUNDANT BUS #1C INPUTS FROM UV RELAY 127-3 AND AUX RELAYS 127-9X AND 127-11X PREVENT LOSS OF FUNCTION	REDUCED REDUNDANCY FOR BUS #1C UV SIGNAL TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B, LOGIC FOR TRAIN A LOB BECOMES 1/1 ON REMAINING BUS #1C UV INPUT	NORMAL POSITION. RELAYS 127-7X AND 127-11X DRIVE TIME DELAY RELAYS 162-7X AND 162-11X RESPECTIVELY TO PREVENT STAGGERED DG START FOLLOWING SISLOP FROM DISABLING AUTO-LOAD LOGIC FOR SLOW TRAIN
12.1.12.01.2	BUS #1C UNDERVOLTAGE AND CONTROL	127-3	OFF (VOLTS LOW)	UV AUXILIARY RELAYS 127-3X AND 127-7X DE-ENERGIZE, SENDING BUS #1C UV SIGNAL TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	MAINTAINED UV INPUT WILL PREVENT RESTART OF TRAIN A LOADS. TRAIN B SISLOP CONDITION WILL RESULT IN SEQ #2 SISLOP WITH THIS FAILURE

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.1.12.02.1	BUS #1C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-5	ON (VOLTS NORMAL)	UV AUXILIARY RELAYS 127-5I AND PERIODIC TESTING 127-5II WILL NOT DE-ENERGIZE AS REQUIRED ON BUS UNDERVOLTAGE OR (SIS)LOP, DISABLING NORMAL UNDERVOLTAGE TRIP OF TRAIN A 4kV LOADS, LOVATS AND UNIT UV TRIP, AND TRAIN A RFP WTR PP TIMING INPUT		NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. LOVATS AND UNIT UV TRIP NOT CREDITED FOR SIS/SISLOP EVENTS. CONTAINMENT SPRAY PUMP RECEIVES INDEPENDENT TIMING SIGNAL FROM SEQ FOR SISLOP START
12.1.12.02.2	BUS #1C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-5	OFF (VOLTS LOW)	UV AUXILIARY RELAYS 127-5I AND CONTROL ROOM INDICATION 127-5II DE-ENERGIZE, RESULTING IN A BUS #1C UV SIGNAL TO LOVATS AND UNIT UV TRIP, TRAIN A RFP WTR PP TIMING INPUT AND BUS #1C 4kV LOADS. UV TRIP OF BUS #1C 4kV LOADS IS BLOCKED AFTER 1 SEC BY A TIME DELAY RELAY		REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	RANDOMLY TIMED FAILURE WILL CAUSE INTERRUPTION OF TRAIN A SIS/SISLOP RESPONSE. LOVATS AND UNIT TRIP LOGIC BECOME 1/1 ON BUS #2C UV INPUT
12.1.12.03.1	BUS #1C UNDERVOLTAGE AND POWER SWITCH # CONTROL	125VDC CONTROL 11C02	OPEN	UV AUXILIARY RELAYS 127-3I, 127-7I, 127-5I AND 127-5II DE-ENERGIZE, RESULTING IN A BUS #1C UV SIGNAL TO SEQ 1, SEQ 2, CSAS-A, CSAS-B, LOVATS AND UNIT UV TRIP, TRAIN A RFP WTR PP TIMING INPUT AND BUS #1C 4kV LOADS (FOR 1 SEC BEFORE TOR ACTUATION)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	RANDOMLY TIMED FAILURE WILL CAUSE INTERRUPTION OF TRAIN A SIS/SISLOP RESPONSE. LOVATS AND UNIT TRIP LOGIC BECOME 1/1 ON BUS #2C UV INPUT. TRAIN B SISLOP WILL RESULT IN SEQ 2 SISLOP WITH THIS FAILURE
12.1.12.03.2	BUS #1C UNDERVOLTAGE AND POWER SWITCH # CONTROL	125VDC CONTROL 11C02	CLOSED	UV RELAYS 127-3 AND 127-5 FUNCTION NORMALLY	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
12.1.12.04.1	BUS #1C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-9	ON (VOLTS NORMAL)	UV AUXILIARY RELAYS 127-9I AND PERIODIC TESTING 127-11I WILL NOT DE-ENERGIZE AS REQUIRED ON BUS #1C UNDERVOLTAGE OR (SIS)LOP, REDUCING REDUNDANCY OF BUS #1C UV INPUTS TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B		REDUNDANT BUS #1C UV INPUTS FROM UV RELAY 127-3 AND AUX RELAYS 127-3I AND 127-7I	REDUCED REDUNDANCY FOR BUS #1C UNDERVOLTAGE SIGNAL TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B. TRAIN A LOGIC BECOMES 1/1 ON REMAINING BUS #1C UV INPUTS	NORMAL POSITION
12.1.12.04.2	BUS #1C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-9	OFF (VOLTS LOW)	UV AUXILIARY RELAYS 127-9I AND CONTROL ROOM INDICATION, 127-11I DE-ENERGIZE, SENDING BUS #1C UNDERVOLTAGE SIGNAL TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B	ANNUNCIATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A FOR SIS, CONTAINMENT SPRAY FOR SISLOP	
12.1.12.05.1	BUS #1C UNDERVOLTAGE AND POWER SWITCH # CONTROL	125VDC CONTROL 11C03	OPEN	(SAME AS 12.1.12.4.1)	PERIODIC TESTING	(SAME AS 12.1.12.4.1)	(SAME AS 12.1.12.4.1)	
12.1.12.05.2	BUS #1C UNDERVOLTAGE AND POWER SWITCH # CONTROL	125VDC CONTROL 11C03	CLOSED	UV RELAY 127-9 FUNCTIONS NORMALLY	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION

TABLE 12-1: POWER DISTRIBUTION SYSTEM FHRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.12.06.1	BUS #1C UNDERVOLTAGE AND CONTROL	SRQ 1 (15-9,11)	CONTACTS OPEN (OFF)	BUS #1C LOADS (RECEPT COND, HTR DR, TPCW PP) AND NORMAL FEEDER BREAKER WILL NOT TRIP AND REMAIN OPEN ON SRQ 1 SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN A FOR SISLOP, NONE FOR SIS	*NORMAL POSITION. MAINTAINED TRIP SIGNAL REQUIRED FOR MSR LOADS TO PREVENT START POST-SISLOP. COND PPS, HTR DR PP, TPCW PP AND BUS #1A/1C TIE BREAKER ARE LOCKED OUT BY SEPARATE MAINTAINED SRQ CONTACTS OR OVERLOAD LOCKOUT RELAY ACTUATION
12.1.12.06.2	BUS #1C UNDERVOLTAGE AND CONTROL	SRQ 1 (15-9,11)	CONTACTS CLOSED (ON)	BUS #1C LOADS AND TIE BREAKER TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	TRIP SIGNALS AUTOMATICALLY CLEARED BY TIME DELAY RELAY WHICH RESETS UV RELAYS 194 AND 194-1
12.1.12.07.1	BUS #1C UNDERVOLTAGE AND CONTROL	194 194-1 (RELAYS)	CONTACTS OPEN (OFF)	BUS #1C FEEDER AND TIE BREAKERS (11C01 AND 11C02) AND LOADS (RECEPT NORMAL LIGHTING TRANSFORMER AND SST-1 AND SST-3) WILL NOT TRIP ON BUS #1C UNDERVOLTAGE OR (RECEPT COND, HTR DR, TPCW PPS AND TIE BREAKER) ON SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN A FOR SISLOP, NONE FOR SIS	NORMAL POSITION. COND PPS, HTR DR PP, TPCW PP AND BUS #1A/1C TIE BREAKER ARE LOCKED OUT BY SEPARATE MAINTAINED SRQ CONTACTS OR OVERLOAD LOCKOUT RELAY ACTUATION
12.1.12.07.2	BUS #1C UNDERVOLTAGE AND CONTROL	194 194-1 (RELAYS)	CONTACTS CLOSED (ON)	BUS #1C FEEDER AND TIE BREAKERS (11C01 AND 11C02) AND LOADS (RECEPT NORMAL LIGHTING TRANSFORMER AND SST-1 AND SST-3) TRIP	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	*LOCKOUT NOT CURRENTLY PROVIDED FOR MSR LOADS, EXCEPT THOSE RECEIVING A SEPARATE MAINTAINED SISLOP SIGNAL (EG. CONDENSATE AND HEATER DRAIN PP) ON SISLOP ACTUATION OF OVERLOAD LOCKOUT (EG. TPCW) CONTROL POWER FROM 11C01 CUBICLE
12.1.12.08.1	BUS #1C UNDERVOLTAGE AND CONTROL POWER CONTROL	BUS #1C 125VDC	VOLTS LOW	BUS #1C FEEDER AND TIE BREAKERS (11C01 AND 11C02) AND LOADS WILL NOT TRIP ON BUS #1C UNDERVOLTAGE OR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	
12.2.01.01.1	Y-WINDING CURRENT LIMITING REACTOR		OPEN	LOSS OF POWER IN ONE OR MORE PHASES OF TRAIN B DURING DC TESTING WITH NORMAL OFF-SITE SOURCE ALIGNED. NONE WITH BYPASS BREAKER CLOSED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS DURING DC TESTING, NONE REQUIRED FOR SIS DURING NORMAL OPERATION OR FOR SISLOP	INOPERABILITY OF TRAIN B FOR SIS DURING DC TESTING, NONE FOR SIS DURING NORMAL OPERATION OR FOR SISLOP	*TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING
12.2.01.01.2	Y-WINDING CURRENT LIMITING REACTOR		SHORT	LOSS OF FAULT PROTECTION FOR ONE OR MORE PHASES OF TRAIN B DURING DC TESTING WITH NORMAL OFF-SITE SOURCE ALIGNED	PERIODIC TESTING	REDUNDANT TRAIN FOR DC TESTING, NONE REQUIRED FOR NORMAL OPERATION	POTENTIAL INOPERABILITY OF TRAIN B DURING DC TESTING, NONE FOR NORMAL OPERATION	*TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING
12.2.01.01.3	Y-WINDING CURRENT LIMITING REACTOR		GROUND	LOSS OF NORMAL OFF-SITE SOURCE (C-IPMR Y-WINDING) FOR TRAIN B WITH GROUND OF MORE THAN ONE PHASE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	INOPERABILITY OF TRAIN B FOR SIS	GROUND OF 2 OR MORE PHASES REQUIRED FOR THIS FAILURE IN UNGROUNDING DELTA-CONNECTED SYSTEM. TRIP OF FEEDER BREAKER 12C02 ISOLATES THIS GROUND FAULT ON SISLOP

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.02.01.1	152-1RY1 (BRBAKBR)	BRBAKBR	OPEN	C-1PBR Y-WINDING REACTANCE CANNOT BE BYPASSED, RESULTING IN DEGRADED TRAIN B VOLTAGE CONDITIONS DURING SIS LOADING TRANSIENT WITH NORMAL OFF-SITE SOURCE ALIGNED. NO EFFECT DURING SISLOP DUE TO 12C02 TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	INOPERABILITY OF TRAIN B FOR SIS. NO EFFECT FOR SISLOP	*INCLUDES CONTROL ROOM HANDSWITCH HS-167. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION (EG. DURING DG SURVEILLANCE) BECAUSE OF BUS VOLTAGE DEGRADATION WHICH WOULD OCCUR ON SIS
12.2.02.01.2	152-1RY1 (BRBAKBR)	BRBAKBR	CLOSED	C-1PBR Y-WINDING REACTANCE BYPASSED, RESULTING IN POTENTIAL FOR EXCESSIVE FAULT CURRENTS DURING DG TESTING WITH NORMAL OFF-SITE SOURCE ALIGNED. NO EFFECT ON SIS LOADING TRANSIENT	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED FOR NORMAL OPERATION ON SIS/SISLOP	POTENTIAL INOPERABILITY OF TRAIN B DURING DG LOAD TESTING, NONE FOR NORMAL OPERATION OR SIS/SISLOP	NORMAL POSITION. DG BRBR TRIPPED ON SIS/SISLOP IF CLOSED
12.2.02.02.1	152-1RY1 (BRBAKBR)	152-12C15 "b" CONTACT	OPEN	INTERLOCK FROM DG BREAKER DEFEATED, PERMITTING REACTANCE TO BE BYPASSED DURING DG LOAD TESTING	PERIODIC TESTING	(SAME AS 12.2.2.1.1)	(SAME AS 12.2.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.2.02.02.2	152-1RY1 (BRBAKBR)	152-12C15 "b" CONTACT	CLOSED	INTERLOCK FROM DG BREAKER DEFEATED, PERMITTING REACTANCE TO BE BYPASSED DURING DG TESTING	PERIODIC TESTING	(SAME AS 12.2.2.1.2)	(SAME AS 12.2.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.2.02.03.1	152-1RY1 (BRBAKBR)	152-12C15 CELL SWITCH	OPEN	C-1PBR Y-WINDING REACTANCE CANNOT BE BYPASSED WITH DG BREAKER CLOSED, EVEN IN DG BRBR TEST POSITION	PERIODIC TESTING	(SAME AS 12.2.2.1.1)	(SAME AS 12.2.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.2.02.03.2	152-1RY1 (BRBAKBR)	152-12C15 CELL SWITCH	CLOSED	INTERLOCK FROM DG BREAKER DEFEATED, PERMITTING REACTANCE TO BE BYPASSED DURING DG BRBAKBR TESTING	PERIODIC TESTING	(SAME AS 12.2.2.1.2)	(SAME AS 12.2.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING
12.2.02.04.1	152-1RY1 (BRBAKBR)	BUS #2C 125VDC CONTROL POWER (#12C15)	VOLTS LOW	C-1PBR Y-WINDING REACTANCE BYPASS BREAKER CANNOT BE REPOSITIONED. IF OPEN, DEGRADES TRAIN B VOLTAGE CONDITION DURING SIS LOADING TRANSIENT. IF CLOSED, RESULTS IN POTENTIAL FOR EXCESSIVE FAULT CURRENTS DURING DG TESTING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B WITH BYPASS BREAKER MISPOSITIONED	*TECH SPEC ACTION ENTRY REQUIRED WITH BREAKER MISPOSITIONED
12.2.03.01.1	152-12C02 (BRBAKBR)	BRBAKBR	OPEN	LOSS OF NORMAL OFF-SITE SOURCE FOR TRAIN B. NORMAL FOLLOWING SISLOP. NO EFFECT IF BUS #2C ENERGIZED FROM ALTERNATE SOURCE VIA TIE BRBAKBR 12C01	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	INOPERABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	*NORMAL FEEDER BREAKER FOR BUS #2C. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OFFSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT
12.2.03.01.2	152-12C02 (BRBAKBR)	BRBAKBR	CLOSED	NORMAL OFF-SITE SOURCE CANNOT BE ISOLATED FROM BUS #2C, DEGRADING TRAIN B SISLOP RESPONSE BY ENERGIZING C-1PBR VIA Y-SECONDARY. ALSO PREVENTS TRAIN A SISLOP FOR DEGRADED GRID CONDITIONS DUE TO INABILITY TO OBTAIN TRAIN B	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE FOR SISLOP WITH DEGRADED GRID CONDITIONS, NONE REQUIRED FOR SIS	*INOPERABILITY OF TRAIN B FOR SISLOP, INOPERABILITY OF TRAIN A FOR SISLOP WITH DEGRADED GRID CONDITIONS, NONE FOR SIS	NORMAL POSITION

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM PMBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
12.2.03.02.1	152-12C02 (BRKBR)	194-4 (RRLAY)	CONTACTS OPEN (OFF)	BREAKER WILL NOT TRIP ON SEQ (LOB, LOP, SISLOP) OR BUS UNDERVOLTAGE SIGNALS	PERIODIC TESTING	(SAME AS 12.2.3.1.2)	(SAME AS 12.2.3.1.2)	RELAY ACTUATED BY SEQ 2 OR BUS #2C UV RELAY 127-6T1
12.2.03.02.2	152-12C02 (BRKBR)	194-4 (RRLAY)	CONTACTS CLOSED (ON)	BREAKER TRIPS, BUT CAN BE RECLOS'D AFTER 2 SECOND TIME DELAY	CONTROL ROOM INDICATION, ANNUNCIATION	(SAME AS 12.2.3.1.1)	(SAME AS 12.2.3.1.1)	*SURVEILLANCE TESTING MUST SPECIFICALLY CHECK FOR RELAY CONTACT FAILURE, SINCE TOR PREVENTS RETRIP IF BRKR SUBSEQUENTLY RECLOS'D
12.2.03.03.1	152-12C02 (BRKBR)	C-IPNR PROTECTIVE TRIPS	CONTACTS OPEN	BREAKER WILL NOT TRIP IN EVENT OF C-IPNR DIFFERENTIAL, SUDDEN PRESSURE OR OTHER TROUBLE. REMAINING C-IPNR PROTECTIVE TRIPS TO 12C02 UNAFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION OF CONTACTS. FAILURE ADDRESSSES OWN TRIP FUNCTION (CONTACT SET) AT A TIME. REMAINING PROTECTIVE TRIPS PREVENT FAULT
12.2.03.03.2	152-12C02 (BRKBR)	C-IPNR PROTECTIVE TRIPS	CONTACTS CLOSED	BREAKER TRIPS IF CLOSED, CAUSING LOB FOR TRAIN B. NORMAL FOR SISLOP WITH C-IPNR TROUBLE. NO EFFECT IF BUS #2C ENERGIZED FROM ALTERNATE SOURCE VIA TIB BREAKER 12C01	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	INOPERABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	PROPAGATION TO 4LV SWGR ROOM. *TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OFFSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT
12.2.03.04.1	152-12C02 (BRKBR)	BRBS 12C01, 11B04, 12C15, BT1 "a" CONTACTS	CONTACTS OPEN	BUS #2C PARALLELED ALARM INOPERABLE. NO EFFECT ON BRKR OPERATION	PERIODIC TESTING	NONE REQUIRED	NONE	FUSES PROTECT BRKR CONTROL SCHEME FROM ALARM CNT FAILURE. ALARM ACTUATED IF DG PARALLELED TO C-IPNR W/BT1 CLOSED OR IF DG OR C-IPNR PARALLELED TO ALTERNATE SOURCE (MAIN/B-IPNR)
12.2.03.04.2	152-12C02 (BRKBR)	BRBS 12C01, 11B04, 12C15, BT1 "a" CONTACTS	CONTACTS CLOSED	BUS #2C PARALLELED ALARM CANNOT BE CLEARED. NO EFFECT ON BRKR OPERATION	PERIODIC TESTING	NONE REQUIRED	NONE	
12.2.03.05.1	152-12C02 (BRKBR)	"a" CONTACTS	CONTACTS OPEN	BUS #2C PARALLELED ALARM AND DG DROOP CETS DISABLED. RESULTS IN ISOCRONOUS DG MODE WHICH CAN CAUSE DG OVERLOAD TRIP DURING PARALLELED OPERATION FOR TESTING OR FOLLOWING OFF-SITE POWER RESTORATION POST-SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO ALTERNATE OR NORMAL OFFSITE SOURCE WITHOUT LOSS OF BECS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. DROOP MODE REQUIRED FOR PARALLELED OPERATION TO PERMIT CONTROL OF DG LOADING. DROOP AND PICKUP OTHERWISE REQUIRED
12.2.03.05.2	152-12C02 (BRKBR)	"a" CONTACTS	CONTACTS CLOSED	BUS #2C PARALLELED ALARM WILL OCCUR W/ BUS ENERGIZED FROM OTHER SOURCES. DG DROOP CNT ALSO ENABLED, RESULTING IN LOSS OF DG FREQUENCY CONTROL FOR SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B DG	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. NORMAL POSITION. ISOCRONOUS MODE REQUIRED FOR LOB, LOP OR SISLOP OPERATION TO ENSURE PROPER FREQUENCY FOR LOAD MOTOR PERFORMANCE

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.03.06.1	152-12C02 (BREAKER)	"b" CONTACTS	CONTACTS OPEN	BUS #2C CANNOT BE RE-ENERGIZED PERIODIC TESTING FROM ALTERNATE SOURCE POST-TRIP RECPT BY DROP AND PICKUP OF BUS #1B		NONE REQUIRED	NONE. NO INTERRUPTION OF BUS #2C ECCS LOADS WILL OCCUR DURING DROP AND PICKUP OF BUS #1B	NORMAL POSITION. DROP AND PICKUP WILL RESULT IN INTERRUPTION OF RCP OPERATION, IF RESTARTED, FOR SCGR EVENTS
12.2.03.06.2	152-12C02 (BREAKER)	"b" CONTACTS	CONTACTS CLOSED	INTERLOCK TO BUS TIE BREAKER 12C01 OPERATED, PERMITTING NORMAL OPPOSITE SOURCE AND MAIN GENERATOR TO BE PARALLELED MANUALLY THROUGH BUS #2C DURING MAIN GENERATOR COAST-DOWN	PERIODIC TESTING	NONE REQUIRED	NONE	BREAKER AUXILIARY CONTACT FAILURE AND CONCURRENT OPERATOR ERROR REQUIRED TO PARALLEL MAIN GENERATOR THROUGH BUS #2C. THIS IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS OF PLANT
12.2.03.07.1	152-12C02 (BREAKER)	186, 186X (RELAYS)	ON	BREAKER TRIPS AND SENDS OVERLOAD LOCK-OUT SIGNAL TO BLOCK CLOSING OF DG BREAK AND BUS TIE BREAK TO PREVENT RE-ENERGIZING POTENTIALLY FAULTED BUS. NO EFFECT IF DG OR BUS TIE BREAKER ALREADY CLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	OVERLOAD LOCK-OUT PREVENTS CLOSING BREAK TO A FAULTED BUS
12.2.03.07.2	152-12C02 (BREAKER)	186, 186X (RELAYS)	OFF	BREAKER OVERLOAD TRIP DISABLED. IF A FAULT OCCURS, POTENTIALLY RESULTS IN 4KV ROOM ELECTRICAL FIRE	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. BUS FAULT PLUS BREAK OVERLOAD RELAY FAILURE IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS OF PLANT
12.2.03.08.1	152-12C02 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN B SISLOP RESPONSE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	FAILURE TO TRIP 12C02 WOULD RESULT IN REENERGIZING C-IPNR FROM DG #2 VIA BUS #2C
12.2.04.01.1	152-11B04 (BREAKER)	BREAKER	OPEN	LOSS OF POWER TO RCP B AND EXCITER IF DURING POWER OPERATION. BUS #1B AND #2C CANNOT BE FED FROM ALTERNATE OPPOSITE SOURCE (MAIN/B IPNR)	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN B ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE WITH C-IPNR RELATED LOP	*NORMAL POSITION DURING PLANT S/U PRIOR TO SYNCHRONIZING MAIN GEN TO GRID. SCGR DOSE CALC REV (TO PRECLUDE CREDIT FOR RCP) AND ROI REV REQ SINCE CANNOT START RCP FROM BUS #1C/2C POST-SIS/SISLOP
12.2.04.01.2	152-11B04 (BREAKER)	BREAKER	CLOSED	BUS #1B CANNOT BE ISOLATED FROM B-IPNR AND MAIN GENERATOR FOR STARTUP OR LOVATS. INTERLOCKS PREVENT CLOSURE OF BUS #2C TIE BREAKER WITH MAIN GENERATOR TRIPPED (VOLTS LOW) AND BUS #2C REENERGIZED FROM C-IPNR. NO EFFECT IF BUS #2C REENERGIZED FROM DG	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	WITHOUT INTERRUPTION OF ECCS LOADS DUE TO VOLT TRANSIENT NORMAL POSITION DURING POWER OPS. SWD BREAK TRIPS AND RCP OVERCURRENT TRIPS ISOLATE ENERGY SOURCES FROM POTENTIAL MAIN GENERATOR FAULTS

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRR UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
12.2.04.02.1 (BBBAEER)	152-11804	BB1 (RELAY)	CONTACTS OPEN (OFF)	AUTOMATIC RECLOSURE OF BREAKER FOR LOVATS IS DISABLED. MANUAL BREAKER RECLOSURE FOR ALIGNMENT OFF ALTERNATE OPPOSITE SOURCE UNAPPECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OPPOSITE SOURCE EVEN IF LOVATS FUNCTIONS AS DESIGNED
12.2.04.02.2 (BBBAEER)	152-11804	BB1 (RELAY)	CONTACTS CLOSED (ON)	LOVATS RECLOSURE SIGNAL TO BREAKER, PERIODIC TESTING CAUSING PREMATURE RECLOSING BREAKER 18KV ISOLATION COMPLETE	PERIODIC TESTING	NONE REQUIRED	NONE	VERIFICATION REQUIRED THAT MAIN GENERATOR UNDERVOLTAGE RELAY 221X SETPOINT (40X) IS LOW ENOUGH TO PREVENT MOD FAILURE DUE TO FLASHOVER BY RESIDUAL GENERATOR OUTPUT BACKUP TRIP FROM B-IPMR 18KV OVERCURRENT ISOLATES FAULT FROM MAIN GENERATOR AND IPMR. FAULT CANNOT BE (RE)EMERGIIZED WITHOUT A SECOND FAILURE (SG. BACKUP TRIP FAILURE OR OPERATOR ERROR IN CLOSING BUS TIE BREAKER) WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.2.04.03.1 (BBBAEER)	152-11804	186-3, 186-3A, 186-4 (RELAYS)	OFF	AUTOMATIC TRIP OR LOCKOUT OF BREAKER OR INTERLOCK TO BUS TIE 12C01 TO ISOLATE FAULT ON B-IPMR 4 KV OVERCURRENT IS DISABLED	PERIODIC TESTING	NONE REQUIRED	NONE	OPERATOR ERROR IN CLOSING BUS TIE BREAKER WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.2.04.03.2 (BBBAEER)	152-11804	186-3, 186-3A, 186-4 (RELAYS)	ON	BREAKER TRIPS, CANNOT BE RECLOSURE TO ALIGN ALTERNATE OPPOSITE SOURCE TO BUS #2C	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR BUS, TRAIN B ALTERNATE OPPOSITE REDUNDANT TRAIN FOR SISLOP	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE WITH C-IPMR RELATED LOP	STRECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION
12.2.04.04.1 (BBBAEER)	152-11804	OTHBR MAIN GEN MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS OPEN (OFF)	BREAKER WILL NOT TRIP IN EVENT OF IPMR DIFFERENTIAL, SUDDEN PRESSURE OR OTHER MAIN GENERATOR, MAIN IPMR OR A/B IPMR TROUBLE	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION OF CONTACTS. FAILURE ADDRESSES ONE TRIP FUNCTION (CONTACT SET) AT A TIME. REMAINING PROTECTIVE TRIPS PREVENT FAULT
12.2.04.04.2 (BBBAEER)	152-11804	OTHBR MAIN GEN MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED (ON)	(SAME AS 12.2.4.3.2)	CONTROL ROOM INDICATION	(SAME AS 12.2.4.3.2)	(SAME AS 12.2.4.3.2)	PROPAGATION TO 4 KV SWGR ROOM *TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. CONTACTS CLOSED ON OUT-OF-STEP, OVERSPED, LOSS OF FIELD, DIFFERENTIAL, NEGATIVE PHASE SEQUENCE, STATOR GROUND, SUDDEN PRESSURE, OR OVERCURRENT
12.2.04.05.1 (BBBAEER)	152-11804	194-3 (RELAY)	CONTACTS OPEN (OFF)	BREAKER WILL NOT AUTOMATICALLY TRIP ON LOVATS SIGNAL (MAIN GEN TRIPPED, MOTOR OPERATED DISCONNECT CLOSED AND SWGR #1C/2C UNDERVOLTAGE). MANUAL TRIP AND RECLOSURE UNAPPECTED	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OPPOSITE SOURCE EVEN IF LOVATS FUNCTIONS AS DESIGNED

TABLE 12-1: POWER DISTRIBUTION SYSTEM FNBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.04.05.2	152-11804 (BBBAEBB)	194-3 (BBLAY)	CONTACTS CLOSED (ON)	(SAME AS 12.2.4.3.2)	CONTROL ROOM INDICATION	(SAME AS 12.2.4.3.2)	(SAME AS 12.2.4.3.2)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION
12.2.04.06.1	152-11804 (BBBAEBB)	"a" CONTACTS	CONTACTS OPEN	LOSS OF BRER CLOSED INTERLOCK TO RCP SLOW COASTDOWN ENABLE, SOURCES PARALLELED ALARM AND LOVATS END-OF-SEQUENCE INDICATION. LOSS OF DROOP ENABLE INPUT PREVENTS TRANSFER OF BUS #2C FROM DG TO ALTERNATE OPPOSITE SOURCE WITHOUT DROP AND PICKUP	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, REDUNDANT TRAIN FOR SISLOP	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE FOR C-IPRR RELATED LOP, WITHOUT LOSS OF ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. LOVATS AND RCP SLOW COASTDOWN NOT CREDITED IN SIS/SISLOP EVENTS
12.2.04.06.2	152-11804 (BBBAEBB)	"a" CONTACTS	CONTACTS CLOSED	RCP SLOW COASTDOWN ENABLED, DG #2 DROOP ENABLED WITH BUS #1B/2C TIE BRBAEBB CLOSED. LOVATS MAY INDICATE END-OF-SEQUENCE PRIOR TO RECLOSURE. DROOP ENABLED PREVENTS ISOCRONOUS OPERATION OF DG WITH BUS #1B-2C TIE BRER CLOSED	RCP SLOW COASTDOWN INDICATION, DG	NONE REQUIRED	NONE	*ROI REVISION REQD: IPRR FROM DG TO ALT OPPOSITE SOURCE MUST OCCUR WITH BUS #1B ENERGIZED BEFORE TIE BRER CLOSED, WITH THIS FAILURE
12.2.04.07.1	152-11804 (BBBAEBB)	"b" CONTACTS	CONTACTS OPEN	LOSS OF BRER OPEN INTERLOCK TO LOVATS AND BUS #1B-2C TIE BRER. LOVATS AUTO-OPEN OF MOTOR OPERATED DISCONNECT AND RECLOSURE OF #1A04/11804 DISABLED. TIE BRER CANNOT BE CLOSED TO RE-ENERGIZE BUS #1B FROM OPPOSITE RECEIPT BY DROP AND PICKUP OF BUS #2C	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	
12.2.04.07.2	152-11804 (BBBAEBB)	"b" CONTACTS	CONTACTS CLOSED	INTERLOCK DISABLED TO BUS #1B-2C TIE BRER 12C01, PERMITTING PARALLELING OF MAIN GENERATOR TO NORMAL OPPOSITE SOURCE THROUGH BUS #2C. NO EFFECT ON MOTOR OPERATED DISCONNECT DUE TO SEPARATE GENERATOR VOLTS OPEN PERMISSIVE AND BUS LOAD BRBAEBB TRIP	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	SECOND FAILURE (EG. OPERATOR ERROR) NEEDED FOR PARALLELING OR MOD FAILURE TO OCCUR, WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS.
12.2.04.08.1	152-11804 (BBBAEBB)	BUS #1B 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED IF CLOSED OR RECLOSURE IF OPEN, RESULTING IN LOSS OF ALTERNATE OPPOSITE SOURCE TO BUS #2C	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN B ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE WITH C-IPRR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHRA

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.05.01.1	BUS #1B NSR LOADS	BBBAER(S)	OPEN	BICITER TRIPS AND CANNOT BE STARTED FOR MAIN GENERATOR OPERATION, OR RCP B TRIPS AND CANNOT BE RESTARTED FOR SCTR. NO EFFECT ON ECCS LOADS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	INCLUDES RCP-B, BICITER BREAKERS 152-11803, 152-11802 RESPECTIVELY
12.2.05.01.2	BUS #1B NSR LOADS	BBBAER(S)	CLOSED	RCP B OR BICITER CANNOT BE TRIPPED TO CLEAR BUS #1B	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS DURING PLANT STARTUP, OR SISLOP. NORMAL OPPOSITE SOURCE FOR SIS DURING NORMAL OPERATION	REDUCED TRAIN B ELECTRICAL MARGIN FOR SIS DURING PLANT S/U (W/ TIB BRKR 12C01 CLOSED). TRAIN B ALT OPPOSITE SOURCE ALSO INOP, CAUSING POTENTIAL LONG-TERM INOP OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE W/ C-IPNR LOP	NORMAL POSITION DURING POWER OPERATION. TECH BPRC ACTION ENTRY REQUIRED WITH THIS FAILURE. FAILURE TO TRIP RCP AND BICITER SHOWN ACCEPTABLE FOR SIS BY VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)
12.2.05.02.1	BUS #1B NSR LOADS	127-2I (RBLAY)	CONTACTS OPEN (OFF)	RCP B AND BICITER WILL NOT TRIP AUTOMATICALLY ON BUS #1B UNDERVOLTAGE DURING NORMAL MAIN GENERATOR OPERATION. RCP AND BICITER SLOW COASTDOWN UNDERVOLTAGE TRIP, SIS/SISLOP TRIP AND MANUAL TRIPS UNAFFECTED	PERIODIC TESTING	TRIP OF RCP AND TIB BRKR FOR SISLOP DURING PLANT STARTUP, REDUNDANT TRAIN FOR SIS DURING PLANT STARTUP, NONE REQUIRED FOR SIS/SISLOP DURING NORMAL OPS	REDUCED RELIABILITY OF TRAIN B FOR SISLOP AND INOPERABILITY FOR SIS DURING PLANT STARTUP (WITH BUS #1B-2C TIB BRKR CLOSED). NONE FOR SIS/SISLOP DURING NORMAL OPERATION	NORMAL POSITION. BUS #1B UNDERVOLTAGE RELAY
12.2.05.02.2	BUS #1B NSR LOADS	127-2I (RBLAY)	CONTACTS CLOSED (ON)	RCP B AND BICITER TRIP. NO EFFECT ON RESTART AFTER MAIN GENERATOR TRIP DUE TO LOSS OF FIELD	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	BICITER TRIP CAUSES LOSS OF MAIN GENERATOR FIELD
12.2.05.03.1	BUS #1B NSR LOADS	281-I 281-Y	ON (281-I CLOSED, 281-Y OPEN)	RCP AND BICITER SLOW COASTDOWN UNDERVOLTAGE TRIP ENABLED, NORMAL UNDERVOLTAGE TRIP DISABLED	PERIODIC TESTING	TRIP OF RCP AND TIB BRKR FOR SISLOP DURING PLANT STARTUP, REDUNDANT TRAIN FOR SIS DURING PLANT STARTUP, NONE REQUIRED FOR SIS/SISLOP DURING NORMAL OPS	REDUCED RELIABILITY OF TRAIN B FOR SIS/SISLOP DURING PLANT STARTUP (WITH BUS #1B-2C TIB BRKR CLOSED), NONE FOR SIS/SISLOP DURING NORMAL OPERATION OR AFTER MAIN GENERATOR VOLTS < 40%	RELAYS ENERGIZED WHEN MAIN GENERATOR FREQUENCY < 58 HZ TO SELECT SLOW COASTDOWN VS. NORMAL AT-POWER UNDERVOLTAGE TRIPS. NO EFFECT ON MANUAL TRIP OF BICITER OR MANUAL TRIP/RESTART OF RCPS FOR SCTR OR ALIGNMENT OF ALTERNATE OPPOSITE SOURCE
12.2.05.03.2	BUS #1B NSR LOADS	281-I 281-Y	OFF (281-I OPEN, 281-Y CLOSED)	RCP AND BICITER SLOW COASTDOWN UNDERVOLTAGE TRIP DISABLED, NORMAL UNDERVOLTAGE TRIP ENABLED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION DURING POWER OPERATION
12.2.05.04.1	BUS #1B NSR LOADS	227I (RBLAY)	CONTACTS OPEN (OFF)	RCP B AND BICITER SLOW COASTDOWN TRIP DISABLED (TRIP WILL NOT OCCUR WITH MAIN GEN VOLTS < 40%). NORMAL UNDERVOLTAGE, SIS/SISLOP AND MANUAL TRIPS UNAFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. MAIN GENERATOR UNDERVOLTAGE RELAY. SLOW COASTDOWN TRIP ENABLED ONLY IF BRKR 11A04 OR 11B04 IS CLOSED AND MAIN GENERATOR FREQUENCY IS < 58 HZ.
12.2.05.04.2	BUS #1B NSR LOADS	227I (RBLAY)	CONTACTS CLOSED (ON)	RCP B AND BICITER SLOW COASTDOWN TRIP WILL OCCUR AS SOON AS MAIN GENERATOR FREQUENCY < 58 HZ, IRRESPECTIVE OF VOLTAGE. NORMAL UNDERVOLTAGE TRIP, SIS/SISLOP AND MANUAL TRIPS UNAFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	RELAY DE-ENERGIZED WHEN MAIN GENERATOR VOLTS < 40 % AS PART OF RCP SLOW COASTDOWN SEQUENCE. BICITER TRIP WILL AFFECT SLOW COASTDOWN OF ALL 3 RCPS BY INTERRUPTING MAIN GENERATOR FIELD. SIS/SISLOP TRIP NOT PROVIDED FOR BICITER MOTOR

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
TABLE 12-1: POWER DISTRIBUTION SYSTEM PBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
12.2.05.05.1	BUS #1B MSR LOADS	194-3 (RBLAY)	CONTACTS OPEN (OFF)	LOVATS TRIP OF RCP B AND EXCITER DISABLED. NORMAL UNDERVOLTAGE, SIS/SISLOP AND MANUAL TRIPS UNAPFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. LOVATS NOT CREDITED FOR SIS/SISLOP EVENTS
12.2.05.05.2	BUS #1B MSR LOADS	194-3 (RBLAY)	CONTACTS CLOSED (ON)	LOVATS TRIP OF RCP B AND EXCITER. RCP CANNOT BE RESTARTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	*SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPS. BOI REVISION REQUIRED TO ADDRESS POTENTIAL INABILITY TO RESTART RCPS IN UNAPFFECTED LOOPS
12.2.05.06.1	BUS #1B MSR LOADS	186-SIS (RBLAY)	CONTACTS OPEN (OFF)	SIS/SISLOP TRIP OF RCPS A, B AND C DISABLED. SISLOP TRIP OF BUS #1A-1C AND #1B-2C TIE BREAKERS 11C01 AND 12C01 UNAPFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS. TIE BREAKER TRIPS FOR SISLOP	REDUCED ELECTRICAL MARGINS ON BOTH TRAINS FOR SIS DURING PLANT STARTUP (TIE BREAKERS 11C01 AND 12C01 CLOSED), REDUCED RELIABILITY OF BOTH TRAINS FOR SISLOP WITH TIE BREAKERS CLOSED, NONE FOR SIS WITH TIE BREAKERS OPEN	NORMAL POSITION. FAILURE TO TRIP RCPS DUE TO THIS SINGLE FAILURE SHOWN ACCEPTABLE FOR SIS BY BUS VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)
12.2.05.06.2	BUS #1B MSR LOADS	186-SIS (RBLAY)	CONTACTS CLOSED (ON)	RCPS A, B AND C TRIP, CANNOT BE RESTARTED	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	*SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPS
12.2.05.07.1	BUS #1B MSR LOADS	BUS #1B 125VDC CONTROL POWER	VOLTS LOW	RCP B AND EXCITER CANNOT BE TRIPPED OR RESTARTED, SIS/SISLOP TRIP RBLAY 186-SIS CANNOT BE ENERGIZED TO TRIP RCP A, B AND C. TIE BRKR TRIP UNAPFFECTED	CONTROL ROOM INDICATION	NONE FOR SIS DURING PLANT STARTUP, REDUNDANT TRAIN AND TIE BRKR TRIP FOR SISLOP, NONE REQUIRED FOR SIS DURING NORMAL OPERATION	REDUCED ELEC MARGINS ON BOTH TRAINS FOR SIS DURING PLANT S/U (W/ TIE BRKR 11C01, 12C01 CLOSED). TRAIN B ALT OPPOSITE SOURCE INOP, CAUSING POTENTIAL LONG-TERM INOP OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRIP BUS #2C FROM DG TO OPPOSITE W/ C-IFMR LOP	*TRCH SPEC ACTION ENTRY REQUIRED FOR INOP ALTERNATE OPPOSITE SOURCE ON TRAIN B. FAILURE TO TRIP RCPS SHOWN ACCEPTABLE FOR SIS BY BUS VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)
12.2.06.01.1	BUS #1B CONTROLS	194-3 (RBLAY)	CONTACTS OPEN (OFF)	BUS #1B FEEDER BRKR 11B04, RCP B AND EXCITER WILL NOT AUTOMATICALLY TRIP ON LOVATS SIGNAL, CAUSING SLOW RCP COASTDOWN ON MAIN GENERATOR VS. PLTWHEEL COASTDOWN. MANUAL TRIPS UNAPFFECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OPPOSITE SOURCE EVEN IF LOVATS FUNCTIONS AS DESIGNED
12.2.06.01.2	BUS #1B CONTROLS	194-3 (RBLAY)	CONTACTS CLOSED (ON)	UNDERVOLTAGE TRIP OF RCP B, EXCITER AND BUS #1B FEEDER BRKR 11B04 FOR ANY MAIN GENERATOR TRIP WITH MOTOR OPERATED DISCONNECT CLOSED. TRIP SIGNALS RESET WHEN MOTOR OPERATED DISCONNECT IS OPENED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP. TRAIN B ALTERNATE OPPOSITE AVAILABLE AFTER MOTOR OPERATED DISCONNECT OPENED, AS NORMAL	*TRCH SPEC ACTION ENTRY REQUIRED WHENEVER BUS #1C OR 2C ENERGIZED FROM ALTERNATE OPPOSITE SOURCE

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.07.01.1	152-12C01 (BRKBR)	BRKBR	OPEN	LOSS OF POWER TO RCP B AND BICITER DURING PLANT STARTUP, INABILITY TO ALIGN BUS #2C TO ALTERNATE OPPOSITE SOURCE	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN B ALT OPPOSITE SOURCE INOPERABLE, CAUSING POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE FOR C-IPNR RELATED LOP. RCP B CANNOT BE RE-ENERGIZED FROM MAIN/B-IPNR POST-SGTR	NOT REVISION REQUIRED TO PRECLUDE RCP RESTART FROM BUS #1C/2C POST-SIS/SISLOP TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT. SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCP OPERATION
12.2.07.01.2	152-12C01 (BRKBR)	BRKBR	CLOSED	BUS #1B CANNOT BE ISOLATED FROM BUS #2C	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, RCP TRIP FOR SIS	TRAIN B INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	UNORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OPPOSITE SOURCE TO BUS #2C. NO CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT
12.2.07.02.1	152-12C01 (BRKBR)	186 (12C02)	CONTACTS OPEN (ON)	BRKBR CANNOT BE CLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN B INOPERABLE	12C02-186 RELAY ALSO TRIPS 12C02 AND BLOCKS CLOSING OF DG BRK 12C15, RESULTING IN LOSS OF BUS #2C
12.2.07.02.2	152-12C01 (BRKBR)	186 (12C02)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM BUS #2C NORMAL PREDR 12C02 DISABLED, PERMITTING PARALLELING OF BUS #1B TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. C-IPNR Y-WEDG OVERCURRENT LOCKOUT RELAY. SECOND FAILURE (EG. OPERATOR ERROR) NEEDED FOR PARALLELING TO OCCUR, WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.2.07.03.1	152-12C01 (BRKBR)	186-3A (11B04)	CONTACTS OPEN (ON)	BRKBR CANNOT BE CLOSED	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	INOPERABILITY OF TRAIN B ALTERNATE OPPOSITE SOURCE, RESULTING IN INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE WITH C-IPNR RELATED LOP	11B04 186-3A RELAY ALSO TRIPS 11B04. RCP-B UNAVAILABLE POST-SGTR AS A RESULT OF THIS FAILURE
12.2.07.03.2	152-12C01 (BRKBR)	186-3A (11B04)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM BUS #1B NORMAL PREDR 11B04 DISABLED, PERMITTING PARALLELING OF BUS #2C TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. SECOND FAILURE (EG. OPERATOR ERROR) NEEDED FOR PARALLELING TO OCCUR, WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.2.07.04.1	152-12C01 (BRKBR)	152-12C02 "b" CONTACTS	CONTACTS OPEN	BRKBR CANNOT BE CLOSED TO ENERGIZE BUS #2C FROM ALTERNATE OPPOSITE SOURCE POST-TRIP BICBPT BY DROP AND PICKUP OF BUS #1B	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP. NO INTERRUPTION OF ECCS LOADS WILL OCCUR DURING DROP AND PICKUP OF BUS #1B	INTERRUPTION OF RCP B COULD OCCUR POST-SGTR WITH LOSS OF NORMAL OPPOSITE SOURCE. CONTACTS PARALLELED WITH 227-Y RELAY CONTACTS (WHICH OPEN ON LOW MAIN GENERATOR VOLTAGE) IN BRKBR CONTROL CIRCUIT

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
 ON ONOPRR UNIT 1
 TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.2.07.04.2	152-12C01 (BREAKER)	152-12C02 "b" CONTACTS	CONTACTS CLOSED	INTERLOCK FROM 12C02 DEFEATED, PERIODIC TESTING PERMITTING NORMAL OFFSITE SOURCE AND MAIN GENERATOR TO BE PARALLELED MANUALLY THROUGH BUS #2C DURING MAIN GENERATOR COASTDOWN		NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	CONCURRENT OPERATOR ERROR IS REQUIRED FOR PARALLELING TO OCCUR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE THE SIS/SISLOP DESIGN BASIS
12.2.07.05.1	152-12C01 (BREAKER)	152-11B04 "b" CONTACTS	CONTACTS OPEN	BREAKER CANNOT BE CLOSED POST-TRIP UNLESS BUS #2C FEEDER BREAKER 12C02 IS OPEN. REQUIRES TRANSFER BY DROP AND PICKUP FOR SIS. NO EFFECT FOR SISLOP OR WITH MAIN GENERATOR ON LINE	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	TRANSFER TO ALTERNATE OFFSITE SOURCE NOT REQUIRED FOR SIS, UNAFFECTED FOR SISLOP. FAILURE DOES NOT PREVENT RCP B RESTART FROM ALT OFFSITE SOURCE, IF NEEDED
12.2.07.05.2	152-12C01 (BREAKER)	152-11B04 "b" CONTACTS	CONTACTS CLOSED	INTERLOCK FROM 11B04 DEFEATED, PERIODIC TESTING PERMITTING NORMAL OFFSITE SOURCE AND MAIN GENERATOR TO BE PARALLELED MANUALLY THROUGH BUS #2C DURING MAIN GENERATOR COASTDOWN. NO EFFECT WITH MAIN GENERATOR ON LINE		NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	THIS SINGLE FAILURE PLUS CONCURRENT OPERATOR ERROR REQUIRED FOR PARALLELING, WHICH IS A DOUBLE FAILURE OUTSIDE SIS/SISLOP DESIGN BASIS
12.2.07.06.1	152-12C01 (BREAKER)	227Y (RBLAY)	CONTACTS OPEN (ON)	BUS #1B AND 2C CANNOT BE PARALLELED DURING NORMAL POWER OPERATION EXCEPT BY DROP AND PICKUP OF EITHER BUS. NO EFFECT ON BUS OPERATIONS POST-TRIP	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION FOLLOWING PLANT TRIP AND MAIN GENERATOR/RCP COASTDOWN
12.2.07.06.2	152-12C01 (BREAKER)	227Y (RBLAY)	CONTACTS CLOSED (OFF)	INTERLOCK FROM MAIN GENERATOR VOLTAGE DEFEATED, PERMITTING NORMAL OFFSITE SOURCE TO BE PARALLELED MANUALLY WITH MAIN GENERATOR THROUGH BUS #2C DURING MAIN GENERATOR COASTDOWN	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION DURING POWER OPERATION. THIS FAILURE PLUS CONCURRENT OPERATOR ERROR DURING SIS/SISLOP EVENT IS A DOUBLE FAILURE WHICH IS OUTSIDE PLANT DESIGN BASIS
12.2.07.07.1	152-12C01 (BREAKER)	SBQ 2 (13-9,11)	CONTACTS OPEN (OFF)	BREAKER WILL NOT TRIP ON SISLOP	PERIODIC TESTING	NONE REQUIRED FOR SIS OR FOR SISLOP DURING NORMAL POWER OPERATION. REDUNDANT TRAIN FOR SISLOP DURING PLANT STARTUP	NONE FOR SIS, POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP DURING PLANT STARTUP (WITH BUS #1B/2C TRIP BREAKER 12C01 CLOSED)	NORMAL POSITION. TRIP ENSURES THAT DC DOES NOT ATTEMPT TO ENERGIZE RCPS POST-SISLOP
12.2.07.07.2	152-12C01 (BREAKER)	SBQ 2 (13-9,11)	CONTACTS CLOSED (ON)	BREAKER TRIPS AND CANNOT BE RECLOSED, PREVENTING BUS #1A AND 1C FROM BEING PARALLELED	CONTROL ROOM INDICATION	NORMAL OFFSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	INOPERABILITY OF TRAIN B ALTERNATE OFFSITE SOURCE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DC TO OFFSITE SOURCE WITH C-1PWR RBLAYED LOP	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.07.08.1 (BBRAKBR)	152-12C01	194-4 (RELAY)	CONTACTS OPEN (OFF)	BRKBR WILL NOT TRIP ON BUS #2C UNDERVOLTAGE. SEPARATE SBQ 2 SISLOP SIGNAL TO BRKBR NOT AFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN B FOR SIS DURING PLANT STARTUP (WITH BUS #1B/2C TIE BRKBR CLOSED), NONE FOR SISLOP DUE TO SEPARATE SISLOP TRIP SIGNAL	NORMAL POSITION. RELAY ACTUATED BY SBQ 2 (SISLOP ONLY) OR BUS #2C UNDERVOLTAGE. UNDERVOLTAGE INPUT IS BLOCKED AFTER 1 SECOND BY TIME DELAY RELAY
12.2.07.08.2 (BBRAKBR)	152-12C01	194-4 (RELAY)	CONTACTS CLOSED (ON)	BRKBR TRIPS, CAN BE RECLOSED IF NEEDED AFTER 2 SEC. IF FAILURE OCCURS WHEN BRKBR OPEN (EG. NORMAL POWER OPERATION), WILL NOT SUBSEQUENTLY TRIP IF NEEDED. SISLOP TRIP OF BRKBR UNAPPECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN B FOR SIS DURING PLANT STARTUP (WITH BUS #1B/2C TIE BRKBR CLOSED), NONE FOR SISLOP DUE TO SEPARATE SISLOP TRIP SIGNAL	*TECH SPEC ACTION ENTRY REQUIRED WITH BUS #2C EMERGIzed FROM ALTERNATE OFFSITE SOURCE
12.2.07.09.1 (BBRAKBR)	152-12C01	"a" CONTACTS	OPEN	SOURCES PARALLELED ALARM AND DC DROOP CIRCUIT INPUT DISABLED. RESULTS IN ISOCHRONOUS DC MODE IF BRKBR 11804 CLOSED (EG. TO RESTART RCPS), WHICH CAN CAUSE DC OVERLOAD TRIP DURING TRANSFER BACK TO OPPOSITE POWER FOR SISLOP RECOVERY	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DC TO OPPOSITE SOURCE WITH C-1PBR RELATED LOP. NONE FOR SIS	*NORMAL POSITION DURING POWER OPERATION. TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. DROOP MODE REQUIRED TO CONTROL DC LOAD WHEN PARALLELED TO OPPOSITE SOURCE. OTHERWISE DROP AND PICKUP REQUIRED
12.2.07.09.2 (BBRAKBR)	152-12C01	"a" CONTACTS	CLOSED	SOURCES PARALLELED ALARM WILL OCCUR WITH BRKBR 11804 AND 12C02 CLOSED (EG. DURING NORMAL OPERATION). DC DROOP CIRCUIT ENABLED IF BRKBR 11804 CLOSED (EG. TO RESTART RCPS POST-SIS/SISLOP), RESULTING IN LOSS OF DC FREQ CONTROL FOR SISLOP	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	NORMAL POSITION DURING PLANT STARTUP. ISOCHRONOUS MODE REQUIRED FOR LOB, LOP OR SISLOP OPERATION TO ENSURE PROPER FREQUENCY FOR LOAD MOTOR OPERATION
12.2.07.10.1 (BBRAKBR)	152-12C01	"b" CONTACTS	OPEN	DC BRKBR CANNOT BE CLOSED	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	NORMAL POSITION DURING PLANT STARTUP. INTERLOCKS DO NOT BLOCK CLOSING OF BUS TIE BRKBR 12C01 IF DG BRKBR ALREADY CLOSED
12.2.07.10.2 (BBRAKBR)	152-12C01	"b" CONTACTS	CLOSED	INTERLOCK TO DC BRKBR DISABLED, PERMITTING DG BRKBR TO CLOSE WHEN BUS #1B PARALLELED TO BUS #2C (EG. DURING PLANT STARTUP)	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION DURING POWER OPERATION. SEPARATE SISLOP TRIP OF BRKBR PREVENTS AUTOMATIC PARALLELING FOR SISLOP EVENTS. SECOND FAILURE OR OPERATOR ERROR REQUIRED TO INADVERTANTLY PARALLEL FOR SIS
12.2.07.11.1 (BBRAKBR)	152-12C01	186 (12C01)	ON	BRKBR TRIPS AND SENDS OVERLOAD LOCK-OUT SIGNAL TO BLOCK CLOSING OF DG BRKBR, TO PREVENT RE-ENERGIZING POTENTIALLY FAULTED BUS	CONTROL ROOM INDICATION	NORMAL OFFSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	INOPERABILITY OF TRAIN B ALTERNATE OFFSITE SOURCE AND DG	

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.07.11.2	152-12C01 (BREAKER)	186 (12C01)	OFF	BREAKER OVERLOAD TRIP DISABLED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. SEPARATE BUS #18/2C FEEDER BREAKER OVERCURRENT TRIPS WOULD CLEAR FAULTS WITH THIS FAILURE
12.2.07.12.1	152-12C01 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN B SISLOP RESPONSE AND PREVENTING TRAIN A SISLOP IF BREAKER INITIALLY CLOSED TO ALIGN BUS #2C TO ALTERNATE OPPOSITE SOURCE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE FOR TRAIN B ALIGNED TO ALTERNATE OPPOSITE SOURCE	*INOPERABILITY OF TRAIN B FOR SISLOP, AND TRAIN A FOR SISLOP WITH TRAIN B ALIGNED TO ALTERNATE OPPOSITE SOURCE	*SINCE MAIN GENERATOR COASTDOWN ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ENTRY IS REQUIRED WHENEVER BUS #1C OR 2C IS ALIGNED TO THE ALTERNATE OPPOSITE SOURCE
12.2.08.01.1	[NOT USED]							[THIS BLOCK OF RECORDS RESERVED FOR DUPLICATION OF DG BREAKER RECORDS FROM SECTION 10, IF REQUIRED]
12.2.09.01.1	152-12C10 (BREAKER)	BREAKER	OPEN	LOSS OF TRAIN B 480V LOADS ON SWGR #2 AND ECCS, INCLUDING IMMEDIATE LOSS OF BFP WTR PP, RECIRC, CCM, SVC, 2 HPV ISOLATION MOVY, 1 SI/CLR FLOW PATH, WITH DELAYED FAILURE OF HPV PP, CHG PP, DG AND DC BUS #2 DUE TO LOSS OF COOLING AND BATTERY CHARGING	CONTROL ROOM INDICATION	REDUNDANT TRAIN AND FLOW PATHS, FAIL-CLOSED BV-851A (W/ BACKUP #2) AND BV-2900 FOR CONTAINMENT ISOLATION. NONE FOR REDUCED CLR HEAT REMOVAL	TRAIN B ECCS INOPERABLE, TRAIN A CLR HEAT REMOVAL DEGRADED	*SST #2 4kV FEEDER BRKR. SEE ITEMS 6.2.4.3.1 AND 7.2.3.2.1. ADDITIONALLY, BOT REVISION REQUIRED TO TRIP TRAIN B SI/PP PUMPS PRIOR TO LOSS OF 125VDC BUS #2 FOR THIS FAILURE, TO ENSURE SI TERMINATION AT LO-LO RWST LEVEL SETPOINT
12.2.09.01.2	152-12C10 (BREAKER)	BREAKER	CLOSED	NONE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF 480V SWGR #2 ENERGIZED FROM BUS 2-3 TIE BREAKER IN LIBU OF SST #2 VIA THIS BREAKER
12.2.09.02.1	152-12C10 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
12.2.10.01.1	152-12C11 (BREAKER)	BREAKER	OPEN	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	SST #3 4kV ALTERNATE FEEDER BREAKER. INCLUDES CONTROL ROOM HANDSWITCH AND LOCAL/REMOTE INDICATION. NORMALLY RACKED OUT
12.2.10.01.2	152-12C11 (BREAKER)	BREAKER	CLOSED	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.10.02.1	152-12C11 (BREAKER)	152-11C11 "b" CONTACTS	OPEN	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.10.02.2	152-12C11 (BREAKER)	152-11C11 "b" CONTACTS	CLOSED	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	

EMERGENCY CORRECTING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
12.2.10.03.1	152-12C11 (BRBAERB)	152-11C11 CELL SWITCH CONTACTS	OPEN	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.10.03.2	152-12C11 (BRBAERB)	152-11C11 CELL SWITCH CONTACTS	CLOSED	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.10.04.1	152-12C11 (BRBAERB)	[NOT USED]						
12.2.10.04.2	152-12C11 (BRBAERB)	[NOT USED]						
12.2.10.05.1	152-12C11 (BRBAERB)	127-611 (RBLAT)	CONTACTS OPEN (OFF)	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.10.05.2	152-12C11 (BRBAERB)	127-611 (RBLAT)	CONTACTS CLOSED (ON)	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.10.06.1	152-12C11 (BRBAERB)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	NONE. BREAKER NORMALLY RACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.11.01.1	BUS #2C WSR LOADS	BRBAERB	OPEN	TRAIN B MAIN CIRC PUMP, TPCW PUMP, CONDENSATE PUMP(S), HEATER DRAIN PUMP OR ALTERNATE LIGHTING TRANSFORMER TRIPS AND CANNOT BE RE-ENERGIZED	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	INCLUDES BREAKERS 12C03, 12C06, 12C08, 12C09, 12C12, 12C13
12.2.11.01.2	BUS #2C WSR LOADS	BRBAERB	CLOSED	TRAIN B MAIN CIRC PUMP, TPCW PUMP, CONDENSATE PUMP(S), HEATER DRAIN PUMP OR ALTERNATE LIGHTING TRANSFORMER CANNOT BE TRIPPED ON BUS UNDERVOLTAGE OR SEQ (AS APPLICABLE)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B FOR SISLOP, REDUCED RELIABILITY FOR SIS	CONDENSATE AND HEATER DRAIN PUMPS RECEIVE DIRECT SEQ SIS/SISLOP SIGNALS TO TRIP AS PART OF NFW ISOLATION. VALVES AND INTERLOCKS PREVENT UNAMALYZED CONDENSATE INJECTION EVEN IF PUMPS DO NOT TRIP
12.2.12.01.1	BUS #2C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-4	ON (VOLTS NORMAL)	UV AUXILIARY RELAYS 127-4X AND 127-6X WILL NOT DE-ENERGIZE AS REQUIRED ON BUS UNDERVOLTAGE OR (SIS)LOP, REDUCING REDUNDANCY OF BUS #2C UV INPUTS TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B	PERIODIC TESTING	REDUNDANT BUS #2C INPUTS FROM UV RELAY 127-10 AND AUX RELAYS 127-10X AND 127-12X PREVENT LOSS OF FUNCTION	REDUCED REDUNDANCY FOR BUS #2C UV SIGNAL TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B, LOGIC FOR TRAIN B LOB BECOMES 1/1 ON REMAINING BUS #2C UV INPUT	NORMAL POSITION. RELAYS 127-4X AND 127-10X DRIVE TIME DELAY RELAYS 162-4X AND 162-10X RESPECTIVELY TO PREVENT STAGGERED DG START FOLLOWING SISLOP FROM DISABLING AUTO-LOAD LOGIC FOR SLOW TRAIN
12.2.12.01.2	BUS #2C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-4	OFF (VOLTS LOW)	UV AUXILIARY RELAYS 127-4X AND 127-6X DE-ENERGIZE, SENDING BUS #2C UV SIGNAL TO SEQ 1, SEQ 2, CSAS-A AND CSAS-B	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	MAINTAINED UV INPUT WILL PREVENT RESTART OF TRAIN B LOADS. TRAIN A SISLOP CONDITION WILL RESULT IN SEQ #1 SISLOP WITH THIS FAILURE
12.2.12.02.1	BUS #2C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-6	ON (VOLTS NORMAL)	UV AUXILIARY RELAYS 127-6X AND 127-611 WILL NOT DE-ENERGIZE AS REQUIRED ON BUS UNDERVOLTAGE OR (SIS)LOP, DISABLING NORMAL UNDERVOLTAGE TRIP OF TRAIN B 4KV LOADS, LOVATS AND UNIT UV TRIP, AND TRAIN B RRF WTR PP TIMING INPUT	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. LOVATS AND UNIT UV TRIP NOT CREDITED FOR SIS/SISLOP EVENTS. CONTAINMENT SPRAY PUMP RECEIVES INDEPENDENT TIMING SIGNAL FROM SEQ FOR SISLOP START

EMERGENCY CORE SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM PDBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.12.02.2	BUS #2C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-6	OFF (VOLTS LOW)	UV AUXILIARY RELAYS 127-6X AND CONTROL ROOM INDICATION 127-6X1 DE-ENERGIZE, RESULTING IN A BUS #2C UV SIGNAL TO LOVATS AND UNIT UV TRIP, TRAIN B RFP WTR PP TIMING INPUT AND BUS #2C 4W LOADS. UV TRIP OF BUS #2C 4W LOADS IS BLOCKED AFTER 1 SEC BY A TIME DELAY RELAY	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	RANDOMLY TIMED FAILURE WILL CAUSE INTERRUPTION OF TRAIN B SIS/SISLOP RESPONSE. LOVATS AND UNIT TRIP LOGIC BECOME I/I ON BUS #1C UV INPUT
12.2.12.05.1	BUS #2C UNDERVOLTAGE AND POWER SWITCH @ CONTROL	125VDC CONTROL 12C02	OPEN	UV AUXILIARY RELAYS 127-4X, 127-8X, 127-6X AND 127-6X1 DE-ENERGIZE, RESULTING IN A BUS #2C UV SIGNAL TO SRQ 1, SRQ 2, CSAS-A, CSAS-B, LOVATS AND UNIT UV TRIP, TRAIN B RFP WTR PP TIMING INPUT AND BUS #2C 4W LOADS (FOR 1 SEC BEFORE TOR ACTUATION)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	RANDOMLY TIMED FAILURE WILL CAUSE INTERRUPTION OF TRAIN B SIS/SISLOP RESPONSE. LOVATS AND UNIT TRIP LOGIC BECOME I/I ON BUS #1C UV INPUT. TRAIN A SISLOP WILL RESULT IN SRQ 1 SISLOP WITH THIS FAILURE
12.2.12.03.2	BUS #2C UNDERVOLTAGE AND POWER SWITCH @ CONTROL	125VDC CONTROL 12C02	CLOSED	UV RELAYS 127-4 AND 127-6 FUNCTION NORMALLY	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
12.2.12.04.1	BUS #2C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-10	ON (VOLTS NORMAL)	UV AUXILIARY RELAYS 127-10X AND 127-12X WILL NOT DE-ENERGIZE AS REQUIRED ON BUS #2C UNDERVOLTAGE OR (SIS)LOP, REDUCING REDUNDANCY OF BUS #2C UV INPUTS TO SRQ 1, SRQ 2, CSAS-A AND CSAS-B	PERIODIC TESTING	REDUNDANT BUS #2C UV INPUTS FROM UV RELAY 127-4 AND AUX RELAYS 127-4X AND 127-8X	REDUCES REDUNDANCY FOR BUS #2C UNDERVOLTAGE SIGNAL TO SRQ 1, SRQ 2, CSAS-A AND CSAS-B. TRAIN B LOGIC BECOMES I/I ON REMAINING BUS #2C UV INPUTS	
12.2.12.04.2	BUS #2C UNDERVOLTAGE AND (UV RELAY) CONTROL	127-10	OFF (VOLTS LOW)	UV AUXILIARY RELAYS 127-10X AND 127-12X DE-ENERGIZE, SENDING BUS #2C UNDERVOLTAGE SIGNAL TO SRQ 1, SRQ 2, CSAS-A AND CSAS-B	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B FOR SIS, CONTAINMENT SPRAY FOR SISLOP	
12.2.12.05.1	BUS #2C UNDERVOLTAGE AND POWER SWITCH @ CONTROL	125VDC CONTROL 12C03	OPEN	(SAME AS 12.2.12.4.1)	PERIODIC TESTING	(SAME AS 12.2.12.4.1)	(SAME AS 12.2.12.4.1)	
12.2.12.05.2	BUS #2C UNDERVOLTAGE AND POWER SWITCH @ CONTROL	125VDC CONTROL 12C03	CLOSED	UV RELAY 127-10 FUNCTIONS NORMALLY	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION
12.2.12.06.1	BUS #2C UNDERVOLTAGE AND (15-9,11) CONTROL	SRQ 2	CONTACTS OPEN (OFF)	BUS #2C LOADS (EXCEPT COND. WTR DR, TPCW PPS) AND NORMAL FEEDER BRKR WILL NOT TRIP AND REMAIN OPEN ON SRQ 2 SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	NORMAL POSITION. MAINTAINED TRIP SIGNAL REQUIRED FOR MSR LOADS TO PREVENT START POST-SISLOP. COND PPS, WTR DR PP, TPCW PP AND BUS #1B/2C TIE BRKR ARE LOCKED OUT BY SEPARATE MAINTAINED SRQ CONTACTS OR OVERLOAD LOCKOUT RELAY ACTUATION

EMERGENCY CORRECTING SYSTEM SINGLE FAILURE ANALYSIS

SAN ONOFFER UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITSM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.2.12.06.2	BUS #2C UNDERVOLTAGE AND CONTROL	SBQ 2 (15-9,11)	CONTACTS CLOSED (ON)	BUS #2C LOADS AND TIE BRKERS TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	TRIP SIGNALS AUTOMATICALLY CLEARED BY TIME DELAY RELAY WHICH RESETS UV RELAYS 194-4 AND 194-5
12.2.12.07.1	BUS #2C UNDERVOLTAGE AND CONTROL	194-4 (RELAYS)	CONTACTS OPEN (OFF)	BUS #2C FEEDER AND TIE BRKERS (12C01 AND 12C02) AND LOADS (RECEPT ALTERNATE LIGHTING TRANSFORMER AND SST-1 AND SST-3) WILL NOT TRIP ON BUS #2C UNDERVOLTAGE OR (RECEPT COND, HTR DR, TPCW PPS AND TIE BRKR) ON SISLOP	PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	NORMAL POSITION. COND PPS, HTR DR PP, TPCW PP AND BUS #1B/2C TIE BRKR ARE LOCKED OUT BY SEPARATE MAINTAINED SBQ CONTACTS OR OVERLOAD LOCKOUT RELAY ACTUATION
12.2.12.07.2	BUS #2C UNDERVOLTAGE AND CONTROL	194-4 (RELAYS)	CONTACTS CLOSED (ON)	BUS #2C FEEDER AND TIE BRKERS (12C01 AND 12C02) AND LOADS (RECEPT ALTERNATE LIGHTING TRANSFORMER AND SST-1 AND SST-3) TRIP	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	*LOCKOUT NOT CURRENTLY PROVIDED FOR MSR LOADS, RECEPT THOSE RECEIVING A SEPARATE MAINTAINED SISLOP SIGNAL (EG. CONDENSATE AND HEATER DRAIN PP) OR SISLOP ACTUATION OF OVERLOAD LOCKOUT (EG. TPCW)
12.2.12.08.1	BUS #2C UNDERVOLTAGE AND CONTROL	BUS #2C 125VDC	VOLTS LOW	BUS #2C FEEDER AND TIE BRKERS (12C01 AND 12C02) AND LOADS WILL NOT TRIP ON BUS #2C UNDERVOLTAGE OR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	CONTROL POWER FROM 12C01 CUBICLE

TABLE 12-1: AUXILIARY POWER FMEA

PART II: 480 V SYSTEM

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.3.01.01.1	52-1102 (BRBAKBB)	BRBAKBB	OPEN	INTERRUPTION OF ALL TRAIN A LOADS ON 480V SWGR/MCC, INCLUDING IMMEDIATE LOSS OF TRAIN A RECIRC, BRP WTR (SPRAY), HYDRAZINE, CCW AND SWC PUMPS, C/R AND 1/2 MAIN IPWR COOLING, AND DELAYED LOSS OF HPW PP, DG, AND DC BUS #1. MOVs FAIL AS-IS	CONTROL ROOM INDICATION	NONE FOR SIS/SISLOP, TRAIN A 480V PWR VIA SWGR #1-3 TIE BRER AND SST #3 FOR LO-LO RWST LEVEL TRIP. REDUND MAIN IPWR COOLING FOR ALT OPSITE SOURCE	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DG AND HPW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OPSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VENT OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IPWR HAS 2 TRAINS OF FORCED AIR CLNG
12.3.01.01.2	52-1102 (BRBAKBB)	BRBAKBB	CLOSED	480V POWER AVAILABLE TO TRAIN A ECCS LOADS FROM SST #1 AS REQUIRED. HOWEVER, BRER WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS ON 480V SWGR #1	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. BRER FAILURES BOUND SST #1 FAILURES, SINCE CREDIT NOT TAKEN FOR MSR FANS IN IPWR RATING. SISLOP TRIP/LOCKOUT AND BRER COORDINATION PREVENT FEEDER TRIP WITH MSR LOAD FAILURES. BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.3.01.02.1	52-1102 (BRBAKBB)	52-1103 "b" CONTACT	OPEN	BRER CANNOT BE CLOSED UNLESS SWGR #1-3 TIE BRER 52-1103 IS IN TEST POSITION. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF SWGR #1 NOT REENERGIZED VIA BRER 52-1102 FROM SST #1
12.3.01.02.2	52-1102 (BRBAKBB)	52-1103 "b" CONTACT	CLOSED	BRER CAN BE CLOSED TO PARALLEL SST #1 AND SST #3 THROUGH 480V SWGR #1. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. 480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.3.01.03.1	52-1102 (BRBAKBB)	52-1103 133 CONTACT	OPEN	BRER CANNOT BE CLOSED UNLESS SWGR #1-3 TIE BRER IS OPEN. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. 133 CONTACTS FROM CELL SWITCH
12.3.01.03.2	52-1102 (BRBAKBB)	52-1103 133 CONTACT	CLOSED	(SAME AS 12.3.1.2.2)	PERIODIC TESTING	(SAME AS 12.3.1.2.2)	(SAME AS 12.3.1.2.2)	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.3.01.04.1 (BBBARBR)	52-1102	"b" CONTACTS	OPEN	BRER CLOSED INTERLOCK TO SWGR #1-3 TIE BRER PREVENTS TIE BRER CLOSING UNLESS 52-1102 IS IN TEST POSITION OR SWGR #3 NORMAL PERDRR BRER IS OPEN, AND SWGR #2-3 TIE BRER IS OPEN	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM EITHER TRAIN BY OPENING ITS NORMAL PERDRR BRER 52-1303 AND THEN CLOSING EITHER TIE BRER	NORMAL POSITION
12.3.01.04.2 (BBBARBR)	52-1102	"b" CONTACTS	CLOSED	BRER OPEN SIGNAL TO SWGR #1-3 TIE BRER ALLOWS PARALLELING SST #1 AND 3 THROUGH 480V SWGR #1, ALTHOUGH FAULT PROTECTION IS NOT PROVIDED FOR SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.3.01.05.1 (BBBARBR)	52-1102	133 CONTACTS	OPEN	BRER NOT-IN-TEST INTERLOCK TO SWGR #1-3 TIE BRER PREVENTS TIE BRER CLOSING UNLESS 52-1102 OR SWGR #3 NORMAL PERDRR BRER IS OPEN, AND SWGR #2-3 TIE BRER IS OPEN	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM EITHER TRAIN BY OPENING NORMAL PERDRR BRER 52-1303 AND THEN CLOSING EITHER TIE BRER	NORMAL POSITION
12.3.01.05.2 (BBBARBR)	52-1102	133 CONTACTS	CLOSED	BRER IN-TEST SIGNAL TO SWGR #1-3 TIE BRER ALLOWS PARALLELING SST #1 AND 3 THROUGH 480V SWGR #1, ALTHOUGH FAULT PROTECTION IS NOT PROVIDED FOR SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.3.01.06.1 (BBBARBR)	52-1102	86 (RELAY)	ON	OVLD TRIPS BRER AND BLOCES CLOSE OF SWGR #1-3 TIE BRER. CAUSES LOSS OF ALL TRAIN A 480V SWGR/MCC LOADS, INCL IMMEDIATE LOSS OF RECIRC, RFP WTR, HYDRAZINE, CCW AND SWC PUMPS, C/R AND 1/2 MAIN IPWR COOLING, AND DELAYED LOSS OF NPW PP, DC AND DC BUS #1	CONTROL ROOM INDICATION	NONE FOR INJECT OR RECIRC (INCLUDING LO-LO RWST LEVEL TRIP). NONE FOR RCPs POST-SGTR. REDUNDANT MAIN IPWR COOLING FOR ALTERNATE OPPOSITE SOURCE	TRAIN A ECCS (OPERABLE, TRAIN B POTENTIALLY INOP DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN A SI/PW, LOSS OF C/R COOLING FOR ECCS ACTUATION AND CONTROL. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAIL	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. BOT REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. DOSE CALC REV REQD FOR 10 MIN INJ NODE SPRAY W/ ONE REP WTR PP AND NO FILTERED HVAC. TRIP OF R/U C/R VENT ADEQUACY ALSO REQD
12.3.01.06.2 (BBBARBR)	52-1102	86 (RELAY)	OFF	BRER WILL NOT TRIP IN EVENT OF BUS FAULT, NOR LOCK-OUT SWGR #1-3 TIE BRER	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS. RELAY DOES NOT PROVIDE OVERLOAD PROTECTION FOR BRER OR 480V SIDE OF SST #1 BRER NORMALLY CLOSED, NOT REQUIRED TO TRIP OPEN EXCEPT FOR FAULT PROTECTION OR RE-ENERGIZING SWGR #1 FROM SWGR #3/SST #3. CAN BE TRIPPED LOCALLY IF NEEDED FOR TIE BRER CLOSURE
12.3.01.07.1 (BBBARBR)	52-1102	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	

TABLE 12-1: POWER DISTRIBUTION SYSTEM PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.3.02.01.1	52-1103 (BRBARBR)	BRBARBR	OPEN	BRER CANNOT BE CLOSED TO RE-ENERGIZE SWGR #3 FROM TRAIN A 480V SWGR #1	CONTROL ROOM INDICATION, PERIODIC TESTING	SST #3/BRER 52-1303 AVAILABLE FOR TRAIN A POWER, SWGR #2-3 TIE BRER 52-1203 AVAILABLE FOR TRAIN B POWER TO SWGR #1	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 THIRD-OF-A-KIND LOADS (NOV-358/NOV-450C UPS, NOV-883)	NORMAL POSITION
12.3.02.01.2	52-1103 (BRBARBR)	BRBARBR	CLOSED	BRER WILL NOT OPEN ON SIS/SISLOP. POTENTIALLY CAUSES LOSS OR INTERRUPTION OF ALL TRAIN A 480V LOADS DURING SIS/SISLOP, INCLUDING RECIRC, RFP WTR, HYDRAZINE, CCW AN SWC PPS, C/R AND 1/2 MAIN IPMR COOLING, AND DELAYED LOSS OF MPW PP, DC AND DC BUS #1	CONTROL ROOM INDICATION	NONE FOR SIS/SISLOP, TRAIN A 480V PWR THRU TIE BRER AND SST #3 FOR LO-LO RWST LEVEL TRIP. REDUNDANT MAIN IPMR COOLING FOR ALT OPPOSITE SOURCE	*TRAIN A POTENTIALLY INOP DUE TO VOLTAGE DEGRADATION AND SST #1/BRER OVERLOAD DURING SIS/SISLOP LOADING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF CONTROL ROOM COOLING. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE	*TECH SPEC ACTION ENTRY REQD WITH SWGR #1-3 OR SWGR #2-3 TIE BRER CLOSED DURING NORMAL OPS. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL LOADS AND RE-ENERGIZE SWGR #1. LO-LO RWST LEVEL TRIP OF SI/FW AFFECTED IF 480VAC AND 125VDC LOST W/ REV EMERGIZED NORMAL POSITION. LOSS OF SST #1 OR 52-1102 POWER CONTACTS PLUS THIS FAILURE DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.3.02.02.1	52-1103 (BRBARBR)	52-1102 "b" CONTACT OR 133 CONTACT	OPEN	BRER CANNOT BE CLOSED IF SWGR #3 NORMAL FEEDER BRER 52-1303 IS ALREADY CLOSED. PREVENTS RE-ENERGIZING 480V SWGR #1 FROM SST #3/SWGR #3 IN THE EVENT OF SST #1 OR 52-1102 FAILURE	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS OPERATOR ERROR PLUS FAULT IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.3.02.02.2	52-1103 (BRBARBR)	52-1102 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM 480V SWGR #1 NORMAL FEEDER BRER DEPRATED. ALLOWS PARALLELING SST #1 AND 3 THROUGH SWGR #1, ALTHOUGH BUS NOT FAULT PROTECTED IN SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS OPERATOR ERROR PLUS FAULT IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.3.02.03.1	52-1103 (BRBARBR)	52-1203 "b" CONTACT OR 133 CONTACT	OPEN	INTERLOCK FROM SWGR #2-3 TIE BRER PREVENTS BRER CLOSE TO RE-ENERGIZE SWGR #3 FROM TRAIN A SWGR #1	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN B VIA SWGR #2-3 TIE BRER 52-1203	52-1203 "b"/133 CONTACTS MAY ALSO PREVENT RECLOSURE OF SWGR #3 NORMAL FEEDER BRER 52-1303 TO RE-ENERGIZE SWGR #3 FROM TRAIN A VIA SST #3
12.3.02.03.2	52-1103 (BRBARBR)	52-1203 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM SWGR #2-3 TIE BRER 52-1203 DEPRATED. ALLOWS PARALLELING TRAIN A (SWGR #1) TO TRAIN B (SWGR #2) VIA 480V SWGR #3 IF NORMAL FEEDER BRER 52-1303 IS OPEN (EG. FOLLOWING SISLOP TRIP OF BRER)	PERIODIC TESTING	NONE. ADMINISTRATIVE CONTROLS DO NOT ALLOW THIS CONFIGURATION IN MODES 1 - 4	LOSS OF AUTOMATIC PROTECTION AGAINST PARALLELING REDUNDANT TRAINS A AND B 480V SWGR	*TECH SPEC ACTION ENTRY REQD FOR THIS CONDITION SINCE SIS/SISLOP TRIP SIGNALS ARE MOMENTARY ONLY (VIA TDRs) AND DO NOT PREVENT PARALLELING BY A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR AFTER TRIP SWGR #2-3 TIE BRER 52-1203
12.3.02.04.1	52-1103 (BRBARBR)	52-1303 "b" CONTACT OR 133 CONTACT	OPEN	INTERLOCK FROM SWGR #3 NORMAL FEEDER BRER 52-1303 PREVENTS BRER CLOSE TO RE-ENERGIZE SWGR #3 FROM TRAIN A SWGR #1 (IE, W/ 52-1102 CLOSED)	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN A VIA THIS BRER AND SST #3	CLOSE MAY ALSO BE DISABLED BY 52-1303 "b"/133 INTERLOCK
12.3.02.04.2	52-1103 (BRBARBR)	52-1303 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM SWGR #3 NORMAL FEEDER BRER 52-1303 DEPRATED. ALLOWS PARALLELING SST #1 AND SST #3 THROUGH 480V SWGR #1, ALTHOUGH FAULT PROTECTION IS NOT PROVIDED FOR SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.3.02.05.1	52-1103 (BREAKER)	52-1102 86 (RELAY)	CONTACTS OPEN (ON)	OVERLOAD INTERLOCK FROM 480V SWGR #1 NORMAL FEEDER BRKR 52-1102 PREVENTS CLOSING BRKR TO RE-ENERGIZE SWGR #3 FROM TRAIN A SWGR #1	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN A VIA BRKR 52-1303 AND SST #3 OR TRAIN B VIA TIE BRKR 52-1203	EFFECT OF 86 RELAY FAILURE ON BOTH 52-1102 AND 52-1103 IS ADDRESSED IN ITEM 12.3.01.06.1
12.3.02.05.2	52-1103 (BREAKER)	52-1102 86 (RELAY)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM 480V SWGR #1 NORMAL FEEDER BRKR 52-1102 DELETED. ALLOWS PARALLELING OF SWGR #3 TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE PLANT DESIGN BASIS
12.3.02.06.1	52-1103 (BREAKER)	52-1303 86-1 (RELAY)	CONTACTS OPEN (ON)	OVERLOAD INTERLOCK FROM 480V SWGR #3 NORMAL FEEDER BRKR 52-1303 PREVENTS CLOSING BRKR TO RE-ENERGIZE SWGR #3 FROM TRAIN A 480V SWGR #1	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN B VIA SWGR #2-3 TIE BRKR 52-1203	CONCURRENT EFFECT OF 86 AND 86-1 RELAY OPERATION ON 52-1103, 1203 AND 1303 IS ADDRESSED IN THE ENTRIES FOR 52-1303 IN SECTION 12.6 OF THIS ANALYSIS
12.3.02.06.2	52-1103 (BREAKER)	52-1303 86-1 (RELAY)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM 480V SWGR #3 NORMAL FEEDER BRKR 52-1303 DELETED. ALLOWS PARALLELING OF SWGR #1 TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.3.02.07.1	52-1103 (BREAKER)	SEQ 1 (18-6,8)	CONTACTS OPEN (OFF)	BRKR WILL NOT TRIP ON SIS/SISLOP TO AUTOMATICALLY ISOLATE TRAIN A 480V SWGR #1 FROM SWGR #3 LOADS	PERIODIC TESTING	NONE REQUIRED IF BRKR INITIALLY OPEN	NONE IF BRKR INITIALLY OPEN	NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED IF TIE BRKR CLOSED IN MODES 1 - 4
12.3.02.07.2	52-1103 (BREAKER)	SEQ 1 (18-6,8)	CONTACTS CLOSED (ON)	BRKR WILL TRIP, IF CLOSED. HOWEVER, RESET OF TRIP SIGNAL AFTER 5 SEC VIA TDR PREVENTS SUBSEQUENT RETRIP IF NEEDED	CONTROL ROOM INDICATION	NONE REQUIRED IF BRKR INITIALLY OPEN	NONE IF BRKR INITIALLY OPEN	
12.3.02.08.1	52-1103 (BREAKER)	"b" CONTACTS	OPEN	BRKR CLOSED INTERLOCK TO SWGR #1 FEEDER BRKR, SWGR #3 FEEDER BRKR, AND SWGR #2-3 TIE BRKR PREVENTS THEIR CLOSING, IF OPEN, UNLESS 52-1103 IS IN THE TEST POSITION	PERIODIC TESTING	NONE REQUIRED FOR SHORT TERM, OPERATOR ACTIONS FOR LONG-TERM	NONE FOR SHORT TERM. FOR LONG TERM, SWGR #3 CAN BE RE-ENERGIZED WITH THIS FAILURE BY LOCALLY RACKING-OUT SWGR #1-3 TIE BRKR 52-1103 IN 48V ROOM AND THEN CONNECTING TO TRAIN A VIA 52-1303 OR TRAIN B VIA 52-1203 TO PREVENT LOSS OF NOV-358/NOV-850C UPS	NOV-358/NOV-850C UPS DUTY CYCLE > 30 MINUTES TO PERMIT CREDIT FOR OPERATOR ACTION LOCALLY IN THE 48V ROOM OR 480V ROOM
12.3.02.08.2	52-1103 (BREAKER)	"b" CONTACTS	CLOSED	BRKR OPEN SIGNAL TO SWGR #1 FEEDER BRKR, SWGR #3 FEEDER BRKR, AND SWGR #2-3 TIE BRKR. ALLOWS PARALLELING SST #1 AND 3 THROUGH 480V SWGR #1 OR PARALLELING TRAIN A AND B THROUGH 480V SWGR #3	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. 480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS

TABLE 12-1: POWER DISTRIBUTION SYSTEM FHRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.3.02.09.1	52-1103 (BRBAKBR)	133 CONTACTS	OPEN	BRER NOT-IN-TEST SIGNAL TO SWGR #1 PREDEER BRER, SWGR #3 PREDEER BRER, AND SWGR #2-3 TIE BRER PREVENTS TBRIR CLOSING, IF OPEN, UNLESS 52-1103 IS OPEN	PERIODIC TESTING	REDUNDANT TRAIN A AND B POWERED VALVES FOR CLR, REDUNDANT SI/PW PUMP TRIPS FOR LO-LO RWST LEVEL TRIP	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP WITHOUT INTERRUPTION OF TRAIN B 480V POWER, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE MOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR BCCIRC, REDUNDANT CHECK VALVE CRS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE BCCIRC BOUNDARY FUNCTION
12.3.02.09.2	52-1103 (BRBAKBR)	133 CONTACTS	CLOSED	BRER-IN-TEST SIGNAL TO SWGR #1 PREDEER BRER, SWGR #3 PREDEER BRER, AND SWGR #2-3 TIE BRER. ALLOWS PARALLELING SST #1 AND 3 THROUGH 480V SWGR #1 OR PARALLELING TRAIN A AND B THROUGH 480V SWGR #3	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.3.02.10.1	52-1103 (BRBAKBR)	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED IF BRER INITIALLY OPEN	NONE IF BRER INITIALLY OPEN. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA 52-1303 OR TRAIN B VIA 52-1203	*TECH SPEC ACTION ENTRY REQUIRED IF SWGR #1-3 TIE BRER CLOSED DURING NORMAL OPERATION
12.3.03.01.1	MCC-1	52-1118 (BRBAKBR)	OPEN	LOSS OF POWER TO MCC-1 LOADS, INCLUDING MOV-1100B/C, 1/3 SI PATHS, 1/3 CLR PATHS, ALT HLR PATH, 1 BCCIRC TRAIN, 1 HYDRAZINE PUMP, 1 CCM TRAIN, 2 MPW ISOLATION MOVIS, CONTROL ROOM AND 1/2 MAIN IPMR COOLING, RCP MOTOR COOLING	CONTROL ROOM INDICATION	NONE FOR SIS/SISLOP, REDUNDANT MAIN IPMR COOLING FOR ALTERNATE OPPOSITE SOURCE	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOPERABLE DUE TO INTERRUPTION OF CONTROL ROOM COOLING. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE. RCPs ALSO UNAVAILABLE FOR SCTR	*MCC-1 480V ACS. C/R DOSE CALC REV REQD TO PRECLUDE CREDIT FOR HVAC FILTER UNIT. ALSO, VERIFICATION REQD THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING FOR C/R EQUIPMENT. CHARGING PUMPS ALSO UNAVAILABLE FOR INJECTION IF MOV-1100C ON TRAIN A
12.3.03.01.2	MCC-1	52-1118 (BRBAKBR)	CLOSED	480V POWER AVAILABLE TO TRAIN A MCC-1 LOADS. HOWEVER, BRER WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. BRERS MUST COORDINATE TO PREVENT FEEDER TRIP UNDER SIS AS WELL AS SISLOP. MCC BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.3.03.02.1	MCC-1	MSR LOADS	ON (BRER CLOSED)	LOAD(S) WILL NOT TRIP ON SISLOP OR TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-1 PREDEER BRER 52-1118	PERIODIC TESTING	(SAME AS 12.3.3.1.1)	*(SAME AS 12.3.3.1.1)	INCLUDES C/R COOLING, RCP MOTOR COOLING AND 1 OF 2 TRAINS OF MAIN IPMR FORCED AIR COOLING
12.3.03.02.2	MCC-1	MSR LOADS	OFF (BRER OPEN)	LOSS OF ONE OR MORE MCC-1 MSR LOADS, INCLUDING CONTROL ROOM AND 1/2 MAIN IPMR COOLING, RCP MOTOR COOLING	PERIODIC TESTING	NONE FOR SIS/SISLOP, REDUNDANT MAIN IPMR COOLING FOR ALT OPPOSITE SOURCE. NONE FOR RCPs POST-SCTR	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO INTERRUPTION OF CONTROL ROOM COOLING, REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE, RCPs UNAVAILABLE FOR SCTR	*VERIFICATION REQUIRED OF BACKUP CONTROL ROOM VENTILATION ADEQUACY. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING

TABLE 12-1: POWER DISTRIBUTION SYSTEM PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.3.01.02.3	MCC-1	NSR LOADS	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF NSR LOADS, CHALLENGING MCC-1 LOAD AND FEEDER BREAKS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BREAKS AND BREAK COORDINATION TO PREVENT FEEDER BREAK TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRES TRIP OF ALL NON-IB LOADS ON A SAFETY SIGNAL (IE, SIS AND SISLOP) MCC-1A 480V ACB
12.3.04.01.1	MCC-1A	52-1123 (BRKBRK)	OPEN	LOSS OF POWER TO MCC-1A LOADS, CONTROL ROOM INDICATION INCLUDING TRAIN A HPW PUMP LUBE OIL PAN COOLER	PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A INOPERABLE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. BREAKS MUST COORDINATE TO PREVENT FEEDER TRIP. MCC BUS FAULT PLUS BREAK FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.3.04.01.2	MCC-1A	52-1123 (BRKBRK)	CLOSED	480V POWER AVAILABLE TO TRAIN A MCC-1A LOADS. HOWEVER, BREAK WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	INCLUDES MAIN STEAM DUMP SYSTEM MOVs
12.3.04.02.1	MCC-1A	NSR LOADS	ON (BREAK CLOSED)	LOAD(S) WILL NOT TRIP ON SISLOP OR TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-1A FEEDER BREAK 52-1123	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 12.3.4.1.1)	(SAME AS 12.3.4.1.1)	
12.3.04.02.2	MCC-1A	NSR LOADS	OFF (BREAK OPEN)	LOSS OF ONE OR MORE MCC-1A NSR LOADS, INCLUDING MAIN STEAM DUMP ISOLATION MOVs	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED. BRANCH LINE ISOLATION NOT CREDITED IN NSLB ANALYSES	POTENTIAL LOSS OF MAIN STEAM ISOLATION CAPABILITY FOR OTHERWISE ISOLABLE STEAM LINE BREAK	
12.3.04.02.3	MCC-1A	NSR LOADS	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF NSR LOADS, CHALLENGING MCC-1A LOAD AND FEEDER BREAKS. SINCE ALL LOADS RECEIPT HPW PP LUBE OIL PAN CLR ARE NSR, AND ALL LOCATED IN TURBINE BUILDING, FEEDER BREAK MAY TRIP FROM CONCURRENT FAULT IN NSLB OUTSIDE CONTAINMENT	NONE	NONE REQUIRED. HPW LUBE OIL TEMPERATURE SHOWN BY CALC TO REMAIN ACCEPTABLE WITHOUT COOLING DURING INJECTION PHASE OF NSLB	LOSS OF TRAIN A HPW PP LUBE OIL PAN COOLER FOR NSLB OUTSIDE CONTAINMENT	*CALCULATION REQUIRED TO DEMONSTRATE THAT OPERATION OF PAN COOLER WOULD NOT ADVERSELY AFFECT HPW PUMP FUNCTION FOR NSLB VIA EXCESSIVE LUBE OIL TEMPERATURE IN THIS EVENT, CAUSED BY INDUCTION OF STEAM THROUGH PAN/COLL UNIT
12.3.05.01.1	MCC-1B	52-1129 (BRKBRK)	OPEN	LOSS OF POWER TO MCC-1B LOADS, INCLUDING TRAIN A DC AUXILIARIES	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN A INOPERABLE FOR SISLOP, NONE FOR SIS	MCC-1B 480V ACB
12.3.05.01.2	MCC-1B	52-1129 (BRKBRK)	CLOSED	480V POWER AVAILABLE TO TRAIN A MCC-1B LOADS. HOWEVER, BREAK WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. HOWEVER, BREAKS COORDINATE TO PREVENT FEEDER TRIP. MCC BUS FAULT PLUS BREAK FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.3.05.02.1	MCC-1B	NSR LOADS	ON (BREAK CLOSED)	LOAD(S) WILL NOT TRIP ON SISLOP OR TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-1B FEEDER BREAK 52-1129	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 12.3.5.1.1)	(SAME AS 12.3.5.1.1)	INCLUDES THUNDERBOLT SIREN ALTERNATE SUPPLY, DC BLDG RECEPTACLES, SUMP PUMPS AND DC COMPRESSORS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.3.05.02.2	MCC-1B	MSR LOADS	OFF (BRRR OPEN)	LOSS OF ONE OR MORE MCC-1B MSR LOADS, INCLUDING ALTERNATE SUPPLY FOR THUNDERBOLT SIREN SYSTEM, 1/2 DG #1 STARTING AIR COMPRESSORS, 1/2 DG #1 INSTRUMENT AIR COMPRESSORS, OR DG #1 ERBP-WARM HEATER	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INABILITY TO RESTART TRAIN A DC IF OPPOSITE POWER IS LOST AFTER INITIAL SIS STARTING ATTEMPTS, DUE TO LOSS OF ERBP-WARM SYSTEM. NONE FOR SIS	DC QUALIFIED BASED ON OPERATION OF ERBP-WARM SYSTEM PRIOR TO ENGINE OPERATION
12.3.05.02.3	MCC-1B	MSR LOADS	RQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-1B LOAD AND FEEDER BREAKERS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BREAKERS AND BRRR COORDINATION TO PREVENT FEEDER BREAK TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT TRIPPED/LOCKED OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP) NORMAL POSITION WITH BATTERY CHARGER B IN SERVICE
12.3.06.01.1	125VDC BUS #1	52-1110	OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #1	CONTROL ROOM INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN A 125VDC CONTROL POWER	CHARGER B IN SERVICE
12.3.06.01.2	125VDC BUS #1	52-1110	CLOSED	480V POWER AVAILABLE TO TRAIN A 125VDC BATTERY CHARGER A	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	PARALLELING OF BATTERY CHARGERS PRECLUDED BY ADMINISTRATIVE CONTROL
12.3.06.02.1	125VDC BUS #1	52-1130	OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #1	CONTROL ROOM INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN A 125VDC CONTROL POWER	NORMAL POSITION WITH BATTERY CHARGER A IN SERVICE
12.3.06.02.2	125VDC BUS #1	52-1130	CLOSED	480V POWER AVAILABLE TO TRAIN A 125VDC BATTERY CHARGER B	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	PARALLELING OF BATTERY CHARGERS PRECLUDED BY ADMINISTRATIVE CONTROL
12.3.07.01.1	[NOT USED]							[THIS BLOCK OF RECORDS RESERVED FOR LATER ADDITION OF OTHER TRAIN A 480V SWGR #1 SR LOADS]
12.3.08.01.1	SWGR #1 MSR LOADS	BBBAAE(S)	OPEN	TRAIN A MSR LOAD(S) TRIP, CANNOT BE RESTARTED. POTENTIALLY DISABLES 1/3 INSTRUMENT AIR COMPRESSORS FOR SECONDARY RECIRC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT AIR COMPRESSORS POWERED BY SWGR #2 AND 3 FOR SECONDARY RECIRC, NONE REQUIRED FOR OTHER ECCS FUNCTIONS	REDUCED RELIABILITY FOR ISA SUPPLY TO SECONDARY RECIRC VALVES, NONE FOR OTHER ECCS FUNCTIONS	CAN ALSO DISABLE ONE SCREEN WASH PUMP, CONDENSER VACUUM PUMP, FIRE PUMP, AND SPHERE ENCLOSURE BUILDING (SBB) SUPPLY OR EXHAUST FAN
12.3.08.01.2	SWGR #1 MSR LOADS	BREAKE(S)	CLOSED	TRAIN A 480V MSR LOAD(S) WILL NOT TRIP ON BUS UNDERVOLTAGE, SBQ SIGNAL (INCLUDING SISLOP LOCKOUT) OR FAULT	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	TRAIN A INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	
12.3.08.01.3	SWGR #1 MSR LOADS	BBBAAE(S)	RQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF TRAIN A 480V MSR LOAD(S), CHALLENGING SWGR #1 LOAD AND FEEDER BREAKERS	NONE	BRRR COORDINATION TO PREVENT FEEDER BREAK TRIP FOR COMPLETE FAULTS, NONE FOR OVERCURRENT FAILURE OF LOADS BELOW FAULT PROTECTION SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.3.09.01.1	SWGR #1 UNDERVOLTAGE AND (11-2,4) CONTROL	SEQ 1	CONTACTS OPEN (OFF)	UV AUX RELAYS 27-1X1, 27-1X2 AND 27-1X3 WILL NOT ENERGIZE AS REQUIRED ON SEQ 1 (SISLOP) ACTUATION. UNDERVOLTAGE ACTUATION UNAFFECTED	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS. REDUNDANT MAIN IPWR COOLING FOR ALTERNATE OFFSITE SOURCE	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO SWGR #1 VOLTAGE DEGRADATION AND/OR DC OVERLOAD, MOTOR COOLING WITH THIS W/ POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*NORMAL POSITION. RCPS ALSO UNAVAILABLE DUE TO LOSS OF FAILURE. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING
12.3.09.01.2	SWGR #1 UNDERVOLTAGE AND (11-2,4) CONTROL	SEQ 1	CONTACTS CLOSED (ON)	UV AUX RELAYS 27-1X1, 27-1X2 AND 27-1X3 ENERGIZE, TRIPPING ALL TRAIN A 480V LOADS EXCEPT MCCS AND ATE COMPRESSORS, RESULTING IN IMMEDIATE LOSS OF TRAIN A RECIRC, BFP WTR, HYDRAZINE, CCW AND SVC PPS. DELAYED LOSS OF DC BUS #1 DUE TO LOSS OF BOTH CHGRS	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR INJECTION, NONE FOR RECIRC (INCLUDING LO-LO RWST LEVEL TRIP)	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOPERABLE DUE TO: CCW FLOW BYPASS VIA NOV-1208 AND LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW	*TRAIN A SIGNAL TO UV RELAYS IS NORMALLY MOMENTARY. MAINTAINED SIGNAL DUE TO RELAY FAILURE PREVENTS RESTART OF AFFECTED LOADS
12.3.09.02.1	SWGR #1 UNDERVOLTAGE AND (UV RELAY) CONTROL	27-1	ON (VOLTS LOW)	UV AUX RELAYS 27-1X1, 27-1X2 AND 27-1X3 ENERGIZE, TRIPPING ALL TRAIN A 480V LOADS EXCEPT MCCS AND AIR COMPRESSORS, RESULTING IN IMMEDIATE LOSS OF TRAIN A RECIRC, BFP WTR, HYDRAZINE, CCW AND SVC PPS. DELAYED LOSS OF DC BUS #1 DUE TO LOSS OF BOTH CHGRS	CONTROL ROOM INDICATION	(SAME AS 12.3.9.1.2)	*(SAME AS 12.3.9.1.2)	*BOI REV REQD TO CLOSE AFFECTED CCW HE NOV TO RECOVER CCW HEAT REMOVAL CAPABILITY WITH FAILURE OF ONE SVC PUMP, AND TRIP AFFECTED SI/PW PUMPS BEFORE DC POWER IS LOST
12.3.09.02.2	SWGR #1 UNDERVOLTAGE AND (UV RELAY) CONTROL	27-1	OFF (VOLTS NORMAL)	UV AUX RELAYS 27-1X1, 27-1X2 AND 27-1X3 WILL NOT ENERGIZE AS REQUIRED ON BUS UNDERVOLTAGE. SEQ ACTUATION UNAFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP	
12.3.09.03.1	SWGR #1 UNDERVOLTAGE AND (10-10,12) CONTROL	SEQ 1	CONTACTS OPEN (OFF)	SWGR #1 LOCKOUT RELAY WILL NOT TRIP TRAIN A 480V SWGR #1 NSB LOADS ON SISLOP, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS A AND C	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPWR COOLING FOR ALTERNATE OFFSITE SOURCE	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*NORMAL POSITION. INCLUDES RESET SWITCH. RCPS ALSO LOST. VERIF REQD THAT PORTABLE B/U VENTILATION FOR C/R PROVIDES ADEQUATE COOLING. DOSE CALC REV REQD TO ELIMINATE CREDIT FOR FILTERED HVAC AND RCPS POST-3GTR. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING
12.3.09.03.2	SWGR #1 UNDERVOLTAGE AND (10-10,12) CONTROL	SEQ 1	CONTACTS CLOSED (ON)	SWGR #1 LOCKOUT RELAY TRIPS TRAIN A 480V SWGR #1 NSB LOADS, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS A AND C	CONTROL ROOM INDICATION	REDUNDANT AIR COMPRESSORS POWERED FROM SWGR #2 AND #3 FOR SECONDARY RECIRC, NONE REQUIRED FOR OTHER EVENTS	INOPERABILITY OF SWGR #1 POWERED AIR COMPRESSOR FOR SECONDARY RECIRC VALVES, NONE FOR OTHER EVENTS	

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.3.09.04.1	SWGR #1 UNDERVOLTAGE AND CONTROL	86-1 (RBLAY)	TRIP	SWGR #1 LOCKOUT RELAY TRIPS ALL TRAIN A 480V SWGR #1 MSR LOADS, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS A AND C	CONTROL ROOM INDICATION	(SAME AS 12.3.9.3.2)	(SAME AS 12.3.9.3.2)	SWGR #1 SISLOP LOCKOUT RELAY
12.3.09.04.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-1 (RBLAY)	RESET	SWGR #1 LOCKOUT RELAY WILL NOT TRIP TRAIN A 480V SWGR #1 MSR LOADS ON SISLOP, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS A AND C	PERIODIC TESTING	(SAME AS 12.3.9.3.1)	*(SAME AS 12.3.9.3.1)	
12.3.09.05.1	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (11-5,7) (11-9,11)	CONTACTS OPEN (OFF)	MCC-1 LOCKOUT RELAYS 86-M1-1, 86-M1-2, 86-M1-3 WILL NOT ENERGIZE AS REQUIRED ON SISLOP	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPMR COOLING FOR ALTERNATE OPPOSITE SOURCE	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RMST LEVEL TRIP OF SI/PM. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 1 PREVENT THIS FAILURE UNLESS SEQ 1 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. RCP# ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.3.09.05.2	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (11-5,7) (11-9,11)	CONTACTS CLOSED (ON)	MCC-1 LOCKOUT RELAYS 86-M1-1, 86-M1-2, 86-M1-3 TRIP AND LOCKOUT MCC-1 MSR LOADS, INCLUDING CONTROL ROOM AND 1/2 MAIN IPMR COOLING, RCP COOLING FANS	CONTROL ROOM INDICATION	NONE FOR BCCS ACTUATION AND CONTROL, REDUNDANT MAIN IPMR COOLING FOR ALTERNATE OPPOSITE SOURCE	*POTENTIAL INOP OF TRAIN A AND B DUE TO LOSS OF CONTROL ROOM COOLING AFFECTING BOTH TRAINS OF BCCS ACTUATION AND CONTROL. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE. MCPPS UNAVAILABLE FOR SCTR	CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 1 BLOCK/RESET. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.3.09.06.1	SWGR #1 UNDERVOLTAGE AND CONTROL	SD-1-3 (RBLAY)	ON	MCC-1 LOCKOUT RELAYS 86-M1-1, 86-M1-2, 86-M1-3 WILL ALTERNATE BETWEEN RESET AND TRIP STATE AS SOON AS SISLOP OR MANUAL LOCKOUT INITIATION OCCURS, AND IMMEDIATELY RESET AFTER SEQ BLOCK/RESET	PERIODIC TESTING	(SAME AS 12.3.9.5.1)	*(SAME AS 12.3.9.5.1)	LOCKOUT RESET RELAY FOR 86-M1-1, 86-M1-2, 86-M1-3. INCLUDES HANDSWITCH
12.3.09.06.2	SWGR #1 UNDERVOLTAGE AND CONTROL	SD-1-3 (RBLAY)	OFF	MCC-1 LOCKOUT RELAYS 86-M1-1, 86-M1-2, 86-M1-3 CANNOT BE RESET, PREVENTING RESTART OF MCC-1 MSR LOADS POST-SISLOP, INCLUDING CONTROL ROOM AND 1/2 MAIN IPMR COOLING, RCP COOLING FANS	PERIODIC TESTING	(SAME AS 12.3.9.5.2)	*(SAME AS 12.3.9.5.2)	NORMAL POSITION. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.3.09.07.1	SWGR #1 UNDERVOLTAGE AND CONTROL	86-6 (RBLAY)	ON	SWGR #1 LOCKOUT RELAY 86-1 AND MCC-1 LOCKOUT RELAYS 86-M1-1, 86-M1-2, 86-M1-3 TRIP AND LOCKOUT MSR LOADS INCLUDING AIR COMPRESSOR, CONTROL ROOM AND 1/2 MAIN IPMR COOLING, RCP MOTOR COOLING FANS AND PRESSURIZER HEATER GROUPS A AND C	CONTROL ROOM INDICATION	(SAME AS 12.3.9.5.2)	*(SAME AS 12.3.9.5.2)	MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.3.09.07.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-6 (RELAY)	OFF	SWGR #1 LOCKOUT RELAY 86-1 AND PERIODIC TESTING NCC-1 LOCKOUT RELAYS 86-M1-1, 86-M1-2, 86-M1-3 CANNOT BE MANUALLY ACTUATED, NO EFFECT ON SISLOP ACTUATION		REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP	*NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF MSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT AS PER RC 1.75 AND IBB 384
12.3.09.08.1	SWGR #1 UNDERVOLTAGE AND CONTROL	86-M1-1 (LOCKOUT RELAY)	TRIP	RELAY TRIPS AND LOCKS-OUT ITS NCC-1 MSR LOADS, INCLUDING 1/2 MAIN IPNR COOLING, 2/3 RCP COOLING FANS. ALSO STARTS TRAIN A CHARGING PUMP LUBE OIL PAN COOLER	CONTROL ROOM INDICATION	REDUNDANT MAIN IPNR COOLING FOR ALTERNATE OPPOSITE SOURCE, NONE FOR RCPs	REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE. RCPs UNAVAILABLE FOR SCTR, DUE TO LOSS OF MOTOR COOLING	MAIN IPNR HAS 2 TRAINS OF FORCED AIR COOLING
12.3.09.08.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-M1-1 (LOCKOUT RELAY)	RESET	RELAY WILL NOT TRIP AND LOCKOUT ITS NCC-1 MSR LOADS	PERIODIC TESTING	(SAME AS 12.3.9.5.1)	*(SAME AS 12.3.9.5.1)	NORMAL POSITION
12.3.09.09.1	SWGR #1 UNDERVOLTAGE AND CONTROL	86-M1-2 (LOCKOUT RELAY)	TRIP	RELAY TRIPS AND LOCKS-OUT ITS NCC-1 MSR LOADS, INCLUDING RCP-A LUBE OIL PUMP, RCP COOLING FAN A-7, BOTH CONTROL ROOM HEAT PUMPS	CONTROL ROOM INDICATION	NONE	*LOSS OF CONTROL ROOM COOLING, POTENTIALLY DISABLING BOTH TRAINS OF ECCS ACTUATION AND CONTROL	*VERIFICATION REQUIRED THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING. DOSE CALC REV REQD TO ELIMINATE CREDIT FOR FILTERED BVAC AND POST-SCTR RCP OPS
12.3.09.09.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-M1-2 (LOCKOUT RELAY)	RESET	RELAY WILL NOT TRIP AND LOCKOUT ITS NCC-1 MSR LOADS	PERIODIC TESTING	(SAME AS 12.3.9.5.1)	*(SAME AS 12.3.9.5.1)	NORMAL POSITION
12.3.09.10.1	SWGR #1 UNDERVOLTAGE AND CONTROL	86-M1-3 (LOCKOUT RELAY)	TRIP	RELAY TRIPS AND LOCKS-OUT ITS NCC-1 MSR LOADS, INCLUDING BORIC ACID TANK HEATERS AND CONTROL ROOM EMERGENCY FILTER UNIT DUCT HEATER	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS. C/R DUCT HEATER NOT CREDITED POST-SIS/SISLOP FOR EMERGENCY SUPPLY FAN/FILTER EFFICIENCY
12.3.09.10.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-M1-3 (LOCKOUT RELAY)	RESET	RELAY WILL NOT TRIP AND LOCKOUT ITS NCC-1 MSR LOADS	PERIODIC TESTING	(SAME AS 12.3.9.5.1)	*(SAME AS 12.3.9.5.1)	NORMAL POSITION
12.3.09.11.1	SWGR #1 UNDERVOLTAGE AND CONTROL	125VDC BUS #1 (72-118)	VOLTS LOW	LOCKOUT RELAYS FOR SWGR #1, NCC-1 WILL NOT TRIP AND LOCKOUT THEIR MSR LOADS	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPNR COOLING FOR ALTERNATE OPPOSITE SOURCE	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/NCC VOLY DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	RCPs ALSO UNAVAILABLE FOR SCTR. MAIN IPNR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.01.01.1	52-1202 (BBBAE3R)	BBBAE3R	OPEN	INTERRUPTION OF ALL TRAIN B LOADS ON 480V SWGR/NCC, INCLUDING IMMEDIATE LOSS OF TRAIN B RBCIRC, RFP WTR (SPRAW), HYDRAZINE, CCW AND SWC PUMPS, 1/2 MAIN IPNR COOLING, AND DELAYED LOSS OF MFW PP, DG, AND DC BUS #2. MOVs FAIL AS-IS	CONTROL ROOM INDICATION	REDUNDANT TRAIN, TRAIN B 480V POWER VIA SWGR #2-3 TIE BRKR AND SST #3 FOR LO-LO RWST LEVEL TRIP, REDUNDANT MAIN IPNR COOLING FOR ALT OPPOSITE SOURCE	*TRAIN B ECCS INOP FOR INJECTION, TRAIN B DG AND MFW PP POTENTIALLY INOP DUE TO INTERRUPT OF AUXILIARIES, INCL CLNG. TRAIN A POTENTIALLY INOP FOR RBCIRC DUE TO LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*480V ACB FROM SST #2. ROI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-EMERGIZE SWGR #2 TO RESTORE POWER TO MOV-850A AND DC BUS #2 BATTERY CHARGERS FOR TRAIN B SI/PW TERMINATION. MAIN IPNR HAS 2 TRAINS OF FORCED AIR COOLING

EMERGENCY CORR SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.01.01.2	52-1202 (BRBAKBR)	BRBAKBR	CLOSED	480V POWER AVAILABLE TO TRAIN B ECCS LOADS FROM SST #2 AS REQUIRED. HOWEVER, BRER WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS ON 480V SWGR #2	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. BRER FAILURES BOUND SST #2 FAILURES, SINCE CREDIT NOT TAKEN FOR MSR FANS IN XPRR RATING. SISLOP TRIP/LOCKOUT AND BRER COORDINATION PREVENT FREDER TRIP WITH MSR LOAD FAILURES. BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.4.01.02.1	52-1202 (BRBAKBR)	52-1203 "b" CONTACT	OPEN	BRER CANNOT BE CLOSED UNLESS SWGR #2-3 TIE BRER 52-1203 IS IN TEST POSITION. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF SWGR #2 NOT ENERGIZED VIA BRER 52-1202 FROM SST #2
12.4.01.02.2	52-1202 (BRBAKBR)	52-1203 "b" CONTACT	CLOSED	BRER CAN BE CLOSED TO PARALLEL SST #2 AND SST #3 THROUGH 480V SWGR #2. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. 480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.01.03.1	52-1202 (BRBAKBR)	52-1203 133 CONTACT	OPEN	BRER CANNOT BE CLOSED UNLESS SWGR #2-3 TIE BRER IS OPEN. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. 133 CONTACTS FROM CELL SWITCH
12.4.01.03.2	52-1202 (BRBAKBR)	52-1203 133 CONTACT	CLOSED	(SAME AS 12.4.1.2.2)	PERIODIC TESTING	(SAME AS 12.4.1.2.2)	(SAME AS 12.4.1.2.2)	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.01.04.1	52-1202 (BRBAKBR)	52-1200 "b" CONTACT	OPEN	BRER CANNOT BE CLOSED UNLESS SWGR #2 EMERGENCY POWER BRER 52-1200 IS IN TEST POSITION. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	*SWGR #2 EMERGENCY POWER VIA XPRR FROM SDGAB 12 KV LINE VS. SONGS 220 KV SWD. TECH SPEC ACTION ENTRY REQUIRED IF SWGR #2 NOT ENERGIZED VIA BRER 52-1202 FROM SST #2
12.4.01.04.2	52-1202 (BRBAKBR)	52-1200 "b" CONTACT	CLOSED	BRER CAN BE CLOSED TO PARALLEL SST #2 AND EMERGENCY POWER FROM SDGAB THROUGH SWGR #2. NO EFFECT IF BRER ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. 480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.01.05.1	52-1202 (BREAKER)	52-1200 133 CONTACT	OPEN	BRKR CANNOT BE CLOSED UNLESS SWGR #2 EMERGENCY POWER BRKR 52-1200 IS OPEN. NO EFFECT IF BRKR ALREADY CLOSED IN NORMAL ALIGNMENT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. 133 CONTACTS FROM CHLL SWITCH
12.4.01.05.2	52-1202 (BREAKER)	52-1200 133 CONTACT	CLOSED	(SAME AS 12.4.1.4.2)	PERIODIC TESTING	(SAME AS 12.4.1.4.2)	(SAME AS 12.4.1.4.2)	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.01.06.1	52-1202 (BREAKER)	"b" CONTACTS	OPEN	BRKR CLOSED INTERLOCK TO SWGR #2-3 TIE BRKR PREVENTS TIE BRKR CLOSING UNLESS 52-1202 IS IN TEST POSITION OR SWGR #3 NORMAL PREDRR BRKR IS OPEN, AND SWGR #1-3 TIE BRKR IS OPEN	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM EITHER TRAIN BY OPENING ITS NORMAL PREDRR BRKR 52-1303 AND THEN CLOSING EITHER TIE BRKR	NORMAL POSITION
12.4.01.06.2	52-1202 (BREAKER)	"b" CONTACTS	CLOSED	BRKR OPEN SIGNAL TO SWGR #2-3 TIE BRKR ALLOWS PARALLELING SST #2 AND 3 THROUGH 480V SWGR #2, ALTHOUGH FAULT PROTECTION IS NOT PROVIDED FOR SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.01.07.1	52-1202 (BREAKER)	133 CONTACTS	OPEN	BRKR NOT-IN-TEST INTERLOCK TO SWGR #2-3 TIE BRKR PREVENTS TIE BRKR CLOSING UNLESS 52-1202 OR SWGR #3 NORMAL PREDRR BRKR IS OPEN, AND SWGR #1-3 TIE BRKR IS OPEN	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM EITHER TRAIN BY OPENING NORMAL PREDRR BRKR 52-1303 AND THEN CLOSING EITHER TIE BRKR	NORMAL POSITION
12.4.01.07.2	52-1202 (BREAKER)	133 CONTACTS	CLOSED	BRKR IN-TEST SIGNAL TO SWGR #2-3 TIE BRKR ALLOWS PARALLELING SST #2 AND 3 THROUGH 480V SWGR #2, ALTHOUGH FAULT PROTECTION IS NOT PROVIDED FOR SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.01.08.1	52-1202 (BREAKER)	86 (RELAY)	ON	OVLD TRIPS BRKR AND BLOCES CLOSURE OF SWGR #2-3 TIE BRKR. CAUSES LOSS OF ALL TRAIN B 480V SWGR/MCC LOADS, INCL IMMEDIATE LOSS OF REACTOR, REF WTR, HYDRAZINE, CCW AND SWC PPS, 1/2 MAIN IPHR COOLING, AND DELAYED LOSS OF HPW PP, DG AND DC BUS #2	CONTROL ROOM INDICATION	NONE REQD FOR INJECTION, NONE FOR REACTOR (INCL LO-LO RWST LEVEL TRIP). REDUNDANT MAIN IPHR COOLING FOR ALT OFFSITE SOURCE. NONE FOR RCP; POST-SCTR	*TRAIN B ECCS INOPERABLE; TRAIN A POTENTIALLY INOP DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN B SI/PP. REDUCED RELIABILITY OF ALT OFFSITE SOURCE. RCPs ALSO UNAVAILABLE FOR SCTR	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. BOI REV REQD TO TRIP AFFECTED SI/PP PP BEFORE DC POWER LOST. SWGR #2 EMERGENCY POWER FROM SDG&E 12 kV SOURCE NOT ANALYZED/CREDITED. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.01.08.2 (BBBAKBR)	52-1202	86 (RELAY)	OFF	BRER WILL NOT TRIP IN EVENT OF PERIODIC TESTING BUS FAULT, NOB LOCK-OUT SWGR #2-3 TIE BRER		NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS. RELAY DOES NOT PROVIDE OVERLOAD PROTECTION FOR BRER OR 480V SIDE OF SST #2 BRER NORMALLY CLOSED, NOT REQUIRED TO TRIP OPEN RECEIPT FOR FAULT PROTECTION OR RE-ENERGIZING SWGR #2 FROM SWGR #3/SST #3. CAN BE TRIPPED LOCALLY IF NEEDED FOR TIE BRER CLOSURE
12.4.01.09.1 (BBBAKBR)	52-1202	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BRER CANNOT BE CLOSED TO RE-ENERGIZE SWGR #3 FROM TRAIN B 480V SWGR #2 CONTROL ROOM INDICATION, PERIODIC TESTING SST #3/BRER 52-1303 AND SWGR #1-3 TIE BRER 52-1103 AVAILABLE FOR TRAIN A POWER TO SWGR #3 REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 THIRD-OF-A-KIND LOADS (NOV-350/NOV-850C UPS, NOV-883)
12.4.02.01.1 (BBBAKBR)	52-1203	BBBAKBR	OPEN	BRER CANNOT BE CLOSED TO RE-ENERGIZE SWGR #3 FROM TRAIN B 480V SWGR #2	CONTROL ROOM INDICATION, PERIODIC TESTING	SST #3/BRER 52-1303 AND SWGR #1-3 TIE BRER 52-1103 AVAILABLE FOR TRAIN A POWER TO SWGR #3	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 THIRD-OF-A-KIND LOADS (NOV-350/NOV-850C UPS, NOV-883)	NORMAL POSITION
12.4.02.01.2 (BBBAKBR)	52-1203	BBBAKBR	CLOSED	BRER WILL NOT OPEN ON SIS/SISLOP. POTENTIALLY CAUSES LOSS OR INTERRUPTION OF ALL TRAIN B 480V LOADS DURING SIS/SISLOP, INCLUDING RECIRC, RFP WTR, HYDRAZINE, CCW AND SWC PPS, 1/2 MAIN IPHR COOLING, AND DELAYED LOSS OF MPW PP, DG AND DC BUS #2	CONTROL ROOM INDICATION	REDUNDANT TRAIN, TRAIN B 480V POWER THRU TIE BRER AND SST #3 FOR LO-LO RWST LEVEL TRIP, REDUNDANT MAIN IPHR COOLING FOR ALT OPPOSITE SOURCE	*TRAIN B POTENTIALLY INOP DUE TO VOLTAGE DEGRADATION AND SST #2/BRER OVERLOAD DURING SIS/SISLOP LOADING. TRAIN A POTENTIALLY INOP FOR RECIRC DUE TO LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PM. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE	*TECH SPEC ACTION ENTRY REQD WITH EITHER SWGR #1-3 OR SWGR #2-3 TIE BRER CLOSED DURING NORMAL OPS. NOI REV REQD TO TRIP AFFECTED SI/PM PP BEFORE DC POWER LOST IF CANNOT RE-ENERGIZE 480V SWGR. LO-LO RWST LEVEL TRIP AFFECTED IF 480V POWER NOT LOST WITH 480V NORMAL POSITION. LOSS OF SST #2 OR 52-1202 POWER CONTACTS PLUS THIS FAILURE DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.02.02.1 (BBBAKBR)	52-1203	52-1202 "b" CONTACT OR 133 CONTACT	OPEN	BRER CANNOT BE CLOSED IF SWGR #3 NORMAL PROBR BRER 52-1303 IS ALREADY CLOSED. PREVENTS RE-ENERGIZING 480V SWGR #2 FROM SST #3/SWGR #3 IN THE EVENT OF SST #2 OR 52-1202 FAILURE	PERIODIC TESTING	NONE REQUIRED	NONE	480V POWER NOT LOST WITH 480V NORMAL POSITION. LOSS OF SST #2 OR 52-1202 POWER CONTACTS PLUS THIS FAILURE DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.02.02.2 (BBBAKBR)	52-1203	52-1202 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM 480V SWGR #2 NORMAL PROBR BRER DEFEATED. ALLOWS PARALLELING SST #2 AND 3 THROUGH SWGR #2, ALTHOUGH BUS NOT FAULT PROTECTED IN SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS OPERATOR ERROR PLUS FAULT IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.4.02.03.1 (BBBAKBR)	52-1203	52-1103 "b" CONTACT OR 133 CONTACT	OPEN	INTERLOCK FROM SWGR #1-3 TIE BRER PREVENTS BRER CLOSE TO RE-ENERGIZE SWGR #3 FROM TRAIN B SWGR #2	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN A VIA SWGR #1-3 TIE BRER 52-1103	52-1103 "b"/133 CONTACTS MAY ALSO PREVENT RECLOSURE OF SWGR #3 NORMAL PROBR BRER 52-1303 TO RE-ENERGIZE SWGR #3 FROM TRAIN A VIA SST #3

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
ONOPRR UNIT 1
TABLE 12-1: POWER DISTRIBUTION SYSTEM FMBA

ITEM #	DSVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.02.03.2	52-1203 (BREAKER)	52-1103 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM SWGR #1-3 TIE BRER 52-1103 DEPRATED. ALLOWS PARALLELING TRAIN A (SWGR #1) TO TRAIN B (SWGR #2) VIA 480V SWGR #3 IF NORMAL FEEDER BRER 52-1303 IS OPEN (EG. FOLLOWING SISLOP TRIP OF BRER)	PERIODIC TESTING	NONE. ADMINISTRATIVE CONTROLS DO NOT ALLOW THIS CONFIGURATION IN MODES 1 - 4	LOSS OF AUTOMATIC PROTECTION AGAINST PARALLELING REDUNDANT TRAINS A AND B 480V SWGR	*TRCH SPCC ACTION ENTRY REQD FOR THIS CONDITION SINCE SIS/SISLOP TRIP SIGNALS ARE MOMENTARY ONLY (VIA TDRs) AND DO NOT PREVENT PARALLELING BY A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR AFTER TRIP
12.4.02.04.1	52-1203 (BREAKER)	52-1303 "b" CONTACT OR 133 CONTACT	OPEN	INTERLOCK FROM SWGR #3 NORMAL FEEDER BRER 52-1303 PREVENTS BRER CLOSURE TO RE-ENERGIZE SWGR #3 FROM TRAIN B SWGR #2 (IB, W/ 52-1202 CLOSED)	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN A VIA THIS BRER AND SST #3	SWGR #1-3 TIE BRER 52-1103 CLOSURE MAY ALSO BE DISABLED BY 52-1303 "b"/133 INTERLOCK
12.4.02.04.2	52-1203 (BREAKER)	52-1303 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM SWGR #5 NORMAL FEEDER BRER 52-1303 DEPRATED. ALLOWS PARALLELING SST #2 AND SST #3 THROUGH 480V SWGR #2, ALTHOUGH FAULT PROTECTION IS NOT PROVIDED FOR SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDUREALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.02.05.1	52-1203 (BREAKER)	52-1200 "b" CONTACT OR 133 CONTACT	OPEN	INTERLOCK FROM SWGR #2 EMERGENCY POWER FEEDER 52-1200 PREVENTS BRER CLOSURE TO RE-ENERGIZE SWGR #3 FROM TRAIN B SWGR #2 (IB, W/ 52-1202 CLOSED)	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN A VIA 52-1203 AND SST #3 OR 52-1103 AND SWGR #1	480V LOAD TRANSFER PROCEDUREALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.02.05.2	52-1203 (BREAKER)	52-1200 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM SWGR #2 EMERGENCY POWER FEEDER 52-1200 DEPRATED, ALLOWS PARALLELING EMERGENCY POWER FROM SDGAR WITH SST #3 VIA SWGR #2, ALTHOUGH FAULT PROTECTION IS NOT PROVIDED FOR SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDUREALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.02.06.1	52-1203 (BREAKER)	52-1202 85 (RBLA7)	CONTACTS OPEN (ON)	OVERLOAD INTERLOCK FROM 480V SWGR #2 NORMAL FEEDER BRER 52-1202 PREVENTS CLOSING BRER TO RE-ENERGIZE SWGR #3 FROM TRAIN B SWGR #2	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN A VIA BRER 52-1303 AND SST #3 ON TIE BRER 52-1103 FROM SWGR #1	EFFECT OF '86 RELAY FAILURE ON BOTH 52-1202 AND 52-1203 IS ADDRESSED IN ITEM 12.4.01.06.1
12.4.02.06.2	52-1203 (BREAKER)	52-1202 85 (RBLAT)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM 480V SWGR #2 NORMAL FEEDER BRER 52-1202 DEPRATED. ALLOWS PARALLELING OF SWGR #3 TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE PLANT DESIGN BASIS

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DRY/CB ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.02.07.1	52-1203 (BRBAKBR)	52-1303 86-1 (RELAT)	CONTACTS OPEN (ON)	OVERLOAD INTERLOCK FROM 480V SWGR #3 NORMAL PERDDB BRER 52-1303 PREVENTS CLOSING BRER TO RE-ENERGIZE SWGR #3 FROM TRAIN B 480V SWGR #2	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA SWGR #1-3 TIE BRER 52-1103	CONCURRENT EFFECT OF 86 AND 86-1 RELAY OPERATION ON 52-1103, 1203 AND 1303 IS ADDRESSED IN THE ENTRIES FOR 52-1303 IN SECTION 12.6
12.4.02.07.2	52-1203 (BRBAKBR)	52-1303 86-1 (RELAT)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK FROM 480V SWGR #3 NORMAL PERDDB BRER 52-1303 DELETED. ALLOWS PARALLELING OF SWGR #2 TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.02.08.1	52-1203 (BRBAKBR)	SEQ 2 (21-5,7)	CONTACTS OPEN (OFF)	BRER WILL NOT TRIP ON SIS/SISLOP TO AUTOMATICALLY ISOLATE TRAIN B 480V SWGR #2 FROM SWGR #3 LOADS	PERIODIC TESTING	NONE REQUIRED IF BRER INITIALLY OPEN	NONE IF BRER INITIALLY OPEN	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED IF TIE BRER CLOSED IN MODES 1 - 4
12.4.02.08.2	52-1203 (BRBAKBR)	SEQ 2 (21-5,7)	CONTACTS CLOSED (ON)	BRER WILL TRIP, IF CLOSED. HOWEVER, RESET OF TRIP SIGNAL AFTER 5 SEC VIA TDR PREVENTS SUBSEQUENT RETRIP IF NEEDED	CONTROL ROOM INDICATION	NONE REQUIRED IF BRER INITIALLY OPEN	NONE IF BRER INITIALLY OPEN	
12.4.02.09.1	52-1203 (BRBAKBR)	"a" CONTACTS	OPEN	BRER OPEN SIGNAL TO SWGR #3 125VDC CONTROL POWER SELECTOR PREVENTS AUTOMATIC TRANSFER OF SWGR #3 CONTROL POWER TO TRAIN B (125VDC BUS #2) WHEN SWGR #3 PARALLELED TO SWGR #2	PERIODIC TESTING	NONE REQUIRED	NONE	CROSS-TRAIN POWER AND CONTROL ALIGNMENT DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS. SWGR #3 CONTROL POWER MAY ALSO BE MANUALLY SELECTED WITH LOCAL SWITCHES SS1 AND SS2
12.4.02.09.2	52-1203 (BRBAKBR)	"a" CONTACTS	CLOSED	BRER CLOSED SIGNAL TO SWGR #3 125VDC CONTROL POWER SELECTOR. CONTROL POWER REMAINS ALIGNED TO TRAIN A (125VDC BUS #1) UNTIL REDUNDANT "b" CONTACTS FROM 52-1203 OPEN	PERIODIC TESTING	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION, SINCE A SUBSEQUENT SINGLE FAILURE COULD RESULT IN CROSS-TRAIN POWER/CONTROL AT SWGR #3 AND LOSS OF ELECTRICAL SEPARATION BETWEEN REDUNDANT TRAINS A AND B
12.4.02.10.1	52-1203 (BRBAKBR)	"b" CONTACTS	OPEN	BRER CLOSED INTERLOCK TO SWGR #2 AND 3 PERDDB BRERS, AND SWGR #1-3 TIE BRER PREVENTS THEIR CLOSING, IF OPEN, UNLESS 52-1203 IS IN THE TEST POSITION. ALSO SENDS BRER CLOSED SIGNAL TO SWGR #3 CONTROL POWER SELECTOR, CAUSING LOSS OF SWGR #3 CONTROL PWR	PERIODIC TESTING	NONE REQUIRED FOR SHORT TERM, OPERATOR ACTIONS FOR LONG-TERM	NONE FOR SHORT TERM. FOR LONG TERM, SWGR #3 CAN BE RE-ENERGIZED WITH THIS FAILURE BY LOCALLY RACKING-OUT SWGR #2-3 TIE BRER 52-1203 IN 480V ROOM AND THEN CONNECTING TO TRAIN A VIA 52-1303 OR 52-1103 TO PREVENT LOSS OF NOV-358/NOV-850C UPS	*NOV-358/NOV-850C UPS DUTY CYCLE > 30 MINUTES TO PERMIT CREDIT FOR OPERATOR ACTION LOCALLY IN THE 48V ROOM OR 480V ROOM. BOI CHANGE REQUIRED TO INCLUDE PLACING SWGR #3 CONTROL POWER SELECTOR IN MANUAL TO RE-ESTABLISH 125VDC CONTROL POWER TO SWGR #3 BRERS
12.4.02.10.2	52-1203 (BRBAKBR)	"b" CONTACTS	CLOSED	BRER OPEN SIGNAL TO SWGR #2 AND 3 PERDDB BRERS, AND SWGR #1-3 TIE BRER. ALLOWS PARALLELING SST #2 AND 3 THRU 480V SWGR #2 OR PARALLELING TRAIN A AND B THRU 480V SWGR #3. ALSO CAUSES SELECTION OF SWGR #3 CONTROL PWR TO TRAIN A IF "a" CONTACT OPEN	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION SINCE A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR COULD RESULT IN CROSS-TRAIN POWER AND CONTROL AT SWGR #3 AND LOSS OF ELECTRICAL SEPARATION BETWEEN REDUNDANT TRAINS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 TABLE 12-1: POWER DISTRIBUTION SYSTEM FNBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.02.11.1	52-1203 (BRBAKBR)	133 CONTACTS	OPEN	BRER NOT-IN-TEST SIGNAL TO SWGR #2 PREDBR BRER, SWGR #3 PREDBR BRER, AND SWGR #1-3 TIB BRER PREVENTS TIBR CLOSING, IF OPEN, UNLESS 52-1203 IS OPEN	PERIODIC TESTING	REDUNDANT TRAIN A AND B POWERD VALVES FOR CLR, REDUNDANT SI/PW PUMP TRIPS FOR LO-LO RWST LEVEL TRIP	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP WITHOUT INTERRUPTION OF TRAIN B 480V POWER, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE MOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CRS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION
12.4.02.11.2	52-1203 (BRBAKBR)	133 CONTACTS	CLOSED	BRER-IN-TEST SIGNAL TO SWGR #2 PREDBR BRER, SWGR #3 PREDBR BRER, AND SWGR #1-3 TIB BRER. ALLOWS PARALLELING SST #2 AND 3 THROUGH 480V SWGR #2 OR PARALLELING TRAIN A AND B THROUGH 480V SWGR #3	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.4.02.12.1	52-1203 (BRBAKBR)	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED IF BRER INITIALLY OPEN	NONE IF BRER INITIALLY OPEN. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA 52-1303 AND SST #3 OR 52-1103 AND SWGR #1	*TECH SPEC ACTION ENTRY REQUIRED IF SWGR #2-3 TIB BRER CLOSED DURING NORMAL OPERATION
12.4.03.01.1	MCC-2 (BRBAKBR)	52-1218	OPEN	LOSS OF POWER TO MCC-2 LOADS, INCLUDING MOV-1100C/D, 1/3 SI PATHS, 1/3 CLR PATHS, PRIMARY AND ALT HLE PATHS, 1 RECIRC TRAIN, 1 HYDRAZINE PUMP, 1 CCM TRAIN, 1 MFW ISOLATION MOV, MFW PUMP LUBE OIL PAM CLR, 1/2 MAIN IPMR COOLING, AND RCP MOTOR COOLING	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS/SISLOP, REDUNDANT MAIN IPMR COOLING FOR ALT OPPOSITE SOURCE. NONE FOR RCP OPERATION POST-SCTR	TRAIN B ECCS INOPERABLE. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs UNAVAILABLE FOR SCTR	*MCC-2 480V ACB. BOI REV BRQD TO RE-ENERGIZE UTILITY BUS FROM MCC-1 VIA HTS-7 TO RECOVER HLE PRIMARY PATH WITH THIS FAILURE. CHARGING PUMPS ALSO UNAVAILABLE FOR INJECTION IF MOV-1100C IS ON TRAIN B. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.03.01.2	MCC-2 (BRBAKBR)	52-1218	CLOSED	480V POWER AVAILABLE TO TRAIN B MCC-2 LOADS. HOWEVER, BRER WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. BRERS MUST COORDINATE TO PREVENT PREDBR TRIP UNDER SIS AS WELL AS SISLOP. MCC BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.4.03.02.1	MCC-2	NSR LOADS	ON (BRER CLOSED)	LOAD(S) WILL NOT TRIP ON SISLOP OR TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-2 PREDBR BRER 52-1218	PERIODIC TESTING	(SAME AS 12.4.3.1.1)	(SAME AS 12.4.3.1.1)	INCLUDES RCP MOTOR COOLING, 1 OF 2 TRAINS OF MAIN IPMR FORCED AIR COOLING
12.4.03.02.2	MCC-2	NSR LOADS	OFF (BRER OPEN)	LOSS OF ONE OR MORE MCC-2 NSR LOADS, INCLUDING 1/2 MAIN IPMR COOLING, RCP LUBE OIL PUMPS AND MOTOR COOLING	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP, REDUNDANT MAIN IPMR COOLING FOR ALT OPPOSITE SOURCE. NONE FOR RCP OPERATION POST-SCTR	NONE FOR SIS/SISLOP, REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs UNAVAILABLE FOR SCTR	*DOSE CALC REV BRQD TO ELIMINATE CREDIT FOR RCP OPERATION POST-SCTR. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.03.02.3	MCC-2	NSR LOADS	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF NSR LOADS, CHALLENGING MCC-2 LOAD AND PREDBR BRERS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BRERS AND BRER COORDINATION TO PREVENT PREDBR BRER TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR TBB 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (TR, SIS AND SISLOP)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SRR ONOFFER UNIT 1
TABLE 12-1: POWER DISTRIBUTION SYSTEM PNEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.04.01.1	MCC-2A	52-1223 (888A888)	OPEN	LOSS OF POWER TO MCC-2A LOADS, INCLUDING TRAIN B HYDRAZINE PUMP, NOV-1100C AND REACTOR AUX BLDG HVAC	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR INJECTION, NONE FOR RECIRC	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOPERABLE FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	*MCC-2A 480V ACB. VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERMS
12.4.04.01.2	MCC-2A	52-1123 (888A888)	CLOSED	480V POWER AVAILABLE TO TRAIN B MCC-2A LOADS. HOWEVER, BRER WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. BRERS MUST COORDINATE TO PREVENT FREDBR TRIP. MCC BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.4.04.02.1	MCC-2A	NSR LOADS	ON (888R CLOSED)	LOAD(S) WILL NOT TRIP ON SISLOP OR TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-2A FREDBR BRER 52-1223	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 12.4.4.1.1)	(SAME AS 12.4.4.1.1)	
12.4.04.02.2	MCC-2A	NSR LOADS	OFF (888R OPEN)	LOSS OF DNB OR MORE MCC-2A NSR LOADS, INCLUDING REACTOR AUX BLDG HVAC	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR INJECTION, NONE FOR RECIRC	*POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	*VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM COOLING AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERMS
12.4.04.02.3	MCC-2A	NSR LOADS	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF NSR LOADS, CHALLENGING MCC-2A LOAD AND FREDBR BRERS. SINCE ALL LOADS RECEIPT HYDRAZINE PUMP AND NOV-1100C ARE NSR AND ALL LOCATED IN RT AUX BLDG, FREDBR BRER MAY TRIP FROM CONCURRENT FAULT DUE TO POST-LOCA DOSES IN AREA	NONE	REDUNDANT TRAIN FOR INJECTION, NONE FOR RECIRC	*LOSS OF TRAIN A HYDRAZINE PUMP, AND POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	* (SAME AS 12.4.4.2.2)
12.4.05.01.1	MCC-2B	52-1229 (888A888)	OPEN	LOSS OF POWER TO MCC-2B LOADS, INCLUDING TRAIN B DC AUXILIARIES	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN B INOPERABLE FOR SISLOP, NONE FOR SIS	MCC-2B 480V ACB
12.4.05.01.2	MCC-2B	52-1229 (888A888)	CLOSED	480V POWER AVAILABLE TO TRAIN B MCC-2B LOADS. HOWEVER, BRER WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. HOWEVER, BRERS COORDINATE TO PREVENT FREDBR TRIP. MCC BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.4.05.02.1	MCC-2B	NSR LOADS	ON (888R CLOSED)	LOAD(S) WILL NOT TRIP ON SISLOP OR TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-2B FREDBR BRER 52-1229	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 12.4.5.1.1)	(SAME AS 12.4.5.1.1)	INCLUDES THUNDERBOLT SIREN, DC BLDG RECEPTACLES, SUMP PUMPS AND DC COMPRESSORS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.05.02.2	MCC-2B	NSR LOADS	OFF (BRRR OPEN)	LOSS OF ONE OR MORE MCC-2B NSR LOADS, INCLUDING THUNDERBOLT SIREN SYSTEM, 1/2 DG #2 STARTING AIR COMPRESSORS, 1/2 DG #2 INSTRUMENT AIR COMPRESSORS, OR DG #2 ERSP-WARM HEATER	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL INABILITY TO RESTART TRAIN B DC IF OFFSITE POWER IS LOST AFTER INITIAL SIS STARTING ATTEMPTS, DUE TO LOSS OF ERSP-WARM SYSTEM. NONE FOR SIS	DC QUALIFIED BASED ON OPERATION OF ERSP-WARM SYSTEM PRIOR TO ENGINE OPERATION
12.4.05.02.3	MCC-2B	NSR LOADS	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF NSR LOADS, CHALLENGING MCC-2B LOAD AND PROBE BRRS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BRRS AND BRRR COORDINATION TO PREVENT BRDR BRTR TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT TRIPPED/LOCKED OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IB LOADS ON A SAFETY SIGNAL (IB, SIS AND SISLOP) 480V BRTR FOR BATTERY CHARGER
12.4.05.03.1	MCC-2B	8-12B26 (BRRRBR)	OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #2	CONTROL ROOM INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN B 125VDC CONTROL POWER	480V BRTR FOR BATTERY CHARGER D
12.4.05.03.2	MCC-2B	8-12B26 (BRRRBR)	CLOSED	480V POWER AVAILABLE TO TRAIN B 125VDC BATTERY CHARGER D	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	PARALLELING OF BATTERY CHARGERS PRECLUDED BY ADMINISTRATIVE CONTROL
12.4.05.04.1	MCC-2B	8-12B30 (BRRRBR)	OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #2	CONTROL ROOM INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN B 125VDC CONTROL POWER	480V BRTR FOR BATTERY CHARGER C
12.4.05.04.2	MCC-2B	8-12B30 (BRRRBR)	CLOSED	480V POWER AVAILABLE TO TRAIN B 125VDC BATTERY CHARGER C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	PARALLELING OF BATTERY CHARGERS PRECLUDED BY ADMINISTRATIVE CONTROL
12.4.06.01.1	52-1200 (BRRRBR)							480V ACS FOR SWGR #2 EMERGENCY POWER FROM SDGAR 12 kV SOURCE. THIS SOURCE NOT CREDITED/ANALYZED FOR SIS/SISLOP EVENTS. THEREFORE, IMPACT OF BREAKER FAILURES BOUNDED BY OTHER ENTRIES ABOVE (THIS BLOCK OF RECORDS RESERVED FOR LATER ADDITION OF OTHER TRAIN B 480V SWGR #2 SR LOADS)
12.4.07.01.1	(NOT USED)							
12.4.08.01.1	SWGR #2 NSR LOADS	BRRRBR(S)	OPEN	TRAIN B NSR LOAD(S) TRIP, CANNOT BE RESTARTED. POTENTIALLY DISABLES 1/3 INSTRUMENT AIR COMPRESSORS FOR SECONDARY RECIRC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT AIR COMPRESSORS POWERED BY SWGR #1 AND 3 FOR SECONDARY RECIRC, NONE REQUIRED FOR OTHER ECCS FUNCTIONS	REDUCED RELIABILITY FOR ISA SUPPLY TO SECONDARY RECIRC VALVES, NONE FOR OTHER ECCS FUNCTIONS	CAN ALSO DISABLE ONE SCREEN WASH PUMP, CONDENSER VACUUM PUMP, FIRE PUMP, AND SPHERE ENCLOSURE BUILDING (SEB) SUPPLY OR EXHAUST FAN
12.4.09.01.2	SWGR #2 NSR LOADS	BRRRBR(S)	CLOSED	TRAIN B 480V NSR LOAD(S) WILL NOT TRIP ON BUS UNDERVOLTAGE, SEQ SIGNAL (INCLUDING SISLOP LOCKOUT) OR FAULT	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN	TRAIN B INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.08.01.3	SWGR #2 MSR LOADS	BBBAER(S)	EQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF TRAIN B 480V MSR LOAD(S), CHALLENGING SWGR #2 LOAD AND PBDDBE BEERS	NONE	BEER COORDINATION TO PREVENT PBDDBE BEER TRIP FOR COMPLETE FAULTS, NONE FOR OVERCURRENT FAILURE OF LOADS BELOW FAULT PROTECTION SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RC 1.75 OR IRRR 184 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1E LOADS ON A SAFETY SIGNAL (IE, SIS AND SISLOP)
12.4.09.01.1	SWGR #2 UNDERVOLTAGE AND (11-2,4) CONTROL	SBQ 2	CONTACTS OPEN (OFF)	UV AUX RELAYS 27-1X1, 27-1X2, 27-1X3 AND 27-1X4 WILL NOT ENERGIZE AS REQUIRED ON SBQ 2 (SISLOP) ACTUATION. UNDERVOLTAGE ACTUATION UNAPFFECTED	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPMR COOLING FOR ALTERNATE OFFSITE SOURCE	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO SWGR #2 VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	NORMAL POSITION. RCPS UNAVAILABLE DUE TO LOSS OF MOTOR CLNG WITH THIS FAILURE. RELAY 27-1X4 PROVIDES SISLOP UV TRIP OF SWGR #3 LOADS. HOWEVER, SWGR #3 IS ISOLATED ON SIS/SISLOP VIA SEPARATE SEQUENCER CONTACTS. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.09.01.2	SWGR #2 UNDERVOLTAGE AND (11-2,4) CONTROL	SBQ 2	CONTACTS CLOSED (ON)	UV AUX RELAYS 27-1X1, 27-1X2, 27-1X3 AND 27-1X4 ENERGIZE, TRIPPING ALL TRAIN B 480V LOADS EXCEPT MCCS AND AIR COMPRESSORS, RESULTING IN IMMEDIATE LOSS OF TRAIN B BECIRC, BEP VTR, HYDRAZINE, CCW AND SMC PPS. DELAYED LOSS OF DC BUS #2 VIA LOSS OF CTRGRS	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR INJECTION, NONE FOR BECIRC (INCLUDING LO-LO RWST LEVEL TRIP)	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOPERABLE DUE TO: CCW FLOW BYPASS VIA NOV-720A AND LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW	SISLOP SIGNAL TO SWGR #2 UV RELAYS IS NORMALLY MOMENTARY. MAINTAINED SIGNAL DUE TO RELAY FAILURE PREVENTS RESTART OF AFFECTED LOADS. SWGR #3 LOADS OTHER THAN AIR COMPRESSOR AND MCCS WILL ALSO TRIP WITH THIS FAILURE
12.4.09.02.1	SWGR #2 UNDERVOLTAGE AND (UV RELAY) CONTROL	27-1	ON (VOLTS LOW)	UV AUX RELAYS 27-1X1, 27-1X2 AND 27-1X3 ENERGIZE, TRIPPING ALL TRAIN B 480V LOADS EXCEPT MCCS AND AIR COMPRESSORS, RESULTING IN IMMEDIATE LOSS OF TRAIN B BECIRC, BEP VTR, HYDRAZINE, CCW AND SMC PPS, DELAYED LOSS OF DC BUS #2 VIA LOSS OF CTRGRS	CONTROL ROOM INDICATION	(SAME AS 12.4.9.1.2)	(SAME AS 12.4.9.1.2)	*BOI REV REQD TO CLOSE AFFECTED CCW BY NOV TO RECOVER CCW HEAT REMOVAL CAPABILITY WITH FAILURE OF ONE SMC PUMP, AND TRIP AFFECTED SI/PW PUMPS BEFORE DC POWER IS LOST
12.4.09.02.2	SWGR #2 UNDERVOLTAGE AND (UV RELAY) CONTROL	27-1	OFF (VOLTS NORMAL)	UV AUX RELAYS 27-1X1, 27-1X2 AND 27-1X3 WILL NOT ENERGIZE AS REQUIRED ON BUS UNDERVOLTAGE. SBQ ACTUATION UNAPFFECTED	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	
12.4.09.03.1	SWGR #2 UNDERVOLTAGE AND (10-10,12) CONTROL	SBQ 2	CONTACTS OPEN (OFF)	SWGR #2 LOCKOUT RELAY WILL NOT TRIP TRAIN B 480V SWGR #2 MSR LOADS ON SISLOP, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS B AND D	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPMR COOLING FOR ALT OFFSITE SOURCE	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*NORMAL POSITION. INCLUDES RESET SWITCH. BOI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE 125VDC CONTROL POWER IS LOST. RCPS ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.09.03.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SBQ 2 (10-10,12)	CONTACTS CLOSED (ON)	SWGR #2 LOCKOUT RELAY TRIPS TRAIN B 480V SWGR #2 MSR LOADS, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS B AND D	CONTROL ROOM INDICATION	REDUNDANT AIR COMPRESSORS POWERED FROM SWGR #1 AND 3 FOR SECONDARY RECIRC, WOMB REQUIRED FOR OTHER EVENTS	INOPERABILITY OF SWGR #2 POWERED AIR COMPRESSOR FOR SECONDARY RECIRC VALVES, WOMB FOR OTHER EVENTS	
12.4.09.04.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-2 (RBLAT)	TRIP	SWGR #2 LOCKOUT RELAY TRIPS ALL TRAIN B 480V SWGR #2 MSR LOADS, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS B AND D	CONTROL ROOM INDICATION	(SAME AS 12.4.9.3.2)	(SAME AS 12.4.9.3.2)	SWGR #2 SISLOP LOCKOUT RELAY
12.4.09.04.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-2 (RBLAT)	RESBT	SWGR #2 LOCKOUT RELAY WILL NOT TRIP TRAIN B 480V SWGR #2 MSR LOADS ON SISLOP, INCLUDING AIR COMPRESSORS, PRESSURIZER HEATER GROUPS B AND D	PERIODIC TESTING	(SAME AS 12.4.9.3.1)	(SAME AS 12.4.9.3.1)	
12.4.09.05.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SBQ 2 (12-1,3) (12-5,7)	CONTACTS OPEN (OFF)	MCC-2 LOCKOUT RELAYS 86-M2-1, 86-M2-2, 86-M2-3 WILL NOT ENERGIZE AS REQUIRED ON SISLOP	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPMR COOLING FOR ALTERNATE OPPOSITE SOURCE	POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RUST LEVEL TRIP OF SI/PV. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SBQ 2 PREVENT THIS FAILURE UNLESS SBQ 2 LOAD GROUP A OUTPUT ON RELAY DRIVEN CARD(S) FAIL. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.09.05.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SBQ 2 (12-1,3) (12-5,7)	CONTACTS CLOSED (ON)	MCC-2 LOCKOUT RELAYS 86-M2-1, 86-M2-2, 86-M2-3 TRIP AND LOCKOUT MCC-2 MSR LOADS, INCLUDING SPHRRS PURGE AND EXHAUST, 1/2 MAIN IPMR COOLING, RCP MOTOR COOLING, RCP-B LUBE OIL PUMP	CONTROL ROOM INDICATION	CONTAINMENT SPRAY PLUS #2 RECOMBINER ON REDUNDANT TRAIN FOR POST-LOCA #2 CONTROL, REDUNDANT MAIN IPMR COOLING FOR ALT OPPOSITE SOURCE	SPHRRS PURGE UNAVAILABLE FOR POST-LOCA #2 CONTROL, REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SBQ 2 BLOCK/RESBT. VERIF REQD OF ADEQUACY OF CONTAINMENT SPRAY W/ #2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MITIG TO PREVENT POST-LOCA #2 POCKETS. RCPs ALSO LOST. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.09.06.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-5 (RBLAT)	ON	MCC-2 LOCKOUT RELAYS 86-M2-1, 86-M2-2, 86-M2-3 WILL ALTERNATE BETWEEN RESBT AND TRIP STATE AS SOON AS SISLOP OR MANUAL LOCKOUT INITIATION OCCURS, AND IMMEDIATELY RESBT AFTER SBQ BLOCK/RESBT	PERIODIC TESTING	(SAME AS 12.4.9.5.1)	(SAME AS 12.4.9.5.1)	LOCKOUT RESBT RELAY FOR 86-M2-1, 86-M2-2, 86-M2-3. INCLUDES HANDSWITCH
12.4.09.06.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-5 (RBLAT)	OFF	MCC-2 LOCKOUT RELAYS 86-M2-1, 86-M2-2, 86-M2-3 CANNOT BE RESET, PREVENTING RESTART OF MCC-2 MSR LOADS POST-SISLOP, INCLUDING SPHRRS PURGE AND EXHAUST, 1/2 MAIN IPMR COOLING, RCP MOTOR COOLING, RCP-B LUBE OIL PUMP	PERIODIC TESTING	(SAME AS 12.4.9.5.2)	(SAME AS 12.4.9.5.2)	NORMAL POSITION. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING

TABLE 12-1: POWER DISTRIBUTION SYSTEM PNB3A

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.09.07.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-9 (RBLAY)	ON	SWGR #2 LOCKOUT RBLAY 86-2 AND MCC-2 LOCKOUT RELAYS 86-H2-1, 86-H2-2, 86-H2-3 TRIP AND LOCKOUT MSR LOADS INCLUDING AIR COMPRESSOR, 1/2 MAIN IPMR COOLING, RCP MOTOR COOLING, SPHRRR PURGE AND EXHAUST, AND PRESSURIZER HEATER GROUPS B AND D	CONTROL ROOM INDICATION	(SAME AS 12.4.9.5.2)	(SAME AS 12.4.9.5.2)	MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.09.07.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-9 (RBLAY)	OFF	SWGR #2 LOCKOUT RBLAY 86-2 AND MCC-2 LOCKOUT RELAYS 86-H2-1, 86-H2-2, 86-H2-3 CANNOT BE MANUALLY ACTUATED, NO EFFECT ON SISLOP ACTUATION	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	*NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF MSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT AS PER RC 1.75 AND IRR 384
12.4.09.08.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-1 (LOCKOUT RBLAY)	TRIP	RELAY TRIPS AND LOCKS-OUT ITS MCC-2 MSR LOADS, INCLUDING 1/2 MAIN IPMR COOLING, SPHRRR COOLING/FILTER FANS, REACTOR CAVITY FANS	CONTROL ROOM INDICATION	CONTAINMENT SPRAY PLUS H2 RECOMBINER FROM REDUNDANT TRAIN FOR POST-LOCA H2 CONTROL, REDUNDANT MAIN IPMR COOLING FOR ALTERNATE OPPOSITE SOURCE	FANS UNAVAILABLE FOR FORCED CIRCULATION OF SPHRRR ATMOSPHERE FOR POST-LOCA H2 CONTROL, REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE	*VERIFICATION REQD OF ADEQUACY OF CONTAINMENT SPRAY PLUS H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKETS. MAIN IPMR HAS 2 TRAINS OF FORCED AIR COOLING
12.4.09.08.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-1 (LOCKOUT RBLAY)	RESET	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-2 MSR LOADS	PERIODIC TESTING	(SAME AS 12.4.9.5.1)	*(SAME AS 12.4.9.5.1)	NORMAL POSITION
12.4.09.09.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-2 (LOCKOUT RBLAY)	TRIP	RELAY TRIPS AND LOCKS-OUT ITS MCC-2 MSR LOADS, INCLUDING RCP-B LUBE OIL PUMP, SPHRRR PURGE AND CIRCULATION FANS	CONTROL ROOM INDICATION	CONTAINMENT SPRAY PLUS H2 RECOMBINER FROM REDUNDANT TRAIN FOR POST-LOCA H2 CONTROL	FANS UNAVAILABLE FOR FORCED CIRCULATION OF SPHRRR ATMOSPHERE FOR POST-LOCA H2 CONTROL	*VERIFICATION REQD OF ADEQUACY OF CONTAINMENT SPRAY PLUS H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKETS
12.4.09.09.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-2 (LOCKOUT RBLAY)	RESET	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-2 MSR LOADS	PERIODIC TESTING	(SAME AS 12.4.9.5.1)	*(SAME AS 12.4.9.5.1)	NORMAL POSITION
12.4.09.10.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-3 (LOCKOUT RBLAY)	TRIP	RELAY TRIPS AND LOCKS-OUT ITS MCC-2 MSR LOADS, INCLUDING RCP COOLING FANS AND SPHRRR EXHAUST FAN	CONTROL ROOM INDICATION	CONTAINMENT SPRAY PLUS H2 RECOMBINER FROM REDUNDANT TRAIN FOR POST-LOCA H2 CONTROL, NONE FOR RCP'S POST-SCTR	FANS UNAVAILABLE FOR SPHRRR PURGE FOR POST-LOCA H2 CONTROL OR FOR RCP MOTOR COOLING	*VERIFICATION REQD OF ADEQUACY OF CONTAINMENT SPRAY PLUS H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKETS
12.4.09.10.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-3 (LOCKOUT RBLAY)	RESET	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-2 MSR LOADS	PERIODIC TESTING	(SAME AS 12.4.9.5.1)	*(SAME AS 12.4.9.5.1)	NORMAL POSITION
12.4.09.11.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (11-9,11)	CONTACTS OPEN (OFF)	MCC-2A LOCKOUT RELAYS 86-H2A-1, 86-H2A-2 WILL NOT ENERGIZE AS REQUIRED ON SISLOP	PERIODIC TESTING	NONE FOR SISLOP, NONE FOR RCP'S POST-SCTR, NONE OTHERWISE REQUIRED FOR SIS	*POTENTIAL IMOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL IMOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. RCP'S UNAVAIL FOR SCTR	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 NOT PROVIDED FOR MCC-2A LOCKOUT ACTUATION

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.09.11.2	SWGR #2 UNDERSVOLTAGE AND CONTROL	SEQ 2 (11-9,11)	CONTACTS CLOSED (ON)	MCC-2A LOCKOUT RELAYS 86-N2A-1, 86-N2A-2 TRIP AND LOCKOUT MCC-2A NSR LOADS, INCLUDING REACTOR AUX BLDG HVAC AND BORIC ACID TANK HEATER. ALSO STARTS TRAIN B CHARGING PUMP LUBE OIL PAN COOLER	CONTROL ROOM INDICATION	NONE REQUIRED FOR INJECTION, NONE FOR RECIRC	*POTENTIAL IMOPRABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF CHARGING PUMP ROOM COOLING	*CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 2 BLOCK/RESET. VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERM
12.4.09.12.1	SWGR #2 UNDERSVOLTAGE AND CONTROL	SD-1-4 (RELAY)	ON	MCC-2A LOCKOUT RELAYS 86-N2A-1, 86-N2A-2 WILL ALTERNATE BETWEEN RESET AND TRIP STATE AS SOON AS SISLOP OR MANUAL LOCKOUT INITIATION OCCURS, AND IMMEDIATELY RESET AFTER SEQ BLOCK/RESET	PERIODIC TESTING	(SAME AS 12.4.9.11.1)	*(SAME AS 12.4.9.11.1)	LOCKOUT RESET RELAY FOR 86-N2A-1, 86-N2A-2. INCLUDES HANDSWITCH
12.4.09.12.2	SWGR #2 UNDERSVOLTAGE AND CONTROL	SD-1-4 (RELAY)	OFF	MCC-2A LOCKOUT RELAYS 86-N2A-1, 86-N2A-2 CANNOT BE RESET, PREVENTING RESTART OF MCC-2A NSR LOADS POST-SISLOP, INCLUDING REACTOR BUILDING SUPPLY FAN AND BORIC ACID TANK HEATER	PERIODIC TESTING	(SAME AS 12.4.9.11.2)	(SAME AS 12.4.9.11.2)	NORMAL POSITION. BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS
12.4.09.13.1	SWGR #2 UNDERSVOLTAGE AND CONTROL	86-8 (RELAY)	ON	MCC-2A LOCKOUT RELAYS 86-N2A-1, -2 AND MCC-3 LOCKOUT RELAYS 86-N3-1, -2, -3, -4 TRIP AND LOCKOUT NSR LOADS INCLUDING REACTOR AUX BLDG SUPPLY FAN, A/B-IFMR COOLING, RCP-C LUBE OIL PUMP, REHEATER STM ISOLATION MOVs	CONTROL ROOM INDICATION	NONE REQD FOR INJECTION, NONE FOR RECIRC	*POTENTIAL IMOP OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	AUXILIARY IFMR A/B HAVE "OA" RATING (IE, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OPPOSITE SOURCE DUTY WITHOUT RCPs
12.4.09.13.2	SWGR #2 UNDERSVOLTAGE AND CONTROL	86-8 (RELAY)	OFF	MCC-2A LOCKOUT RELAYS 86-N2A-1, -2 AND MCC-3 LOCKOUT RELAYS 86-N3-1, -2, -3, -4 CANNOT BE MANUALLY ACTUATED, NO EFFECT ON SISLOP ACTUATION	PERIODIC TESTING	REDUNDANT TRAIN FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRAIN B AND SWING LOADS (SWGR #3) FOR SIS, NONE FOR SISLOP	*NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF NSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT IS PER RG 1.75 AND IBBE 384 BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS
12.4.09.14.1	SWGR #2 UNDERSVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-N2A-1	TRIP	RELAY TRIPS AND LOCKS-OUT ITS MCC-2A NSR LOADS, INCLUDING REACTOR AUX BLDG HVAC AND BORIC ACID TANK HEATER. ALSO STARTS TRAIN B CHARGING PUMP LUBE OIL PAN COOLER	CONTROL ROOM INDICATION	(SAME AS 12.4.9.11.2)	*(SAME AS 12.4.9.11.2)	BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS
12.4.09.14.2	SWGR #2 UNDERSVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-N2A-1	RESET	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-2A NSR LOADS	PERIODIC TESTING	(SAME AS 12.4.9.11.1)	*(SAME AS 12.4.9.11.1)	NORMAL POSITION

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.4.09.15.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-M2A-2	TRIP	RBLAY TRIPS AND LOCKS-OUT ITS MCC-2A MSR LOADS, INCLUDING RADWASTE AUXILIARIES AND NORMAL 480V POWER TO DEDICATED SAFE SHUTDOWN (DSD) SYSTEM	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	DSD SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS
12.4.09.15.2	SWGR #2 UNDERVOLTAGE AND (LOCKOUT RBLAY) CONTROL	86-M2A-2	RESET	RBLAY WILL NOT TRIP AND LOCKOUT ITS MCC-2A MSR LOADS	PERIODIC TESTING	(SAME AS 12.4.9.11.1)	*(SAME AS 12.4.9.11.1)	NORMAL POSITION
12.4.09.16.1	SWGR #2 UNDERVOLTAGE AND (72-226) CONTROL	125VDC BUS #2	VOLTS LOW	LOCKOUT RBLAYS FOR SWGR #2, MCC-2, MCC-2A, SWGR #3, MCC-3 WILL NOT TRIP AND LOCKOUT THEIR MSR LOADS	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPMR COOLING FOR ALTERNATE OPPOSITE SOURCE	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNSOLUBLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PM. REDUCED RELIABILITY OF ALY OPPOSITE SOURCE	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RBLAYS. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. RCPs ALSO LOST, UNAVAILABLE FOR SGTR. MAIN IPMR HAS 2 TRAINS OF COOLING
12.5.01.01.1	[NOT USED]							[THIS BLOCK OF RECORDS RESERVED FOR FUTURE TRAIN A 480V SWGR #3]
12.6.01.01.1	52-1303 (BREAKER)	BREAKER	OPEN	BRKR CANNOT BE CLOSED TO RE-ENERGIZE SWGR #3 FROM SST #3	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A (VIA SWGR #1-3 TIE BRKR) AND TRAIN B (VIA SWGR #2-3 TIE BRKR) AS REQUIRED	BRKR FAILURES BOUND SST #3 FAILURES SINCE CREDIT NOT TAKEN FOR MSR FANS IN IPMR RATING
12.6.01.01.2	52-1303 (BREAKER)	BREAKER	CLOSED	TRAIN A 480V POWER AVAILABLE TO SWING LOADS FROM SST #3. HOWEVER, BRKR WILL NOT OPEN ON SISLOP OR TO ISOLATE FAULTS DUE TO NON-SR LOADS ON 480V SWGR #3/MCC-3. SIS/SISLOP TRIPS OF 48V PERDDB AND 480V TIE BRKRS UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SHORT TERM, OPERATOR ACTIONS FOR LONG TERM	NONE FOR SHORT TERM. FOR LONG TERM, SWGR #3 CAN BE RE-ENERGIZED VIA SST #3 OR, WITH LOCAL BACK-OUT OF 52-1303, FROM TRAIN A OR B VIA SWGR #1 AND 2 TIE BRKRS, RESPECTIVELY	NORMAL POSITION. SIS/SISLOP TRIP OF 48V PERDDB TO SST #3 AND 480V TIE BRKRS PLUS BRKR COORDINATION PREVENT PERDDB TRIP WITH MSR LOAD FAILURES. BUS FAULT PLUS BRKR FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS. UPS DUTY CYCLE > 30 MIN TO PERMIT LOCAL ACTIONS 52-1103 "b" CONTACTS MAY ALSO PREVENT CLOSURE OF SWGR #2-3 TIE BRKR TO RE-ENERGIZE SWGR #3 FROM TRAIN B. LOSS OF SST #1 OR 52-1103 POWER CONTACTS PLUS THIS FAILURE DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.6.01.02.1	52-1103 (BREAKER)	52-1103 "b" CONTACT OR 133 CONTACT	OPEN	BRKR CANNOT BE RECLOSED IF OPEN TO RE-ENERGIZE SWGR #3 FROM SST #3	PERIODIC TESTING	SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN A VIA SWGR #1-3 TIE BRKR 52-1103	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 THIRD-OF-A-KIND LOADS (NOV-358/850C UPS, NOV-883)	52-1103 "b" CONTACTS MAY ALSO PREVENT CLOSURE OF SWGR #2-3 TIE BRKR TO RE-ENERGIZE SWGR #3 FROM TRAIN B. LOSS OF SST #1 OR 52-1103 POWER CONTACTS PLUS THIS FAILURE DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.6.01.02.2	52-1103 (BREAKER)	52-1103 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM 480V SWGR #1-3 TIE BRKR DEPRATED, ALLOWS PARALLELING SST #1 AND 3 THROUGH SWGR #3, ALTHOUGH BUS NOT FAULT PROTECTED IN SUCH A CONFIGURATION	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS OPERATOR ERROR PLUS FAULT IS OUTSIDE SIS/SISLOP DESIGN BASIS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.6.01.03.1	52-1303 (BRBAKBB)	52-1203 "b" CONTACT OR 133 CONTACT	OPEN	INTERLOCK FROM SWGR #2-3 TIE BRER PREVENTS BRER CLOSURE TO RE-ENERGIZE SWGR #3 FROM SST #3	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED POST-SIS/SISLOP FROM TRAIN B VIA SWGR #2-3 TIE BRER 52-1203	52-1203 "b"/133 CONTACTS MAY ALSO PREVENT RECLOSURE OF SWGR #1-3 TIE BRER 52-1103 TO RE-ENERGIZE SWGR #3 FROM TRAIN A
12.6.01.03.2	52-1303 (BRBAKBB)	52-1203 "b" CONTACT OR 133 CONTACT	CLOSED	INTERLOCK FROM SWGR #2-3 TIE BRER 52-1203 DEPRATED. ALLOWS PARALLELING SST #3 TO TRAIN B (SWGR #2) VIA 480V SWGR #3 IF SWGR #1-3 TIE BRER 52-1103 IS OPEN (EG. FOLLOWING SISLOP TRIP OF BRER)	PERIODIC TESTING	NONE. ADMINISTRATIVE CONTROLS DO NOT ALLOW THIS CONFIGURATION IN MODES 1 - 4	LOSS OF AUTOMATIC PROTECTION AGAINST PARALLELING REDUNDANT TRAINS A AND B AT 480V SWGR	STECH SPEC ACTION ENTRY REQD FOR THIS CONDITION SINCE SIS/SISLOP TRIP SIGNALS ARE MOMENTARY ONLY (VIA TDRs) AND DO NOT PREVENT PARALLELING BY A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR AFTER TRIP
12.6.01.04.1	52-1303 (BRBAKBB)	86-3 (BRLAT)	ON	SWGR #3 TRIP/LOCKOUT SIGNAL PREVENTS CLOSING BRER TO RE-ENERGIZE SWGR #3 FROM SST #3	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A AND B AS REQUIRED VIA SWGR #1-3 OR SWGR #2-3 TIE BRERS, RESPECTIVELY	SWGR #3 SISLOP LOCKOUT RELAY
12.6.01.04.2	52-1303 (BRBAKBB)	86-3 (BRLAT)	OFF	TRAIN B SISLOP TRIP/LOCKOUT OF SWGR #3 DEPRATED. TRAIN A SIS/SISLOP TRIP OF 4 kV PREDBR 11C11 TO SST #3 UNAPPECTED	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 ISOLATED FROM NORMAL TRAIN A SOURCE AT 4 kV BRER ON SIS/SISLOP AS REQUIRED	NORMAL POSITION
12.6.01.05.1	52-1303 (BRBAKBB)	52-1303 86, 86-1 (BRLATS)	CONTACTS OPEN (ON)	OVERLOAD INTERLOCK PREVENTS CLOSING BRER TO RE-ENERGIZE SWGR #3 FROM SST #3 OR VIA TIE BRERS FROM SWGR #1 OR #2	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A AND B POWERED VALVES FOR CLR, REDUNDANT SI/PW PUMP TRIPS FOR LO-LO RWST LEVEL TRIP	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE NOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CBS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION
12.6.01.05.2	52-1303 (BRBAKBB)	52-1303 86, 86-1 (BRLATS)	CONTACTS CLOSED (OFF)	OVERLOAD INTERLOCK DEPRATED. ALLOWS PARALLELING OF SWGR #1 OR 2 TO FAULTED BUS	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS BUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.6.01.06.1	52-1303 (BRBAKBB)	"b" CONTACTS	OPEN	BRER CLOSED INTERLOCK TO SWGR #1-3 TIE BRER AND SWGR #2-3 TIE BRER PREVENTS TRIBE CLOSING, IF OPEN, UNLESS 52-1303 IS IN THE TEST POSITION	PERIODIC TESTING	NONE REQUIRED FOR SHORT TERM, OPERATOR ACTIONS FOR LONG-TERM	NONE FOR SHORT TERM. FOR LONG TERM, SWGR #3 CAN BE RE-ENERGIZED WITH THIS FAILURE FROM TRAIN A AND B VIA SWGR #1-3 AND SWGR #2-3 TIE BRERS, RESPECTIVELY AFTER LOCALLY BACKING-OUT 52-1303 TO TEST POSITION	NOV-358/NOV-850C UPS DUTY CYCLE > 30 MINUTES PERMITS CREDIT FOR OPERATOR ACTION LOCALLY IN THE 480V ROOM. NORMAL PREDBR BRERS 11C11 (4kV) AND 52-1303 (480V) CAN ALSO BE RECLOSURE FROM CONTROL ROOM TO RE-ENERGIZE SWGR #3 FROM SST #3
12.6.01.06.2	52-1303 (BRBAKBB)	"b" CONTACTS	CLOSED	BRER OPEN SIGNAL TO SWGR #1-3 TIE BRER AND SWGR #2-3 TIE BRER. ALLOWS PARALLELING SST #1 AND 3 THROUGH 480V SWGR #1 OR PARALLELING TRAIN A (SST #3) AND B (SWGR #2) THROUGH 480V SWGR #3	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDUREALLY BY DBOB AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP REQUIRES INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
12.6.01.07.1	52-1303 (BRBAKBB)	133 CONTACTS	OPEN	BRKR NOT-IN-TRST SIGNAL TO SWGR #1-3 TIE BRKR AND SWGR #2-3 TIE BRKR PREVENTS THEIR CLOSING, IF OPEN, UNLESS 52-1303 IS OPEN	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 CAN BE RE-ENERGIZED AS REQUIRED FROM TRAIN A AND B BY CLOSING SWGR #1-3 OR SWGR #2-3 TIE BRKRS, RESPECTIVELY AFTER 52-1303 TRIP	NORMAL POSITION
12.6.01.07.2	52-1303 (BRBAKBB)	133 CONTACTS	CLOSED	BRKR-IN-TRST SIGNAL TO SWGR #1-3 TIE BRKR AND SWGR #2-3 TIE BRKR. ALLOWS PARALLELING SST #1 AND 3 THROUGH 480V SWGR #3 OR PARALLELING TRAIN A (SST #3) WITH TRAIN B (SWGR #2) THROUGH 480V SWGR #3	PERIODIC TESTING	NONE REQUIRED	NONE	480V LOAD TRANSFER PROCEDURALLY BY DROP AND PICKUP. PARALLELING SOURCES DURING SIS/SISLOP PERIODS INTERLOCK FAILURE PLUS OPERATOR ERROR, WHICH IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS
12.6.01.08.1	52-1303 (BRBAKBB)	SWGR #3 125VDC CONTROL POWER	VOLTS LOW	BRKR CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR SHORT TERM. OPERATOR ACTIONS FOR LONG TERM	NONE FOR SHORT TERM. FOR LONG TERM, SWGR #3 CAN BE RE-ENERGIZED AS REQUIRED FROM TRAIN A AND TRAIN B BY CLOSING SWGR #1-3 OR SWGR #2-3 TIE BRKRS, RESPECTIVELY AFTER 52-1303 TRIP	NOV-358/850C UPS DUTY CYCLE > 30 MINUTES TO PERMIT CREDIT FOR OPERATOR ACTION LOCALLY IN THE 480V ROOM TO MANUALLY TRIP 52-1303 AND RESTORE CONTROL POWER (VIA MANUAL SELECTOR SWITCHES) AS NEEDED
12.6.02.01.1	MCC-3 (BRBAKBB)	52-1314 (BRBAKBB)	OPEN	LOSS OF POWER TO MCC-3 LOADS, INCLUDING NOV-358/850C UPS BATTERY CHARGER, NOV-883, SWGR ROOM HVAC, A/B-IPNR COOLING, RCP-C LUBE OIL PUMP, REHEATER STM ISOLATION VALVES	CONTROL ROOM INDICATION	NONE FOR LOSS OF SWGR RM HVAC, REDUNDANT TRAIN A/B POWERED VALVES FOR CLR, REDUNDANT SI/PW PUMP TRIPS FOR LO-LO TR	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC. ALSO RESULTS IN DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*MCC-3 480V ACB. VERIF REQ THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING FOR SWGR ROOM EQUIPMENT. AUX IPNR A/B HAVE "OA" RATING (IE, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCP.
12.6.02.01.2	MCC-3 (BRBAKBB)	52-1314 (BRBAKBB)	CLOSED	480V POWER AVAILABLE TO MCC-3 LOADS. HOWEVER, BRKR WILL NOT TRIP IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. BRKRS MUST COORDINATE TO PREVENT REDDER TRIP UNDER SIS AS WELL AS SISLOP. MCC BUS FAULT PLUS BRKR FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.6.02.02.1	MCC-3	NSR LOADS	ON (BRKR CLOSED)	LOAD(S) WILL NOT TRIP ON SISLOP OR TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-3 REDDER BRKR 52-1314	PERIODIC TESTING	(SAME AS 12.6.2.1.1)	*(SAME AS 12.6.2.1.1)	
12.6.02.02.2	MCC-3	NSR LOADS	OFF (BRKR OPEN)	LOSS OF ONE OR MORE MCC-3 NSR LOADS, INCLUDING SWGR RM HVAC, A/B-IPNR COOLING, RCP-C LUBE OIL PUMP, REHEATER STM ISOLATION VALVES	PERIODIC TESTING	NONE FOR LOSS OF SWGR RM HVAC	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC	RCPs ALSO UNAVAILABLE FOR SCTR. REHEATER STEAM ISOLATION NOT CREDITED FOR NSLB. AUX IPNR A/B HAVE "OA" RATING (IE, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.6.02.02.3	MCC-3	MSR LOADS	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-3 LOAD AND FEEDER BREAKERS	NONE	SIS/SISLOP ISOLATION OF SWGR #3, BREAK COORDINATION TO PREVENT FEEDER TRIP FOR FAULTS, NONE FOR OVERCURRENT FAILURE OF LOADS BELOW SETPOINT	*POTENTIAL COMMON-CAUSE IMPROBABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR TREE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-SR LOADS ON A SAFETY SIGNAL (TR, SIS AND SISLOP)
12.6.03.01.1	MCC-3A	52-1307 (BREAKER)	OPEN	LOSS OF POWER TO MCC-3A LOADS, INCLUDING POST-ACCIDENT SAMPLING SYSTEM (PASS)	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	MCC-3A 480V ACB. PASS NOT REQUIRED FOR DESIGN BASIS SIS/SISLOP EVENT MITIGATION
12.6.03.01.2	MCC-3A	52-1307 (BREAKER)	CLOSED	480V POWER AVAILABLE TO MCC-3A PERIODIC TESTING LOADS. HOWEVER, BREAK WILL NOT TRIP ON SIS/SISLOP OR IF NEEDED TO ISOLATE FAULTS DUE TO NON-SR LOADS	PERIODIC TESTING	NONE REQUIRED	NONE	*NORMAL POSITION. ROI REV REQ TO INDIVIDUALLY ISOLATE NON-ESSENTIAL LOADS FROM SWGR #3 BEFORE RE-ENERGIZING POST-SIS/SISLOP
12.6.03.02.1	MCC-3A	MSR LOADS	ON (BREAK CLOSED)	LOAD(S) WILL NOT TRIP TO ISOLATE COMMON-CAUSE FAULTS, POTENTIALLY RESULTING IN TRIP OF MCC-3A FEEDER BREAKER 52-1307	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 12.6.3.1.1)	(SAME AS 12.6.3.1.1)	PASS NOT REQUIRED FOR DESIGN BASIS SIS/SISLOP EVENT MITIGATION
12.6.03.02.2	MCC-3A	MSR LOADS	OFF (BREAK OPEN)	LOSS OF ONE OR MORE MCC-3A MSR LOADS, INCLUDING PASS	CONTROL ROOM INDICATION, PERIODIC TESTING	(SAME AS 12.6.3.1.1)	(SAME AS 12.6.3.1.1)	PASS NOT REQUIRED FOR DESIGN BASIS SIS/SISLOP EVENT MITIGATION
12.6.03.02.3	MCC-3A	MSR LOADS	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-3A LOAD AND FEEDER BREAKERS. SINCE ALL LOADS ARE MSR AND LOCATED IN HARSH POST-ACCIDENT ENVIRONMENTS, FEEDER BREAKER MAY TRIP FROM CONCURRENT FAULTS POST-ACCIDENT	NONE	NONE REQUIRED	NONE	PASS NOT REQUIRED FOR SIS/SISLOP DESIGN BASIS EVENT MITIGATION
12.6.04.01.1 (NOT USED)								[THIS BLOCK OF RECORDS RESERVED FOR LATER ADDITION OF OTHER 480V SWGR #3 LOADS]
12.6.05.01.1 (NOT USED)								
12.6.06.01.1	SWGR #3 MSR LOADS	BREAKER(S)	OPEN	SWGR #3 MSR LOAD(S) TRIP, CANNOT BE RESTARTED. POTENTIALLY DISABLES 1/3 INSTRUMENT AIR COMPRESSORS FOR SECONDARY RECIRC	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT AIR COMPRESSORS POWERED BY SWGR #1 AND 2 FOR SECONDARY RECIRC, NONE REQUIRED FOR OTHER ECCS FUNCTIONS	REDUCED RELIABILITY FOR ISA SUPPLY TO SECONDARY RECIRC VALVES, NONE FOR OTHER ECCS FUNCTIONS	CAN ALSO DISABLE MAIN TURBINE AUX LUBE OIL PUMP
12.6.06.01.2	SWGR #3 MSR LOADS	BREAKER(S)	CLOSED	SWGR #3 480V MSR LOAD(S) WILL NOT TRIP ON BUS UNDERVOLTAGE, SEQ SIGNAL (INCLUDING SISLOP LOCKOUT) OR FAULT	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN A AND B POWERED VALVES FOR CLR, REDUNDANT SI/FW PUMP TRIPS FOR LO-LO RWST LEVEL TRIP	SWGR #3 IMPROBABLE FOR SISLOP, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS (IF NOT ALIGNED PRIOR TO MOV-358/850C UPS BATTERY END-OF-DISCHARGE)	AUX IPMS A/B COOLING FANS ALSO AFFECTED. HOWEVER, IPMS HAVE "OA" RATING (IE, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRE UNIT 1
 TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.6.05.01.3	SWGR #3 MSR LOADS	BBABBB(S)	BQ/SBISMIC	POTENTIAL COMMON-CAUSE FAULT OF SWGR #3 480V MSR LOAD(S), CHALLENGING SWGR #3 LOAD AND PREDER BRERS	NONE	O/C TRIP OF INDIVIDUAL LOAD BRERS AND BRER COORDINATION TO PREVENT PREDER (OR TIB) BRER TRIP FOR COMPLETE FAULTS, NONE FOR O/C FAILURE OF LOAD BRERS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF SWGR #3, IF RE-ENERGIZED POST-SIS/SISLOP, DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IB LOADS ON SAFETY SIGNAL (IB, SIS AND SISLOP). BOI REV REQD TO ISOLATE ALL NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3. BRER COORD ALSO REQD FOR TIB BRER
12.6.07.01.1	SWGR #3 UNDERVOLTAGE AND (RELAY) CONTROL	27-114	CONTACTS OPEN (OFF)	UV AUX RELAYS 27-111, 27-112 WILL NOT ENERGIZE AS REQUIRED ON SEQ 2 (SISLOP) ACTUATION TO SWGR #2. UNDERVOLTAGE ACTUATION UNAPPECTED	PERIODIC TESTING	NONE REQD	NONE	ALIGN NORMAL POSITION. SWGR #3 ISOLATED BY SEPARATE SIS/SISLOP TRIP OF 48V SST #3 PREDER AND 480V TIB BRERS FROM RESPECTIVE SEQUENCERS. UV TRIP REMAINS AVAILABLE FOR NON-SIS/SISLOP EVENTS
12.6.07.01.2	SWGR #3 UNDERVOLTAGE AND (RELAY) CONTROL	27-114	CONTACTS CLOSED (ON)	UV AUX RELAYS 27-111, 27-112 ENERGIZE, TRIPPING ALL SWGR #3 480V LOADS EXCEPT MCCS AND AIR COMPRESSORS, RESULTING IN LOSS OF CCW PP G-15C, AUX SWC PP, MAIN TURBINE AUX LUBE OIL PP, AND CAUSING AUTO-START OF TURBINE EMERGENCY DC LUBE OIL PUMP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. CCW PUMP G-15C NOT CREDITED FOR TECH SPEC REQUIREMENTS. AUX SWC PP NOT CREDITED EXCEPT FOR LOSS OF BOTH SWC PP, WHICH REMAIN AVAILABLE FOR THIS FAILURE	SISLOP SIGNAL TO UV AUX RELAY 27-114 IS NORMALLY MOMENTARY. MAINTAINED SIGNAL DUE TO RELAY OR SBQ CONTACT FAILURE PREVENTS RESTART OF AFFECTED LOADS
12.6.07.02.1	SWGR #3 UNDERVOLTAGE AND (UV RELAY) CONTROL	27-1	ON (VOLTS LOW)	(SAME AS 12.6.7.1.2)	CONTROL ROOM INDICATION	(SAME AS 12.6.7.1.2)	(SAME AS 12.6.7.1.2)	
12.6.07.02.2	SWGR #3 UNDERVOLTAGE AND (UV RELAY) CONTROL	27-1	OFF (VOLTS NORMAL)	UV AUX RELAYS 27-111, 27-112 WILL NOT ENERGIZE AS REQUIRED ON BUS UNDERVOLTAGE. SEQ ACTUATION VIA RELAY 27-114 UNAPPECTED	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 ISOLATED BY SEPARATE SIS/SISLOP TRIP OF 48V SST #3 PREDER AND 480V TIB BRERS	*NORMAL POSITION. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3
12.6.07.03.1	SWGR #3 UNDERVOLTAGE AND (11-5,7) CONTROL	SBQ 2	CONTACTS OPEN (OFF)	SWGR #3 LOCKOUT RELAY WILL NOT TRIP SWGR #3 480V NORMAL PREDER BRER OR MSR LOADS ON SISLOP, INCLUDING AIR COMPRESSORS AND MAIN TURBINE AUX LUBE OIL PUMP	PERIODIC TESTING	(SAME AS 12.6.7.2.2)	(SAME AS 12.6.7.2.2)	*(SAME AS 12.6.7.2.2)
12.6.07.03.2	SWGR #3 UNDERVOLTAGE AND (11-5,7) CONTROL	SBQ 2	CONTACTS CLOSED (ON)	SWGR #3 LOCKOUT RELAY TRIPS 480V SWGR #3 NORMAL PREDER BRER AND MSR LOADS, INCLUDING AIR COMPRESSORS AND MAIN TURBINE AUX LUBE OIL PUMP	CONTROL ROOM INDICATION	REDUNDANT AIR COMPRESSORS POWERED FROM SWGR #1 AND 2 FOR SECONDARY RECIRC, NONE REQUIRED FOR OTHER EVENTS	INOPERABILITY OF SWGR #3 POWERED AIR COMPRESSOR FOR SECONDARY RECIRC VALVES, NONE FOR OTHER EVENTS	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A OR B VIA SWGR #1-3 OR #2-3 TIB BRERS, RESPECTIVELY TO POWER ESSENTIAL SWING LOADS (NOV-358/850C UPS AND NOV-883)

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.6.07.04.1	SWGR #3 UNDERVOLTAGE AND CONTROL	86-3 (RELAY)	TRIP	SWGR #3 LOCKOUT RELAY TRIPS ALL SWGR #3 480V MSB LOADS, INCLUDING AIR COMPRESSORS AND MAIN TURBINE AUX LUBE OIL PUMP	CONTROL ROOM INDICATION	(SAME AS 12.6.7.3.2)	(SAME AS 12.6.7.3.2)	SWGR #3 SISLOP LOCKOUT RELAY
12.6.07.04.2	SWGR #3 UNDERVOLTAGE AND CONTROL	86-3 (RELAY)	RESET	SWGR #3 LOCKOUT RELAY WILL NOT TRIP SWGR #3 480V MSB LOADS ON SISLOP, INCLUDING AIR COMPRESSORS AND MAIN TURBINE AUX LUBE OIL PUMP	PERIODIC TESTING	(SAME AS 12.6.7.3.1)	(SAME AS 12.6.7.3.1)	
12.6.07.05.1	SWGR #3 UNDERVOLTAGE AND CONTROL	SBQ 2 (13-1,3) (13-5,7)	CONTACTS OPEN (OFF)	MCC-3 LOCKOUT RELAYS 86-M3-1, 86-M3-2, 86-M3-3 AND 86-M3-4 WILL NOT REENERGIZE AS REQUIRED ON SISLOP	PERIODIC TESTING	NONE REQUIRED	NONE. SWGR #3 ISOLATED BY SEPARATE TRIP OF 48V SST #3 FREDER AND 480V TIE BREAKERS ON SIS/SISLOP	*NORMAL POSITION. REDUNDANT INPUTS FROM SBQ 2 PREVENT THIS FAILURE UNLESS SBQ 2 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. ROI REV REQD TO INDIVIDUALLY TRIP/LOCKOUT NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP
12.6.07.05.2	SWGR #3 UNDERVOLTAGE AND CONTROL	SBQ 2 (13-1,3) (13-5,7)	CONTACTS CLOSED (ON)	MCC-3 LOCKOUT RELAYS 86-M3-1, 86-M3-2, 86-M3-3 AND 86-M3-4 TRIP AND LOCKOUT MCC-3 MSB LOADS, INCLUDING A/B-IPMR COOLING, RCP-C LUBE OIL PUMP, REHEATER STEAM ISOLATION VALVES, CIRC WATER INTAKE AND INTAKE RECIRC GATES	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SBQ 2 BLOCK/RESET. REHEATER STEAM ISOLATION NOT CRYSTALLINE FOR MSLB. AUX IPMR A/B HAVE "OA" RATING (IE, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALT OFFSITE SOURCE DUTY WITHOUT RCPs
12.6.07.06.1	SWGR #3 UNDERVOLTAGE AND CONTROL	SD-1-6 (RELAY)	ON	MCC-3 LOCKOUT RELAYS 86-M3-1, 86-M3-2, 86-M3-3 AND 86-M3-4 WILL ALTERNATE BETWEEN RESET AND TRIP STATE AS SOON AS SISLOP OR MANUAL LOCKOUT INITIATION OCCURS, AND IMMEDIATELY RESET AFTER SBQ BLOCK/RESET	PERIODIC TESTING	(SAME AS 12.6.7.5.1)	(SAME AS 12.6.7.5.1)	LOCKOUT RESET RELAY FOR 86-M3-1, 86-M3-2, 86-M3-3 AND 86-M3-4. INCLUDES HANDSWITCH. ROI REV REQD TO INDIVIDUALLY TRIP/LOCKOUT NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP
12.6.07.06.2	SWGR #3 UNDERVOLTAGE AND CONTROL	SD-1-6 (RELAY)	OFF	MCC-3 LOCKOUT RELAYS 86-M3-1, 86-M3-2, 86-M3-3 AND 86-M3-4 CANNOT BE RESET, PREVENTING RESTART OF MCC-3 MSB LOADS POST-SISLOP, INCLUDING A/B-IPMR COOLING, RCP-C LUBE OIL PP, REHEATER STM ISOLATION MOVs, CIRC WATER INTAKE AND INTAKE RECIRC GATES	PERIODIC TESTING	(SAME AS 12.6.7.5.2)	(SAME AS 12.6.7.5.2)	NORMAL POSITION. AUX IPMRs A/B HAVE "OA" RATING (IE, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs
12.6.07.07.1	SWGR #3 UNDERVOLTAGE AND CONTROL	86-9 (RELAY)	ON	MCC-2A LOCKOUT RELAYS 86-2A-1, -2 AND MCC-3 LOCKOUT RELAYS 86-M3-1, -2, -3, -4 TRIP AND LOCKOUT MSB LOADS, INCLUDING REACTOR AUX BLDG SUPPLY FAN, A/B-IPMR COOLING, RCP-C LUBE OIL PP, REHEATER STM ISOL MOVs, CIRC WTR INTAKE AND INTAKE RECIRC GATES	CONTROL ROOM INDICATION	NONE REQUIRED FOR INJECTION, NONE FOR RECIRC, NONE FOR RCPs POST-SGT8	*POTENTIAL INOP OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM, NONE FOR INJECTION	AUX IPMRs A/B HAVE "OA" RATING (IE, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRE UNIT 1
 TABLE 12-1: POWER DISTRIBUTION SYSTEM PMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.6.07.07.2	SWGR #3 UNDERVOLTAGE AND CONTROL	86-M (RELAY)	OPF	MCC-2A LOCKOUT RELAYS 86-2A-1, PERIODIC TESTING -2 AND MCC-3 LOCKOUT RELAYS 86-M3-1, -2, -3, -4 CANNOT BE MANUALLY ACTUATED, NO EFFECT ON SISLOP ACTUATION		REDUNDANT TRIP FOR SIS, NONE REQUIRED FOR SISLOP	REDUCED RELIABILITY OF TRIP B AND SWING (SWGR #3) FOR SIS, NONE FOR SISLOP	NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF MSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT AS PER EG 1.75 AND IBBE 384 *VERIFICATION REQUIRED THAT LOSS OF TURBINE-GENERATOR HYDROGEN SEAL OIL OR OTHER AUXILIARIES WILL NOT RESULT IN FIRE OR EXPLOSION CONCURRENT WITH SIS/SISLOP EVENT. BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS
12.6.07.08.1	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-1	TRIP	RELAY TRIPS AND LOCKS-OUT ITS MCC-3 MSR LOADS, INCLUDING TURBINE-GENERATOR AUXILIARIES AND BORIC ACID INJECTION PUMP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	*VERIFICATION REQUIRED THAT LOSS OF TURBINE-GENERATOR HYDROGEN SEAL OIL OR OTHER AUXILIARIES WILL NOT RESULT IN FIRE OR EXPLOSION CONCURRENT WITH SIS/SISLOP EVENT. BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS
12.6.07.08.2	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-1	BBSBT	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-3 MSR LOADS	PERIODIC TESTING	(SAME AS 12.6.7.5.1)	(SAME AS 12.6.7.5.1)	NORMAL POSITION
12.6.07.09.1	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-2	TRIP	RELAY TRIPS AND LOCKS-OUT ITS MCC-3 MSR LOADS, INCLUDING TURBINE-GENERATOR AUXILIARIES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	*VERIFICATION REQUIRED THAT LOSS OF GENERATOR HYDROGEN SEAL OIL OR OTHER AUXILIARIES WILL NOT RESULT IN EXPLOSION OR FIRE CONCURRENT WITH SIS/SISLOP EVENT
12.6.07.09.2	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-2	BBSBT	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-3 MSR LOADS	PERIODIC TESTING	(SAME AS 12.6.7.5.1)	(SAME AS 12.6.7.5.1)	NORMAL POSITION
12.6.07.10.1	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-3	TRIP	RELAY TRIPS AND LOCKS-OUT ITS MCC-3 MSR LOADS, INCLUDING RCP-C LUBE OIL PUMP, REHEATER STEAM ISOLATION MOVs, CIRC WATER INTAKE AND INTAKE RECIRC GATES	CONTROL ROOM INDICATION	NONE FOR RCPs POST-SGTR, NONE OTHERWISE REQUIRED	RCPs UNAVAILABLE FOR SGTR. NONE OTHERWISE	REHEATER STEAM ISOLATION NOT CREDITED FOR MSLB
12.6.07.10.2	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-3	BBSBT	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-3 MSR LOADS	PERIODIC TESTING	(SAME AS 12.6.7.5.1)	(SAME AS 12.6.7.5.1)	NORMAL POSITION
12.6.07.11.1	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-4	TRIP	RELAY TRIPS AND LOCKS OUT ITS MCC-3 MSR LOADS, INCLUDING A/B-IPHE COOLING, REHEATER STEAM ISOLATION MOVs	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	REHEATER STEAM ISOLATION NOT CREDITED FOR MSLB. AUI IPHRS A/B HAVE "OA" BATING (IE, WITHOUT PANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OPPOSITE SOURCE DUTY WITHOUT RCPs
12.6.07.11.2	SWGR #3 UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL	86-M3-4	BBSBT	RELAY WILL NOT TRIP AND LOCKOUT ITS MCC-3 MSR LOADS	PERIODIC TESTING	(SAME AS 12.6.7.5.1)	(SAME AS 12.6.7.5.1)	NORMAL POSITION

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.6.07.12.1	SWGR #3 UNDBRVOLTAGE AND CONTROL	125VDC BUS #2 (72-226)	VOLTS LOW	SWGR #2, MCC-2, MCC-2A, SWGR #3, MCC-3 LOCKOUT RELAYS WILL NOT TRIP AND LOCKOUT THEIR NSR LOADS	PERIODIC TESTING	NONE FOR SISLOP, NONE FOR POST-SGTR, NONE OTHERWISE REQUIRED FOR SIS	POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A S1/PW. RCP9 ALSO UNAVAILABLE FOR SGTR	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. BOI REV REQD TO INDIVIDUALLY ISOLATE SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP
12.6.08.01.1	SWGR #3 CONTROL POWER	SS1 (SWITCH)	AUTO	SWGR #3 CONTROL POWER SELECTED TO TRAIN A IF SWGR #2-3 TIE BRKR IS OPEN ("a" CONTACTS OPEN, "b" CONTACTS CLOSED) AND SELECTOR SWITCH SS2 IS NOT ON	LOCAL INDICATION	NONE REQUIRED	NONE. SWGR #3 CONTROL POWER AUTO-SELECTS TO TRAIN A OR B AS REQUIRED	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQD IF SSI #3 ENERGIZED VIA 152-12C11 (TRAIN B) IN MODES 1 - 4, SINCE SUCH AN ALIGNMENT COULD RESULT IN CROSS-TRAIN POWER AND CONTROL
12.6.08.01.2	SWGR #3 CONTROL POWER	SS1 (SWITCH)	ON	SWGR #3 CONTROL POWER SELECTED TO TRAIN A (IF CONTACTOR 2 RELAY C2A INITIALLY OFF) (IRRESPECTIVE OF SWGR #2-3 TIE BRKR POSITION OR SUBSEQUENT OPERATION OF SELECTOR SWITCH SS2	LOCAL INDICATION	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA SSI #3 OR SWGR #1-3 TIE BRKR	POTENTIAL CROSS-TRAIN ALIGNMENT OF SWGR #3 POWER AND CONTROL IF SWGR #3 RE-ENERGIZED FROM TRAIN B VIA SWGR #2-3 TIE BRKR POST-SIS/SISLOP	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE. BOI REV REQD TO PRECLUDE CROSS-TRAIN ALIGNMENT POST-SIS/SISLOP
12.6.08.01.3	SWGR #3 CONTROL POWER	SS1 (SWITCH)	OFF	SWGR #3 CONTROL POWER CANNOT BE SELECTED TO TRAIN A. RESULTS IN LOSS OF SWGR #3 CONTROL POWER AND FAULT PROTECTION DURING NORMAL OPERATION (IE, WITH SWGR #2-3 TIE BRKR OPEN)	CONTROL ROOM AND LOCAL INDICATION	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN B VIA SWGR #2-3	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. ISOLATION OF SWGR #3 LOADS BY SIS/SISLOP TRIP OF 4kV PERDOR AND 480V TIE BRKR ISOLATES COMMON-CAUSE FAULTS FROM REDUNDANT TRAINS A AND B	*TECH SPEC ACTION ENTRY REQD WITH THIS FAILURE. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP
12.6.08.02.1	SWGR #3 CONTROL POWER	52-1203 "b" CONTACTS	OPEN	SWGR #3 CONTROL POWER WILL NOT AUTO-SELECT TO TRAIN A IF SWGR #2-3 TIE BRKR IS OPEN. MANUAL SELECTION TO TRAIN A VIA SELECTOR SWITCH SS1 AND SS2 ARE UNAFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SHORT TERM, OPERATOR ACTIONS FOR LONG TERM	NONE FOR SHORT TERM. FOR LONG TERM, CONTROL POWER CAN BE MANUALLY SELECTED TO PERMIT SWGR #3 TO BE RE-ENERGIZED FROM EITHER TRAIN VIA SWGR #1-3 AND SWGR #2-3 TIE BRKR	*BOI REV REQD FOR LOCAL OPERATOR ACTION TO MANUALLY SELECT CONTROL POWER VIA SSI AND SS2. UPS DUFFY CYCLE > 30 MINUTES PERMITS CREDIT FOR LOCAL OPERATOR ACTION AT SWGR #3 AND SSI/SS2
12.6.08.02.2	SWGR #3 CONTROL POWER	52-1203 "b" CONTACTS	CLOSED	SWGR #3 CONTROL POWER SELECTED TO TRAIN A WITH SSI IN AUTO (AND CONTACTOR 2 RELAY C2A INITIALLY OFF). MANUAL SELECTION TO TRAIN B VIA SSI AND SS2 UNAFFECTED	PERIODIC TESTING	(SAME AS 12.6.8.1.2)	(SAME AS 12.6.8.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQD WITH THIS FAILURE
12.6.08.03.1	SWGR #3 CONTROL POWER	C1A (RELAY)	ON	SWGR #3 CONTROL POWER SELECTED TO TRAIN A IF SWGR #2-3 TIE BRKR IS OPEN ("b" CONTACTS CLOSED) OR SSI IS ON. CONTROL POWER CANNOT BE SELECTED TO TRAIN B (IRRESPECTIVE OF POSITIONS OF SWGR #2-3 TIE BRKR OR SELECTOR SWITCH SS2	PERIODIC TESTING	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA SSI #3 OR SWGR #1-3 TIE BRKR	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE

TABLE 12-1: POWER DISTRIBUTION SYSTEM FNBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.6.08.01.2	SWGR #3 CONTROL POWER	C1A (RELAY)	OFF	SWGR #3 CONTROL POWER CANNOT BE SELECTED TO TRAIN A. RESULTS IN LOSS OF SWGR #3 CONTROL POWER AND FAULT PROTECTION DURING NORMAL OPERATION (IE, WITH SWGR #2-3 TIE BRKR OPEN AND SS2 NOT IN OM)	PERIODIC TESTING	(SAME AS 12.6.8.1.3)	(SAME AS 12.6.8.1.3)	*(SAME AS 12.6.8.1.3)
12.6.08.04.1	SWGR #3 CONTROL POWER	C1B (RELAY)	ON	SWGR #3 CONTROL POWER AUTO/MANUAL SELECTION TO TRAIN A OR B UNEXPECTED. HOWEVER, CROSS-CONNECTS NEGATIVE POLE OF DC BUS #1 TO DC BUS #2 WHEN TRAIN B CONTROL POWER SELECTED (SAME AS 12.6.8.3.2)	LOCAL INDICATION	REDUNDANT CONTACTOR RELAYS C1A, C2A, C2B	REDUCED REDUNDANCY FOR SEPARATION OF TRAIN A (DC BUS #1) AND TRAIN B (DC BUS #2) CONTROL POWER	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
12.6.08.04.2	SWGR #3 CONTROL POWER	C1B (RELAY)	OFF	(SAME AS 12.6.8.3.2)	LOCAL INDICATION	(SAME AS 12.6.8.1.3)	(SAME AS 12.6.8.1.3)	*(SAME AS 12.6.8.1.3)
12.6.08.05.1	SWGR #3 CONTROL POWER	125VDC BUS #1 (72-116)	VOLTS LOW	LOSS OF TRAIN A CONTROL POWER TO SWGR #3, RESULTING IN LOSS OF FAULT PROTECTION DURING NORMAL OPERATION (IE, WITH SWGR #2-3 TIE BRKR OPEN AND SELECTOR SWITCH SS2 NOT ON)	CONTROL ROOM AND LOCAL INDICATION	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN B VIA SWGR #2-3 TIE BRKR	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3. ISOLATION OF SWGR #3 LOADS BY SIS/SISLOP TRIP OF 4kV PERDER AND 480V TIE BRKR PROVIDES ISOLATION OF COMMON-CAUSE FAULTS FROM REDUNDANT TRAINS A AND B	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
12.6.08.05.1	SWGR #3 CONTROL POWER	SS2 (SWITCH)	AUTO	SWGR #3 CONTROL POWER SELECTED TO TRAIN B IF SWGR #2-3 TIE BRKR IS CLOSED ("a" CONTACTS CLOSED, "b" CONTACTS OPEN) AND SELECTOR SWITCH SS1 IS NOT ON	LOCAL INDICATION	NONE REQUIRED	NONE. SWGR #3 CONTROL POWER AUTO-SELECTS TO TRAIN A OR B AS REQUIRED	NORMAL POSITION
12.6.08.06.2	SWGR #3 CONTROL POWER	SS2 (SWITCH)	ON	SWGR #3 CONTROL POWER SELECTED TO TRAIN B IF CONTACTOR RELAY C1A DE-ENERGIZES (EG, DUE TO RELAY FAILURE OR SS1/52-1203 "b" CONTACT STATUS)	LOCAL INDICATION	REDUNDANT CONTACTOR 1 RELAY C1A	REDUCED REDUNDANCY FOR SEPARATION OF TRAIN A (DC BUS #1) AND TRAIN B (DC BUS #2) CONTROL POWER	*TECH SPEC ACTION REQUIRED WITH THIS FAILURE
12.6.08.06.3	SWGR #3 CONTROL POWER	SS2 (SWITCH)	OFF	SWGR #3 CONTROL POWER CANNOT BE SELECTED TO TRAIN B	LOCAL INDICATION	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA SST #3 OR SWGR #1-3 TIE BRKR	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
12.6.08.07.1	SWGR #3 CONTROL POWER	52-1203 "a" CONTACTS	OPEN	SWGR #3 CONTROL POWER WILL NOT AUTO-SELECT TO TRAIN B IF SWGR #2-3 TIE BRKR IS CLOSED. MANUAL SELECTION TO TRAIN B VIA SELECTOR SWITCH SS2 UNEXPECTED	PERIODIC TESTING	FOR SHORT TERM, SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA SST #3 OR SWGR #1-3 TIE BRKR. OPERATOR ACTIONS FOR LONG TERM	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 IN SHORT TERM. FOR LONG TERM, CONTROL POWER CAN BE MANUALLY SELECTED TO PERMIT SWGR #3 TO BE RE-ENERGIZED FROM EITHER TRAIN	*BOI REV REQUIRED FOR LOCAL OPERATOR ACTION TO MANUALLY SELECT CONTROL POWER VIA SS1 AND SS2. UPS DUTY CYCLE > 30 MINUTES PERMITS CREDIT FOR OPERATOR ACTION LOCALLY IF SWGR #3 AND SS1/SS2
12.6.08.07.2	SWGR #3 CONTROL POWER	52-1203 "a" CONTACTS	CLOSED	SWGR #3 CONTROL POWER SELECTED TO TRAIN B IF CONTACTOR RELAY C1A DE-ENERGIZED (EG, DUE TO RELAY FAILURE OR SS1/52-1203 "b" CONTACT STATUS)	PERIODIC TESTING	(SAME AS 12.6.8.6.2)	(SAME AS 12.6.8.6.2)	*(SAME AS 12.6.8.6.2)

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMMEDIATE COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.6.08.08.1	SWGR #3 CONTROL POWER	C2A (RELAY)	ON	SWGR #3 CONTROL POWER CANNOT BE SELECTED TO TRAIN A IRRESPECTIVE OF SS1 OR 52-1203 "B" CONTACT STATUS. RESULTS IN LOSS OF FAULT PROTECTION DURING NORMAL OPERATION (I.E. SWGR #2-3 TIE BRK OPEN AND SELECTOR SWITCH SS2 NOT ON)	PERIODIC TESTING	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN B VIA SWGR #2-3 TIE BRK	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3. ISOLATION OF SWGR #3 LOADS BY SIS/SISLOP TRIP OF 4kV FEEDER AND 480V TIE BRK PROVIDES ISOLATION OF COMMON-CAUSE FAULTS FROM REDUNDANT TRAINS A AND B	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
12.6.08.08.2	SWGR #3 CONTROL POWER	C2A (RELAY)	OFF	SWGR #3 CONTROL POWER CANNOT BE SELECTED TO TRAIN B	PERIODIC TESTING	(SAME AS 12.6.8.6.3)	(SAME AS 12.6.8.6.3)	*(SAME AS 12.6.8.6.3)
12.6.08.09.1	SWGR #3 CONTROL POWER	C2B (RELAY)	ON	SWGR #3 CONTROL POWER AUTO/MANUAL SELECTION TO TRAIN A OR B UNAPPROXED. HOWEVER, FAILURE CROSS-CONNECTS NEGATIVE POLE OF DC BUS #2 TO DC BUS #1 WHEN TRAIN A CONTROL POWER IS SELECTED	LOCAL INDICATION	REDUNDANT CONTACTOR RELAYS C1A, C1B, C2A	REDUCED REDUNDANCY FOR SEPARATION OF TRAIN A (DC BUS #1) AND TRAIN B (DC BUS #2) CONTROL POWER	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
12.6.08.09.2	SWGR #3 CONTROL POWER	C2B (RELAY)	OFF	(SAME AS 12.6.8.8.2)	LOCAL INDICATION	(SAME AS 12.6.8.6.3)	(SAME AS 12.6.8.6.3)	*(SAME AS 12.6.8.6.3)
12.6.08.10.1	SWGR #3 CONTROL POWER	125VDC BUS #2 (72-204)	VOLTS LOW	LOSS OF TRAIN B CONTROL POWER TO SWGR #3	LOCAL INDICATION	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA SST #3 OR SWGR #1-3 TIE BRK	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3	

TABLE 12-1: AUXILIARY POWER FMEA

PART III: 125 VDC SYSTEM

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	IMBIBENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.7.01.01.1	125VDC BUS #1 BATTERY CHARGER SET A	CHARGER	INPUT OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #1	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN A 125VDC CONTROL POWER	ANNUNCIATION OCCURS ON LOW BUS VOLTAGE WITH CHARGER #A IN SERVICE. REDUNDANT CHARGER MUST BE MANUALLY ALIGNED. BATTERY DUTY CYCLE (190 MIN) IS GREATER THAN 30 MIN REQUIRED TO PERMIT CREDIT FOR THIS OPERATOR ACTION OUTSIDE CONTROL ROOM
12.7.01.01.2	125VDC BUS #1 BATTERY CHARGER SET A	CHARGER	INPUT SHORT	480V BRKR S1-1110 TRIPS TO PROTECT SWGR #1. RESULTS IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #1	CONTROL ROOM AND LOCAL INDICATION, ANNUNCIATION AT DG LOCAL PANEL	(SAME AS 12.7.1.1.1)	(SAME AS 12.7.1.1.1)	
12.7.01.01.3	125VDC BUS #1 BATTERY CHARGER SET A	CHARGER	OUTPUT VOLTS HIGH	RESULTS IN HIGHER THAN ASSUMED VOLTAGE FOR TRAIN A 125VDC LOADS	LOCAL INDICATION	REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN A 125VDC LOADS DUE TO LOSS OF QUALIFIED LIFE	*CONDITION LIMITED BY CHGR HI-VOLTS SHUTDOWN. VERIFY REQD THAT EQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN A VITAL/REG BUSES 1, 2, 3/3A, 4 DUE TO VOLTS REGULATE CAPABILITY OF INVERTERS
12.7.01.01.4	125VDC BUS #1 BATTERY CHARGER SET A	CHARGER	OUTPUT VOLTS LOW	(SAME AS 12.7.1.1.1)	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.7.1.1.1)	(SAME AS 12.7.1.1.1)	(SAME AS 12.7.1.1.1)
12.7.01.01.5	125VDC BUS #1 BATTERY CHARGER SET A	CHARGER	OUTPUT SHORT	BATTERY CHARGER CURRENT LIMITS, OUTPUT BREAKER TRIPS TO CLEAR FAULT FROM BUS, RESULTING IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR 125VDC BUS #1	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.7.1.1.1)	(SAME AS 12.7.1.1.1)	(SAME AS 12.7.1.1.1)
12.7.01.02.1	125VDC BUS #1 BATTERY CHARGER SET A	72-143 (BREAKER)	OPEN (TRIPPED)	(SAME AS 12.7.1.1.1)	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.7.1.1.1)	(SAME AS 12.7.1.1.1)	(SAME AS 12.7.1.1.1) CHARGER SET A OUTPUT BREAKER ON 125VDC BUS #1
12.7.01.02.2	125VDC BUS #1 BATTERY CHARGER SET A	72-143 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP TO REMOVE CHARGER #A FROM SERVICE OR TO CLEAR FAULT BETWEEN CHARGER OUTPUT AND BREAKER	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS CHGR OUTPUT FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS. BRKR TRIP NOT REQD FOR FAULT ON BUS SIDE OF BRKR SINCE CHGR WILL CURRENT-LIMIT AND BATTERY WOULD NOT FBED FAULT THROUGH THIS CURRENT PATH
12.7.02.01.1	125VDC BUS #1 BATTERY CHARGER SET B	CHARGER	INPUT OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #1	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN A 125VDC CONTROL POWER	ANNUNCIATION OCCURS ON LOW BUS VOLTAGE WITH CHARGER #B IN SERVICE. REDUNDANT CHARGER MUST BE MANUALLY ALIGNED. BATTERY DUTY CYCLE (190 MIN) IS GREATER THAN 30 MIN REQUIRED TO PERMIT CREDIT FOR THIS OPERATOR ACTION OUTSIDE CONTROL ROOM

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
12.7.02.01.2	125VDC BUS #1 BATTERY CHARGER SBT B	CHARGER	INPUT SHORT	480V BRKR 52-1130 TRIPS TO PROTECT SWGR #1. RESULTS IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #1	CONTROL ROOM AND LOCAL INDICATION, ANNUNCIATION AT DG LOCAL PANEL	(SAME AS 12.7.2.1.1)	(SAME AS 12.7.2.1.1)	
12.7.02.01.3	125VDC BUS #1 BATTERY CHARGER SBT B	CHARGER	OUTPUT VOLTS HIGH	RESULTS IN HIGHER THAN ASSUMED VOLTAGE FOR TRAIN A 125VDC LOADS	LOCAL INDICATION	REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN A 125VDC LOADS DUE TO LOSS OF QUALIFYING LIFE	*CONDITION LIMITED BY CRGR RE-VOLTS SHUTDOWN. VERIF REQ THAT EQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN A VITAL/RBG BUSES 1, 2, 3/3A, 4 DUE TO VOLTS REGULATE CAPABILITY OF INVERTERS (SAME AS 12.7.2.1.1)
12.7.02.01.4	125VDC BUS #1 BATTERY CHARGER SBT B	CHARGER	OUTPUT VOLTS LOW	(SAME AS 12.7.2.1.1)	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.7.2.1.1)	(SAME AS 12.7.2.1.1)	
12.7.02.01.5	125VDC BUS #1 BATTERY CHARGER SBT B	CHARGER	OUTPUT SHORT	BATTERY CHARGER CURRENT LIMITS, OUTPUT BRKAKER TRIPS TO CLEAR FAULT FROM BUS, RESULTING IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR 125VDC BUS #1	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.7.2.1.1)	(SAME AS 12.7.2.1.1)	(SAME AS 12.7.2.1.1)
12.7.02.02.1	125VDC BUS #1 BATTERY CHARGER SBT B	72-142 (BRKAKER)	OPEN (TRIPPED)	(SAME AS 12.7.2.1.1)	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.7.2.1.1)	(SAME AS 12.7.2.1.1)	(SAME AS 12.7.2.1.1) CHARGER SBT B OUTPUT BRKAKER ON 125VDC BUS #1
12.7.02.02.2	125VDC BUS #1 BATTERY CHARGER SBT B	72-142 (BRKAKER)	CLOSED	BRKAKER WILL NOT TRIP TO REMOVE CHARGER #B FROM SERVICE OR TO CLEAR FAULT BETWEEN CHARGER OUTPUT AND BRKAKER	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS CRGR OUTPUT FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS. BRKR TRIP NOT REQD FOR FAULT ON BUS SIDE OF BRKR, SINCE CRGR CURRENT-LIMITS AND BATTERY WOULD NOT FEED FAULT THROUGH THIS CURRENT PATH
12.7.03.01.1	125VDC BATTERY BANK #1		OUTPUT VOLTS LOW	NO EFFECT WITH FULL CAPACITY CHARGER IN SERVICE. LOSS OF 125VDC BUS #1 LOADS DURING SISLOP EVENT OR OTHER INTERRUPTION OF FULL CAPACITY CHARGING, INCLUDING DG #1, MAIN IPMR AND GEN PROTECTION, TRAIN A RCCS LOADS	PERIODIC TESTING	NONE REQUIRED FOR SIS, NONE FOR SISLOP. ALT OR DEDICATED SHUTDOWN FOR NON-SIS/LOP EVENTS AS PBR UFHA	*NONE FOR SIS (CONTINUED CRGR SEE ITEMS 12.7.5.5.1, 12.7.5.9.1, 12.7.5.14.2, 12.7.6.1.1, 12.7.6.1.2, 12.7.6.2.1, 12.7.6.2.2, 12.7.6.3.1. SEE FOLLOWING ITEM FOR DISCUSSION OF FAULT PROPAGATION SCENARIO.	CONCURRENT LOSS OF BUS/LOAD O/C OVERCURRENT TRIP OF SWD BRKR PROTECTS MAIN/C-IPMR FOR PRIMARY SIDE FAULTS ONLY
12.7.03.01.2	125VDC BATTERY BANK #1		OUTPUT SHORT	LOSS OF 125VDC BUS #1 DUE TO LOW VOLTAGE	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	NONE FOR SIS/SISLOP, ALT OR DEDICATED SHUTDOWN FOR NON-SIS/SISLOP EVENTS	*INOP OF TRAIN A, POTENTIAL INOP OF TRAIN B DUE TO 4 KV ROOM FIRE OR LOSS OF CONTAINMENT INTEGRITY RESULTING FROM COMMON-CAUSE FAULT OF NON-BQ RCPs (LOCA/MSLB) OR BICITER (MSLB O/S CONTAINMENT) W/ CONCURRENT LOSS OF BUS/LOAD OVERCURRENT PROTECTION	*FAILURE CAUSES LOSS OF CONTROL PWR TO ALL BUS #1A/1B/1C BRKR. B/U O/C PROTECTION REQD FOR RCPs AND MAIN GEN BICITER TO PREVENT PROPAGATING COMMON-CAUSE FAULTS OF THESE LOADS USING ENERGY OF MAIN GEN/IPMR, FOR WHICH LOW-SIDE PROTECTION CONCURRENTLY LOST

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODES	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.7.03.02.1	125VDC BATTERY BANK #1	72-144 (BBBARBR)	OPEN	(SAME AS 12.7.3.1.1)	PERIODIC TESTING	(SAME AS 12.7.3.1.1)	*(SAME AS 12.7.3.1.1)	(SAME AS 12.7.3.1.1)
12.7.03.02.2	125VDC BATTERY BANK #1	72-144 (BBBARBR)	CLOSED	BBBARBR WILL NOT TRIP IF REQUIRED TO ISOLATE BUS FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.04.01.1	125VDC BUS #1 SHUNT		OPEN	LOSS OF 125VDC BUS #1	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.7.3.1.2)	*(SAME AS 12.7.3.1.2)	*(SAME AS 12.7.3.1.2)
12.7.04.01.2	125VDC BUS #1 SHUNT		SHORT	LOSS OF 125VDC BUS #1 AMPS INDICATION	LOCAL INDICATION	NONE REQUIRED	NONE	
12.7.04.01.3	125VDC BUS #1 SHUNT		GROUND	125VDC BUS #1 POSITIVE OR NEGATIVE POLE BECOMES GROUNDED	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	NONE REQUIRED	NONE	*BOUNDS GROUND OF ANY OTHER 125VDC BUS #1 DEVICE. T/S ACTION ENTRY REQD FOR THIS CONDITION, SINCE A SECOND COMMON-CAUSE GROUND OF NON-BQ LOADS COULD DISABLE 125VDC BUS #1 SR LOADS. VBRIP REQD ON X GROUND FOR T/S ENTRY IN THIS NORMALLY UNGROUNDED SYSTEM
12.7.05.01.1	125VDC BUS #1 SR LOADS	72-135 (BBBARBR)	OPEN	LOSS OF INVERTER FOR VITAL/REGULATED BUS #1, CAUSING AUTO-TRANSFER TO BACKUP SOURCE (MCC-2 VIA MANUAL TRANSFER SWITCH #7)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #1 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG
12.7.05.01.2	125VDC BUS #1 SR LOADS	72-135 (BBBARBR)	CLOSED	BBBARBR WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON INVERTER #1	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.02.1	125VDC BUS #1 SR LOADS	72-136 (BBBARBR)	OPEN	LOSS OF INVERTER FOR VITAL/REGULATED BUS #2, CAUSING AUTO-TRANSFER TO BACKUP SOURCE (MCC-2 VIA MANUAL TRANSFER SWITCH #7)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #2 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG
12.7.05.02.2	125VDC BUS #1 SR LOADS	72-136 (BBBARBR)	CLOSED	BBBARBR WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON INVERTER #2	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.7.05.03.1	125VDC BUS #1 SR LOADS	72-137 (BREAKER)	OPEN	LOSS OF INVERTER FOR VITAL/REGULATED BUS #3/3A, CAUSING AUTO-TRANSFER TO BACKUP SOURCE (MCC-2 VIA MANUAL TRANSFER SWITCH #7)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #3 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DC
12.7.05.03.2	125VDC BUS #1 SR LOADS	72-137 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON INVERTER #3	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.04.1	125VDC BUS #1 SR LOADS	72-131 (BREAKER)	OPEN	LOSS OF INVERTER FOR VITAL/REGULATED BUS #4, CAUSING AUTO-TRANSFER TO BACKUP SOURCE (MCC-2 VIA MANUAL TRANSFER SWITCH #7)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #4 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DC
12.7.05.04.2	125VDC BUS #1 SR LOADS	72-131 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON INVERTER #3	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.05.1	125VDC BUS #1 SR LOADS	72-103 (BREAKER)	OPEN	LOSS OF 125VDC CONTROL POWER TO 4KV BUS #1A, 1B, 1C, PREVENTING TRIP OR CLOSE OF ANY TIE, FEEDER OR LOAD BREAKER ON THESE BUSESSES. ALSO RESULTS IN BUS #1C UNDERVOLTAGE SIGNAL TO TRAIN B SEQ 2 LOP/SISLOP LOGIC	CONTROL ROOM INDICATION	NONE FOR SIS/SISLOP. ALT OR DEDICATED SHUTDOWN FOR NON-SIS/SISLOP EVENTS	*INOP OF TRAIN A, WITH POTENTIAL INOP OF TRAIN B DUE TO 4 KV ROOM FIRE OR LOSS OF CONTAINMENT INTEGRITY, DUE TO COMMON-CAUSE FAULT OF NON-EQ RCP MOTORS FED BY MAIN GEN/A/B-1PWR W/ LOSS OF BUS #1A/1B CONTROL POWER. SISLOP LOGIC BECOMES 1/2 ON BUS #2C	*SEE ITEMS 1.1.3.10.1, 1.1.6.15.1, 1.1.11.6.1, 1.1.12.4.1, 2.1.6.14.1, 8.3.1.7.1, 10.1.2.5.1, 12.1.2.4.1, 12.1.3.8.1, 12.1.4.8.1, 12.1.5.7.1, 12.1.7.12.1, 12.1.9.2.1, 12.1.10.6.1, 12.1.12.8.1, 12.2.5.7.1. B/U PENETRATION O/C PROTECT REQD FOR RCP MOTORS
12.7.05.05.2	125VDC BUS #1 SR LOADS	72-103 (BREAKER)	CLOSED	BREK WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON 4KV BUS #1A/1B/1C CONTROL BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE THE PLANT DESIGN BASIS
12.7.05.06.1	125VDC BUS #1 SR LOADS	72-112 (BREAKER)	OPEN	LOSS OF 125VDC CONTROL POWER TO 480V SWGR #1, RESULTING IN INABILITY TO TRIP OR CLOSE ANY TIE, FEEDER OR LOAD BREAKER, AND LOSS OF TRAIN A 480V SWGR #1 UV AND FAULT PROTECTION. MCC'S UNAPPECTED FOR SIS, ENTIRE TRAIN LOST DUE TO BUS/DC OVLD FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A, REDUCED REDUNDANCY FOR RE-ENERGIZING 480V SWGR #3 POST-SIS/SISLOP	*SEE ITEMS 2.1.3.6.1, 5.1.3.6.1, 6.1.3.11.1, 7.1.3.12.1, 12.3.1.7.1, 12.3.2.10.1. LOCAL OPERATOR ACTION REQUIRED TO RE-ENERGIZE SWGR #3 IF FAILURE OCCURS BEFORE BRKR 52-1303 CAN BE OPENED AND WGR LOADS STRIPPED

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPBB UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.7.05.06.2	125VDC BUS #1 SR LOADS	72-112 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON 480V SWGR #1 CONTROL BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.07.1	125VDC BUS #1 SR LOADS	72-105 72-114 72-119 72-126 (BREAKERS)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN A DG #1 BICITR/FIBLD, LOCAL PANEL (RIGHT AND LBPT PRD), OR PURL OIL STANDBY PUMP	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN A FOR SISLOP, NONE FOR SIS	SEE ITEM 10.1.1.8.1
12.7.05.07.2	125VDC BUS #1 SR LOADS	72-105 72-114 72-119 72-126 (BREAKERS)	CLOSED	BREAKER(S) WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS INPUT FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.08.1	125VDC BUS #1 SR LOADS	72-116 (BREAKER)	OPEN	LOSS OF TRAIN A 125VDC CONTROL POWER TO 480V SWGR #3	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED REDUNDANCY FOR RE-ENERGIZING 480V SWGR #3 POST-SIS/SISLOP	*SEE ITEMS 6.3.3.11.1, 7.3.3.7.1, 12.6.8.5.1. TRCH SPEC ACTION ENTRY REQUIRED WITH BRER IN THIS POSITION
12.7.05.08.2	125VDC BUS #1 SR LOADS	72-116 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.09.1	125VDC BUS #1 SR LOADS	72-118 (BREAKER)	OPEN	LOSS OF 125VDC CONTROL POWER TO 480V SWGR #1/MCC SISLOP LOCKOUT RELAYS, DISABLING SRQ #1 SISLOP TRIP/LOCKOUT OF MSR LOADS	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN XPRM COOLING FOR ALT OFFSITE SOURCE	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO ENST LEVEL TRIP OF TRAIN A SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	SEE ITEM 12.3.09.11.1. RCP# ALSO LOST, UNAVAILABLE FOR SCGR. MAIN XPRM HAS 2 TRAINS OF FORCED AIR COOLING
12.7.05.09.2	125VDC BUS #1 SR LOADS	72-118 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.10.1	125VDC BUS #1 SR LOADS	72-121 (BREAKER)	OPEN	LOSS OF 125VDC CONTROL POWER TO CHEMICAL CONTROL BOARD, INCLUDING SOLENOID CONTROL VALVE (3V-84), CAUSING CLOSURE OF S/G BLOWDOWN ISOLATION VALVES CV-100, 100A, 100B	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEM 4.3.7.6.1. VALVE SAFETY FUNCTION IS FAIL-CLOSED
12.7.05.10.2	125VDC BUS #1 SR LOADS	72-121 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE COMMON-CAUSE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. BREAKER IS I0CPB50.49(6)(7) ISOLATION DEVICE FOR NON-QUALIFIED LOADS ON THIS PRDOR

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SYSTEM OPERATE UNIT 1
 TABLE 12-1: POWER DISTRIBUTION SYSTEM FMSA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.7.05.11.1	125VDC BUS #1 SR LOADS	72-122 (BBBAKBB)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN A HYDRAZINE ADDITION SYSTEM ISOLATION VALVE SV-600, CONTAINMENT ISOLATION VALVES CV-537, CV-533, CAUSING VALVES TO FAIL CLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CONTAINMENT SPRAY HYDRAZINE ADDITION SYSTEM	SEE ITEM 5.1.7.4.1. CONTAINMENT ISOLATION VALVE SAFETY FUNCTION IS FAIL-CLOSED
12.7.05.11.2	125VDC BUS #1 SR LOADS	72-122 (BBBAKBB)	CLOSED	BBBAKBB WILL NOT TRIP IF REQUIRED TO ISOLATE COMMON-CAUSE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. SEPARATE 10CPB50.49(b)(2) FUSES PROVIDED TO ISOLATE NON-QUALIFIED LOADS FROM THIS BREAKER (EG. SV-600, WHICH IS ONLY QUALIFIED FOR 2 HRS POST-LOCA)
12.7.05.12.1	125VDC BUS #1 SR LOADS	72-123 (BBBAKBB)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN A SAFETY INJECTION HEADER VENT ISOLATION VALVES SV-702B AND D, CAUSING VALVES TO FAIL CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	SEE ITEM 1.4.12.6.1. VALVES SAFETY FUNCTION IS FAIL-CLOSED
12.7.05.12.2	125VDC BUS #1 SR LOADS	72-123 (BBBAKBB)	CLOSED	BBBAKBB WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.13.1	125VDC BUS #1 SR LOADS	72-124 (BBBAKBB)	OPEN	LOSS OF 125VDC CONTROL POWER TO 88Q #1, DISABLING TRAIN A ECCS ACTUATION, INCLUDING CONTAINMENT SPRAY ACTUATION AND DG AUTO-START	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR INJECTION, NONE REQUIRED FOR BECTIC	INOPERABILITY OF TRAIN A FOR INJECTION, NONE FOR BECTIC	SEE ITEM 8.1.12.1.1. SRQ OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. SRQ NORMALLY BLOCKED/RESET AS PART OF BECTIC ENTRY. THEREFORE, MANUAL ACTUATION OF BREAKERS AND CONTROL OF LOADS CAN BE CREDITED FOR BECTIC
12.7.05.13.2	125VDC BUS #1 SR LOADS	72-124 (BBBAKBB)	CLOSED	BBBAKBB WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.14.1	125VDC BUS #1 SR LOADS	72-128 (BBBAKBB)	OPEN	LOSS OF TRAIN A 125VDC CONTROL POWER TO MAIN STEAM DUMP SYSTEM, RESULTING IN INOPERABILITY OF FAST-OPENING MODE. NORMAL CONTROL MODE AND CONTROL FROM REMOTE SHUTDOWN PANEL (C-38) UNAFFECTED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
12.7.05.14.2	125VDC BUS #1 SR LOADS	72-129 (BBBAKBB)	CLOSED	BBBAKBB WILL NOT TRIP IF REQUIRED TO ISOLATE COMMON-CAUSE FAULT	PERIODIC TESTING	NONE FOR CCW FLOW BYPASS. REPAIRS OR ADDITIONAL DG FUEL FOR C-IFMR RELATED (SIS)LOP	*POTENTIAL INOP OF TRAIN A WITH *STEAM DUMP SYSTEM AND SOLENOIDS NOT EQ. TRCH SPEC TO: UNISOLABLE CCW FLOW BYPASS AND INABILITY TO TRANSFER FROM DG TO OFFSITE SOURCE WITH C-IFMR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/FW	ACTION ENTRY REQD WITH THIS FAILURE

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.7.05.15.1	125VDC BUS #1 SR LOADS	72-130 (88BAK88)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN A SI AND HFW ISOLATION VALVES INCLUDING BV-851/2/3/4B, NOV-850B, PCV-1112 (SV-1112 ONLY), PCV-456, CV-142/3/4 (TRAIN A SV ONLY). VALVES FAIL TO NORMAL OPERATING POSITIONS	CONTROL ROOM INDICATION	REDUNDANT TRIP	IMPROBABILITY OF TRAIN A SI/FW PUMPING FOR INJECTION AND SECONDARY RECIRC. REDUCED REDUNDANCY FOR HFW ISOLATION	SEE ITEMS 1.1.4.7.1, 1.1.5.6.1, 1.1.7.5.1, 1.1.8.3.1, 1.1.9.4.1, 1.4.9.3.1, 2.4.9.7.1, 2.4.28.5.1, 3.1.4.7.1, 4.3.6.3.1. CHARGING PUMP FLOW NOT CREDITED FOR INJECTION, SV-1112 NORMALLY DE-ENERGIZED VIA OVERRIDE FOR CLR, HLR FUNCTIONS
12.7.05.15.2	125VDC BUS #1 SR LOADS	72-130 (88BAK88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.16.1	125VDC BUS #1 SR LOADS	72-134 (88BAK88)	OPEN	LOSS OF TRAIN A 125VDC CONTROL POWER TO HIS COINCIDENTOR, RESULTING IN REACTOR TRIP AND ROD STOP SIGNALS	PERIODIC TESTING	NONE REQUIRED	NONE	REACTOR TRIP NORMALLY OCCURS FOR SIS/SISLOP EVENTS ON LOW PRESSURIZER PRESSURE (RPS OR SEQ) OR HIGH CONTAINMENT PRESSURE (SEQ ONLY)
12.7.05.16.2	125VDC BUS #1 SR LOADS	72-134 (88BAK88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.7.05.17.1	125VDC BUS #1 SR LOADS	72-141 (88BAK88)	OPEN	LOSS OF 125VDC POWER TO CONTROL ROD SYSTEM AND SCRAM BREAKERS, RESULTING IN SCRAM BREAKER UNDERVOLTAGE TRIP	PERIODIC TESTING	NONE REQUIRED	NONE	REACTOR TRIP NORMALLY OCCURS FOR SIS/SISLOP EVENTS ON LOW PRESSURIZER PRESSURE (RPS OR SEQ) OR HIGH CONTAINMENT PRESSURE (SEQ ONLY)
12.7.05.17.2	125VDC BUS #1 SR LOADS	72-141 (88BAK88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULTS	PERIODIC TESTING	NONE REQUIRED	NONE	REACTOR TRIP SIGNAL OPENS SCRAM BREAKERS TO ISOLATE THE CONTROL ROD MECHANISMS
12.7.06.01.1	125VDC BUS #1 NSR LOADS	72-101 72-111 72-113 (88BAK88)	OPEN	LOSS OF 125VDC POWER TO TURBINE CONTROL AND PROTECTION (INCLUDING ALL NON-MECHANICAL TRIPS); BREAKER STEAM DUMP. TURBINE MECHANICAL TRIPS (INCLUDING OVERSPEED) ARE UNAFFECTED	CONTROL ROOM INDICATION	NONE FOR SIS, NONE REQUIRED FOR SISLOP	*LOSS OF TURBINE TRIP CAPABILITY FOR SIS EVENTS, RESULTING IN EXCESS STEAM DEMAND (SIMILAR TO STEAM LINE BREAK) CONCURRENT WITH SBLOCA OR SCGR. NONE FOR SISLOP DUE TO MECHANICAL TRIPS ON LOW CONDENSER VACUUM OR OVERSPEED	*TURBINE TRIP VALVE IS ENERGIZE TO ACTUATE. REANALYSIS OF AFFECTED TRANSIENTS MAY BE REQD TO DETERMINE EFFECT OF THIS FAILURE. MANUAL BLOCK VALVES CAN BE CLOSED LOCALLY IF PERMITTED BY RADIOLOGICAL CONDITIONS. DIVERSE TURBINE TRIP TO BE ADDED BY DCP T-3407
12.7.06.01.2	125VDC BUS #1 NSR LOADS	72-101 72-111 72-113 (88BAK88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE COMMON-CAUSE FAULT, RESULTING IN LOSS OF 125VDC BUS #1	PERIODIC TESTING	NONE FOR CCW FLOW BYPASS, ADDITIONAL DC FUEL OR REPAIRS FOR C-IFMR RELATED (SIS)LOP	*POTENTIAL IMOP OF TRAIN A WITH POTENTIAL IMOP OF TRAIN B DUE TO UNISOLABLE CCW FLOW BYPASS AND INABILITY TO TRANSFER FROM DC TO OPPOSITE SOURCE WITH C-IFMR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/FW	*CONFIGURATION DOES NOT MEET E.G. 1.75 OR 1838 381 CRITERIA DUE TO LACK OF A SIS/SISLOP TRIP OF THE NON-1B LOADS FROM THIS BUS

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 TABLE 12-1: POWER DISTRIBUTION SYSTEM FNBA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHIBITORY COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.7.06.02.1	125VDC BUS #1 MSR LOADS	72-108 72-109 72-115 (BBRAEBBS)	OPEN	LOSS OF 125VDC POWER TO MAIN GENERATOR CONTROL AND PROTECTION, MAIN/A/B-IFMR PROTECTION	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, ADDITIONAL DG FUEL OR REPAIRS FOR C-IFMR RELATED (SIS)LOP. ALT OR DEDICATED SHUTDOWN FOR NON-SIS/SISLOP EVENTS AS PER UFGA	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY DUE TO INABILITY TO TRANSFER FROM DG ₂ TO OPPOSITE SOURCE FOR SISLOP EVENT INVOLVING C-IFMR RELATED LOP	*SEE ITEM 12.9.8.1.1. VERIFY REQD THAT LOSS OF #2 CMTL DOES NOT CAUSE LOSS OF NEARBY ECCS EQUIP AND CABLING (INCL NOV-35A/850C INVERTER, MFM PUMPS) VIA PIPE OR EXPLOSION. SEPARATE 220vV BRKR AND RCP O/C TRIPS PREVENT PROPAGATION OF COMMON-CAUSE FAULTS
12.7.06.02.2	125VDC BUS #1 MSR LOADS	72-108 72-109 72-115 (BBRAEBBS)	CLOSED	(SAME AS 12.7.6.1.2)	PERIODIC TESTING	(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)
12.7.06.03.1	125VDC BUS #1 MSR LOADS	OTHER	OPEN	LOSS OF 125VDC POWER TO REACTOR PLANT OR TURBINE PLANT ANNUNCIATORS (72-104, 102), RCP THERMAL BARRIER PUMP (72-120), MOTOR OPERATED DISCONNECT SWITCH (72-132) AND OTHER MISCELLANEOUS LOADS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL FOR C-IFMR RELATED (SIS)LOP	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER FROM DG ₂ TO OPPOSITE FOR C-IFMR RELATED (SIS)LOP	SEE ITEMS 6.4.8.5.1, 12.9.7.3.1. MOTOR OPERATED DISCONNECT SWITCH CAN BE OPERATED MANUALLY VIA LOCAL HAND-CRANK, BUT INTERLOCK FROM FAILED RELAYS WILL STILL BLOCK RECLOSING OF SWD BRKBS
12.7.06.03.2	125VDC BUS #1 MSR LOADS	OTHER	CLOSED	(SAME AS 12.7.6.1.2)	PERIODIC TESTING	(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)
12.8.01.01.1	125VDC BUS #2 BATTERY CHARGER SBT C	CHARGER	INPUT OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #2	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN B 125VDC CONTROL POWER	ANNUNCIATION OCCURS ON LOW BUS VOLTAGE WITH CHARGER DC IN SERVICE. REDUNDANT CHARGER MUST BE MANUALLY ALIGNED. BATTERY DUTY CYCLE (>90 MIN) IS GREATER THAN 30 MIN TO PERMIT CREDIT FOR THIS OPERATOR ACTION OUTSIDE THE CONTROL ROOM
12.8.01.01.2	125VDC BUS #2 BATTERY CHARGER SBT C	CHARGER	INPUT SHORT	480V BRKR 52-12B30 TRIPS TO PROTECT MCC-2B. RESULTS IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #2	CONTROL ROOM AND LOCAL INDICATION, ANNUNCIATION AT DG LOCAL PANEL	(SAME AS 12.8.1.1.1)	(SAME AS 12.8.1.1.1)	
12.8.01.01.3	125VDC BUS #2 BATTERY CHARGER SBT C	CHARGER	OUTPUT VOLTS HIGH	RESULTS IN HIGHER THAN ASSUMED VOLTAGE FOR TRAIN B 125VDC LOADS	LOCAL INDICATION AND ALARM	REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN B 125VDC LOADS DUE TO LOSS OF QUALIFIED LIFE	*CONDITION LIMITED BY CHARGER HI-VOLTS SHUTDOWN. VERIFY REQD THAT RQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN B VITAL BUS 5, 6 OR CEAS INVERTERS DUE TO VOLTAGE REGULATING CAPABILITY

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.8.01.01.4	125VDC BUS #2 BATTERY CHARGER SET C	CHARGER	OUTPUT VOLTS LOW	(SAME AS 12.8.1.1.1)	CONTROL ROOM AND DC LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.8.1.1.1)	(SAME AS 12.8.1.1.1)	(SAME AS 12.8.1.1.1)
12.8.01.01.5	125VDC BUS #2 BATTERY CHARGER SET C	CHARGER	OUTPUT SHORT	BATTERY CHARGER CURRENT-LIMITS, OUTPUT BRKR TRIPS TO CLEAR FAULT FROM BUS, RESULTING IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR 125VDC BUS #2	CONTROL ROOM AND DC LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.8.1.1.1)	(SAME AS 12.8.1.1.1)	(SAME AS 12.8.1.1.1)
12.8.01.02.1	125VDC BUS #2 BATTERY CHARGER SET C	12-202 (BRKBR)	OPEN (TRIPPED)	(SAME AS 12.8.1.1.1)	CONTROL ROOM AND DC LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.8.1.1.1)	(SAME AS 12.8.1.1.1)	(SAME AS 12.8.1.1.1) CHARGER SET C OUTPUT BRKR ON 125VDC BUS #2
12.8.01.02.2	125VDC BUS #2 BATTERY CHARGER SET C	12-202 (BRKBR)	CLOSED	BRKBR WILL NOT TRIP TO REMOVE CHARGER AC FROM SERVICE OR TO CLEAR FAULT BETWEEN CHARGER OUTPUT AND BRKBR	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS CHGR OUTPUT FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE THE PLANT DESIGN BASIS. BRKR TRIP NOT REQD FOR FAULT ON BUS SIDE OF BRKR SINCE CHGR WILL CURRENT-LIMIT AND BATTERY DOES NOT FEED FAULT THROUGH THIS PATH
12.8.02.01.1	125VDC BUS #2 BATTERY CHARGER SET D	CHARGER	INPUT OPEN	LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #2	CONTROL ROOM AND DC LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	REDUNDANT CHARGER	REDUCED RELIABILITY OF TRAIN B 125VDC CONTROL POWER	ANNUNCIATION OCCURS ON LOW BUS VOLTAGE WITH CHARGER #D IN SERVICE. REDUNDANT CHARGER MUST BE MANUALLY ALIGNED. BATTERY DUTY CYCLE (>90 MIN) IS GREATER THAN 30 MIN TO PERMIT CREDIT FOR THIS OPERATOR ACTION OUTSIDE CONTROL ROOM
12.8.02.01.2	125VDC BUS #2 BATTERY CHARGER SET D	CHARGER	INPUT SHORT	480V BRKR 52-12B26 TRIPS TO PROTECT MCC-2B. RESULTS IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR DC BUS #2	CONTROL ROOM AND LOCAL INDICATION, ANNUNCIATION AT DC LOCAL PANEL	(SAME AS 12.8.2.1.1)	(SAME AS 12.8.2.1.1)	
12.8.02.01.3	125VDC BUS #2 BATTERY CHARGER SET D	CHARGER	OUTPUT VOLTS HIGH	RESULTS IN HIGHER THAN ASSUMED VOLTAGE FOR TRAIN B 125VDC LOADS	LOCAL INDICATION AND ALARM	REDUNDANT TRAIN	POTENTIAL INOPERABILITY OF TRAIN B 125VDC LOADS DUE TO LOSS OF QUALIFIED LIFE	*CONDITION LIMITED BY CHARGER HI-VOLTS SHUTDOWN, VERIFY REQD THAT BQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN B VITAL BUS 5, 6 OR CSAS INVERTERS DUE TO VOLTAGE REGULATING CAPABILITY
12.8.02.01.4	125VDC BUS #2 BATTERY CHARGER SET D	CHARGER	OUTPUT VOLTS LOW	(SAME AS 12.8.2.1.1)	CONTROL ROOM AND DC LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.8.2.1.1)	(SAME AS 12.8.2.1.1)	(SAME AS 12.8.2.1.1)

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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.8.02.01.5	125VDC BUS #2 BATTERY CHARGER SET D	CHARGER	OUTPUT SHORT	BATTERY CHARGER CURRENT-LIMITS, OUTPUT BRKR TRIPS TO CLEAR FAULT FROM BUS, RESULTING IN LOSS OF 1 OF 2 FULL CAPACITY CHARGERS FOR 125VDC BUS #2	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.8.2.1.1)	(SAME AS 12.8.2.1.1)	(SAME AS 12.8.2.1.1)
12.8.02.02.1	125VDC BUS #2 BATTERY CHARGER SET D	72-201 (BRKR)	OPEN (TRIPPED)	(SAME AS 12.8.2.1.1)	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.8.2.1.1)	(SAME AS 12.8.2.1.1)	(SAME AS 12.8.2.1.1) CHARGER SET D OUTPUT BRKR ON 125VDC BUS #2
12.8.02.02.2	125VDC BUS #2 BATTERY CHARGER SET D	72-203 (BRKR)	CLOSED	BRKBR WILL NOT TRIP TO REMOVE CHARGER #D FROM SERVICE OR TO CLEAR FAULT BETWEEN CHARGER OUTPUT AND BRKBR	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS CRGR OUTPUT FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE THE PLANT DESIGN BASIS. BRKR TRIP NOT REQD FOR FAULT ON BUS SIDE OF BRKR SINCE CRGR WILL CURRENT-LIMIT AND BATTERY WOULD NOT FEED FAULT THROUGH THIS PATH
12.8.03.01.1	125VDC BATTERY BANK #2		OUTPUT VOLTS LOW	NO EFFECT WITH FULL CAPACITY CHARGER IN SERVICE. LOSS OF 125VDC BUS #2 LOADS DURING SISLOP EVENT OR OTHER INTERRUPTION OF FULL CAPACITY CHARGING, INCLUDING DG #2, TRAIN B ECCS LOADS	PERIODIC TESTING	NONE REQUIRED FOR SIS, REDUNDANT TRAIN FOR SISLOP	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	FAILURE WOULD ONLY HAVE INDICATED EFFECTS BETWEEN SISLOP AND DG BRKR CLOSURE, SINCE CHARGER WOULD SUPPLY DC BUS #2 VOLTAGE AT ALL OTHER TIMES
12.8.03.01.2	125VDC BATTERY BANK #2		OUTPUT SHORT	LOSS OF 125VDC BUS #2, DUE TO LOW VOLTAGE	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B FOR SIS AND SISLOP	OUTPUT BRKR WILL NOT TRIP ON OVERCURRENT WITH THIS FAULT, SINCE ONLY BATTERY CRGR WOULD SUPPLY FAULT THROUGH THIS PATH, AND CRGR CURRENT-LIMIT IS INSUFFICIENT TO CAUSE BRKR TRIP
12.8.03.02.1	125VDC BATTERY BANK #2	72-201 (BRKR)	OPEN	(SAME AS 12.8.3.1.1)	PERIODIC TESTING	(SAME AS 12.8.3.1.1)	(SAME AS 12.8.3.1.1)	(SAME AS 12.8.3.1.1)
12.8.03.02.2	125VDC BATTERY BANK #2	72-201 (BRKR)	CLOSED	BRKBR WILL NOT TRIP IF REQUIRED TO ISOLATE BUS FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.8.04.01.1	125VDC BUS #2 SHUNT		OPEN	LOSS OF 125VDC BUS #2	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	(SAME AS 12.8.3.1.2)	(SAME AS 12.8.3.1.2)	
12.8.04.01.2	125VDC BUS #2 SHUNT		SHORT	LOSS OF 125VDC BUS #2 AMPS INDICATION	LOCAL INDICATION	NONE REQUIRED	NONE	

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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.8.04.01.3	125VDC BUS #2 SHUNT		GROUND	125VDC BUS #2 POSITIVE OR NEGATIVE POLE BECOMES GROUNDED	CONTROL ROOM AND DG LOCAL PANEL ANNUNCIATION, LOCAL INDICATION	NONE REQUIRED	NONE	*BOUNDS GROUND OF ANY OTHER 125VDC BUS #2 DEVICE. T/S ACTION ENTRY REQD FOR THIS CONDITION, SINCE A SECOND COMMON-CAUSE GROUND OF NON-BQ LOADS COULD DISABLE 125VDC BUS #2 SR LOADS IN THIS NORMALLY UNGROUNDING SYSTEM. VERIF REQD ON X GROUND FOR T/S ENTRY
12.8.05.01.1	125VDC BUS #2 SR LOADS	72-217 (BBBAERB)	OPEN	LOSS OF INVERTER FOR VITAL BUSES #5, 6, CAUSING AUTO-TRANSFER TO BACKUP SOURCE (MCC-2)	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE REQUIRED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT REENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL BUSES 5, 6 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG
12.8.05.01.2	125VDC BUS #2 SR LOADS	72-217 (BBBAERB)	CLOSED	BBBAERB WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON INVERTER #5	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.8.05.02.1	125VDC BUS #2 SR LOADS	72-223 (BBBAERB)	OPEN	LOSS OF CSAS INVERTERS, INCLUDING TRAIN B CONTROL POWER FOR CLR VALVES PCV-1115D/B/P	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	REDUNDANT TRAIN FOR CSAS AND CLR FLOW CONTROL	TRAIN B CSAS INOPERABLE, TRAIN A CSAS LOGIC WILL ACTUATE ON SEQ #1 SIS/SISLOP. LOSS OF 1 OF 2 REDUNDANT FLOW CONTROL TRAINS FOR CLR VALVES PCV-1115D/B/P	SEE ITEM 2.4.23.2.1. PREMATURE ACTUATION OF CONTAINMENT SPRAY WILL OCCUR WITH THIS FAILURE, SINCE 2/3 HI-HI PRESSURE LOGIC IS SATISFIED BY FAIL STATE OF THE AFFECTED CSAS PRESSURE SENSING LOOPS
12.8.05.02.2	125VDC BUS #2 SR LOADS	72-223 (BBBAERB)	CLOSED	BBBAERB WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON CSAS INVERTERS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.8.05.03.1	125VDC BUS #2 SR LOADS	72-204 (BBBAERB)	OPEN	LOSS OF TRAIN B 125VDC CONTROL POWER TO 480V SWGR #3	CONTROL ROOM INDICATION	REDUNDANT TRAIN	REDUCED REDUNDANCY FOR RE-ENERGIZING 480V SWGR #3 POST-SIS/SISLOP	*SEE ITEM 12.6.8.10.1. TECH SPEC ACTION ENTRY REQUIRED WITH BRER IN THIS POSITION NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.8.05.03.2	125VDC BUS #2 SR LOADS	72-204 (BBBAERB)	CLOSED	BBBAERB WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	SEE ITEMS 2.2.3.6.1, 2.4.23.3.1, 5.2.3.6.1, 6.2.3.11.1, 7.2.3.12.1, 12.4.1.9.1, 12.4.2.12.1. LOCAL OPERATOR ACTION REQUIRED TO TRANSFER SWGR #3 BACK TO TRAIN A POWER IF FAILURE OCCURS AFTER TIE BRER 52-1203 IS CLOSED POST-SISLOP
12.8.05.04.1	125VDC BUS #2 SR LOADS	72-205 (BBBAERB)	OPEN	LOSS OF 125VDC CONTROL POWER TO 480V SWGR #2, RESULTING IN INABILITY TO TRIP OR CLOSE ANY TIE, PRESSOR OR LOAD BBBAERB, AND LOSS OF TRAIN B 480V SWGR #2 UV AND FAULT PROTECTION. MCC'S UNAFFECTED FOR SIS, ENTIRE TRAIN LOST DUE TO BUS/DG OVLD FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B, REDUCED REDUNDANCY FOR RE-ENERGIZING 480V SWGR #3 POST-SIS/SISLOP	SEE ITEMS 2.2.3.6.1, 2.4.23.3.1, 5.2.3.6.1, 6.2.3.11.1, 7.2.3.12.1, 12.4.1.9.1, 12.4.2.12.1. LOCAL OPERATOR ACTION REQUIRED TO TRANSFER SWGR #3 BACK TO TRAIN A POWER IF FAILURE OCCURS AFTER TIE BRER 52-1203 IS CLOSED POST-SISLOP

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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.8.05.04.2	125VDC BUS #2 SR LOADS	72-205 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON 480V SWGR #2 CONTROL BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.8.05.05.1	125VDC BUS #2 SR LOADS	72-206 (BREAKER)	OPEN	LOSS OF 125VDC CONTROL POWER TO 4LV BUS #2C, PREVENTING TRIP OR CLOSE OF ANY TIE, PREDOR OR LOAD BREAKER ON THIS BUS. ALSO RESULTS IN BUS #2C UNDERVOLTAGE SIGNAL TO TRAIN A SEQ 1 LOP/SISLOP LOGIC	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR ECCS LOADS, REDUNDANT VALVES FOR LO-LO RWST LEVEL TRIP	*INOP OF TRAIN B, WITH POTENTIAL INOP OF TRAIN A DUE TO LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW PUMPS. TRAIN A SISLOP LOGIC BECOMES 1/2 ON BUS #1C UV	SEE ITEMS 1.2.3.10.1, 1.2.6.15.1, 1.2.11.4.1, 1.2.12.5.1, 2.2.6.14.1, 8.3.2.7.1, 10.2.2.5.1, 12.2.2.4.1, 12.2.7.12.1, 12.2.9.2.1, 12.2.10.6.1, 12.2.12.8.1. NOT REV REQD TO TRIP PUMP BRKS LOCALLY TO ISOL FAULTS DUE TO LOSS-OF-SUCTION MOTOR FAILURES
12.8.05.05.2	125VDC BUS #2 SR LOADS	72-206 (BREAKER)	CLOSED	BKR WILL NOT TRIP IF REQUIRED TO ISOLATE INPUT FAULT ON 4LV BUS #2C CONTROL BUS	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE THE PLANT DESIGN BASIS
12.8.05.06.1	125VDC BUS #2 SR LOADS	72-210 72-222 72-224 72-225 (BREAKERS)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN B DG #2 EXCITER/PIBLD, LOCAL PANEL (RIGHT AND LEFT PBD), OR PUBL OIL STANDBY PUMP	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	SEE ITEM 10.2.1.8.1
12.8.05.06.2	125VDC BUS #2 SR LOADS	72-220 72-222 72-224 72-225 (BREAKERS)	CLOSED	BREAKER(S) WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS INPUT FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.8.05.07.1	125VDC BUS #2 SR LOADS	72-211 (BREAKER)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN B SI AND MPW ISOLATION VALVES INCLUDING HV-851/2/3/4A, MOV-850A, PCV-457/458, CV-142/3/4 (TRAIN B SV ONLY). VALVES FAIL TO NORMAL OPERATING POSITIONS	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SI/PW PURPING FOR INJECTION AND SECONDARY RECIRC, REDUCED REDUNDANCY FOR MPW ISOLATION	SEE ITEMS 1.2.4.7.1, 1.2.5.6.1, 1.2.7.5.1, 1.2.8.3.1, 1.2.9.4.1, 1.4.9.4.1
12.8.05.07.2	125VDC BUS #2 SR LOADS	72-211 (BREAKER)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS
12.8.05.08.1	125VDC BUS #2 SR LOADS	72-212 (BREAKER)	OPEN	LOSS OF 125VDC CONTROL POWER TO SEQ #2, DISABLING TRAIN B ECCS ACTUATION, INCLUDING CONTAINMENT SPRAY ACTUATION AND DG AUTO-START	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR INJECTION, NONE REQUIRED FOR RECIRC	INOPERABILITY OF TRAIN B FOR INJECTION, NONE FOR RECIRC	SEE ITEM 8.2.12.1.1. SEQ OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. SEQ NORMALLY BLOCKED/RESST AS PART OF RECIRC ENTRY. THEREFORE, MANUAL ACTUATION OF BREAKERS AND CONTROL OF LOADS CAN BE CREDITED FOR RECIRC

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 TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.8.05.08.2	125VDC BUS #2 SR LOADS	72-212 (88BAE88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS SEE ITEM 2.2.6.14.1
12.8.05.09.1	125VDC BUS #2 SR LOADS	72-218 (88BAE88)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN B CHARGING PUMP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	TRAIN B INOPERABLE FOR CLR, (WITH TRAIN A PRE-SELECTED) AND SISLOP	
12.8.05.09.2	125VDC BUS #2 SR LOADS	72-218 (88BAE88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS SEE ITEMS 2.4.12.3.3, 3.1.7.3.3, 5.2.7.4.1. CONTAINMENT ISOL VLV SAFETY FUNCTION IS FAIL-CLOSED. B/U #2 AVAIL TO INSIDE CONTAINMENT VLVS (EG. HLR PRIMARY PATH VALVE CV-305) VIA LOCAL OPS OF CV-532 MANUAL BYPASS OUTSIDE SHIELD WALL
12.8.05.10.1	125VDC BUS #2 SR LOADS	72-220 (88BAE88)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN B HYDRAZINE ADDITION SYSTEM ISOLATION VALVE SV-601, CONTAINMENT ISOLATION VALVES CV-532, CV-534, CV-115, CAUSING VALVES TO FAIL CLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CONTAINMENT SPRAY HYDRAZINE ADDITION SYSTEM	
12.8.05.10.2	125VDC BUS #2 SR LOADS	72-220 (88BAE88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE COMMON-CAUSE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. SEPARATE 10CFR50.49(b)(2) FUSES PROVIDED TO ISOLATE NON-QUALIFIED LOADS FROM THIS BREAKER (EG. SV-601, WHICH IS ONLY QUALIFIED FOR 2 HRS POST-LOCA) SEE ITEMS 1.4.11.6.1, 1.4.20.5.1. VALVES SAFETY FUNCTION IS FAIL-CLOSED
12.8.05.11.1	125VDC BUS #2 SR LOADS	72-221 (88BAE88)	OPEN	LOSS OF 125VDC CONTROL POWER TO TRAIN B CONTAINMENT ISOLATION VALVES CV-102, 104, 106, 146, 147 AND CV-535, SI HEADER VENT ISOLATION VALVES SV-702A AND C, AND SAMPLE ISOLATION VALVE CV-3302, CAUSING VALVES TO FAIL CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
12.8.05.11.2	125VDC BUS #2 SR LOADS	72-221 (88BAE88)	CLOSED	BREAKER WILL NOT TRIP IF REQUIRED TO ISOLATE FAULT	PERIODIC TESTING	NONE REQUIRED	NONE	NORMAL POSITION. THIS FAILURE PLUS FAULT DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE THE PLANT DESIGN BASIS SEE ITEMS 12.4.9.16.1, 12.6.7.12.1. SWGR #3 NON-SR LOADS CAN BE MANUALLY ISOLATED PRIOR TO RE-ENERGIZING THE BUS FROM TRAIN A OR B. MAIN IPMR FLOW BYPASS, LOSS OF LO-LO RWST HAS 2 TRAINS OF FORCED AIR LEVEL TRIP OF TRAIN B SI/FW. COOLING REDUCED RELIABILITY OF ALT OFFSITE SOURCE
12.8.05.12.1	125VDC BUS #2 SR LOADS	72-226 (88BAE88)	OPEN	LOSS OF 125VDC CONTROL POWER TO 480V SWGR #2, SWGR #3, AND MCC SISLOP LOCKOUT RELAYS, DISABLING SEQ #2 SISLOP TRIP/LOCKOUT OF MSR LOADS	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPMR COOLING FOR ALT OFFSITE SOURCE	POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FROM TRAIN A OR B. MAIN IPMR FLOW BYPASS, LOSS OF LO-LO RWST HAS 2 TRAINS OF FORCED AIR LEVEL TRIP OF TRAIN B SI/FW. COOLING REDUCED RELIABILITY OF ALT OFFSITE SOURCE	

TABLE 12-1: AUXILIARY POWER FMEA
PART IV: SWITCHYARD AND COMMON

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERRANT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.9.01.01.1	CB 4032 (PCB-5)	BRKBR	OPEN	BRKBR TRIPS, CANNOT BE RECLOSURED TO PROVIDE POWER FROM SWD W BUS TO C-IPNR. BRK 6032 FROM NW BUS UNAFFECTED UNLESS BRKBR FAIL LOCAL BACKUP (BFLBU) ACTUATES	CONTROL ROOM INDICATION	REDUNDANT BREAKER FROM SWD W BUS FOR SIS, DG PLUS ALTERNATE OFFSITE SOURCE FOR C-IPNR RELATED (SIS)LOP	220 KV SWD BREAKER BETWEEN W BUS AND LINE SIDE OF C-IPNR	
12.9.01.01.2	CB 4032 (PCB-5)	BRKBR	CLOSED	BREAKER CANNOT BE TRIPPED FOR ISOLATION OF SWD W BUS FROM C-IPNR RELATED OR OTHER FAULTS. BRKBR FAIL LOCAL BACKUP WILL TRIP REDUNDANT BRKBR 6032 FROM SWD W BUS AND ALL SWD W BUS BRKBR (INCL MAIN IPNR BRK 4012) AS NEEDED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS, DG PLUS ALTERNATE OFFSITE SOURCE VIA SWD W BRK 6012 FOR C-IPNR RELATED (SIS)LOP	NONE FOR SIS, REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE FOR C-IPNR RELATED (SIS)LOP	NORMAL POSITION. FAILED BREAKER CAN BE ISOLATED VIA DISCONNECTS AFTER BFLBU ISOLATION OF SWD W BUS, TO PERMIT RECLOSING REDUNDANT BRK 6032 IF NEEDED. ALTERNATE OFFSITE SOURCE REQUIRED FOR C-IPNR RELATED (SIS)LOP PRIOR TO REHAUSTION OF DG FUEL SUPPLY
12.9.01.02.1	CB 4032 (PCB-5)	BRKBR FAIL LOCAL BACKUP (BFLBU)	TRIPPED	REDUNDANT BRK 6032 AND SWD W BUS BRK (INCLUDING MAIN IPNR BRK 4012) TRIP TO ISOLATE SWD W BUS AND C-IPNR LINE SIDE, CANNOT BE RECLOSURED. RESULTS IN LOP AND LOVATS ACTUATION INCLUDING MAIN GEN AND 6012 TRIP DUE TO BUS #1C/2C UNDERVOLTAGE	CONTROL ROOM INDICATION ANNUNCIATION	DG AND ALTERNATE OFFSITE SOURCE VIA SWD W BUS BRK 6012	LOSS OF NORMAL OFFSITE SOURCE TO BUS #1C/2C, SO THAT SIS BECOMES C-IPNR RELATED SISLOP. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE FOR POST-SISLOP TRANSFER OF SWGR #1C/2C FROM DG	BFLBU PROVIDES FAULT ISOLATION IN THE EVENT THAT BRK RECEIVES A TRIP SIGNAL BUT DOES NOT TRIP. SPURIOUS BFLBU BOUNDS ACTUATION OF SWD W BUS DIFFERENTIAL TRIP, WHICH DOES NOT TRIP BRK 6032. 4012 LOVATS TRIP SIGNAL RESETS WHEN MOTOR OF DISCONNECT OPN
12.9.01.02.2	CB 4032 (PCB-5)	BRKBR FAIL LOCAL BACKUP (BFLBU)	UNTRIPPED	C-IPNR OR SWD (W BUS) FAULTS WILL NOT BE ISOLATED IN EVENT OF BRK FAILURE	PERIODIC TESTING	NORMAL BRK TRIPS	REDUCED RELIABILITY FOR FAULT ISOLATION IN EVENT OF C-IPNR RELATED (SIS)LOP	NORMAL POSITION. BRKBR FAILURE PLUS BFLBU FAILURE IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.9.02.01.1	CB 6032 (PCB-6)	BRKBR	OPEN	BRKBR TRIPS, CANNOT BE RECLOSURED TO PROVIDE POWER FROM SWD W BUS TO C-IPNR. BRK 4032 FROM NW BUS UNAFFECTED UNLESS BRKBR FAIL LOCAL BACKUP (BFLBU) ACTUATES	CONTROL ROOM INDICATION	REDUNDANT BREAKER FROM SWD W BUS FOR SIS, DG PLUS ALTERNATE OFFSITE SOURCE FOR C-IPNR RELATED (SIS)LOP	REDUCED REDUNDANCY OF NORMAL BUS AND LINE SIDE OF C-IPNR	
12.9.02.01.2	CB 6032 (PCB-6)	BRKBR	CLOSED	BREAKER CANNOT BE TRIPPED FOR ISOLATION OF SWD W BUS FROM C-IPNR RELATED OR OTHER FAULTS. BRKBR FAIL LOCAL BACKUP WILL TRIP REDUNDANT BRKBR 4032 FROM SWD W BUS AND ALL SWD W BUS BRKBR (INCL MAIN IPNR BRK 6012) AS NEEDED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS, DG PLUS ALTERNATE OFFSITE SOURCE VIA SWD W BRK 4012 FOR C-IPNR RELATED (SIS)LOP	NONE FOR SIS, REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE FOR C-IPNR RELATED (SIS)LOP	NORMAL POSITION. FAILED BREAKER CAN BE ISOLATED VIA DISCONNECTS AFTER BFLBU ISOLATION OF SWD W BUS, TO PERMIT RECLOSING REDUNDANT BRK 4032 IF NEEDED. ALTERNATE OFFSITE SOURCE REQUIRED FOR C-IPNR RELATED (SIS)LOP PRIOR TO REHAUSTION OF DG FUEL SUPPLY

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.9.02.02.1	CB 6032 (PCB-6)	BREAKER FAIL LOCAL BACKUP (BPLBU)	TRIPPED	REDUNDANT BRKR 4032 AND SWTD NW BUS BRKR (INCLUDING MAIN IPHR BRKR 6012) TRIP TO ISOLATE SWTD NW BUS AND C-IPHR LINE SIDE, CANNOT BE RECLOSED. RESULTS IN LOP AND LOVATS ACTUATION INCLUDING MAIN GEN AND 4012 TRIP DUE TO BUS #1C/2C UNDERVOLTAGE	CONTROL ROOM INDICATION ANNUNCIATION	DC AND ALTERNATE OFFSITE SOURCE VIA SWTD NW BUS BRKR 4012	LOSS OF NORMAL OFFSITE SOURCE TO BUS #1C/2C, SO THAT SIS BECOMES C-IPHR RELATED SISLOP. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE FOR POST-SISLOP TRANSFER OF BUS #1C/2C FROM DG.	BPLBU PROVIDES FAULT ISOLATION IN THE EVENT THAT BRKR RECEIVES A TRIP SIGNAL BUT DOES NOT TRIP. SPURIOUS BPLBU SOUNDS ACTUATION OF SWTD NW BUS DIFFERENTIAL TRIP, WHICH DOES NOT TRIP BRKR 4032. 4012 LOVATS TRIP SIGNAL RESETS WBRN MOTOR OF DISCONNECT OPEN
12.9.02.02.2	CB 6032 (PCB-6)	BREAKER FAIL LOCAL BACKUP (BPLBU)	UNTRIPPED	C-IPHR OR SWTD (NW BUS) FAULTS WILL NOT BE ISOLATED IN EVENT OF BRKR FAILURE	PERIODIC TESTING	NORMAL BRKR TRIPS	REDUCED RELIABILITY FOR FAULT ISOLATION IN EVENT OF C-IPHR RELATED (SIS)LOP	NORMAL POSITION. BREAKER FAILURE PLUS BPLBU FAILURE IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.9.05.01.1	CB 4032 CB 6032	C-IPHR PROTECTIVE TRIPS (OFF)	CONTACTS OPEN	C-IPHR 220 kV AND 4 kV BREAKERS WILL NOT TRIP IN EVENT OF IPHR DIFFERENTIAL, SUDDEN PRESSURE OR OTHER TROUBLE. REMAINING C-IPHR TRIPS TO BREAKERS UNAPPECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. FAILURE ADDRESSES ONE TRIP FUNCTION (CONTACT STY) AT A TIME. REMAINING PROTECTIVE TRIPS PREVENT FAULT PROPAGATION TO 4 kV SWGR BN. FAILURE BOUNDS OPEN, SHORT OR GROUND IN ANY PHASE OR PHASES OF C-IPHR DISCONNECT SWITCHES IN CONTROL CABINETS CAN ALSO BE USED TO INTERRUPT THE TRIP SIGNALS
12.9.03.01.2	CB 4032 CB 6032	C-IPHR PROTECTIVE TRIPS (ON)	CONTACTS CLOSED	SWTD BRKR 4032 AND 6032 TRIP, CANNOT BE RECLOSED. RESULTS IN LOP AND LOVATS ACTUATION, INCLUDING MAIN GENERATOR TRIP (BRKR 4012 AND 6012) DUE TO BUS #1C/2C UNDERVOLTAGE	CONTROL ROOM INDICATION	DC AND ALTERNATE OFFSITE SOURCE VIA SWTD BRKR 4012 AND 6012	LOSS OF NORMAL OFFSITE SOURCE FOR BUS #1C/2C, SO THAT SIS BECOMES SISLOP. ALTERNATE OFFSITE SOURCE AVAILABLE AFTER MOTOR OPERATED DISCONNECT OPENS OR AT LEAST ONE OF BUS #1C/2C RECOVERS VOLTAGE VIA DG, TO RESET LOVATS SIGNAL	
12.9.04.01.1	CB 4012 (PCB-1)	BREAKER	OPEN	BREAKER TRIPS, CANNOT BE RECLOSED TO PROVIDE POWER FROM SWTD NB BUS TO MAIN IPHR FOR ALTERNATE OFFSITE SOURCE. REDUNDANT BRKR 6012 FROM NW BUS UNAPPECTED UNLESS BREAKER FAIL LOCAL BACKUP (BPLBU) ACTUATES	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, DC PLUS ALTERNATE OFFSITE SOURCE VIA REDUNDANT SWTD NW BRKR 6012 FOR C-IPHR RELATED (SIS)LOP	REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE TO BUS #1C/2C. NORMAL OFFSITE SOURCE UNAPPECTED	220 kV SWTD BREAKER BETWEEN NB BUS AND LINE SIDE OF MAIN IPHR. DOES NOT CAUSE LOSS-OF-LOAD UNIT TRIP UNLESS REDUNDANT BRKR 6012 OPENS
12.9.04.01.2	CB 4012 (PCB-1)	BREAKER	CLOSED	BRKR CANNOT BE TRIPPED TO ISOLATE SWTD NW BUS FROM MAIN GEN AND MAIN A/B-IPHRs FOR FAULT PROTECTION OR UNIT TRIP. BRKR FAIL LOCAL BACKUP WILL TRIP REDUNDANT BRKR 6012 FROM SWTD NW BUS AND ALL SWTD NB BUS BRKR (INCL C-IPHR BRKR 4032) AS NEEDED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS, DC PLUS REPEATS (DISCONNECTS, LOCAL RESETS) TO RESTORE ALT OFFSITE SOURCE VIA REDUNDANT BRKR 6012 FOR C-IPHR RELATED (SIS)LOP	LOSS OF ALTERNATE OFFSITE SOURCE FOR BUS #1C/2C POST-SISLOP OR OTHER CAUSE OF UNIT TRIP, UNTIL BRKR IS ISOLATED BY DISCONNECTS AND LOCAL RESET OF BPLBU IN SWTD, NONE FOR SIS	VERIFICATION REQUIRED THAT APPLICABLE PROCEDURES ADDRESS THIS CONDITION POST-SISLOP

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHRA

ITSM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.9.04.02.1	CB 4012 (PCB-1)	BREAKER FAILURE LOCAL BACKUP (BPLBU)	TRIPPED	REDUNDANT BRKR 6012 AND SWTD NW BUS BRKRS (INCLUDING C-IPMR BRKR 4032) TRIP TO ISOLATE SWTD NW BUS AND MAIN IPMR LINE SIDE, CANNOT BE RECLOSED. RESULTS IN UNIT TRIP	CONTROL ROOM INDICATION,	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL REQUIRED FOR C-IPMR RELATED SISLOP	*LOSS OF ALTERNATE OPPOSITE SOURCE FOR BUS #1C/2C POST-SISLOP, NONE FOR SIS	BPLBU PROVIDES FAULT ISOLATION IN THE EVENT THAT BRKR RECEIVES A TRIP SIGNAL BUT DOES NOT TRIP. SPURIOUS BPLBU BOUNDS ACTUATION OF SWTD NW BUS DIFFERENTIAL TRIP, WHICH DOES NOT TRIP BRKR 6032
12.9.04.02.2	CB 4012 (PCB-1)	BREAKER FAILURE LOCAL BACKUP (BPLBU)	UNTRIPPED	MAIN GENERATOR, MAIN/A/B-IPMR OR SWTD (NW BUS) FAULTS WILL NOT BE ISOLATED IN EVENT OF BRKR FAILURE	PERIODIC TESTING	NORMAL BRKR TRIPS FOR FAULTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY FOR FAULT ISOLATION IN EVENT OF MAIN GENERATOR OR MAIN/A/B-IPMR FAILURE, NONE FOR SIS/SISLOP	NORMAL POSITION. BREAKER FAILURE PLUS BPLBU FAILURE IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.9.05.01.1	CB 6012 (PCB-2)	BREAKER	OPEN	BREAKER TRIPS, CANNOT BE RECLOSED TO PROVIDE POWER FROM SWTD NW BUS TO MAIN IPMR FOR ALTERNATE OPPOSITE SOURCE. REDUNDANT BRKR 4012 FROM NW BUS UNAPPECTED UNLESS BREAKER FAIL LOCAL BACKUP (BPLBU) ACTUATES	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, DG PLUS ALTERNATE OPPOSITE SOURCE VIA REDUNDANT SWTD NW BRKR 4012 FOR C-IPMR RELATED (SIS)LOP	REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE TO BUS #1C/2C. NORMAL OPPOSITE SOURCE UNAPPECTED	220 kV SWTD BREAKER BETWEEN NW BUS AND LINE SIDE OF MAIN IPMR. DOES NOT CAUSE LOSS-OF-LOAD UNIT TRIP UNLESS REDUNDANT BRKR 4012 OPENS
12.9.05.01.2	CB 6012 (PCB-2)	BREAKER	CLOSED	BRKR CANNOT BE TRIPPED TO ISOLATE OF SWTD NW BUS FROM MAIN GEN AND MAIN/A/B-IPMRs FOR FAULT PROTECTION OR UNIT TRIP. BRKR FAIL LOCAL BACKUP WILL TRIP REDUNDANT BRKR 4012 FROM SWTD NW BUS AND ALL SWTD NW BUS BRKRS (INCL C-IPMR BRKR 4032) AS NEEDED	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE REQUIRED FOR SIS, DG PLUS REPAIRS (DISCONNECTS, LOCAL RESBT) TO RESTORE ALT OPPOSITE SOURCE VIA REDUNDANT BRKR 4012 FOR C-IPMR RELATED (SIS)LOP	*LOSS OF ALTERNATE OPPOSITE SOURCE FOR BUS #1C/2C POST-SISLOP OR OTHER CAUSE OF UNIT TRIP, UNTIL BRKR IS ISOLATED BY DISCONNECTS AND LOCAL RESBT OF BPLBU IN SWTD, NONE FOR SIS	*VERIFICATION REQUIRED THAT APPLICABLE PROCEDURES ADDRESS THIS CONDITION POST-SISLOP
12.9.05.02.1	CB 6012 (PCB-2)	BREAKER FAILURE LOCAL BACKUP (BPLBU)	TRIPPED	REDUNDANT BRKR 4012 AND SWTD NW BUS BRKRS (INCLUDING C-IPMR BRKR 6032) TRIP TO ISOLATE SWTD NW BUS AND MAIN IPMR LINE SIDE, CANNOT BE RECLOSED. RESULTS IN UNIT TRIP	CONTROL ROOM INDICATION,	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL REQUIRED FOR C-IPMR RELATED SISLOP	*LOSS OF ALTERNATE OPPOSITE SOURCE FOR BUS #1C/2C POST-SISLOP, NONE FOR SIS	BPLBU PROVIDES FAULT ISOLATION IN THE EVENT THAT BRKR RECEIVES A TRIP SIGNAL BUT DOES NOT TRIP. SPURIOUS BPLBU BOUNDS ACTUATION OF SWTD NW BUS DIFFERENTIAL TRIP, WHICH DOES NOT TRIP BRKR 4032
12.9.05.02.2	CB 6012 (PCB-2)	BREAKER FAILURE LOCAL BACKUP (BPLBU)	UNTRIPPED	MAIN GENERATOR, MAIN/A/B-IPMR OR SWTD (NW BUS) FAULTS WILL NOT BE ISOLATED IN EVENT OF BRKR FAILURE	PERIODIC TESTING	NORMAL BRKR TRIPS FOR FAULTS, NONE REQUIRED FOR SIS/SISLOP	REDUCED RELIABILITY FOR FAULT ISOLATION IN EVENT OF MAIN GENERATOR OR MAIN/A/B-IPMR FAILURE, NONE FOR SIS/SISLOP	NORMAL POSITION. BREAKER FAILURE PLUS BPLBU FAILURE IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE SIS/SISLOP DESIGN BASIS
12.9.06.01.1	CB 4012 CB 6012	MAIN GEN, MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS OPEN (OPP)	MAIN/A/B-IPMR 220 kV AND 4 kV BREAKERS WILL NOT OPEN IN EVENT OF DIFFERENTIAL, SUDDEN PRESSURE OR OTHER MAIN GENERATOR OR MAIN/A/B-IPMR TROUBLE. REMAINING PROTECTIVE TRIPS TO BREAKERS UNAPPECTED	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION. FAILURE ADDRESSES ONE TRIP FUNCTION (CONTACT SBT) AT A TIME. REMAINING PROTECTIVE TRIPS PREVENT FAULT PROPAGATION TO 4 kV BN. FAILURE BOUNDS OPEN, SHORT OR GROUND IN ANY PHASE OR PHASES OF MAIN/A/B-IPMRs

EMERGENCY CORE SYSTEM SINGLE FAILURE ANALYSIS

ONOPRE UNIT 1

TABLE 12-1: POWER DISTRIBUTION SYSTEM FHRA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.9.06.01.2	CB 4012 CB 6012	MAIN GEN, MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED (ON)	220 kV SWTD BRERS 4012, 6012 AND 4 kV BRERS 11A04, 11B04 TRIP, CANNOT BE RECLOSED. RESULTS IN UNIT TRIP	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL REQUIRED FOR C-IPMR RELATED (SIS)LOP	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN ABILITY TO TRANSFER BUS #1C/2C FROM DG# FOR SISLOP EVENT INVOLVING C-IPMR RELATED LOP	DISCONNECT SWITCHES IN CONTROL CABINETS CAN ALSO BE USED TO INTERERRUPT THE TRIP SIGNALS
12.9.06.02.1	CB 4012 CB 6012	452AY, 452AY1 (RELAYS)	ON	SWTD BRER 4012 OR 6012 CLOSED SIGNAL TO TURBINE/GENERATOR CONTROLS AND LOVATS, PREVENTING LOVATS ACTUATION ON BUS #1C/2C UNDERVOLTAGE (EG. C-IPMR RELATED LOP)	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OFFSITE SOURCE EVENT IF LOVATS FUNCTIONS AS DESIGNED
12.9.06.02.2	CB 4012 CB 6012	452AX, 452AX1 (RELAYS)	OFF	SWTD BRER 4012 AND 6012 OPEN SIGNAL TO MAIN GEN CONTROLS AND LOVATS. SEPARATE MAIN GEN TRIP ON BUS #1C/2C UNDERVOLTAGE AND LOVATS INTERLOCK FROM MAIN GEN PRGQ RELAY 2271 PREVENT PREMATURE OPERATION/FLASHOVER DAMAGE OF MOTOR OP DISCONNECT	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	NORMAL POSITION IMMEDIATELY FOLLOWING UNIT TRIP
12.9.06.03.1	CB 4012 CB 6012	IR-1 (RELAY)	CONTACTS CLOSED (ON)	SWTD BRERS 4012 AND 6012 CAN BE RECLOSED DURING MAIN GENERATOR COASTDOWN OR MOTOR OPERATED DISCONNECT OPEN/CLOSE STROKE	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP. THIS FAILURE PLUS CONCURRENT OPERATOR ERROR DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE PLANT DESIGN BASIS	INTERLOCK FROM MOTOR OPERATED DISCONNECT. RELAY CONTACTS CLOSED WHEN MOTOR OPERATED DISCONNECT IS OPEN (IE, POST-TRIP). PARALLEL CONTACTS FROM MAIN GENERATOR LOW VOLTS RELAY 2277-1 PERMIT BRER CLOSURE FOR CONNECTING MAIN GENERATOR TO THE GRID
12.9.06.03.2	CB 4012 CB 6012	IR-1 (RELAY)	CONTACTS OPEN (OFF)	SWTD BRERS 4012 AND 6012 CANNOT BE RECLOSED AFTER UNIT TRIP AND MOTOR OPERATED DISCONNECT OPENING	PERIODIC TESTING	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL REQUIRED FOR C-IPMR RELATED SISLOP	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG# FOR C-IPMR RELATED (SIS)LOP, NONE FOR SIS	
12.9.06.04.1	CB 4012 CB 6012	2277-1 (RELAY)	CONTACTS OPEN (ON)	SWTD BRERS 4012 AND 6012 CANNOT BE CLOSED TO CONNECT MAIN GENERATOR TO GRID. NO EFFECT ON BRER RECLOSURE WITH MOTOR OPERATED DISCONNECT OPEN	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	INTERLOCK FROM MAIN GENERATOR LOW VOLTS RELAY 2277. RELAY ENERGIZES WHEN VOLTS < 40%. PARALLEL CONTACTS FROM MOTOR OPERATED DISCONNECT AUXILIARY RELAY IR-1 PERMIT BRER CLOSURE WITH MOD OPEN
12.9.06.04.2	CB 4012 CB 6012	2277-1 (RELAY)	CONTACTS CLOSED (OFF)	SWTD BRERS 4012 AND 6012 CAN BE RECLOSED DURING MAIN GENERATOR COASTDOWN OR MOTOR OPERATED DISCONNECT OPEN/CLOSE STROKE	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	THIS FAILURE AND CONCURRENT OPERATOR ERROR DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO OUTSIDE PLANT DESIGN BASIS

TABLE 12-1: POWER DISTRIBUTION SYSTEM PHEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.9.07.01.1	MOTOR OPERATED DISCONNECT	SWITCH	OPEN	SWD BRERS 4012 AND 6012 CAN BE RECLOSURED AS NEEDED TO ALIGN ALTERNATE OPPOSITE SOURCE. MAIN GENERATOR CANNOT BE CONNECTED TO GRID	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	
12.9.07.01.2	MOTOR OPERATED DISCONNECT	SWITCH	CLOSED	SWD BRERS 4012 AND 6012 CANNOT BE RECLOSURED AFTER SIS/SISLOP OR OTHER UNIT TRIP TO ALIGN ALTERNATE OPPOSITE SOURCE WITHOUT MOTORING MAIN GENERATOR	PERIODIC TESTING	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL REQUIRED FOR C-IPMR RELATED (SIS)LOP	LOSS OF ALTERNATE OPPOSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPMR RELATED LOP	NORMAL POSITION
12.9.07.02.1	MOTOR OPERATED DISCONNECT	IR, IR-1 (RELAYS)	ON	MOTOR OPERATED DISCONNECT OPEN SIGNAL TO GENERATOR CONTROLS, LOVATS AND SWD BRERS 4012 AND 6012. DISABLES LOVATS TRIP OF BUS #1A/1B AND 4 kV BRERS 11A04, 11B04, AND PERHITS SWD BRERS 4012 AND 6012 TO BE CLOSED DURING MAIN GEN COASTDOWN	PERIODIC TESTING	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	RELAY IS LATCHING TYPE. THIS FAILURE PLUS OPERATOR ERROR DURING SIS/SISLOP IS A DOUBLE FAILURE SCENARIO WHICH IS OUTSIDE PLANT DESIGN BASIS. OPERATOR ACTION REQUIRED TO ALIGN ALTERNATE OPPOSITE SOURCE EVEN IF LOVATS FUNCTIONS AS DESIGNED
12.9.07.02.2	MOTOR OPERATED DISCONNECT	IR, IR-1 (RELAYS)	OFF	MOTOR OPERATED DISCONNECT CLOSED SIGNAL TO GENERATOR CONTROLS, LOVATS AND SWD BRERS 4012 AND 6012. ENABLES LOVATS TRIP OF BUS #1A/1B AND 4 kV BRERS 11A04, 11B04, AND DISABLES CLOSURE OF SWD BRERS 4012 AND 6012 AFTER MAIN GENERATOR TRIP/COASTDOWN	PERIODIC TESTING	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL REQUIRED FOR C-IPMR RELATED (SIS)LOP	LOSS OF ALTERNATE OPPOSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPMR RELATED LOP	RELAY IS LATCHING TYPE
12.9.07.03.1	MOTOR OPERATED DISCONNECT	125VDC BUS #1 (72-132)	VOLTS LOW	MOTOR OPERATED DISCONNECT CANNOT BE OPERATED FROM CONTROL ROOM. POSITION SIGNAL RELAYS IR AND IR-1 FAIL AS-IS (LATCHING TYPE), POTENTIALLY DISABLING RECLOSURE OF SWD BRERS 4012 AND 6012 OR LOVATS	PERIODIC TESTING	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG FUEL REQUIRED FOR C-IPMR RELATED (SIS)LOP	LOSS OF ALTERNATE OPPOSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPMR RELATED LOP	MOTOR OPERATED DISCONNECT CAN BE OPERATED MANUALLY VIA ATTACHED HAND-CRANK. HOWEVER, INTERLOCK FROM FAILED RELAYS WILL STILL BLOCK RECLOSURE OF SWD BRERS
12.9.08.01.1	CB 4032 CB 6012 CB 6032	125VDC BUS #1 (72-103)	VOLTS LOW	LOSS OF MAIN GENERATOR, MAIN/A/B/C-IPMR PROTECTION	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, ADDITIONAL DG FUEL OR REPAIRS FOR C-IPMR RELATED (SIS)LOP. ALT OR DEDICATED SHUTDOWN FOR NON-SIS/SISLOP EVENTS AS PER UPRA	LOSS OF ALTERNATE OPPOSITE SOURCE FOR BOTH TRAINS, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY DUE TO INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPMR RELATED LOP	SEPARATE 220 kV BRER AND RCP OVERCURRENT TRIPS PREVENT PROPAGATION OF COMMON-CAUSE FAULTS (EG. INTO 4 kV ROOM) WITH THIS FAILURE

TABLE 12-1: POWER DISTRIBUTION SYSTEM FMEA

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.9.08.02.1	CB 4012 CB 4032 CB 6012 CB 6032	480V BUS #A01	VOLTS LOW	LOSS OF AC AUXILIARY POWER TO SWD NR BUS INCLUDING BRERS 4012 AND 4032. AFFECTED BRERS CAN STILL BE TRIPPED AND CLOSED UP TO 5 TIMES USING INTEGRAL HIGH PRESSURE AIR AND SP6 RECHARGERS BEFORE AC POWER IS REQUIRED TO RECHARGE	ANNUNCIATION IN SONGS 2/3 CONTROL ROOM	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	
12.9.08.03.1	CB 4012 CB 4032 CB 6012 CB 6032	480V BUS #A02	VOLTS LOW	LOSS OF AC AUXILIARY POWER TO SWD NW BUS INCLUDING BRERS 6012 AND 6032. AFFECTED BRERS CAN STILL BE TRIPPED AND CLOSED UP TO 5 TIMES USING INTEGRAL HIGH PRESSURE AIR AND SP6 RECHARGERS BEFORE AC POWER IS REQUIRED TO RECHARGE	ANNUNCIATION IN SONGS 2/3 CONTROL ROOM	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	
12.9.08.04.1	CB 4012 CB 4032 CB 6012 CB 6032	480V PANEL #SP1	VOLTS LOW	LOSS OF AC AUXILIARY POWER TO SWD NR AND NW BUS INCLUDING BRERS 4012, 4032, 6012 AND 6032. AFFECTED BRERS CAN STILL BE TRIPPED AND CLOSED UP TO 5 TIMES USING INTEGRAL HIGH PRESSURE AIR AND SP6 RECHARGERS BEFORE AC POWER IS REQUIRED TO RECHARGE	ANNUNCIATION IN SONGS 2/3 CONTROL ROOM	NONE REQUIRED FOR SIS/SISLOP	NONE FOR SIS/SISLOP	PANEL LOCATED IN SCR SWD RELAY HOUSE. POWER NORMALLY PROVIDED VIA 4 KV TO 480V IFRM FROM SONGS 2 NON-1B BUS #2A0V, WITH BACKUP FROM SIMILARLY POWERED BUS IN SDGAB SWD RELAY HOUSE (FROM SONGS 3 NON-1B BUS #3A07). PANEL SUPPLIES 480V BUSES A01, A02
12.9.08.05.1	CB 4012 CB 4032 CB 6012 CB 6032	125VDC PANEL #DP2	VOLTS LOW	LOSS OF CONTROL POWER, BACKUP POWER AND BREAKER FAIL LOCAL BACKUP POWER TO SWD NR AND NW BUS INCLUDING BRERS 4012, 4032, 6012 AND 6032. BRERS CAN BE STILL BE OPERATED MANUALLY BY LOCAL CONTROL IN CABINET ON EACH BREAKER	ANNUNCIATION IN SONGS 2/3 CONTROL ROOM	OVERCURRENT TRIP OF 4 KV BRERS 11C02 AND 12C02 PREVENTS FAULT PROPAGATION INTO 4 KV ROOM. REPAIRS OR ADDITIONAL DG FUEL REQD FOR C-IPMR RELATED LOP	*POTENTIAL FOR FIRE OR EXPLOSION AT C-IPMR AND SWD 220 LV SUPPLY AUTOMATICALLY FROM C-IPMR CAUSED LOP. POTENTIAL DAMAGE TO ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS DUE TO SUSTAINED MOTORING	REALIGNMENT TO ALTERNATE OFFSITE SOURCE NOT REQUIRED IMMEDIATELY, PERMITTING CREDIT FOR LOCAL OPERATION OF SWD BRERS AND REPAIRS WITHIN 7 DAY CAPACITY OF DG FUEL SUPPLY. C-IPMR SEPARATED FROM ESSENTIAL EQUIPMENT AS PER UPNA

TABLE 12-2: SORT OF AUXILIARY POWER DEPENDENCIES

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAP ONOPRR UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
10.1.01.08.1	DC #1	125VDC BUS #1 (72-105)	VOLTS LOW	LOSS OF DC FIELD FLASH AND GOVERNOR CONTROL POWER	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DC	LOSS OF TRAIN A DC FOR LOS, LOP AND SIS/LOP	
12.9.08.01.1	CB 4032 CB 6012 CB 6032	125VDC BUS #1 (72-108)	VOLTS LOW	LOSS OF MAIN GENERATOR, MAIN/A/B/C-IPRR PROTECTION	CONTROL ROOM INDICATION	NONE REQUIRED FOR SIS, ADDITIONAL DG FUEL OR REPAIRS FOR C-IPRR RELATED (SIS)LOP. ALT OR DEDICATED SHUTDOWN FOR NON-SIS/SIS/LOP EVENTS AS PER UPRA	LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY DUE TO INABILITY TO TRANSFER BUS #1C/2C FROM DGs FOR SIS/LOP EVENT INVOLVING C-IPRR RELATED LOP	SEPARATE 220 KV BRKR AND RCP OVERCURRENT TRIPS PREVENT PROPAGATION OF COMMON-CAUSE FAULTS (EG. INTO 4 KV ROOM) WITH THIS FAILURE
12.6.08.05.1	SWGR #3 CONTROL POWBR	125VDC BUS #1 (72-116)	VOLTS LOW	LOSS OF TRAIN A CONTROL POWER TO SWGR #3, RESULTING IN LOSS OF FAULT PROTECTION DURING NORMAL OPERATION (IE, WITH SWGR #2-3 TIE BRKR OPEN AND SELECTOR SWITCH #82 NOT ON)	CONTROL ROOM AND LOCAL INDICATION	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN B VIA SWGR #2-3 TIE BRKR	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3.	*TRCH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
12.3.09.11.1	SWGR #1 UNDERVOLTAGE AND CONTROL	125VDC BUS #1 (72-118)	VOLTS LOW	LOCKOUT RELAYS FOR SWGR #1, MCC-1 WILL NOT TRIP AND LOCKOUT THEIR MSR LOADS	PERIODIC TESTING	NONE FOR SIS/LOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN IPRR COOLING FOR ALTERNATE OFFSITE SOURCE	POTENTIAL INOP OF TRAIN A FOR SIS/LOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RUST LEVEL TRIP OF TRAIN A SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	RCPs ALSO UNAVAILABLE FOR SGTB. MAIN IPRR HAS 2 TRAINS OF FORCED AIR COOLING
06.4.08.05.1	G-964	125VDC BUS #1 (72-120)	VOLTS LOW	EMERGENCY THERMAL BARRIER PUMP DISABLED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE FOR ECCS	EMERGENCY THERMAL BARRIER PUMP NOT CREDITED FOR ECCS EVENTS
04.3.07.06.1	CV-100 CV-100A CV-100B	125VDC BUS #1 (72-121)	VOLTS LOW	SV-84 DE-ENERGIZERS, CLOSING CV-100, 100A, 100B, THEREBY ISOLATING S/G BLOWDOWN TO FLASH TANK AND OUTFALL	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
05.1.07.04.1	SV-600	125VDC BUS #1 (72-122)	VOLTS LOW	TRAIN A HYDRAZINE ISOLATION VALVE FAILS CLOSED, CANNOT BE REOPENED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A HYDRAZINE ADDITION	
07.4.12.06.1	SV-702B SV-702D	125VDC BUS #1 (72-123)	VOLTS LOW	CIS TRAIN A ACTUATED TO SI LOOP B AND C VENT ISOLATION VALVES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
08.1.12.01.1	SBQ 1	125VDC BUS #1 (72-124)	VOLTS LOW	SBQ 1 DISABLED	CONTROL ROOM INDICATION	REDUNDANT SBQ/TRAIN	TRAIN A LOS/LOP/SIS/SIS/LOP DISABLED	SBQ OUTPUT RELAYS ARE ENERGIZE TO ACTUATE
01.1.04.07.1	HV-853B	125VDC BUS #1 (72-130)	VOLTS LOW	HV-853B FAILS TO OPEN (REMAINS CLOSED) ON SIS/SIS/LOP, RELAY 83-2 FAILS OFF, DISABLING TRAIN A PW PUMP SUCTION VALVE CLOSED PROTECTIVE TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR 'SI' AND 'SECONDARY' BECIRC	

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.05.06.1	BV-854B	125VDC BUS #1 (72-130)	VOLTS LOW	BV-854B FAILS TO CLOSE (REMAINS OPEN) ON SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR FLOW, CONDENSATE, HEATER DRAIN PUMP TRIPS AND DISCHARGE VALVE INTERLOCK PREVENT CONDENSATE INJECTION	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RRCIRC	
01.1.07.05.1	BV-851B	125VDC BUS #1 (72-130)	VOLTS LOW	TRAIN A FW PUMP SI FLOW PATH BLOCKED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RRCIRC	INOPERABILITY OF TRAIN A PUMPING FOR SI, NONE FOR SECONDARY RRCIRC	
01.1.08.03.1	BV-852B	125VDC BUS #1 (72-130)	VOLTS LOW	SI FLOW FROM BOTH TRAINS DIVERTED INTO NON-SHISHIC PORTION OF MAIN FW HEADER UNTIL BACKUP VALVES CLOSED. REQUIRED POSITION FOR SECONDARY RECIRCULATION	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT FW ISOLATION VALVES PCV-456, 457, 458, CV-142, 143, 144, NOV-20, 21, 22 ASSUMED IN LOCA/MSLB ANALYSES. NONE FOR NON-SHISHIC HEADER	*SI DELIVERY TIME INCREASED, SI VALVE OPEN NORMAL FOR RELIABILITY REDUCED (VIA SECONDARY RRCIRC NON-SHISHIC PORTION OF FW HEADER)	
01.1.09.04.1	NOV-850B	125VDC BUS #1 (72-130)	VOLTS LOW	INJECTION PATH NOT AUTOMATICALLY ALIGNED TO RCS LOOP B ON SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS DURING SI LOOPS A AND C FOR SI, NONE REQUIRED FOR LO-LO RWST LEVEL OR FOR SECONDARY RRCIRC	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR MSLB (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). NONE FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL OR FOR SECONDARY RRCIRC	
01.4.09.03.1	PCV-456 CV-142, 143, 144	125VDC BUS #1 (72-130)	VOLTS LOW	MAIN FW CONTROL VALVE TO S/G A AND BYPASS VALVES TO S/G A, B, C WILL NOT CLOSE ON TRAIN A SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVE FOR PCV (NOV-21), REDUNDANT SOLENOIDS FOR BYPASS VALVES (SV-3142, SV-150, SV-151)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION	VALVES CAN BE MANUALLY CONTROLLED FOR SECONDARY RRCIRC
02.4.09.07.1	PCV-1112	125VDC BUS #1 (72-130)	VOLTS LOW	SV-1112 CANNOT BE ENERGIZED TO FULLY OPEN PCV-1112 AUTOMATICALLY FOR INJECTION. MODULATION UNAFFECTED FOR COLD LEG RRCIRC BOUNDARY AND HOT LEG RRCIRC PRIMARY PATH FUNCTIONS	CONTROL ROOM INDICATION	NONE FOR INJECTION	INOPERABILITY OF CHARGING PUMP INJECTION PATH TO LOOP A	CHARGING FLOW NOT CREDITED FOR INJECTION
02.4.28.05.1	BCV-427A BCV-427B BCV-427C	125VDC BUS #1 (72-130)	VOLTS LOW	VALVES FAIL CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.1.04.07.1	PCV-1112	125VDC BUS #1 (72-130)	VOLTS LOW	SV-1112 CANNOT BE ENERGIZED TO FULLY OPEN PCV-1112 AUTOMATICALLY FOR INJECTION	CONTROL ROOM INDICATION	NONE FOR INJECTION, NONE REQUIRED FOR CLR OR HLR	INOPERABILITY OF CHARGING PUMP INJECTION PATH TO LOOP A, NONE REQUIRED FOR CLR OR HLR	CHARGING FLOW NOT CREDITED FOR INJECTION
04.3.06.03.1	CV-142 CV-143 CV-144	125VDC BUS #1 (72-130)	VOLTS LOW	MAIN FW BYPASS VALVES TO S/G A/B/C WILL NOT CLOSE ON TRAIN A SIS/SISLOP, VALVE MODULATION UNAFFECTED. AUTOMATIC S/G BLOWDOWN ISOLATION ON APWAS-A AND APWAS-B DISABLED BY DE-ENERGIZING OF RELAY APW1, MANUAL CONTROL UNAFFECTED	CONTROL ROOM INDICATION	REDUNDANT TRAIN B SIGNAL AND SOLENOID VALVES TO CLOSE BYPASS VALVES FOR SI, CONTROL ROOM HARDSWITCH FOR REMOTE MANUAL CONTROL OF BLOWDOWN ISOLATION VV	REDUCED RELIABILITY OF MAIN FW BYPASS VALVES FOR SI BOUNDARY, POTENTIAL DIVERSION OF SECONDARY RRCIRC INVENTORY FROM SYSTEM UNTIL BLOWDOWN ISOLATION VALVES CLOSED REMOTE-MANUALLY	*BLOWDOWN ISOLATION NOT ADDRESSED IN ROI

EMERGENCY CORR COR SYSTEM SINGLE FAILURE ANALYSIS
FOR CHOPPER UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON RCCS	REMARKS
12.9.07.03.1	MOTOR OPERATED DISCONNECT	125VDC BUS #1 (72-132)	VOLTS LOW	MOTOR OPERATED DISCONNECT CANNOT BE OPERATED FROM CONTROL ROOM. POSITION SIGNAL RELAYS TR AND TR-1 FAIL AS-IS (LATCHING TYPE), POTENTIALLY DISABLING ENCLOSURE OF SWD BRERS 4012 AND 4013 OR LOWVATS	PERIODIC TESTING	NONE REQUIRED FOR SIS, REPAIRS OR ADDITIONAL DG PWR. REQUIRED FOR C-IPMR RELATED (SIS)LOP	LOSS OF ALTERNATE OPPOSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG# FOR SISLOP EVENT INVOLVING C-IPMR RELATED LOP	MOTOR OPERATED DISCONNECT CAN BE OPERATED MANUALLY VIA ATTACHED HAND-CRANK. HOWEVER, INTERLOCK FROM FAILED RELAYS WILL STILL BLOCK ENCLOSURE OF SWD BRERS
12.6.08.10.1	SWGR #3 CONTROL POWER	125VDC BUS #2 (72-204)	VOLTS LOW	LOSS OF TRAIN B CONTROL POWER TO SWGR #3	LOCAL INDICATION	SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA SST #3 OR SWGR #1-3 TIE BRER	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3	
10.2.01.08.1	DG #2	125VDC BUS #2 (72-210)	VOLTS LOW	LOSS OF DG FIELD FLASH AND GOVERNOR CONTROL POWER	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DG	LOSS OF TRAIN B DG FOR LOB, LOP AND SISLOP	
01.2.04.07.1	HV-853A	125VDC BUS #2 (72-211)	VOLTS LOW	HV-853A FAILS TO OPEN (REMAINS CLOSED) ON SIS/SISLOP, RELAY 83-2 PATCH OFF, DISABLING TRAIN B FW PUMP SUCTION VALVE CLOSED PROTECTIVE TRIP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	IMOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	
01.2.05.06.1	HV-854A	125VDC BUS #2 (72-211)	VOLTS LOW	HV-854A FAILS TO CLOSE (REMAINS OPEN) ON SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR FLOW. CONDENSATE, HEATER DRAIN PUMP TRIPS AND DISCHARGE VALVE INTERLOCK PREVENT CONDENSATE INJECTION	IMOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	
01.2.07.05.1	HV-851A	125VDC BUS #2 (72-211)	VOLTS LOW	TRAIN B FW PUMP SI FLOW PATH BLOCKED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SI, NONE REQUIRED FOR SECONDARY RECIRC	IMOPERABILITY OF TRAIN B PUMPING FOR SI, NONE FOR SECONDARY RECIRC	
01.2.08.03.1	HV-852A	125VDC BUS #2 (72-211)	VOLTS LOW	SI FLOW FROM BOTH TRAINS DIVERTED INTO NON-SEISMIC PORTION OF MAIN FW HEADER UNTIL BACKUP VALVES CLOSED. REQUIRED POSITION FOR SECONDARY RECIRCULATION	CONTROL ROOM INDICATION PERIODIC TESTING	REDUNDANT FW ISOLATION VALVES PCV-456, 457, 458, CV-142, 143, 144, NOV-20, 21, 22 ASSUMED IN LOCA/MSLB ANALYSES. NONE FOR NON-SEISMIC HEADER DURING SI	*SI DELIVERY TIME INCREASED, SI VALVE OPEN NORMAL FOR RELIABILITY REDUCED (VIA NON-SEISMIC PORTION OF FW HEADER)	
01.2.09.04.1	NOV-850A	125VDC BUS #2 (72-211)	VOLTS LOW	INJECTION PATH NOT AUTOMATICALLY ALIGNED TO RCS LOOP A ON SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOP W AND C FOR SI, NONE REQUIRED FOR LO-LO RVST LEVEL OR FOR SECONDARY RECIRC	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR MSLB (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). NONE FOR AUTO-TERMINATION OF SI ON LO-LO RVST LEVEL OR FOR SECONDARY RECIRC	
01.4.09.04.1	PCV-457, 458 CV-142, 143, 144	125VDC BUS #2 (72-211)	VOLTS LOW	MAIN FW CONTROL VALVES TO S/G B, C AND BYPASS VALVES TO S/G A; B, C WILL NOT CLOSE ON TRAIN B SIS/SISLOP	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES FOR PCVB (NOV-20, NOV-22), REDUNDANT SOLENOIDS FOR BYPASS VALVES (SV-149, SV-2143, SV-2144)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION	VALVES CAN BE MANUALLY CONTROLLED FOR SECONDARY RECIRC
08.2.12.01.1	SEQ 2	125VDC BUS #2 (72-212)	VOLTS LOW	SEQ 2 DISABLED	CONTROL ROOM INDICATION	REDUNDANT SEQ/TRAIN	TRAIN B LOB/LOP/SIS/SISLOP DISABLED	SEQ OUTPUT RELAYS ARE ENERGIZE TO ACTUATE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SOPRE UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.12.03.3	CV-304 CV-305	125VDC BUS #2 (72-220)	VOLTS LOW	ISOLATES BACKUP N2 TO CV-305 INSIDE CONTAINMENT (HLR) BY CLOSING CV-532	CONTROL ROOM INDICATION	LOCAL MANUAL OPERATION OF REDUNDANT BYPASS VALVE IN BACKUP N2 SUPPLY	LOSS OF AUTOMATIC N2 BACKUP TO CV-305	HANDUAL BYPASS VALVE LOCATED ON SAFE SIDE OF SHIELD WALL. ACCESS AND USE BOUNDED BY EXISTING DOSE CALCULATIONS
03.1.07.03.3	CV-304 CV-305	125VDC BUS #2 (72-220)	VOLTS LOW	ISOLATES BACKUP N2 TO CV-305 INSIDE CONTAINMENT (HLR) BY CLOSING CV-532	CONTROL ROOM INDICATION	LOCAL MANUAL OPERATION OF REDUNDANT BYPASS VALVE IN BACKUP N2 SUPPLY	LOSS OF AUTOMATIC N2 BACKUP TO CV-305	HANDUAL BYPASS VALVE LOCATED ON SAFE SIDE OF SHIELD WALL. ACCESS AND USE BOUNDED BY EXISTING DOSE CALCULATIONS
05.2.07.04.1	SV-601	125VDC BUS #2 (72-220)	VOLTS LOW	TRAIN B HYDRAZINE ISOLATION VALVE FAILS CLOSED, CANNOT BE REOPENED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B HYDRAZINE ADDITION	
01.4.11.06.1	SV-102A SV-102C	125VDC BUS #2 (72-221)	VOLTS LOW	CIS TRAIN B ACTUATED TO B1 LOOP B AND C VENT ISOLATION VALVES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.4.20.05.1	SV-3302	125VDC BUS #2 (72-221)	VOLTS LOW	SV-3302 FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
02.4.23.02.1	PCV-1115D PCV-1115B PCV-1115F	125VDC BUS #2 (72-223)	VOLTS LOW	LOSS OF POWER TO TRAIN B CSAS INVERTERS. TRAIN B CONTROLLERS DISABLED FOR PCV-1115D/B/F	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN A CONTROLLERS	LOSS OF 1 OF 2 REDUNDANT CONTROLLERS FOR EACH OF PCV-1115D/B/F FOR CLR FLOW CONTROL	
12.4.09.16.1	SWGR #2 UNDERVOLTAGE AND CONTROL	125VDC BUS #2 (72-226)	VOLTS LOW	LOCKOUT RELAYS FOR SWGR #2, MCC-2, MCC-2A, SWGR #3, MCC-3 WILL NOT TRIP AND LOCKOUT THEIR MSR LOADS	PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS, REDUNDANT MAIN XPHR COOLING FOR ALTERNATE OPPOSITE SOURCE	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW.	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. FOR REV REQ TO INDIVIDUALLY ISOLATE SWGR #3/HCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. RCPS ALSO LOST, UNAVAILABLE FOR SCTR. MAIN XPHR HAS 2 TRAINS OF COOLING
12.6.07.12.1	SWGR #3 UNDERVOLTAGE AND CONTROL	125VDC BUS #2 (72-226)	VOLTS LOW	SWGR #2, MCC-2, MCC-2A, SWGR #3, MCC-3 LOCKOUT RELAYS WILL NOT TRIP AND LOCKOUT THEIR MSR LOADS	PERIODIC TESTING	NONE FOR SISLOP, NONE FOR RCPS POST-SCTR, NONE OTHERWISE REQUIRED FOR SIS	*POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. RCPS ALSO UNAVAILABLE FOR SCTR	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. FOR REV REQ TO INDIVIDUALLY ISOLATE SWGR #3/HCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP
12.1.04.08.1	152-11A04 (BRANBR)	BUS #1A 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED IF CLOSED OR RECLOSED IF OPEN, RESULTING IN LOSS OF ALTERNATE OPPOSITE SOURCE TO BUS #1C	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN A ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-IPHR RELATED LOP	*TRCH SPFC ACTION ENTRY REQUIRED FOR THIS CONDITION

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SIS ONOPRR UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.05.07.1	BUS #1A NSR LOADS	BUS #1A 125VDC CONTROL POWER	VOLTS LOW	RCPs A AND C CANNOT BE TRIPPED CONTROL ROOM INDICATION OR RESTARTED. TIB BRKR TRIP UNAPPECTED		REDUNDANT TRAIN FOR SIS DURING PLANT STARTUP OR FOR SISLOP, NONE REQUIRED FOR SIS DURING NORMAL OPERATION	REDUCED TRAIN A ELECTRICAL MARGIN FOR SIS DURING PLANT S/U (W/ TIB BRKR IIC01 CLOSED). TRAIN A ALT OPPOSITE SOURCE ALSO INOP, CAUSING POTENTIAL LONG TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE W/ C-IPNR LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR INOP ALTERNATE OPPOSITE SOURCE ON TRAIN A. FAILURE TO TRIP RCPs SHOWN ACCEPTABLE FOR SIS BY VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)
12.1.04.08.1	152-11B04 (BRKBRK)	BUS #1B 125VDC CONTROL POWER	VOLTS LOW	BRKR CANNOT BE TRIPPED IF CLOSED OR RECLOSURE IF OPEN, RESULTING IN LOSS OF ALTERNATE OPPOSITE SOURCE TO BUS #2C	CONTROL ROOM INDICATION	NORMAL OPPOSITE SOURCE FOR SIS, REDUNDANT TRAIN FOR SISLOP	TRAIN B ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE WITH C-IPNR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION
12.2.05.07.1	BUS #1B NSR LOADS	BUS #1B 125VDC CONTROL POWER	VOLTS LOW	RCP B AND EXCITER CANNOT BE TRIPPED OR RESTARTED, SIS/SISLOP TRIP RELAY 186-S18 CANNOT BE ENERGIZED TO TRIP RCP A, B AND C. TIB BRKR TRIP UNAPPECTED	CONTROL ROOM INDICATION	NONE FOR SIS DURING PLANT STARTUP, REDUNDANT TRAIN AND TIB BRKR TRIP FOR SISLOP, NONE REQUIRED FOR SIS DURING NORMAL OPERATION	REDUCED ELEC MARGINS ON BOTH TRAINS FOR SIS DURING PLANT S/U (W/ TIB BRKRS IIC01, I2C01 CLOSED). TRAIN B ALT OPPOSITE SOURCE INOP, CAUSING POTENTIAL LONG-TERM INOP OF TRAIN B FOR SISLOP DUE TO INABILITY TO XFER BUS #2C FROM DG TO OPPOSITE W/ C-IPNR LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR INOP ALTERNATE OPPOSITE SOURCE ON TRAIN B. FAILURE TO TRIP RCPs SHOWN ACCEPTABLE FOR SIS BY BUS VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-RCP 3552 CONFIGURATION)
09.1.04.05.1	BUS #1C, 2C UNDERVOLTAGE	BUS #1C	VOLTS LOW	RELAYS 127-31 AND 127-91 DE-ENERGIZE. TRAIN A CSAS TIME DELAY RELAY APDR, AVDR LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN A CSAS LOADING WILL FOLLOW BUS 2C (TRAIN B) VOLTAGE RECOVERY AND SEQ 1 LOAD GROUP B DELAY. THIS FAILURE IS NOT CREDIBLE WITH CONCURRENT BUS 2C LOP, SINCE THAT WOULD BE A DOUBLE FAILURE SCENARIO
09.2.04.05.1	BUS #1C, 2C UNDERVOLTAGE	BUS #1C	VOLTS LOW	RELAYS 127-71 AND 127-111 DE-ENERGIZE. TRAIN B CSAS TIME DELAY RELAY BPDR, BVDR LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN B CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN B CSAS LOADING WILL FOLLOW BUS 2C VOLTAGE RECOVERY AND SEQ 2 LOAD GROUP D DELAY
01.1.03.10.1	G-50B	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	TRAIN A SI PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	
01.1.06.15.1	G-3B	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	TRAIN A FW PUMP CANNOT BE TRIPPED OR RESTARTED, AND ITS MINIFLOW REMAINS ALIGNED TO CONDENSER	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC PUMPING, BACKUP MANUAL MINIFLOW ISOLATION VALVES (FWS-473, 477) FOR RWST INVENTORY	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN A FLOW TO CONDENSER VIA CV-37	*RWST CALCULATIONS INCLUDE CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRS UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.11.04.1	G-1C, G-1D	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	TRAIN A CONDENSATE PUMPS WILL NOT TRIP ON SEQ OR BUS UNDERVOLTAGE SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE BV-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED RELIABILITY AGAINST INJECTION OF CONDENSATE BY TRAIN A	
01.1.12.05.1	G-36B	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	TRAIN A HEATER DRAIN PUMP WILL NOT TRIP ON SEQ OR PW PUMP TRIP SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW. CLOSURE OF SUCTION VALVE BV-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN A	
02.1.06.14.1	G-8B	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	TRAIN A CHARGING PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CHARGING PUMP FOR INJECTION, CLR AND HLR	
08.3.01.07.1	BUS #1C	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	AUX RELAYS 127-3X, 127-7X, 127-9X, 127-11X TRIPPED. SEQ 1 INITIATES LOB, SEQ 2 LOP LOGIC BECOMES 1/2 ON BUS 2C UV INPUTS	CONTROL ROOM INDICATION	REDUNDANT SEQ/TRAIN	TRAIN A DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A. REDUCED REDUNDANCY AGAINST SEQ 2 LOP/SISLOP	RELAYS ARE DE-ENERGIZE TO ACTUATE. FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RETRIPS DG BREAKER DURING SISLOP
10.1.02.05.1	DG #1 BREAKER	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	INABILITY TO TRIP DG BRKR IF CLOSED OR TO CLOSE DG BRKR IF OPEN	PERIODIC TESTING	NONE FOR BRKR CLOSED, REDUNDANT TRAIN/DG FOR BRKR OPEN	INOPERABILITY OF TRAIN A FOR SIS AND SISLOP, WITH CONCURRENT INOPERABILITY OF TRAIN B DUE TO DELAYED OR PREVENTED BUS #1C UNDERVOLTAGE, IF BRKR INITIALLY CLOSED. TRAIN B UNAFFECTED FOR SIS	REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOP LOGIC CHANGED TO SISLOP
12.1.03.08.1	152-11C02 (BREAKER)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN A SISLOP RESPONSE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN A FOR SISLOP, NONE FOR SIS	FAILURE TO TRIP 11C02 WOULD RESULT IN ENERGIZING C-1PWR FROM DG #1 VIA BUS #1C
12.1.07.12.1	152-11C01 (BREAKER)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN A SISLOP RESPONSE AND PREVENTING TRAIN B SISLOP IF BREAKER INITIALLY CLOSED TO ALIGN BUS #1C TO ALTERNATE OPPOSITE SOURCE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP FROM NORMAL ALIGNMENT, NONE FOR TRAIN A INITIALLY ALIGNED TO ALTERNATE OPPOSITE SOURCE	INOPERABILITY OF TRAIN A FOR SISLOP, AND TRAIN B FOR SISLOP WITH TRAIN A ALIGNED TO ALTERNATE OPPOSITE SOURCE	COEXISTENCE ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ACTION ENTRY IS REQUIRED WHENEVER BUS #1C OR 2C IS ALIGNED TO THE ALTERNATE OPPOSITE SOURCE
12.1.09.02.1	152-11C10 (BREAKER)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
12.1.10.06.1	152-11C11 (BREAKER)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SIS, TRAIN B TRIP OF BRKR 92-1303 FOR SISLOP, UPS FOR REQUIRED LOADS < 30 MIN, OPERATOR ACTION >30 MINUTES TO CLOSE 180 V TIE BRKR	INOPERABILITY OF TRAIN A FOR SIS, REDUCED RELIABILITY FOR SISLOP, POTENTIAL LOSS OF NORMAL POWER TO SWGR #3 LOADS	DG LOADING AND BUS VOLTAGE CALCULATIONS DO NOT INCLUDE SWGR #3 LOADS, AND ISOLATION OF SWGR #3 IS REQUIRED FOR NSLS OUTSIDE CONTAINMENT DUE TO UNQUALIFIED MCC-3 IN TURBINE BLOC
12.1.12.08.1	BUS #1C UNDERVOLTAGE AND CONTROL	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	BUS #1C BRKR AND TIE BRKS (11C01 AND 11C02) AND LOADS WILL NOT TRIP ON BUS #1C UNDERVOLTAGE OR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A	CONTROL POWER FROM 11C01 CUBICLE

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
OPER UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
12.1.02.04.1	152-1R21 (BRKBR)	BUS #1C (25VDC CONTROL POWER (#11C14))	VOLTS LOW	C-IPNR T-WINDING REACTANCE BYPASS BREAKER CANNOT BE REPOSITIONED. IF OPEN, DEGRADES TRAIN A VOLTAGE CONDITION DURING SIS LOADING TRANSIENT. IF CLOSED, RESULTS IN POTENTIAL FOR EXCESSIVE FAULT CURRENTS DURING DC TESTING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A WITH BYPASS BREAKER MISPOSITIONED	TECH SPIC ACTION ENTRY REQUIRED WITH BYPASS BREAKER MISPOSITIONED
10.1.02.01.1	DC #1 BREAKER	BUS #1C (11C14)	OPEN	DC CANNOT ENERGIZE BUS #1C FOR LOAD, LOP AND SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN/DC	LOSS OF TRAIN A 48V AND 480 V POWER FOR LOP, LOP AND SISLOP	NORMAL POSITION
10.1.02.01.2	DC #1 BREAKER	BUS #1C (11C14)	CLOSED	DC BREAKER WILL NOT TRIP ON LOAD/LOP/SIS/SISLOP, CAUSING DEGRADED TRAIN A RESPONSE DUE TO SIS BLOCK LOADING AND FAILURE OF TRAIN B DUE TO DELAYED OR PREVENTED BUS #1C UNDERVOLTAGE SIGNAL	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE	DEGRADED TRAIN A RESPONSE AND FAILURE OF TRAIN B FOR SIS WITH LOSS OF OPPOSITE POWER	REQUIRES ENTRY TO TECH SPIC ACTION FOR SINGLE FAILURE RELIEF DURING DC TESTING UNLESS SISLOP LOGIC CHANGED TO SISLOP
01.1.06.02.1	G-3B	BUS #1C (152-11C04)	OPEN	TRAIN A FW PUMP FAILS TO RESTART FOR SI (ON SIS/SISLOP) OR FOR SECONDARY RECIRC (MANUALLY) OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	
01.1.06.02.2	G-3B	BUS #1C (152-11C04)	CLOSED	TRAIN A FW PUMP FAILS TO TRIP DURING SIS/SISLOP STARTING SEQUENCE OR ON LO-LO RWST LEVEL. MAINTAINS DIFFERENTIAL PRESSURE ON RV-851B VALVE DISC AND DEGRADES TRAIN A BUS VOLTAGES DURING LOAD SEQUENCE	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, INCREASED RESPONSE TIME FOR TRAIN A MOTOR-OPERATED VALVES (NOV-850B, NOV-20, NOV-22), REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	NORMAL POSITION. BREAKER TRIPPED AND RECLOSED ON II SRC TIME DELAY FOLLOWING SIS/SISLOP. PUMP UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURES AFTER SI PUMP TRIP ON LO-LO RWST LEVEL
01.1.03.02.1	G-50B	BUS #1C (152-11C05)	OPEN	TRAIN A SI PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	NORMAL POSITION. SI PUMP BREAKER.
01.1.03.02.2	G-50B	BUS #1C (152-11C05)	CLOSED	TRAIN A SI PUMP STARTS, OR FAILS TO TRIP ON LOW RWST LEVEL	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, INOPERABILITY OF TRAIN A PUMPING FOR SECONDARY RECIRC	PUMP COULD BE UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURES FOLLOWING DEPLETION OF RWST BY CONTAINMENT SPRAY
01.1.11.01.1	G-1C, G-1D	BUS #1C (152-11C06) (152-11C08)	OPEN	1 OF 2 CONDENSATE PUMPS TRIPPED TO TRAIN A FW PUMP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	TRAIN A POWERED CONDENSATE PUMP WOULD BE TRIPPED ON SIS/SISLOP IF RUNNING
01.1.11.01.2	G-1C, G-1D	BUS #1C (152-11C06) (152-11C08)	CLOSED	1 OF 2 CONDENSATE PUMPS CANNOT BE TRIPPED TO TRAIN A FW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE RV-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN A	NORMAL POSITION

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
PROPER UNIT 1
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ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.1.12.01.1	G-36B	BUS #1C (152-11C09)	OPEN	HEATER DRAIN PUMP TRIPPED TO TRAIN A PW PUMP SUCTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	HEATER DRAIN PUMP TRIPPED ON SIS/SISLOP
01.1.12.01.2	G-36B	BUS #1C (152-11C09)	CLOSED	HEATER DRAIN PUMP CANNOT BE TRIPPED TO TRAIN A PW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW. CLOSURE OF SUCTION VALVE BV-854B PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN A.	NORMAL POSITION
02.1.06.02.1	G-8B	BUS #1C (152-11C07)	OPEN	TRAIN A CHARGING PUMP TRIPS, OR FAILS TO START ON SIS/SISLOP IF SELECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP/TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR CLR AND HLR PRIMARY PATH	
02.1.06.02.2	G-8B	BUS #1C (152-11C07)	CLOSED	TRAIN A PUMP STARTS OR FAILS TO TRIP ON SIS/SISLOP IF SELECTED. NOV-1100C UNAPFFECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NOV-1100C CLOSERS AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	ADMINISTRATIVELY CONTROLLED SELECTOR SWITCHES ALIGN NOV-1100C POWER TO SAME TRAIN AS CHARGING PUMP SELECTED TO START, WITH OTHER TRAIN CHARGING PUMP TRIPPED AND LOCKED OUT ON SIS/SISLOP
09.1.04.06.1	BUS #1C, 2C UNDERVOLTAGE	BUS #2C	VOLTS LOW	RELAYS 127-4X AND 127-10X DE-ENERGIZE. TRAIN A CSAS TIME DELAY RELAY APDR, AVDR LOGIC BECOMES 1/2 ON BUS 1C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN A CSAS LOADING WILL FOLLOW BUS 1C (TRAIN A) VOLTAGE RECOVERY AND SEQ 1 LOAD GROUP D DELAY
09.2.04.06.1	BUS #1C, 2C UNDERVOLTAGE	BUS #2C	VOLTS LOW	RELAYS 127-8X AND 127-12X DE-ENERGIZE. TRAIN B CSAS TIME DELAY RELAY BPDR, BVDR LOGIC BECOMES 1/2 ON BUS 1C UV INPUTS	CONTROL ROOM ANNUNCIATION	REDUNDANT INPUTS FOR SIS, REDUNDANT TRAIN FOR SISLOP	REDUCED RELIABILITY OF TRAIN A CSAS FOR SIS AND SISLOP CONDITIONS	TRAIN B CSAS LOADING WILL FOLLOW BUS 1C (TRAIN A) VOLTAGE RECOVERY AND SEQ 2 LOAD GROUP D DELAY. THIS FAILURE IS NOT CREDIBLE WITH CONCURRENT BUS 1C LOB, SINCE THAT WOULD BE A DOUBLE FAILURE SCENARIO
01.2.03.10.1	G-50A	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B SI PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL	
01.2.06.15.1	G-3A	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B PW PUMP CANNOT BE TRIPPED OR RESTARTED, AND ITS MIMICFLOW REMAINS ALIGNED TO CONDENSER	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC PUMPING, BACKUP MANUAL MIMIFLOW ISOLATION VALVES (PWS-472, 476) FOR RWST INVENTORY	*INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN B FLOW TO CONDENSER VIA CV-36	*RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TURNS
01.2.11.04.1	G-1A, G-1B	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B CONDENSATE PUMPS WILL NOT TRIP ON SRQ OR BUS UNDERVOLTAGE SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE BV-854A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED RELIABILITY AGAINST INJECTION OF CONDENSATE BY TRAIN B	
01.2.12.05.1	G-36A	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B HEATER DRAIN PUMP WILL NOT TRIP ON SRQ OR PW PUMP TRIP SIGNALS	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI FLOW. CLOSURE OF SUCTION VALVE BV-854A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN B	

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.2.06.14.1	G-8A	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	TRAIN B CHARGING PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CHARGING PUMP FOR INJECTION, CLR AND HLR	
08.3.02.07.1	BUS #2C	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	AUX RELAYS 127-4X, 127-8X, 127-10X, 127-12X TRIPPED. SEQ 2 INITIATES LOB, SEQ 1 LOP LOGIC BECOMES 1/2 ON BUS 1C UV INPUTS	CONTROL ROOM INDICATION	REDUNDANT SEQ/TRAIN	TRAIN B DISABLED FOR BOTH SIS/SISLOP BY LOB TRIP OF LOAD GROUP A. REDUCED REDUNDANCY AGAINST SEQ 1 LOP/SISLOP	RELAYS ARE DE-ENERGIZE TO ACTUATE. FAILURE PREVENTS START OF LOAD GROUP A LOADS DURING SIS AND RESTRIPS DC BRKR DURING SISLOP
10.2.02.05.1	DG #2 BREAKER	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	INABILITY TO TRIP DG BRKR IF CLOSED OR CLOSE DG BRKR IF OPEN	PERIODIC TESTING	NONE FOR BRKR CLOSED, REDUNDANT TRAIN/DG FOR BRKR OPEN	*INOPERABILITY OF TRAIN B FOR SIS AND SISLOP, WITH CONCURRENT INOPERABILITY OF TRAIN A DUE TO DELAYED OR PREVENTED BUS #2C UNDERVOLTAGE, IF BRKR INITIALLY SISLOP CLOSED. TRAIN A UNAFFECTED FOR SIS	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOP LOGIC CHANGED TO
12.2.03.08.1	152-12C02 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN B SISLOP RESPONSE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	FAILURE TO TRIP 12C02 WOULD RESULT IN ENERGIzing C-IPHR FROM DG #2 VIA BUS #2C
12.2.07.12.1	152-12C01 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED, DEGRADING TRAIN B SISLOP RESPONSE AND PREVENTING TRAIN A SISLOP IF BREAKER INITIALLY CLOSED TO ALIGN BUS #2C TO ALTERNATE OFFSITE SOURCE	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE FOR TRAIN B ALIGNED TO ALTERNATE OFFSITE SOURCE	*INOPERABILITY OF TRAIN B FOR SISLOP, AND TRAIN A FOR SISLOP WITH TRAIN B ALIGNED TO ALTERNATE OFFSITE SOURCE	*SINCE MAIN GENERATOR COASTDOWN ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ENTRY IS REQUIRED WHENEVER BUS #1C OR #2C IS ALIGNED TO THE ALTERNATE OFFSITE SOURCE
12.2.09.02.1	152-12C10 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	BREAKER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
12.2.10.06.1	152-12C11 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	NONE. BREAKER NORMALLY BACKED OUT	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	NONE REQUIRED	NONE	
12.2.12.08.1	BUS #2C UNDERVOLTAGE AND CONTROL POWER CONTROL	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	BUS #2C BRKR AND TIE BRKR (12C01 AND 12C02) AND LOADS WILL NOT TRIP ON BUS #2C UNDERVOLTAGE OR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B	CONTROL POWER FROM 12C01 CUBICLE
12.2.02.04.1	152-18Y1 (BREAKER)	BUS #2C 125VDC CONTROL POWER (012C15)	VOLTS LOW	C-IPHR Y-WINDING REACTANCE BYPASS BREAKER CANNOT BE REPOSITIONED. IF OPEN, DEGRADES TRAIN B VOLTAGE CONDITION DURING SIS LOADING TRANSIENT. IF CLOSED, RESULTS IN POTENTIAL FOR EXCESSIVE FAULT CURRENTS DURING DG TESTING	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B WITH BYPASS BREAKER MISPOSITIONED	*TECH SPEC ACTION ENTRY REQUIRED WITH BREAKER MISPOSITIONED
10.2.02.01.1	DG #2 BREAKER (12C15)	BUS #2C	OPEN	DG CANNOT ENERGIze BUS #2C FOR LOB, LOP AND SISLOP	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT TRAIN/DG	LOSS OF TRAIN B 4kV AND 480 V POWER FOR LOB, LOP AND SISLOP	NORMAL POSITION

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
10.2.02.01.2	DG #2 BREAKER	BUS #2C (12C15)	CLOSED	DG BREAKER WILL NOT TRIP ON LOB/LOP/SIS/SISLOP, CAUSING DEGRADED TRAIN B RESPONSE DUE TO SIS BLOCK LOADING AND FAILURE OF TRAIN A DUE TO DELAYED OR PREVENTED BUS #2C UNDERVOLTAGE SIGNAL	CONTROL ROOM INDICATION, PERIODIC TESTING	NONE	DEGRADED TRAIN B RESPONSE AND FAILURE OF TRAIN A FOR SIS WITH LOSS OF OPPOSITE POWER	REQUIRES ENTRY TO TECH SPEC RELIOP DURING DG TESTING UNLESS SISLOP LOGIC CHANGED TO SISLOP
01.2.06.02.1	G-3A	BUS #2C (152-12C04)	OPEN	TRAIN B FW PUMP FAILS TO RESTART FOR SI (ON SIS/SISLOP) OR FOR SECONDARY RECIRC (MANUALLY) OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	
01.2.06.02.2	G-3A	BUS #2C (152-12C04)	CLOSED	TRAIN B FW PUMP FAILS TO TRIP DURING SIS/SISLOP STARTING SEQUENCE OR ON LO-LO RWST LEVEL. MAINTAINS DIFFERENTIAL PRESSURE ON RV-851A VALVE DISC AND DEGRADES TRAIN B BUS VOLTAGES DURING LOAD SEQUENCE	PERIODIC TESTING	REDUNDANT TRAIN FOR SI AND SECONDARY RECIRC, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, INCREASED RESPONSE TIME FOR TRAIN B MOTOR-OPERATED VALVES (NOV-850A, NOV-21), REDUCED RELIABILITY FOR AUTO-TERMINATION OF SI ON LO-LO PUMP TRIP ON LO-LO RWST LEVEL	NORMAL POSITION. BREAKER TRIPPED AND RECLOSED ON 11 SEC TIME DELAY FOLLOWING SIS/SISLOP. PUMP UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURE AFTER SI
01.2.03.02.1	G-50A	BUS #2C (152-12C05)	OPEN	TRAIN B SI PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	NORMAL POSITION. SI PUMP BREAKER.
01.2.03.02.2	G-50A	BUS #2C (152-12C05)	CLOSED	TRAIN B SI PUMP STARTS, OR FAILS TO TRIP ON LOW RWST LEVEL	CONTROL ROOM INDICATION	NONE REQUIRED FOR SI, REDUNDANT NOV-850A/B/C CLOSURE FOR LO-LO RWST LEVEL, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL, INOPERABILITY OF TRAIN B PUMPING FOR SECONDARY RECIRC	PUMP COULD BE UNAVAILABLE FOR SECONDARY RECIRC DUE TO CAVITATION FAILURE FOLLOWING DEPLETION OF RWST BY CONTAINMENT SPRAY
01.2.11.01.1	G-1A, G-1B	BUS #2C (152-12C06) (152-12C08)	OPEN	1 OF 2 CONDENSATE PUMPS TRIPPED TO TRAIN B FW PUMP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	TRAIN B POWERED CONDENSATE PUMP WOULD BE TRIPPED ON SIS/SISLOP IF RUNNING
01.2.11.01.2	G-1A, G-1B	BUS #2C (152-12C06) (152-12C08)	CLOSED	1 OF 2 CONDENSATE PUMPS CANNOT BE TRIPPED TO TRAIN B FW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW, CLOSURE OF SUCTION VALVE BY-851A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN B	NORMAL POSITION
01.2.12.01.1	G-36A	BUS #2C (152-12C09)	OPEN	HEATER DRAIN PUMP TRIPPED TO TRAIN B FW PUMP SUCTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	HEATER DRAIN PUMP TRIPPED ON SIS/SISLOP
01.2.12.01.2	G-36A	BUS #2C (152-12C09)	CLOSED	HEATER DRAIN PUMP CANNOT BE TRIPPED TO TRAIN B FW PUMP SUCTION	PERIODIC TESTING	NONE REQUIRED FOR SI FLOW. CLOSURE OF SUCTION VALVE BY-851A PREVENTS CONDENSATE INJECTION	NONE FOR INJECTION FLOW. REDUCED REDUNDANCY AGAINST INJECTION OF CONDENSATE BY TRAIN B.	NORMAL POSITION
02.2.06.02.1	G-8A	BUS #2C (152-12C07)	OPEN	TRAIN B CHARGING PUMP TRIPS, OR FAILS TO START ON SIS/SISLOP IF SELECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP/TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR CLR AND HLB PRIMARY PATH	
02.2.06.02.2	G-8A	BUS #2C (152-12C07)	CLOSED	TRAIN B PUMP STARTS OR FAILS TO TRIP ON SIS/SISLOP IF SELECTED. NOV-1100C UNAPPECTED	CONTROL ROOM INDICATION, PERIODIC TESTING	NOV-1100C CLOSURES AS REQUIRED	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING INJECTION	ADMINISTRATIVELY CONTROLLED SELECTOR SWITCHES ALIGN NOV-1100C POWER TO SAME TRAIN AS CHARGING PUMP SELECTED TO START, WITH OTHER TRAIN CHARGING PUMP TRIPPED AND LOCKED OUT ON SIS/SISLOP

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SEE UNOFR UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
01.4.10.04.1	NOV-1204	NCC-1 (42-1127)	VOLTS LOW	POTENTIAL PARTIAL DIVERSION OF CONTROL ROOM INDICATION, BOTH TRAINS OF SI FLOW TO APW ANNUNCIATION SYSTEM (G-109 OFF) OR INJECTION OF APW INTO MAIN FW HEADER (G-109 ON)	CONTROL ROOM INDICATION	APW LOGIC, VALVES APW-304 AND NOV-1202 PREVENT SI DIVERSION. FLOW DIVERSION AND INJECTION OF BV-852A/D PREVENT INJECTION OF CONDENSATE TO RCS CONDENSATE TO RCS	REDUCED REDUNDANCY AGAINST SI TO MAIN FW HEADER.	*CROSS-TIE FROM APW PUMP G-109 ACCEPTABILITY REQUIRES: 1) APW LOGIC TO PREVENT TRAIN A START UNLESS TRAIN B FAILED AND 2) DUAL FAILURE OF NOV-1204 OPRN PLUS APW TRAIN B IS OUTSIDE DESIGN BASIS. APW CRK VALVE NOT SEAT LEAK TESTED
02.1.06.12.1	G-88	NCC-1 (42-1129)	VOLTS LOW	TRAIN A MOTOR-DRIVEN LUBE OIL PUMP WILL NOT START ON LOW BEARING PRESSURE WITH PUMP RUNNING	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BOUNDS EQ FAILURE OF LUBE OIL PUMP MOTOR. MOTOR-DRIVEN LUBE OIL PUMP NOT CREDITED IN LIBU OF SHAFT-DRIVEN PUMP
02.1.06.13.1	G-88	NCC-1 (42-1135)	VOLTS LOW	TRAIN A LUBE OIL FAN COOLER WILL NOT START ON SISLOP WITH PUMP RUNNING	PERIODIC TESTING	NONE REQUIRED	NONE	BOUNDS EQ FAILURE OF FAN MOTOR. LUBE OIL FAN COOLER NOT CREDITED IN LIBU OF SHAFT-DRIVEN PUMP
02.1.07.02.1	NOV-19	NCC-1 (42-1146)	VOLTS LOW	NOV-19 FAILS AS-IS	CONTROL ROOM INDICATION	REDUNDANT VALVE (NOV-18)	REDUCED REDUNDANCY FOR CLR DISCHARGE FLOW PATH IF FAILURE PRIOR TO REALIGNMENT	
02.1.05.10.1	NOV-1100B	NCC-1 (42-1147)	VOLTS LOW	NOV-1100B CANNOT BE OPENED REMOTE-MANUALLY OR VIA SIS/SISLOP FOR INJECTION, CLR AND HLR, OR CANNOT BE BE-CLOSED REMOTE-MANUALLY FOR SECONDARY RECIRC	CONTROL ROOM INDICATION	REDUNDANT VALVE/TRAIN	REDUCED REDUNDANCY FOR CHARGING PUMP INJECTION REALIGNMENT	
05.1.06.02.1	G-200A	NCC-1 (42-1153)	OPEN	TRAIN A HYDRAZINE PUMP FAILS TO START OR TRIPS IF RUNNING	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN A HYDRAZINE PUMPING	
05.1.06.02.2	G-200A	NCC-1 (42-1153)	CLOSED	TRAIN A HYDRAZINE PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING	CONTROL ROOM INDICATION	REDUNDANT VALVE CONTROLS TO PREVENT FLOW UNTIL REQUIRED, REDUNDANT TRAIN TO PROVIDE FLOW FOR SISLOP	REDUCED RELIABILITY OF TRAIN A ELECTRICAL POWER FOR SISLOP, HYDRAZINE SYSTEM ISOLATION FOR SIS AND SISLOP	SMALL MOTOR SIZE NOT EXPECTED TO RESULT IN ACTUAL LOSS OF TRAIN A BUS DURING SISLOP
01.4.13.02.1	NOV-356	NCC-1 (42-1158)	VOLTS LOW	NO EFFECT ON INJECTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	IMPACT ON COLD LEG RECIRC ADDRESSED IN SECTION 2
02.1.08.02.1	NOV-356	NCC-1 (42-1158)	VOLTS LOW	NOV-356 CANNOT BE REPOSITIONED, RESULTING IN POTENTIAL LOSS OF 1 OF 3 CLR PATHS (IF CLOSED) OR INABILITY TO ISOLATE PCV-1115A/D (IF OPEN)	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS B AND C FOR CLR	POTENTIAL LOSS OF CLR FLOW PATH TO RCS LOOP A	
03.2.03.02.1	NOV-822A	NCC-1 (42-1164)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, CANNOT BE ALIGNED FOR ALTERNATE HLR PATH TO LOOP C HOT LRG	CONTROL ROOM INDICATION	REDUNDANT VALVE NOV-822B, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	
03.2.05.03.1	NOV-813	NCC-1 (42-1169)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, ALTERNATE HLR PATH CANNOT BE ALIGNED TO LOOP C HOT LRG	CONTROL ROOM INDICATION	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
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01.4.17.02.1	NOV-833	MCC-1 (42-1170)	VOLTS LOW	NO EFFECT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.07.02.1	NOV-833	MCC-1 (42-1170)	VOLTS LOW	VALVE FAILS AS-IS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.1.09.05.1	NOV-850B	MCC-1 (42-1180)	VOLTS LOW	VALVE WILL NOT OPEN ON SIS/SISLOP OR RECLOSE ON LOW RWST LEVEL	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND C FOR SI, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL, REDUNDANT VALVES (BV-851A/B) FOR SECONDARY RECIRC BOUNDARY	SI FLOW REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR HSLB (LOOP C BLOCKED DUE TO COMMON-CAUSE FAILURE). REDUCED REDUNDANCY FOR AUTO-TERMINATION OF SI ON LO-LO RWST LEVEL AND FOR SECONDARY RECIRC	
02.1.01.02.1	NOV-866A	MCC-1 (42-1182)	VOLTS LOW	TRAIN A RECIRC PUMP CANNOT BE ALIGNED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A RECIRC PUMPING CAPABILITY	
01.4.05.03.1	NOV-22	MCC-1 (42-1183)	VOLTS LOW	PW BLOCK VALVE TO S/G C CANNOT BE CLOSED RECEIPT LOCAL-MANUALLY	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES (PCV-458 OR BV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G C FOR SI AND SECONDARY RECIRC	NOV-22 OR PCV-458 CLOSED FOR SECONDARY RECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-143. VALVE LOCATED IN TURBINE BUILDING AND ACCESSIBLE FOR LOCAL MANUAL CONTROL DURING HSLB INSIDE CONTAINMENT
06.1.04.03.1	NOV-720B	MCC-1 (42-1187)	VOLTS LOW	VALVE FAILS AS-IS, WILL NOT ALIGN TRAIN A SVC/CCW HE IF CLOSED, CANNOT BE CLOSED RECEIPT LOCALLY IF OPEN (EG. FOR SVC PUMP FAILURE)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SVC/CCW HE	
01.4.03.03.1	NOV-20	MCC-1 (42-1197)	VOLTS LOW	PW BLOCK VALVE TO S/G B CANNOT BE CLOSED RECEIPT LOCAL-MANUALLY	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES (PCV-457 OR BV-852A/B)	REDUCED REDUNDANCY FOR MAIN PW ISOLATION TO S/G B FOR SI AND SECONDARY RECIRC	NOV-20 OR PCV-457 CLOSED FOR SECONDARY RECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-144. VALVE LOCATED IN TURBINE BUILDING AND ACCESSIBLE FOR LOCAL-MANUAL CONTROL IF NEEDED DURING HSLB INSIDE CONTAINMENT
11.5.01.03.1	UTILITY BUS	MCC-1 (8-1181)	VOLTS LOW	LOSS OF BACKUP SOURCE FROM MCC-1 TO UTILITY BUS AND VITAL TESTING BUSES 1, 2, 3/3A AND 4	LOCAL INDICATION, PERIODIC	TRAIN B POWER TO HLR PRIMARY AND ALTERNATE PATH VALVES	REDUCED RELIABILITY OF HLR PRIMARY PATH (CV-305 CANNOT BE SWING ALIGNED TO SAFETY RELATED POWER)	TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE
02.4.03.12.1	NOV-1100C	MCC-1 (8-1198)	VOLTS LOW	LOSS OF TRAIN A POWER TO NOV-1100C, RESULTING IN FAILURE TO CLOSE AND LOSS OF TRAIN A CHARGING PUMP IF PRESUBLECTED	CONTROL ROOM INDICATION	NONE FOR INJECTION, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR CLR AND HLR	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING CLR AND HLR	EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS
01.1.06.16.1	G-3B	MCC-1A (42-11A15)	VOLTS LOW	LOSS OF TRAIN A PW PUMP LUBE OIL COOLER	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC	LUBE OIL PAN COOLER W-118 REQUIRED FOR EXTENDED PW PUMP OPERATION DURING SBLOCA OR HSLB INSIDE CONTAINMENT

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
10.1.01.01.1 DG #1		NCC-1B	VOLTS LOW	LOSS OF ESSENTIAL ENGINE/GENERATOR AUXILIARIES CAUSING DELAYED DG TRIP	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DG	DELAYED LOSS OF TRAIN A DG FOR LOB, LOP AND SISLOP	
01.4.01.03.1 NOV-21		NCC-2 (42-1242)	VOLTS LOW	FW BLOCK VALVE TO S/G A CANNOT BE CLOSED RECEIPT LOCAL-MANUALLY	CONTROL ROOM INDICATION	REDUNDANT ISOLATION VALVES (PCV-456 OR HV-851A/B)	REDUCED REDUNDANCY FOR MAIN FW ISOLATION TO S/G A FOR SI AND SECONDARY RECIRC	NOV-21 OR PCV-456 CLOSED FOR SECONDARY RECIRC TO PERMIT FLOW CONTROL VIA BYPASS VALVE CV-142. VALVE LOCATED IN TURBINE BUILDING AND ACCESSIBLE FOR LOCAL-MANUAL CONTROL DURING HSLB INSIDE CONTAINMENT
01.4.14.02.1 NOV-357		NCC-2 (42-1243)	VOLTS LOW	NO EFFECT ON INJECTION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	IMPACT ON COLD LEC RECIRCULATION ADDRESSED IN SECTION 2
02.2.08.02.1 NOV-357		NCC-2 (42-1243)	VOLTS LOW	NOV-357 CANNOT BE REPOSITIONED, RESULTING IN POTENTIAL LOSS OF 1 OF 3 CLR PATHS (IF CLOSED) OR INABILITY TO ISOLATE PCV-1115B/E (IF OPEN)	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND C FOR CLR	POTENTIAL LOSS OF CLR FLOW PATH TO RCS LOOP B	
05.3.04.02.1 NOV-880		NCC-2 (42-1262)	VOLTS LOW	VALVE FAILS AS-IS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.04.02.1 NOV-822B		NCC-2 (42-1266)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, CANNOT BE ALIGNED FOR ALTERNATE HLR PATH TO LOOP C HOT LEC	CONTROL ROOM INDICATION	REDUNDANT VALVE NOV-822A, REDUNDANT PRIMARY HLR PATH	REDUCED RELIABILITY OF ALTERNATE HLR PATH	
03.2.06.02.1 NOV-814		NCC-2 (42-1271)	VOLTS LOW	VALVE FAILS AS-IS. IF CLOSED, ALTERNATE HLR PATH CANNOT BE ALIGNED TO LOOP C HOT LEC	CONTROL ROOM INDICATION	REDUNDANT PRIMARY HLR PATH	LOSS OF ALTERNATE HLR PATH	
01.4.18.03.1 NOV-834		NCC-2 (42-1272)	VOLTS LOW	NO EFFECT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.08.03.1 NOV-834		NCC-2 (42-1272)	VOLTS LOW	VALVE FAILS AS-IS	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
01.2.09.05.1 NOV-850A		NCC-2 (42-1274)	VOLTS LOW	VALVE WILL NOT OPEN ON SIS/SISLOP OR RECLOSE ON LOW RVST LEVEL	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS B AND C FOR SI, REDUNDANT PUMP TRIPS FOR LO-LO RVST LEVEL, REDUNDANT VALVES (HV-851A/B) FOR SECONDARY RECIRC BOUNDARY	SI FLOW REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING), 1/1 LOOPS FOR HSLB (LOOP C FOR AUTO-TERMINATION OF SI ON LO-LO RVST LEVEL AND FOR SECONDARY RECIRC	
02.2.04.02.1 NOV-866B		NCC-2 (42-1278)	VOLTS LOW	TRAIN B RECIRC PUMP CANNOT BE ALIGNED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B RECIRC PUMPING CAPABILITY	
02.2.05.10.1 NOV-1100D		NCC-2 (42-1280)	VOLTS LOW	NOV-1100D CANNOT BE OPENED REMOTE-MANUALLY OR VIA SIS/SISLOP FOR INJECTION, CLR AND HLR, OR CANNOT BE RE-CLOSED REMOTE-MANUALLY FOR SECONDARY RECIRC	CONTROL ROOM INDICATION	REDUNDANT VALVE/TRAIN	REDUCED REDUNDANCY FOR CHARGING PUMP SUCTION REALIGNMENT	

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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.2.06.16.1 G-3A		MCC-2 (42-1282)	VOLTS LOW	LOSS OF TRAIN B FW PUMP LUBE OIL COOLER	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC	LUBE OIL FAN COOLER B-17A REQUIRED FOR EXTENDED FW PUMP OPERATION DURING SBLOCA OR NSLS INSIDE CONTAINMENT
06.2.04.03.1 NOV-70A		MCC-2 (42-1288)	VOLTS LOW	VALVE FAILS AS-IS, WILL NOT ALIGN TRAIN B SMC/CCW HI IF CLOSED, CANNOT BE CLOSED EXCEPT LOCALLY IF OPEN (EG. FOR SMC PUMP FAILURE)	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SMC/CCW HI	
02.2.07.02.1 NOV-18		MCC-2 (42-1294)	VOLTS LOW	NOV-18 FAILS AS-IS	CONTROL ROOM INDICATION	REDUNDANT VALVE (NOV-18)	REDUCED REDUNDANCY FOR COLD LEG RECIRCULATION DISCHARGE FLOW PATH IF FAILURE PRIOR TO REALIGNMENT	
11.5.01.03.2 UTILITY BUS		MCC-2 (8-1238)	VOLTS LOW	LOSS OF POWER TO UTILITY BUS AND BACKUP SOURCE FOR VITAL BUSES #1, 2, 3/3A AND 4 FROM MCC-2	LOCAL INDICATION, PERIODIC TESTING	NONE FOR SI/BCS INVENTORY DIVERSION OR FOR CLR PUMPING FOR SBLOCA. ALTERNATE FEED FROM MCC-1 AVAILABLE FOR HLR PRIMARY PATH	POTENTIAL UNISOLABLE DIVERSION OF SI/BCS INVENTORY TO BCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA. REDUCED RELIABILITY OF HLR PRIMARY PATH	NOT REVISION REQUIRED TO SPECIFY LOCAL OPERATOR ACTION TO REALIGN MANUAL TRANSFER SWITCH #7 TO RESTORE SAFETY RELATED POWER FROM REDUNDANT TRAIN TO UTILITY BUS IN SUPPORT OF HLR PRIMARY PATH
11.6.01.04.1 VITAL BUS #5/6		MCC-2 (8-1268A)	VOLTS LOW	LOSS OF BACKUP SOURCE FROM MCC-2 TO VITAL BUSES #5/6	LOCAL INDICATION, PERIODIC TESTING	REDUNDANT TRAIN FOR AFFECTED ECCS FUNCTIONS	REDUCED RELIABILITY OF VITAL BUS #5/6 ECCS LOADS	
02.2.06.13.1 G-8A		MCC-2A (42-12A14)	VOLTS LOW	TRAIN B LUBE OIL FAN COOLER WILL NOT START ON SISLOP WITH PUMP RUNNING	PERIODIC TESTING	NONE REQUIRED	NONE	BOUNDS EQ FAILURE OF FAN MOTOR. LUBE OIL FAN COOLER NOT CREDITED IN LIEU OF SHAFT-DRIVEN PUMP
02.2.06.12.1 G-8A		MCC-2A (42-12A16)	VOLTS LOW	TRAIN B MOTOR-DRIVEN LUBE OIL PUMP WILL NOT START ON LOW BEARING PRESSURE WITH PUMP RUNNING	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BOUNDS EQ FAILURE OF LUBE OIL PUMP MOTOR. MOTOR-DRIVEN LUBE OIL PUMP NOT CREDITED IN LIEU OF SHAFT-DRIVEN PUMP
02.4.03.13.1 NOV-1100C		MCC-2A (42-12A76)	VOLTS LOW	LOSS OF TRAIN B POWER TO NOV-1100C, RESULTING IN FAILURE TO CLOSE AND LOSS OF TRAIN B CHARGING PUMP IF PRESELECTED	CONTROL ROOM INDICATION	NONE FOR INJECTION. REDUNDANT CHECK VALVE AND CHARGING PUMP FOR CLR AND HLR	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING CLR AND HLR	EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS
05.2.06.02.1 G-2008		MCC-2A (42-12A79)	OPEN	TRAIN B HYDRAZINE PUMP FAILS TO START OR TRIPS IF RUNNING	CONTROL ROOM INDICATION, PERIODIC TESTING	REDUNDANT PUMP	INOPERABILITY OF TRAIN B HYDRAZINE PUMPING	
05.2.06.02.2 G-2008		MCC-2A (42-12A79)	CLOSED	TRAIN B HYDRAZINE PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING	CONTROL ROOM INDICATION	REDUNDANT VALVE CONTROLS TO PREVENT FLOW UNTIL REQUIRED, REDUNDANT TRAIN TO PROVIDE FLOW FOR SISLOP	REDUCED RELIABILITY OF TRAIN B ELECTRICAL POWER FOR SISLOP, HYDRAZINE SYSTEM ISOLATION FOR SIS AND SISLOP	SMALL MOTOR SIZE NOT EXPECTED TO RESULT IN ACTUAL LOSS OF TRAIN B BUS DURING SISLOP
01.3.06.02.1 CV-142 CV-143 CV-144		MCC-2A (8-2A29)	VOLTS LOW	MAIN FW BYPASS VALVES REMOTE MANUAL CONTROL DISABLED FOR S/G A/B/C	CONTROL ROOM INDICATION	LOCAL MANUAL CONTROL AT VALVE POSITIONERS	REDUCED RELIABILITY OF MAIN FW BYPASS VALVES FOR SECONDARY RECIRC FLOW CONTROL	NOT DOES NOT ADDRESS REQUIREMENTS FOR LOCAL CONTROL
10.2.01.07.1 DG #2		MCC-2B	VOLTS LOW	LOSS OF ESSENTIAL ENGINE/GENERATOR AUXILIARIES CAUSING DELAYED DG TRIP	CONTROL ROOM ANNUNCIATION	REDUNDANT TRAIN/DG	LOSS OF TRAIN B DG FOR LOB, LOP AND SISLOP	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SIX ONOFFER UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITER #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.4.03.03.1	NOV-9	HCC-3 (42-1367)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.04.04.1	NOV-10	HCC-3 (42-1370)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.05.03.1	NOV-11	HCC-3 (42-1373)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
07.4.06.03.1	NOV-12	HCC-3 (42-1376)	VOLTS LOW	GATE FAILS AS-IS	LOCAL INDICATION	NONE REQUIRED	NONE	
01.4.15.03.1	NOV-358	HCC-3 (42-1385)	VOLTS LOW	CAUSES LOSS OF UPS AFTER >30 MINUTES	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	IMPACT ON COLD LEG RECIRCULATION ADDRESSED IN SECTION 2
05.3.03.05.1	NOV-883	HCC-3 (42-1390)	VOLTS LOW	VALVE CANNOT BE REMOTE-MANUALLY CLOSED FOR RECIRCULATION	CONTROL ROOM INDICATION	REDUNDANT CHECK VALVE (CBS-361)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED BUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
02.4.82.05.1	NOV-883	HCC-3 (42-1396)	VOLTS LOW	VALVE CANNOT BE REMOTE-MANUALLY CLOSED FOR RECIRCULATION	CONTROL ROOM INDICATION	REDUNDANT CHECK VALVE (CBS-361)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED BUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM
01.3.03.06.1	NOV-850C	HCC-3 (8-1391)	VOLTS LOW	CAUSES LOSS OF UPS AFTER >30 MINUTES	CONTROL ROOM INDICATION	REDUNDANT PATHS TO LOOPS A AND B FOR HI FLOW, REDUNDANT PUMP TRIPS FOR LO-LO RWST LEVEL, REDUNDANT VALVES (RV-851A/B) FOR REDUNDANT RECIRC BOUNDARY	INJECTION REDUCED TO 1/2 LOOPS FOR LOCA (ONE LOOP SPILLING) AND 2/2 FOR MSLB. REDUCED REDUNDANCY FOR AUTO-TERMINATION OF HI ON LO-LO RWST LEVEL AND FOR SECONDARY RECIRC BOUNDARY	FAILURE MAY OCCUR > 30 MINUTES PRIOR TO SIS/SISLOP
02.3.01.03.1	NOV-358	HCC-3 (8-1391)	VOLTS LOW	CAUSES LOSS OF UPS AFTER >30 MIN. NOV-358 CANNOT BE REPOSITIONED, RESULTING IN POTENTIAL LOSS OF 1 OF 3 CLR PATHS (IF CLOSED) OR INABILITY TO ISOLATE PCV-1115C/F (IF OPEN)	CONTROL ROOM INDICATION	REDUNDANT FLOW PATHS TO RCS LOOPS A AND B FOR CLR	POTENTIAL LOSS OF CLR FLOW PATH TO RCS LOOP C	
02.1.03.06.1	G-45A	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	TRAIN A RECIRC PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN A RECIRC PUMPING	
05.1.03.06.1	G-27M	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN (RUMS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON)	POTENTIAL LOSS OF TRAIN A CONTAINMENT SPRAY AND HYDRAZINE PUMPING OR INABILITY TO TRIP SPRAY PUMP FOR RECIRCULATION	
06.1.03.11.1	G-15A	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	TRAIN A CCW PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A CCW PUMP	SEE WIRING DIAGRAM 713790 AND ONE LINE DIAGRAM 5182169 FOR POWER SUPPLY
07.1.03.12.1	G-13A	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	TRAIN A SUC PUMP CANNOT BE STARTED OR TRIPPED, TRAIN A LOW DISCHARGE PRESSURE, OVERLOAD AND BUS UNDERVOLTAGE AUTO-START SIGNALS TO G-13B DISABLED	CONTROL ROOM INDICATION	REDUNDANT TRAIN (WITH MANUAL START CAPABILITY FOR NON-SIS/SISLOP EVENTS)	INOPERABILITY OF TRAIN A SUC, REDUCED RELIABILITY OF TRAIN B SUC FOR NON-SIS/SISLOP EVENTS	

EMERGENCY CORRECTION SYSTEM SINGLE FAILURES ANALYSIS
 CONTROL ROOM OPERATOR UNIT 1
 SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BCCS	REMARKS
12.3.01.07.1	52-1102 (BRKBRKR)	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	BRKR CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BRKR NORMALLY CLOSED, NOT REQUIRED TO TRIP OPEN EXCEPT FOR FAULT PROTECTION OR RE-ENERGIZING SWGR #1 FROM SWGR #3/SSY #3. CAN BE TRIPPED LOCALLY IF NEEDED FOR TIE BRKR CLOSURE
12.3.02.10.1	52-1103 (BRKBRKR)	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	BRKR CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED IF BRKR INITIALLY OPEN	NONE IF BRKR INITIALLY OPEN. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA 52-1303 OR TRAIN B VIA 52-1203 (SAME AS 2.1.3.1.1)	*TRCH SPEC ACTION ENTRY REQUIRED IF SWGR #1-3 TIE BRKR CLOSED DURING NORMAL OPERATION
02.1.03.02.1	G-45A (52-1107)	SWGR #1	OPEN	TRAIN A RECIRC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 2.1.3.1.1)	(SAME AS 2.1.3.1.1)	NORMAL POSITION
02.1.03.02.2	G-45A (52-1107)	SWGR #1	CLOSED	TRAIN A RECIRC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING OR (IF PRIOR TO SUBMERGENCE) PUMP DAMAGE	CONTROL ROOM INDICATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN A RECIRC PUMP OR ELECTRICAL POWER	PUMP NORMALLY DRY
07.1.03.02.1	G-13A (52-1114)	SWGR #1	OPEN	TRAIN A SFC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A SFC	NORMAL POSITION FOR STANDBY SERVICE
07.1.03.02.2	G-13A (52-1114)	SWGR #1	CLOSED	TRAIN A SFC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH TRAIN A SFC IN OPERATION
05.1.03.02.1	G-27M (52-1119)	SWGR #1	OPEN	TRAIN A SPRAY PUMP FAILS TO START OR TRIPS IF RUNNING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN A PUMPING FOR CONTAINMENT SPRAY AND ALTERNATE HOT LEG RECIRC	
05.1.03.02.2	G-27M (52-1119)	SWGR #1	CLOSED	TRAIN A SPRAY PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON)	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER FOR SISLOP OR INABILITY TO TRIP FOR RECIRCULATION	NOTE SPECIFY AT MOST 1 SPRAY PUMP RUNNING IN RECIRC, DUE TO RECIRC PUMP FLOW LIMITATIONS
06.1.03.02.1	G-15A (52-1121)	SWGR #1	OPEN	TRAIN A CCM PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 6.1.3.1.1)	(SAME AS 6.1.3.1.1)	NORMAL POSITION FOR STANDBY SERVICE
06.1.03.02.2	G-15A (52-1121)	SWGR #1	CLOSED	TRAIN A CCM PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH PUMP RUNNING
02.2.03.06.1	G-45B	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	TRAIN B RECIRC PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN B RECIRC PUMPING	
05.2.03.06.1	G-27S	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	PUMP CANNOT BE STARTED IF OFF OR TRIPPED IF RUNNING	CONTROL ROOM INDICATION, ANNUNCIATION	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON)	POTENTIAL LOSS OF TRAIN B CONTAINMENT SPRAY AND HYDRAZINE PUMPING OR INABILITY TO TRIP SPRAY PUMP FOR RECIRCULATION	
06.2.03.11.1	G-15B	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	TRAIN B CCM PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B CCM PUMP	

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SIS OPERATOR UNIT I
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.2.03.12.1	G-13B	SVGR #2 125VDC CONTROL POWER	VOLTS LOW	TRAIN B SVC PUMP CANNOT BE STARTED OR TRIPPED, TRAIN B LOW DISCHARGE PRESSURE, OVERLOAD AND BUS UNDERVOLTAGE AUTO-START SIGNALS TO G-13A DISABLED	CONTROL ROOM INDICATION	REDUNDANT TRAIN (WITH MANUAL START CAPABILITY FOR NON-SIS/SISLOP EVENTS)	INOPERABILITY OF TRAIN B SVC, REDUCED RELIABILITY OF TRAIN A SVC FOR NON-SIS/SISLOP EVENTS	
12.4.01.09.1	52-1202 (BRBAKBR)	SVGR #2 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED OR RECLOSD	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BRER NORMALLY CLOSED, NOT REQUIRED TO TRIP OPEN RECPT FOR FAULT PROTECTION OR RE-ENERGIZING SVGR #2 FROM SVGR #3/SST #3. CAN BE TRIPPED LOCALLY IF NEEDED FOR TIE BRER CLOSURE
12.4.02.12.1	52-1203 (BRBARBR)	SVGR #2 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED OR RECLOSD	CONTROL ROOM INDICATION	NONE REQUIRED IF BRER INITIALLY OPEN	NONE IF BRER INITIALLY OPEN. SVGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA 52-1303 AND SST #3 OR 52-1103 AND SVGR #1	*TECH SPEC ACTION ENTRY REQUIRED IF SVGR #2-3 TIE BRER CLOSED DURING NORMAL OPERATION
02.4.23.03.1	PCV-1115D PCV-1115N PCV-1115P	SVGR #2 125VDC CONTROL POWER (052-1226)	VOLTS LOW	CONTROLLER SELECTOR VALVES FOR PDV-1115D/B/P FAIL IN TRAIN A POSITIONS, TRAIN B CONTROLLERS CANNOT BE ALIGNED	CONTROL ROOM INDICATION	REDUNDANT TRAIN A CONTROLLERS	LOSS OF 1 OF 2 REDUNDANT CONTROLLERS FOR EACH OF PCV-1115D/B/P FOR CLR FLOW CONTROL	
02.2.03.02.1	G-45B	SVGR #2 (52-1207)	OPEN	TRAIN B RECIRC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B RECIRC NORMAL POSITION PUMPING	
02.2.03.02.2	G-45B	SVGR #2 (52-1207)	CLOSED	TRAIN B RECIRC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING OR (IF PRIOR TO SUBMERGENCE) PUMP DAMAGE	CONTROL ROOM INDICATION	REDUNDANT TRAIN	POTENTIAL LOSS OF TRAIN B RECIRC PUMP OR ELECTRICAL POWER	PUMP NORMALLY DRY
07.2.03.02.1	G-13B	SVGR #2 (52-1214)	OPEN	TRAIN B SVC PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B SVC	NORMAL POSITION FOR STANDBY SERVICE
07.2.03.02.2	G-13B	SVGR #2 (52-1214)	CLOSED	TRAIN B SVC PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH TRAIN B SVC IN OPERATION
05.2.03.02.1	G-27B	SVGR #2 (52-1219)	OPEN	TRAIN B SPRAY PUMP FAILS TO START OR TRIPS IF RUNNING	PERIODIC TESTING	REDUNDANT TRAIN	INOPERABILITY OF TRAIN B PUMPING FOR CONTAINMENT SPRAY AND ALTERNATE HOT LNG RECIRC	
05.2.03.02.2	G-27B	SVGR #2 (52-1219)	CLOSED	TRAIN B SPRAY PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON) (SAME AS 6.2.3.1.1)	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER FOR SISLOP OR INABILITY TO TRIP FOR RECIRCULATION (SAME AS 6.2.3.1.1)	ROLE SPECIFY AT MOST 1 SPRAY PUMP RUNNING IN RECIRC, DUE TO RECIRC PUMP FLOW LIMITATIONS
06.2.03.02.1	G-15B	SVGR #2 (52-1221)	OPEN	TRAIN B CCW PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	REDUNDANT TRAIN (RUNS IF AFFECTED TRAIN FAILS OFF, CAN BE TRIPPED FOR RECIRC IF AFFECTED TRAIN FAILS ON) (SAME AS 6.2.3.1.1)	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION FOR STANDBY SERVICE
06.2.03.02.2	G-15B	SVGR #2 (52-1221)	CLOSED	TRAIN B CCW PUMP STARTS OR FAILS TO TRIP, RESULTING IN OUT OF SEQUENCE BUS LOADING FOR SISLOP	CONTROL ROOM INDICATION	REDUNDANT TRAIN FOR SISLOP, NONE REQUIRED FOR SIS	POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL POSITION WITH PUMP RUNNING

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
SORT FOR ELECTRICAL/ACTUATION DEPENDENCIES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.3.03.11.1	G-15C	SWGR #3 125VDC CONTROL POWER	VOLTS LOW	SOUTH CCW PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	TRAIN A OR B TO SERVE ALL REQUIRED LOADS	INOPERABILITY OF SOUTH CCW PUMP IF NOT INITIALLY RUNNING	
07.3.03.07.1	G-13C	SWGR #3 125VDC CONTROL POWER	VOLTS LOW	AUX SWC PUMP CANNOT BE STARTED OR TRIPPED	CONTROL ROOM INDICATION	REUNDANT SAFETY RELATED TRAINS	INOPERABILITY OF AUX SWC	SWGR #3 IS ISOLATED ON SIS/SISLOP IRRESPECTIVE OF TRIP STATUS OF ITS INDIVIDUAL LOADS
12.6.01.08.1	52-1303 (BRBARBR)	SWGR #3 125VDC CONTROL POWER	VOLTS LOW	BRER CANNOT BE TRIPPED OR RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR SHORT TERM, OPERATOR ACTIONS FOR LONG TERM	NONE FOR SHORT TERM. FOR LONG TERM, SWGR #3 CAN BE RE-ENERGIZED AS REQUIRED FROM TRAIN A AND TRAIN B BY CLOSING SWGR #1-3 OR SWGR #2-3 TIE BRERS, RESPECTIVELY AFTER 52-1303 TRIP	NOV-358/850C UPS DUTY CYCLE > 30 MINUTES TO PERMIT CREDIT FOR OPERATOR ACTION LOCALLY IN THE 480V ROOM TO MANUALLY TRIP 52-1303 AND RESTORE CONTROL POWER (VIA MANUAL SELECTOR SWITCHES) AS NEEDED
06.3.03.02.1	G-15C	SWGR #3 (52-1305)	OPEN	SOUTH CCW PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 6.3.3.1.1)	(SAME AS 6.3.3.1.1)	NORMAL POSITION FOR STANDBY SERVICE
06.3.03.02.2	G-15C	SWGR #3 (52-1305)	CLOSED	SOUTH CCW PUMP STARTS OR FAILS TO TRIP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE. TRAIN A/B BUS LOADING IMPACT PRECLUDED BY AUTOMATIC ISOLATION OF SWGR #3	NORMAL POSITION WITH PUMP RUNNING
07.3.03.02.1	G-13C	SWGR #3 (52-1313)	OPEN	AUX PUMP FAILS TO START OR TRIPS AFTER STARTING	PERIODIC TESTING	(SAME AS 7.3.3.1.1)	(SAME AS 7.3.3.1.1)	NORMAL POSITION. PUMP MUST BE STARTED MANUALLY TO MEET TECH SPEC 3.3.1 ACTION STATEMENT REQUIREMENTS FOR G-13A OR B INOPERABLE
07.3.03.02.2	G-13C	SWGR #3 (52-1313)	CLOSED	AUX SWC PUMP STARTS OR FAILS TO TRIP	CONTROL ROOM INDICATION	NONE REQUIRED	NONE FOR SIS/SISLOP	SWGR #3 ISOLATED ON SIS/SISLOP

SORT FOR COMMON-CAUSE FAILURES

NOTES FOR COMMON-CAUSE FAILURE SORT

1. This table is a sort of FMEA Tables 1-1 through 12-1 for common-cause failures, provided as an aid to the reviewer.
2. The table is sorted by failure mode, and identifies those items with FAIL_MODE = 'EQ' or 'SEISMIC', or with dependencies on the non-safety related Instrument and Service Air (ISA) system not permitted by Standard Review Plan 15.1.5. The non-safety related Switchyard system and the Main/Auxiliary transformers addressed in Section 12.9 of Table 12-1 are not specifically included in this sort. The COM_SORT program included in Appendix A to this report was used.

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON BECS	REMARKS
01.4.06.05.5	PCV-456 CV-142	LT-453 LOOP	BQ	S/G A OVERFILL PROTECTION SIGNAL CLOSURE PCV-456 AND CV-142	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-454 AND LT-455 LOOPS	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-454 AND LT-455	NONE-BQ S/G NR LEVEL INTRES ASSURED COMMON-CAUSE FAILURES DURING HRLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS
01.4.07.05.5	PCV-457 CV-144	LT-454 LOOP	BQ	S/G B OVERFILL PROTECTION SIGNAL CLOSURE PCV-457 AND CV-144	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-455 LOOPS	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-455	NONE-BQ S/G NR LEVEL INTRES ASSURED COMMON-CAUSE FAILURES DURING HRLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS
01.4.08.05.5	PCV-458 CV-143	LT-455 LOOP	BQ	S/G C OVERFILL PROTECTION SIGNAL CLOSURE PCV-458 AND CV-143	PERIODIC TESTING	NONE REQUIRED FOR SI, NONE FOR SECONDARY RECIRC WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-454 LOOPS	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-454	NONE-BQ S/G NR LEVEL INTRES ASSURED COMMON-CAUSE FAILURES DURING HRLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS
02.1.03.05.1	G-45A	PV-2077	BQ	LOSS OF SERVICE WATER COOLING TO TRAIN A RECIRC PUMP, FUSES BLOW TO PROTECT PUMP CONTROLS	PERIODIC TESTING	ISOLATION FUSES PREVENT (B)(2) REDUCED RELIABILITY OF TRAIN A INTERACTION WITH PUMP CONTROLS RECIRC PUMPING		
02.2.03.05.1	G-45B	PV-3077	BQ	LOSS OF SERVICE WATER COOLING TO TRAIN B RECIRC PUMP, FUSES BLOW TO PROTECT PUMP CONTROLS	PERIODIC TESTING	ISOLATION FUSES PREVENT (B)(2) REDUCED RELIABILITY OF TRAIN B INTERACTION WITH PUMP CONTROLS RECIRC PUMPING		
02.2.06.05.3	G-8A	LC-110081	BQ	LO-LO-LO VCT LEVEL TRIP OF TRAIN B CHARGING PUMP	CONTROL ROOM INDICATION	OVERRIDE SWITCH	INOPERABILITY OF TRAIN B CHARGING PUMP DURING INJECTION, NONE FOR RECIRC WITH CREDIT FOR MANUAL OPERATION OF OVERRIDE	OVERRIDE REQUIRED IF TRAIN A CHARGING PUMP DURING INJECTION, IS SINGLE FAILURE CONCURRENT WITH THIS COMMON-CAUSE FAILURE WITH TRAIN A CHARGING PUMPS AND PIC-1111 ENVIRONMENT NOT HARBH UNTIL POST-LOCAL RECIRCULATION IS INITIATED
02.4.08.01.3	PIC-1111 LOOP	PIC-1111	BQ	LOW DISCHARGE PRESSURE AUTO-START SIGNAL MAY OCCUR TO BOTH CHARGING PUMPS, CAUSING START OF DR-SELECTED PUMP AFTER SEQ BLOCK/RESET	CONTROL ROOM INDICATION, ANNUNCIATION	PCV-1115A/B/C/D/E/P AND PCV-1112 MANUAL CONTROL LIMITS CHARGING FLOW TO WITHIN CAPABILITY OF OPERATING RECIRCULATION PUMP(S)	POTENTIAL OPERATION OF 2 CHARGING PUMPS DURING CLR AND HLR	CHARGING PUMPS AND PIC-1111 ENVIRONMENT NOT HARBH UNTIL POST-LOCAL RECIRCULATION IS INITIATED
02.4.27.01.3	CV-406A	VALVE/ACTUATOR	BQ	VALVE FAILS OPEN. NO EFFECT ON NONE CLR OR HLR SINCE HARBH ENVIRONMENT IN VALVE AREA DOES NOT OCCUR UNTIL RECIRC IS INITIATED, WHICH SEATS VCT CHECK VALVE TO PREVENT GAS BINDING		NONE REQUIRED	NONE	(B)(2) FUSE PROTECTS OTHER UTILITY BUS LOADS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SHEEPER UNIT 1
SORT FOR POTENTIAL COMMON CAUSE FAILURES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
02.4.27.02.3	CV-4068	VALVE/ACTUATOR	BQ	VALVE FAILS OPEN. NO EFFECT ON NONE CLR OR HLR SINCE HARSH ENVIRONMENT DOES NOT OCCUR UNTIL BECIRC IS INITIATED, WHICH SEATS VCT CHECK VALVE TO PREVENT GAS BINDING		NONE REQUIRED	NONE	(b)(2) FUSE PROTECTS OTHER UTILITY BUS LOADS
02.4.28.01.3	HCV-427A	VALVE/ACTUATOR	BQ	VALVE FAILS CLOSED DUE TO POWER ISOLATION BY (b)(2) FUSE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	(b)(2) FUSE PROTECTS OTHER 125 VDC BUS #1 LOADS
02.4.28.02.3	HCV-427B	VALVE/ACTUATOR	BQ	VALVE FAILS CLOSED DUE TO POWER ISOLATION BY (b)(2) FUSE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	(b)(2) FUSE PROTECTS OTHER 125 VDC BUS #1 LOADS
02.4.28.03.3	HCV-427C	VALVE/ACTUATOR	BQ	VALVE FAILS CLOSED DUE TO POWER ISOLATION BY (b)(2) FUSE	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	(b)(2) FUSE PROTECTS OTHER 125 VDC BUS #1 LOADS
03.1.03.01.3	PT-1112 LOOP	PT-1112	BQ	PRIMARY PATH HLR FLOW CANNOT BE MEASURED	CONTROL ROOM INDICATION	ALTERNATE PATH	POTENTIAL IMBALANCE IN CLR/HLR FLOW OR LOSS OF HLR PRIMARY PATH	(SAME AS 3.1.3.1.1)
03.1.10.01.3	PCV-430C PCV-430B	PC-430C/H LOOP	BQ	DIVERSION OF PRIMARY PATH HLR FLOW TO LOOP A AND B COLD LEGS	CONTROL ROOM INDICATION	NONE IF ALTERNATE PATH BQ OR SINGLE FAILURE OCCURS	LOSS OF HLR PRIMARY FLOW PATH	BQ UPGRADE OF BOTH HLR FLOW PATHS REQUIRED
03.2.03.01.3	NOV-822A	VALVE/ACTUATOR	BQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION, CAUSING LOSS OF ALTERNATE HLR PATH IF ONE OF NOV-822A/B IS NOT INITIALLY OPEN	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF ECC
03.2.04.01.3	NOV-822B	VALVE/ACTUATOR	BQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION, CAUSING LOSS OF ALTERNATE HLR PATH IF ONE OF NOV-822A/B IS NOT INITIALLY OPEN	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF ECC
03.2.05.01.3	NOV-813	VALVE/ACTUATOR	BQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION. IF CLOSED, PREVENTS ALIGNMENT OF ALTERNATE HLR PATH	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF ECC. ACTUATOR WILL BE REPLACED WITH BQ MODEL BY DCP 3548.00
03.2.06.01.3	NOV-814	VALVE/ACTUATOR	BQ	VALVE FAILS AS-IS, WITH LOSS OF POSITION INDICATION. IF CLOSED, PREVENTS ALIGNMENT OF ALTERNATE HLR PATH	CONTROL ROOM INDICATION	NONE IF PRIMARY PATH IS SINGLE FAILURE	POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION OF ECC. ACTUATOR WILL BE REPLACED WITH BQ MODEL BY DCP 3548.00
03.2.07.01.3	NOV-833	VALVE/ACTUATOR	BQ	VALVES FAILS AS-IS, WITH LOSS OF POSITION INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION
03.2.08.01.3	NOV-834	VALVE/ACTUATOR	BQ	VALVES FAILS AS-IS, WITH LOSS OF POSITION INDICATION	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	BREAKER AND CONTROL POWER FUSE PROVIDE (b)(2) PROTECTION
03.2.13.01.3	CV-413	VALVE/ACTUATOR	BQ	DIVERSION OF ALTERNATE HLR PATH FLOW TO RCP SEAL WATER RETURN OR RCDT	NONE	NONE, IF HLR PRIMARY PATH IS SINGLE FAILURE	POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH TO RCDT WITH CV-288 BQ FAILURE	FUSE PROVIDES (b)(2) PROTECTION OF OTHER VITAL BUS LOADS. CHECK VALVE TO BE INSTALLED BY DCP 3548 WILL PREVENT FLOW DIVERSION WITH THIS FAILURE
03.2.14.01.3	CV-412	VALVE/ACTUATOR	BQ	DIVERSION OF ALTERNATE HLR FLOW TO RCP SEAL WATER RETURN	NONE	NONE IF HLR PRIMARY PATH IS SINGLE FAILURE	POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR FLOW TO RCP SEAL WATER RETURN	FUSE PROVIDES (b)(2) PROTECTION OF OTHER VITAL BUS LOADS. DCP 3548 WILL INSTALL CHECK VALVE TO PREVENT FLOW DIVERSION VIA THIS PATH

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
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SORT FOR POTENTIAL COMMON CAUSE FAILURES

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03.2.15.01.3	CV-288	VALVE/ACTUATOR	EQ	DIVERSION OF ALTERNATE HLR FLOW TO RCP SEAL WATER RETURN OR RCDT	NONE	NONE IF PRIMARY HLR PATH IS SINGLE FAILURE	POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR FLOW TO RCDT	FUSE PROVIDES (b)(2) PROTECTION OF OTHER UTILITY BUS LOADS. CHECK VALVE TO BE INSTALLED BY DCF 3548 WILL PREVENT FLOW DIVERSION WITH THIS FAILURE
05.1.06.01.2	G-200A	PUMP/MOTOR	EQ	TRAIN A HYDRAZINE PUMP MOTOR FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING AFTER 2 HOURS	MINIMUM 2 HR OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. MOTOR CONTROLLER BREAKER PRECLUDES (b)(2) IMPACT ON OTHER MCC LOADS
05.1.06.05.5	G-200A	LIS-500A LOOP	EQ	MAY CAUSE SPURIOUS LOW LEVEL SIGNAL TO TRAIN A HYDRAZINE PUMP 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING AFTER 2 HOURS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. LIS-500A DEVICE PROVIDES ISOLATION OF NON-EQ INTR FROM OTHER LOADS ON SAME POWER SUPPLY
05.1.07.01.3	SV-600	VALVE/ACTUATOR	EQ	TRAIN A HYDRAZINE ISOLATION VALVE FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE FLOW AFTER 2 HRS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. FUSE PROVIDES (b)(2) PROTECTION OF OTHER DC BUS LOADS
05.2.06.01.2	G-200B	PUMP/MOTOR	EQ	TRAIN B HYDRAZINE PUMP MOTOR FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING AFTER 2 HOURS	MINIMUM 2 HR OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. MOTOR CONTROLLER BREAKER PRECLUDES (b)(2) IMPACT ON OTHER MCC LOADS
05.2.06.05.5	G-200B	LIS-500B LOOP	EQ	MAY CAUSE SPURIOUS LOW LEVEL SIGNAL TO TRAIN B HYDRAZINE PUMP 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE PUMPING AFTER 2 HOURS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. LIS-500B DEVICE PROVIDES ISOLATION OF NON-EQ INTR FROM OTHER LOADS ON SAME POWER SUPPLY
05.2.07.01.3	SV-601	VALVE/ACTUATOR	EQ	TRAIN B HYDRAZINE ISOLATION VALVE FAILS (OPEN, SHORT OR GROUND) 2 HRS AFTER RECIRCULATION INITIATED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	POTENTIAL COMMON-CAUSE LOSS OF HYDRAZINE FLOW AFTER 2 HRS	MINIMUM 2 HRS OPERATION FOLLOWING CSAS ENSURES ADEQUATE HYDRAZINE DELIVERY. FUSE PROVIDES (b)(2) PROTECTION OF OTHER DC BUS LOADS
06.4.03.02.3	TCV-601A	TCV-601A LOOP	EQ	TCV-601A OPENS, CAUSING EXCESS CCW FLOW TO RHR BY B-21A AND DIVERTING FLOW FOR ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCW PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	NONE OF TCV-601A/B ISOLATED BY BLOCK VALVE; OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD

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06.4.04.02.3	TCV-601B	TC-601B LOOP	EQ	TCV-601B OPENS, CAUSING EXCESS CCM FLOW TO RHR HI B-218 AND DIVERTING FLOW FOR ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*NONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REPUDDLING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.06.01.3	PC-605 LOOP	PC-605	EQ	AUTO-START SIGNAL TO CCM AND EMERGENCY THERMAL BARRIER PUMPS, CAUSING PUMPS TO START AS SOON AS RESPECTIVE BUS VOLTAGE AVAILABLE	CONTROL ROOM ANNUNCIATION, PERIODIC TESTING	NONE FOR SISLOP, NONE REQUIRED FOR SIS	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	*EQ FAILURE (INCLUDING OPEN, SHORT OR GROUND) COULD MIMIC NORMAL RESPONSE FOLLOWING BUS UNDERVOLTAGE TRIPS FOR SISLOP EVENT
06.4.07.01.3	CV-722A CV-722B CV-722C	VALVE/ACTUATOR	EQ	CCM FLOW ALIGNED THROUGH THERMAL BARRIER COILS FOR RCP-A, B OR C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	*SOLENOID VALVES BY-1722A, 1722B, 1722C NOT EQ. FUSES PROVIDED FOR (b)(2) PROTECTION OF OTHER CIRCUITS
06.4.08.01.2	G-964	PUMP/MOTOR	EQ	MOTOR MAY FAULT, RESULTING IN UP TO 30A DRAIN ON 125VDC BUS #1 BEFORE OVERCURRENT TRIP OF BREAKER	CONTROL ROOM INDICATION (DC BUS AMPS)	NONE	*POTENTIAL COMMON-CAUSE LOSS OF TRAIN A 125VDC CONTROL POWER FOR LOCA, HSLB OR FWLB. WITH CONCURRENT SINGLE FAILURE OF TRAIN B, RESULTS IN LOSS OF ALL AC POWER	*PUMP/MOTOR AND CABLING NOT QUALIFIED FOR IN-CONTAINMENT ENVIRONMENT, CIRCUIT NOT ISOLATED ON SIS/SISLOP, EFFECT NOT ANALYZED IN DESIGN BASIS BATTERY LOADING CALCULATION
12.3.03.02.3	MCC-1	MSR LOADS	EQ/SB/SIMC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-1 LOAD AND FEEDER BREAKS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BREAKS AND BREAK COORDINATION TO PREVENT FEEDER BREAK TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)
12.3.04.02.3	MCC-1A	MSR LOADS	EQ/SB/SIMC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-1A LOAD AND FEEDER BREAKS. SINCE ALL LOADS RECEIPT HPW PP LUBE OIL FAN CLR ARE MSR, AND ALL LOCATED IN TURBINE BUILDING, FEEDER BREAK MAY TRIP FROM CONCURRENT FAULT IN HSLB	NONE	NONE REQUIRED. HPW LUBE OIL TEMPERATURE SHOWN BY CALC TO REMAIN ACCEPTABLE WITHOUT COOLING DURING INJECTION PHASE OF HSLB	LOSS OF TRAIN A HPW PP LUBE OIL FAN COOLER FOR HSLB OUTSIDE CONTAINMENT	*CALCULATION REQUIRED TO DEMONSTRATE THAT OPERATION OF FAN COOLER WOULD NOT ADVERSELY AFFECT HPW PUMP FUNCTION FOR HSLB VIA RECURSIVE LUBE OIL TEMPERATURE IN THIS EVENT, CAUSED BY INDUCTION OF STEAM THROUGH FAN/COIL UNIT
12.3.05.02.3	MCC-1B	MSR LOADS	EQ/SB/SIMC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-1B LOAD AND FEEDER BREAKS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BREAKS AND BREAK COORDINATION TO PREVENT FEEDER BREAK TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)
12.3.08.01.3	SWGR #1 MSR LOADS	BREAKER(S)	EQ/SB/SIMC	POTENTIAL COMMON-CAUSE FAULT OF TRAIN A 480V MSR LOAD(S), CHALLENGING SWGR #1 LOAD AND FEEDER BREAKS	NONE	BREAK COORDINATION TO PREVENT FEEDER BREAK TRIP FOR COMPLETE FAULTS, NONE FOR OVERCURRENT FAILURE OF LOADS BELOW FAULT PROTECTION SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)

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12.4.03.02.3	MCC-2	MSR LOADS	RQ/SB/SMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-2 LOAD AND FEEDER BRKRS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BRKRS AND BRKR COORDINATION TO PREVENT FEEDER BRKR TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP) *(SANS AS 12.4.4.2.2)
12.4.04.02.3	MCC-2A	MSR LOADS	RQ/SB/SMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-2A LOAD AND FEEDER BRKRS. SINCE ALL LOADS EXCEPT HYDRAZINE PUMP AND NOV-1100C ARE MSR AND ALL LOCATED IN RE AUX BLDG, FEEDER BRKR MAY TRIP FROM CONCURRENT FAULT DUE TO POST-LOCK DISES IN ARRA	NONE	REDUNDANT TRAIN FOR INJECTION, NONE FOR RECIRC	*LOSS OF TRAIN A HYDRAZINE PUMP, AND POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP BOOM	
12.4.05.02.3	MCC-2B	MSR LOADS	RQ/SB/SMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-2B LOAD AND FEEDER BRKRS	NONE	OVERCURRENT TRIP OF INDIVIDUAL LOAD BRKRS AND BRKR COORDINATION TO PREVENT FEEDER BRKR TRIP FOR FAULTS, NONE FOR O/C FAILURE OF LOADS BELOW SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT TRIPPED/LOCKED OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)
12.4.08.01.3	SWGR #2 MSR LOADS	BREAKER(S)	RQ/SB/SMIC	POTENTIAL COMMON-CAUSE FAULT OF TRAIN B (480V MSR LOAD(S)), CHALLENGING SWGR #2 LOAD AND FEEDER BRKRS	NONE	BRKR COORDINATION TO PREVENT FEEDER BRKR TRIP FOR COMPLETE FAULTS, NONE FOR OVERCURRENT FAILURE OF LOADS BELOW FAULT PROTECTION SETPOINTS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)
12.6.02.02.3	MCC-3	MSR LOADS	RQ/SB/SMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-3 LOAD AND FEEDER BRKRS	NONE	SIS/SISLOP ISOLATION OF SWGR #3, BRKR COORDINATION TO PREVENT FEEDER TRIP FOR FAULTS, NONE FOR OVERCURRENT FAILURE OF LOADS BELOW SETPOINT	*POTENTIAL COMMON-CAUSE INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)
12.7.03.02.3	MCC-3A	MSR LOADS	RQ/SB/SMIC	POTENTIAL COMMON-CAUSE FAULT OF MSR LOADS, CHALLENGING MCC-3A LOAD AND FEEDER BRKRS. SINCE ALL LOADS ARE MSR AND LOCATED IN BARSH POST-ACCIDENT ENVIRONMENTS, FEEDER BRKR MAY TRIP FROM CONCURRENT FAULTS POST-ACCIDENT	NONE	NONE REQUIRED	NONE	PASS NOT REQUIRED FOR SIS/SISLOP DESIGN BASIS EVENT MITIGATION
12.6.06.01.3	SWGR #3 MSR LOADS	BREAKER(S)	RQ/SB/SMIC	POTENTIAL COMMON-CAUSE FAULT OF SWGR #3 (480V MSR LOAD(S)), CHALLENGING SWGR #3 LOAD AND FEEDER BRKRS	NONE	O/C TRIP OF INDIVIDUAL LOAD BRKRS AND BRKR COORDINATION TO PREVENT FEEDER (OR TIE) BRKR TRIP FOR COMPLETE FAULTS, NONE FOR O/C FAILURE OF LOAD BRKRS	*POTENTIAL COMMON-CAUSE INOPERABILITY OF SWGR #3, IF RE-ENERGIZED POST-SIS/SISLOP, DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IBBE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON SAFETY SIGNAL (1B, SIS AND SISLOP). BRKR REQD TO ISOLATE ALL NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3. BRKR COORD ALSO REQD FOR TIE BRKR ALIGN

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01.1.04.08.1	HV-853B	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR SYSTEM RESET AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-530. VALVE REQUIRED TO REMAIN OPEN FOR SI AND SECONDARY RECIRC
01.1.05.07.1	HV-854B	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE OPEN FOR SYSTEM RESET AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-531. VALVE REQUIRED TO CLOSE FOR SI AND SECONDARY RECIRC
01.1.06.17.1	G-3B	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION FW PUMP MINIFLOW VALVES CV-37 AND CV-875B	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	NONE. TRAIN A FW PUMP MINIFLOW VALVES REPOSITION AS REQUIRED USING SAFETY RELATED BACK-UP NITROGEN	ISA IS A NON-SAFETY RELATED, NON-BRISIC SYSTEM
01.1.07.06.1	HV-851B	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	NONE. VALVE WILL REPOSITION AS REQUIRED USING SAFETY-RELATED BACKUP NITROGEN	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-528
01.1.08.04.1	HV-852B	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE OPEN FOR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, INOPERABILITY OF TRAIN A PUMPING FOR SECONDARY RECIRC	NON-SAFETY RELATED ISA SYSTEM CAN BE CREDITED FOR NSLB IN CONTAINMENT PER SEP SECTION 15.1.5. AIR-OPERATED HYDRAULIC PUMP IN VALVE ACTUATOR ISOLATED BY SV-529
01.2.04.08.1	HV-853A	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR SYSTEM RESET AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-526. VALVE REQUIRED TO REMAIN OPEN FOR SI AND SECONDARY RECIRC
01.2.05.07.1	HV-854A	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE OPEN FOR SYSTEM RESET AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED	NONE	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-527. VALVE REQUIRED TO CLOSE FOR SI AND SECONDARY RECIRC
01.2.06.17.1	G-3A	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION FW PUMP MINIFLOW VALVES CV-36 AND CV-875A	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	NONE. TRAIN B FW PUMP MINIFLOW VALVES REPOSITION AS REQUIRED USING SAFETY RELATED BACK-UP NITROGEN	ISA IS A NON-SAFETY RELATED, NON-BRISIC SYSTEM
01.2.07.06.1	HV-851A	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE CLOSED FOR CONTAINMENT ISOLATION OR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	BACKUP NITROGEN	NONE. VALVE WILL REPOSITION AS REQUIRED USING SAFETY-RELATED BACKUP NITROGEN	AIR OPERATED HYDRAULIC PUMP IN ACTUATOR ISOLATED BY SV-524
01.2.08.04.1	HV-852A	ISA	PRESSURE LOW	ISA UNAVAILABLE TO REPOSITION VALVE OPEN FOR SECONDARY RECIRCULATION AFTER INJECTION TERMINATED	CONTROL ROOM ANNUNCIATION	NONE REQUIRED FOR SI, REDUNDANT TRAIN FOR SECONDARY RECIRC	NONE FOR SI, INOPERABILITY OF TRAIN B PUMPING FOR SECONDARY RECIRC	NON-SAFETY RELATED ISA SYSTEM CAN BE CREDITED FOR NSLB IN CONTAINMENT PER SEP SECTION 15.1.5. AIR-OPERATED HYDRAULIC PUMP IN VALVE ACTUATOR ISOLATED BY SV-525

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
FOR THE REACTOR CORE UNIT 1
SORT FOR POTENTIAL COMMON CAUSE FAILURES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
01.4.09.12.1	PCV-456,457,458 CV-142,143,144	ISA	PRESSURE LOW	MAIN PW CONTROL VALVES FAIL OPEN, BYPASS VALVES FAIL CLOSED TO S/G A, B, C	CONTROL ROOM ANNUNCIATION	NONE REQUIRED FOR BYPASS VALVES, BACKUP NITROGEN FOR CONTROL VALVES FOR SI. NONE FOR SECONDARY RECIRC	NONE FOR SI (ISA NOT CREDITED FOR PCV CLOSURE), LOSS OF SECONDARY RECIRC TO S/G A/B/C	EACH PCV HAS SEPARATE BACKUP N2 (GNI) SUPPLY FOR CLOSURE. COMMON-CAUSE FAILURE NOT POSTULATED DURING SECONDARY RECIRC, BUT SINGLE FAILURE OF ISA-969 COULD ISOLATE ISA TO CVs. EVALN OF MANUAL BYPASS PATHS REQD FOR MITIGATING EFFECTS ON SECONDARY RECIRC
02.4.09.08.1	PCV-1112	ISA	PRESSURE LOW	ISA UNAVAILABLE FOR PCV-1112 OPENING (INJECTION) OR MODULATION (HLR)	CONTROL ROOM INDICATION, ANNUNCIATION	BACKUP NITROGEN	PCV-1112 OPENS AND MODULATES AS REQUIRED ON BACKUP NITROGEN	
02.4.12.02.1	CV-304 CV-305	ISA	PRESSURE LOW	ISA UNAVAILABLE TO CV-304 AND CV-305. CV-304 CLOSSES, ISOLATING CHARGING PUMP INJECTION TO RCS LOOP A	CONTROL ROOM ANNUNCIATION	NONE FOR INJECTION, BACKUP N2 FOR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A. CV-305 REPOSITIONS AS REQUIRED FOR CLR AND HLR USING BACKUP N2	CHARGING NOT CREDITED FOR INJECTION
02.4.22.02.1	PCV-1115A/D PCV-1115B/E PCV-1115C/F	ISA	PRESSURE LOW	PCV-1115A/B/C FAIL OPEN AND CLR FLOW CANNOT BE THROTTLED BELOW ABOUT 80 GPM PER RCS LOOP. PCV-1115D/E/F MODULATE ON BACKUP N2 AS REQUIRED	CONTROL ROOM INDICATION, ANNUNCIATION	BACKUP N2 FOR PCV-1115D/E/F FLOW CONTROL	INABILITY TO CONTROL CLR FLOW ON ISA OR THROTTLE CLR FLOW BELOW 80 GPM PER RCS LOOP FOR COMBINED CLR/HLR	HYDRAULIC CALC REQUIRED TO VERIFY FLOW THROUGH WIDE OPEN PCV-1115A/B/C, AND UPPER LIMIT FOR PRIMARY PATH HLR FLOW TO REMAIN WITHIN THE CAPABILITIES OF A SINGLE RECIRC PUMP FOR THIS POTENTIAL COMMON-CAUSE FAILURE
02.4.27.05.1	CV-406A CV-406B	ISA	PRESSURE LOW	CV-406A AND CV-406B OPEN, BYPASSING NOV-1100C, POTENTIALLY GAS-BINDING BOTH CHARGING PUMPS DURING VCT LEVEL TRANSIENT PRECEDING SIS/SISLOP IN SBLOCA, AND PRESELECTED PUMP DURING LBLOCA, HSLB, SCTR INJECTION. NO EFFECT IF DURING RECIRC	CONTROL ROOM INDICATION	NONE FOR SBLOCA, REDUNDANT CHECK VALVE AND CHARGING PUMP FOR RECIRC IN OTHER EVENTS	POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	AT LEAST ONE OF CV-406A/B MUST BE FAIL-CLOSED AND/OR LOCKED CLOSED. NO1s MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP SIMILAR TO NOV-1100C FAILURE TO CLOSE
03.1.04.08.1	PCV-1112	ISA	PRESSURE LOW	ISA UNAVAILABLE FOR PCV-1112 OPENING (INJECTION) OR MODULATION (HLR)	CONTROL ROOM INDICATION, ANNUNCIATION	BACKUP NITROGEN	PCV-1112 OPENS AND MODULATES AS REQUIRED ON BACKUP NITROGEN	
03.1.07.02.1	CV-304 CV-305	ISA	PRESSURE LOW	ISA UNAVAILABLE TO CV-304 AND CV-305. CV-304 CLOSSES, ISOLATING CHARGING PUMP INJECTION TO RCS LOOP A	CONTROL ROOM ANNUNCIATION	NONE FOR INJECTION, BACKUP N2 FOR HLR	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A. CV-305 REPOSITIONS AS REQUIRED FOR CLR AND HLR USING BACKUP N2	CHARGING NOT CREDITED FOR INJECTION
03.1.10.03.1	PCV-430C PCV-430B	ISA	PRESSURE LOW	NONE. NORMAL FOR HLR	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.10.03.1	CV-525	ISA	PRESSURE LOW	VALVE DRIPTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE PRESENT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.11.03.1	CV-526	ISA	PRESSURE LOW	VALVE DRIPTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE PRESENT	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	

EMERGENCY CORRECTION SYSTEM SINGLE FAILURE ANALYSIS
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SORT FOR POTENTIAL COMMON CAUSE FAILURES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
03.2.13.03.1	CV-413	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.14.05.1	CV-412	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.15.03.1	CV-288	ISA	PRESSURE LOW	VALVE FAILS TO NORMAL POSITION	CONTROL ROOM INDICATION	REDUNDANT VALVES CV-287 AND *CV-117 PREVENT DIVERSION OF ALTERNATE HLR FLOW TO LOOP B COLD LEG	NONE	
03.2.16.03.1	CV-962	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
03.2.17.04.1	CV-957	ISA	PRESSURE LOW	VALVE FAILS CLOSED	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	
05.1.04.06.1	CV-517	ISA	PRESSURE LOW	CV-517 DRIFTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE, CANNOT BE REOPENED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-518 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP IF CLOSED, BUT TECH SPEC CHANGE REQD. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBLOCA) TO REMAIN BOUNDED BY ANALYSIS
05.1.05.05.1	CV-82	ISA	PRESSURE LOW	CV-82 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION. NOT CONSISTENT WITH SRP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF THE ISOLATION CONFIGURATION FOR THIS PENETRATION
05.2.04.06.1	CV-518	ISA	PRESSURE LOW	CV-518 DRIFTS CLOSED IF INTERNAL HYDRAULIC LEAKAGE, CANNOT BE REOPENED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE FOR INJECTION, NONE REQUIRED FOR RECIRCULATION	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-517 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP IF CLOSED. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBLOCA) TO REMAIN BOUNDED BY ANALYSIS. TECH SPEC CHANGE REQUIRED
05.2.05.05.1	CV-114	ISA	PRESSURE LOW	CV-114 FAILS OPEN, CANNOT BE RECLOSED	CONTROL ROOM INDICATION	NONE REQUIRED FOR CONTAINMENT SPRAY, RECIRC PUMP HEAD TO MAINTAIN LOOP SEAL FOR CONTAINMENT ISOLATION	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION. NOT CONSISTENT WITH SRP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF THE ISOLATION CONFIGURATION FOR THIS PENETRATION
05.3.05.05.1	CV-92	ISA	PRESSURE LOW	VALVE FAILS IN CLOSED POSITION, CANNOT BE OPENED	CONTROL ROOM INDICATION, ANNUNCIATION	NONE REQUIRED	NONE	
06.1.05.03.1	CV-137A	ISA	PRESSURE LOW	VALVE DRIFTS OPEN IF INTERNAL HYDRAULIC LEAKAGE PRESENT, ALIGNING CCW FLOW TO RECIRC BY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE ACTUATOR USES AIR-OPERATED HYDRAULIC PUMP TO MAINTAIN ACCUMULATOR PRESSURE
06.2.05.03.1	CV-137B	ISA	PRESSURE LOW	VALVE DRIFTS OPEN IF INTERNAL HYDRAULIC LEAKAGE PRESENT, ALIGNING CCW FLOW TO RECIRC BY	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	VALVE ACTUATOR USES AIR-OPERATED HYDRAULIC PUMP TO MAINTAIN ACCUMULATOR PRESSURE

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS PROPER UNIT 1
SORT FOR POTENTIAL COMMON CAUSE FAILURES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
06.4.03.03.1	TCV-601A	ISA	PRESSURE LOW	TCV-601A FAILS OPEN, CAUSING EXCESS CCM FLOW TO RRR BY B-21A AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*INCLUDES VALVE ISA-1242. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.04.03.1	TCV-601B	ISA	PRESSURE LOW	TCV-601B FAILS OPEN, CAUSING EXCESS CCM FLOW TO RRR BY B-21B AND DIVERTING FLOW FROM ECCS LOADS	CONTROL ROOM INDICATION, PERIODIC SURVEILLANCE	VALVE ISOLATED BY BLOCK VALVE OR FLOW LIMITED BY STEM COLLAR	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*INCLUDES VALVE ISA-1243. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD
06.4.07.03.1	CV-722A CV-722B CV-722C	ISA	PRESSURE LOW	CV-722A, B AND C FAIL OPEN, ALIGNING CM FLOW THROUGH THERMAL BARRIER COILS FOR RCP-A, B AND C	CONTROL ROOM INDICATION	NONE REQUIRED	NONE	*VALVES NORMALLY OPEN. THIS FAILURE WOULD PREVENT REMOTE-MANUALLY CLOSING FOR THERMAL BARRIER COIL FAILURE. VERIFICATION REQUIRED THAT FLOW RATE INTO CCM SYSTEM FOR THIS EVENT IS LESS THAN LOCA THRESHOLD
07.1.03.11.1	G-13A	SERVICE WATER	PRESSURE LOW	POTENTIAL LONG-TERM DEGRADATION OF TRAIN A SVC PUMP BEARINGS, POTENTIAL SALTWATER BACKFLOW THROUGH NON-SEISMIC LINES POST-SIS/SISLOP	CONTROL ROOM INDICATION	NONE. BACKUP BEARING COOLING REQUIRED FOR LONG-TERM POST-SIS/SISLOP OPERATION	*POTENTIAL INOPERABILITY OF SVC FOR LONG-TERM POST-SIS/SISLOP OPERATION	*COMMON-CAUSE FAILURE MAY OCCUR DUE TO POSTULATED CONCURRENT SEISMIC EVENT. BACKUP BEARING COOLING STEPS REQUIRED IN ROIs. ALSO, FAILURE REDUCES PUMP OUTPUT UNTIL BOUNDARY VALVES LOCALLY CLOSED, SO THAT PUMP IS REQUIRED WITH BACKFLOW CONDITIONS
07.2.03.11.1	G-13B	SERVICE WATER	PRESSURE LOW	POTENTIAL LONG-TERM DEGRADATION OF TRAIN B SVC PUMP BEARINGS, POTENTIAL SALTWATER BACKFLOW THROUGH NON-SEISMIC LINES POST-SIS/SISLOP	CONTROL ROOM INDICATION	NONE. BACKUP BEARING COOLING REQUIRED FOR LONG-TERM POST-SIS/SISLOP OPERATION	*POTENTIAL INOPERABILITY OF SVC FOR LONG-TERM POST-SIS/SISLOP OPERATION	*COMMON-CAUSE FAILURE MAY OCCUR DUE TO POSTULATED CONCURRENT SEISMIC EVENT. BACKUP BEARING COOLING STEPS REQUIRED IN ROIs. ALSO, FAILURE REDUCES PUMP OUTPUT UNTIL BOUNDARY VALVES LOCALLY CLOSED, SO THAT PUMP IS REQUIRED WITH BACKFLOW CONDITIONS
07.3.03.05.1	G-13C	SERVICE WATER	PRESSURE LOW	POTENTIAL LONG-TERM DEGRADATION OF AUX SVC PUMP BEARINGS	CONTROL ROOM INDICATION	REDUNDANT SAFETY RELATED TRAINS	POTENTIAL INOPERABILITY OF AUX SVC PUMP	AUX SVC PUMP IS NOT CREDITED FOR SIS/SISLOP EVENTS (IE, IS NON-SEISMIC), NOR IS IT SUITABLE FOR LONG-TERM OPERATION FOR NON-SIS/SISLOP EVENTS DUE TO THE POTENTIAL FOR SUCTION STRAINER CLOGGING

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 REOPER UNIT 1
 SORT FOR POTENTIAL COMMON CAUSE FAILURES

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	LOCAL EFFECTS AND DEPENDENT FAILURES	METHOD OF DETECTION	INHERENT COMPENSATING PROVISIONS	EFFECT ON ECCS	REMARKS
07.3.03.06.1 G-13C	ISA		PRESSURE LOW	AUX SMC PUMP DISABLED DUE TO LOSS OF SUCTION/PRIME CONTROL	CONTROL ROOM INDICATION	REDUNDANT SAFETY RELATED TRAINS	IMOPERABILITY OF AUX SMC PUMP	AUX SMC PUMP IS NOT CREDITED FOR SIS/SISLOP EVENTS (IB, IS NON-SRISHIC), NOR IS IT SUITABLE FOR LONG-TERM OPERATION FOR NON-SIS/SISLOP EVENTS DUE TO THE POTENTIAL FOR SUCTION STRAINER CLOGGING
07.4.07.01.3 NOV-9 NOV-10 NOV-11 NOV-12	VALVE ACTUATOR		SRISHIC	GATES NOV-10, 11, 12 FAIL CLOSED, GATE NOV-9 FAILS TO G1 OPEN POSITION ON BUMP STOP	CONTROL ROOM ANNUNCIATION, LOCAL INDICATION	NONE FOR INJECTION OR RECIRC (NON-SRISHIC AUX SMC PUMP ALSO LOST)	LOSS OF SUCTION HEAD TO BOTH TRAINS OF SMC PUMPS, POTENTIALLY CAUSING LOSS OF BOTH PUMPS FOR SIS EVENTS (NO CIRC WATER PUMP TRIP) OR IF PRIOR TO SISLOP	GATE ACTUATORS ARE NON-SRISHIC. CIRC WATER PUMP SUCTION NOT LOCATED SUFFICIENTLY ABOVE SMC PUMP SUCTION TO PREVENT LOSS OF SMC PUMP WFR

VII. APPENDICES

APPENDIX A: DBASE III PROGRAMS USED

*PROGRAM: VLV_FLAG.PRG
*FUNCTION: SETS "OK" FIELD IN BOUND_VL.DBF
CLOSE DATABASES
USE BOUND_VL.DBF INDEX BOUND_VL

*THE FOLLOWING STEPS STANDARDIZE THE TERMINOLOGY FOR FLANGES
REPLACE SR_BACKUP WITH 'BLIND FLANGE' FOR SR_BACKUP='FLANGE'
GOTO TOP
REPLACE MSR_BACKUP WITH 'BLIND FLANGE' FOR MSR_BACKUP='FLANGE'

*THE FOLLOWING STEPS SET THE FLAG TO "UNACCEPTABLE" IN ALL RECORDS
GOTO TOP
REPLACE OR WITH 'A' FOR ITEM_NO='12'

*THE FOLLOWING STEPS RESET THE FLAG TO "CONDITIONALLY OK" FOR APPLICABLE RECORDS WITH A NON-SAFETY RELATED BACKUP
GOTO TOP
REPLACE OR WITH 'A' FOR (VSHUT_AUTO='AUTO' .OR. VSHUT_AUTO='CLOSED') .AND. (MSHUT_AUTO='AUTO' .OR. MSHUT_AUTO='CLOSED' .OR. MSHUT_AUTO='CHECK' .OR. MSR_BACKUP='CAP' .OR. MSR_BACKUP='BLIND')

*THE FOLLOWING STEPS RESET THE FLAG TO "OK" FOR APPLICABLE RECORDS WITH A SAFETY RELATED BACKUP
GOTO TOP
REPLACE OR WITH ' ' FOR (VSHUT_AUTO='AUTO' .OR. VSHUT_AUTO='CLOSED') .AND. (MSHUT_AUTO='AUTO' .OR. MSHUT_AUTO='CLOSED' .OR. MSHUT_AUTO='CHECK' .OR. SR_BACKUP='CAP' .OR. SR_BACKUP='BLIND')

*THE FOLLOWING STEPS RESET THE FLAG TO "OK" FOR RECORDS WITH A LOCKED CLOSED SAFETY RELATED BOUNDARY VALVE
GOTO TOP
REPLACE OR WITH ' ' FOR VSHUT_AUTO='CLOSED' .AND. LOCKED='YES'

*THE FOLLOWING STEPS RESET THE FLAG TO "OK" FOR RECORDS WITH A PASSIVE (CHECK OR RELIEF) BOUNDARY VALVE
GOTO TOP
REPLACE OR WITH ' ' FOR VSHUT_AUTO='CHECK' .OR. VSHUT_AUTO='RELIEF'

*THE FOLLOWING STEPS RESET THE FLAG TO "OK" FOR RECORDS IN EACH TRAIN OF INVENTORY-INSENSITIVE, TRAIN-ALIGNED SYSTEMS (IS, SVC)
GOTO TOP
REPLACE OR WITH ' ' FOR ITEM_NO='07.1' .AND. ITEM_NO('07.3')

*THE FOLLOWING STEPS RESET THE FLAG TO "UNACCEPTABLE" FOR RECORDS MARKED IN THE REMARKS COLUMN (EG. RELIEF VALVES WITH TOO LOW A SETPOINT)
GOTO TOP
REPLACE OR WITH 'A' FOR REMARKS='A'
RETURN

*PROGRAM: VIT_SORT.PRG

*FUNCTION: PRINTS THE TABLE OF VITAL/REGULATED POWER DEPENDENCIES, SORTED BY COMPONENT ID

CLOSE DATABASES

USE RCCS_SPA INDR1 RCCSCOMP, RCCS_SPA, RCCSFAIL

SET DEVICE TO PRINT

@ 0,0 SAY CHR(27) + CHR(15)

SET DEVICE TO SCREEN

REPORT FORM C:RCCSCOMP FOR (COMPON_ID='CSAS INV' .OR. COMPON_ID='REG BUS' .OR. COMPON_ID='VITAL BUS' .OR. COMPON_ID='UTILITY BUS') .AND. (ITRN_NO()=11 .AND. FAIL_MODE='VOLTS LOW') SUBJECT TO PRINT

RETURN

*PROGRAM: BUS_SORT.PRG

*FUNCTION: PRINTS THE TABLE OF AUXILIARY POWER DEPENDENCIES, SORTED BY COMPONENT ID

CLOSE DATABASES

USE RCCS_SPA INDR1 RCCSCOMP, RCCS_SPA, RCCSFAIL

SET DEVICE TO PRINT

@ 0,0 SAY CHR(27) + CHR(15)

SET DEVICE TO SCREEN

REPORT FORM C:RCCSCOMP FOR (COMPON_ID='BUS' .OR. COMPON_ID='BNGR' .OR. COMPON_ID='MCC' .OR. COMPON_ID='125VDC BUS') SUBJECT TO PRINT

RETURN

*PROGRAM: CON_SORT.PRG

*FUNCTION: PRINTS TABLE OF COMMON-CAUSE FAILURES (BQ, BRISNIC, INSTRUMENT AIR), SORTED BY FAILURE MODE

CLOSE DATABASES

USE RCCS_SPA INDR1 RCCSFAIL, RCCS_SPA, RCCSCOMP

SET DEVICE TO PRINT

@ 0,0 SAY CHR(27) + CHR(15)

SET DEVICE TO SCREEN

REPORT FORM C:RCCSFAIL FOR FAIL_MODE='BQ' .OR. (ITRN_NO()=04 .AND. (FAIL_MODE='BRISNIC' .OR. (FAIL_MODE='PRESSURE LOW' .AND. COMPON_ID()=GM))) SUBJECT TO PRINT

RETURN

APPENDIX B: REVISION 0 ERRATA

REVISION 0 ERRATA

1. Items 01.4.16.05.1 through 01.4.16.06.2: SEQ actuated relay contacts do not exist in the control circuit for CV-287. The scheme shown on the applicable elementary diagram was misinterpreted. This error was identified during resolution of Action Item 04.3.
2. HCV-1117: This backup isolation valve for excess letdown was not addressed as a separate FMEA line item. The omission was identified during resolution of Action Item 04.3. The valve control circuit is not EQ, so that a potential common-cause failure could occur.
3. Breakers 1RX1 and 1RY1: The potential common-cause seismic failure of these current-limiting reactor bypass breakers was not addressed in the FMEA (eg. item numbers 12.1.02.01.3 and 12.2.02.01.3 were not included). This omission was identified during resolution of Action Item 21.
4. FCV-1115A through -1115F: The potential common-cause effects of seal injection controller input failures, during a LOCA or MSLB inside containment, and common-mode effects of seal injection controller power failure (Regulated Bus #4), were not addressed. This omission was identified during resolution of Action Item 09.1.
5. Item 01.4.22.01.1: FCV-1115A/B/C will fail closed on loss of control power (to the associated I/Ps) rather than open, if instrument air pressure is still available. This error was identified during resolution of Action Item 09.1.
6. Item 04.3.07.03.1: The tag number for the associated instrument air valve is FWS-581 rather than FWS-381. (Typo.)
7. RV-787, PSV-M109, VCC-385: These CCW relief and CLR drain valves should have been included in the respective boundary valve analyses. This omission was identified during independent review of Revision 0 by the Nuclear Safety Group.
8. Items 06.4.21, 06.4.71: The boundary valve tag numbers should be CCW-428 instead of CCW-426, and CCW-492 instead of CCW-493. The backup isolation for CCW-492 is non-safety related valve CCW-493. (Typo.)
9. Safety Injection Actuation: The effect of specific groups of output relays failing to actuate (eg. due to subchannel Load Group or driver card failures) was not explicitly addressed. This simplification was made during Revision 0 development to accommodate time and manpower constraints, and has been carried as an open item for Revision 2.

APPENDIX C: RESOLUTION OF OPEN ITEMS FROM REVISION 0

NOTES FOR LIST OF OPEN ITEMS

1. Action items were developed to address the 26 categories of findings (see Section V.A) identified by Revision 0 of this analysis.
2. The action item numbering corresponds to the 26 categories of Revision 0 findings, with the exception of "Miscellaneous" Category 26. Subitems are identified by decimals (for example, 02.1, 02.2, etc).
3. The action items for "Miscellaneous" Category 26 are numbered from 26 to 37 to facilitate tracking of their status prior to SONGS 1 restart. Item numbers 28, 30 and 33 are not used.
4. The list includes all action items other than 'NO FURTHER ACTION REQUIRED' and 'SAME AS'.
5. Action item 24.2 is not associated with specific FMEA line items since, as discussed in Section II of this analysis, the RHR, PORV and Steam Dump functions were not included in the FMEA tables.

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
ACTION ITEM LIST

ACTION ITEM #	REVISION 1 ACTION ITEM	SCHEDULE
01.1	VERIFY: A) VALVE LOCKING PROGRAM CRITERIA DO NOT EXCLUDE CRITICAL MANUAL VALVES, AND B) OTHER ADMINISTRATIVE CONTROLS ARE SUFFICIENT TO PREVENT MISPOSITIONING OF MANUAL VALVES WHICH ARE NOT COVERED BY THE VALVE LOCKING PROGRAM	RESTART
01.2	EVALUATE MAIN FLOW PATH VALVES VCC-343 AND -344 AND ADD TO VALVE LOCKING PROGRAM AS NEEDED	RESTART
01.3	PREPARE FCNs TO ADD LOCKING DEVICES TO PZR-020, 021 AND OTHER VALVES AS NEEDED	RESTART
01.4	DETERMINE ALLOWABLE CCW SYSTEM LEAKAGE VIA CALCULATION	RESTART
01.5	DETERMINE ACTUAL CCW SYSTEM LEAKAGE VIA OPERATIONS LOGS OF SYSTEM MAKEUP	RESTART
01.6	EVALUATE ACTUAL VS. ALLOWABLE CCW SYSTEM LEAKAGE AND DETERMINE NEED FOR POST-ACCIDENT MAKEUP MODIFICATIONS	RESTART
02.1	DETERMINE APPLICABLE LEAK TEST REQUIREMENTS FOR CONTAINMENT ISOLATION FUNCTION OF SI VALVES AND INCLUDE ALLOWANCE IN DOSE CALCULATIONS	RESTART
02.2	REVISE IST AND OTHER PROCEDURES AS NEEDED FOR SI/RECIRC LEAKAGE TESTING	RESTART
02.3	DETERMINE APPLICABLE LEAK TEST REQUIREMENTS FOR RECIRC SYSTEM AND INCLUDE ALLOWANCE IN DOSE CALCULATIONS	RESTART
03.1	DETERMINE TMI-SOURCE TERM DOSE RATES FOR APPLICABLE MANUAL ACTION LOCATIONS, INCLUDING ACCESS/EGRESS ROUTES	RESTART
03.2	EVALUATE SHIELDING OR BEST-ESTIMATE SOURCE TERM TO RESOLVE MANUAL ACTION LOCATIONS AND ACCESS/EGRESS ROUTES WITH UNACCEPTABLE TMI-SOURCE TERM DOSE RATES	RESTART
03.3	OBTAIN REGULATORY RELIEF FROM TMI SOURCE TERMS FOR SINGLE FAILURE EVENTS IF NEEDED BASED ON DOSE CALCULATION RESULTS	RESTART
04.1	REVISE RWST AND SI/FW LO-LO SETPOINT CALCULATIONS TO ADDRESS INVENTORY DIVERSIONS	RESTART
04.2	MODIFY LETDOWN ISOLATION VALVES (INCLUDING LCV-1112) AS REQUIRED BY RWST INVENTORY, RECIRC FLOW RATE OR DOSE LIMITATIONS	RESTART
04.3	MODIFY EXCESS LETDOWN ISOLATION VALVES AS REQUIRED BY RWST INVENTORY, RECIRC FLOW RATE OR DOSE LIMITATIONS	RESTART
04.4	VERIFY CURRENT EOI FLOATING STEPS ADEQUATELY ADDRESS SI/FW TERMINATION WITH 125VDC BUS FAILURE	RESTART
05	RE-EVALUATE MSLB FOR 2 TRAIN SI WITH RWST DILUTION DUE TO CV-875A/B FAILURE	RESTART

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
ACTION ITEM LIST

ACTION ITEM #	REVISION 1 ACTION ITEM	SCHEDULE
06	IMPLEMENT MMP 1-3619 (INSTALL ICSB-18 POWER LOCK-OUT ON MOV-866A/B)	RESTART
07.1	IMPLEMENT MMP 1-3625 (INSTALL TRIP OF CHARGING PUMP G-8B ON REDUNDANT LOW-LOW-LOW VCT LEVEL SIGNAL)	RESTART
07.2	IMPLEMENT MMP 1-3659 (INSTALL REDUNDANT AUTO-CLOSED VCT ISOLATION VALVE) TO PREVENT GAS BINDING IN COMMON PORTION OF CHARGING PUMP SUCTION HEADER	RESTART
07.3	IMPLEMENT MMP 1-3639 (UPGRADE FCV-5051 ACTUATION TO SAFETY RELATED)	RESTART
07.4	LOCK CV-406A OR B CLOSED AS PER RESOLUTION OF NCR 1-P-7467 AND LER 1-90-06 TO PREVENT CHARGING PUMP GAS BINDING DUE TO LOSS OF UTILITY BUS	RESTART
08.1	PERFORM EVENT-SPECIFIC ANALYSIS OF CLR/HLR FLOW BALANCING	RESTART
08.2	REVISE EOIs AS NEEDED BASED ON ANALYSIS RESULTS	RESTART
09.1	PERFORM HYDRAULIC CALCULATION TO VERIFY MAXIMUM CHARGING PUMP FLOW POST-SIS/SISLOP	RESTART
09.2	MODIFY CHARGING AND/OR SEAL INJECTION VALVES TO LIMIT CHARGING PUMP FLOW AS NEEDED	RESTART
10.1	REVISE DCP 1-3548 TO SPECIFY APPROPRIATE ADMINISTRATIVE CONTROLS ON MOV-822A/B	RESTART
10.2	REVISE PROCEDURES (INCLUDING EOIs) AS NEEDED TO INCLUDE DCP 1-3548 REQUIREMENTS	RESTART
10.3	IMPLEMENT DCP 1-3548 HLR MODIFICATIONS	RESTART
10.4	VERIFY THAT QUALIFIED I/Ps ARE NOT REQUIRED FOR PY-1430C/H TO PRECLUDE FUNCTIONAL (b)(2) INTERACTION WITH PRIMARY PATH HLR	RESTART
11.1	IMPLEMENT CYCLE 12 RECIRC MODS	CYCLE 12
11.2	INCLUDE TECH SPEC CHANGE FOR OPERABILITY OF BOTH RECIRC PUMPS IN PCN 151	RESTART
11.3	REVISE EOIs AS REQUIRED TO: A) RUN BOTH RECIRC PUMPS UNTIL SPRAY SECURED (BOTH REF WTR PP TRIPPED), B) ENSURE THAT TRIPPED PUMPS ARE ON SAME TRAIN, AND C) DO NOT RESET THE CHARGING PUMP LOCKOUT RELAY AFTER MANUAL TRIP (IN ORDER TO PREVENT AUTO-RESTART)	RESTART
12.1	REVISE SECONDARY RECIRC EOI TO POSITION CV-142/143/144 LOCALLY IF UNSUCCESSFUL FROM CONTROL ROOM	RESTART
12.2	EXTEND TEMPORARY MODIFICATION TFM-1-90-FWS-001 (DISCONNECTION OF S/G OVERFILL SIGNALS FROM FCVs/CVs) UNTIL PERMANENT OVERFILL MODIFICATIONS ARE INSTALLED IN CYCLE 12	RESTART
12.3	EVALUATE ALTERNATE SECONDARY RECIRC FLOW PATH CAPABILITY FROM REFUELING WATER PUMP DISCHARGE TO RWST	RESTART

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
ACTION ITEM LIST

ACTION ITEM #	REVISION 1 ACTION ITEM	SCHEDULE
12.4	REVISE EOI TO INCLUDE SECONDARY RECIRCULATION ALIGNMENT VERIFICATION, AS NEEDED	RESTART
12.5	EVALUATE STEPS TO COMPENSATE FOR FCV-5051 INADVERTANT OPENING DURING SECONDARY RECIRC AND REVISE EOI AS NEEDED	RESTART
12.6	INSTALL MMP 1-3623 TO PROVIDE ISOLATION BETWEEN REDUNDANT SEQ BLOCK CIRCUITS	RESTART
13	REVISE EOI AS REQUIRED TO RUN BOTH RECIRC PUMPS UNTIL CONTAINMENT SPRAY FLOW IS SECURED (IE, BOTH REFUELING WATER PUMPS TRIPPED)	RESTART
14.1	PROVIDE LIST OF CCW FLOW PATH VALVES TO BE LOCKED TO ENSURE SAFETY RELATED FLOW PATHS ARE NOT DEGRADED (INCLUDING DIVERSION DUE TO EXCESSIVE FLOW THROUGH OTHER FLOW PATHS)	RESTART
14.2	ADD APPROPRIATE CCW VALVES TO THE VALVE LOCKING PROCEDURE	RESTART
14.3	VERIFY LOW FLOW ALARM SETPOINT PROVIDES ADEQUATE CHARGING PUMP LUBE OIL COOLING POST-ACCIDENT	RESTART
14.4	DETERMINE FUNCTIONAL REQUIREMENTS AND APPROPRIATE SURVEILLANCES FOR CCW CHECK VALVES, AND IMPLEMENT MODIFICATIONS AS NEEDED	RESTART
14.5	REVISE IST PROGRAM TO INCLUDE CCW CHECK VALVES AS NEEDED	RESTART
14.6	IMPLEMENT DCP 1-3553	RESTART
14.7	VERIFY BY EXISTING OR NEW CALCULATION THAT RCS FLOW INTO FAILED THERMAL BARRIER COIL IS LESS THAN 300 GPM LOCA THRESHHOLD	RESTART
15	COMPLETE CALCULATION (DC-3410) TO DETERMINE ACCEPTABILITY OF SWC/CCWHX BYPASSED CONFIGURATION	RESTART
16.1	PROVIDE ADMINISTRATIVE POWER LOCKOUT TO MOV-9, 11	RESTART
16.2	EQUALIFY MOV-9 AND 11 ACTUATORS AND GATES TO SEISMIC CATEGORY A	RESTART
17	REVISE SISLOP LOADING CALCULATION TO ACCOUNT FOR OUT OF SEQUENCE CCW/SWC PUMP LOADING	RESTART
18.1	DETERMINE LICENSING BASIS FOR HVAC RE: POST-ACCIDENT FUNCTION, AND RE: SINGLE FAILURE	RESTART
18.2	VALIDATE OR REVISE APPLICABLE POST-ACCIDENT TEMPERATURE CALCS FOR: CONTROL ROOM, CHG PP ROOM, 4KV AND 480V SWGR ROOMS, AND DETERMINE DURATION, IF ANY, THAT CONTROL ROOM TEMP WOULD EXCEED SEQ OR CSAS INST/LOGIC LIMITS AFTER FAILURE OF NORMAL HVAC	RESTART
18.3	OBTAIN REGULATORY RELIEF TO DEFER HVAC MODIFICATIONS, IF ANY, DETERMINED TO BE NEEDED BY MECHANICAL CALCULATIONS	RESTART
18.4	REVISE PROCEDURES (INCLUDING TECH SPEC ACTION ENTRY CRITERIA) AS NEEDED TO JUSTIFY OPERATION UNTIL COMPLETION OF ANY REQUIRED HVAC MODIFICATIONS	RESTART

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
ACTION ITEM LIST

ACTION ITEM #	REVISION 1 ACTION ITEM	SCHEDULE
18.5	DETERMINE IF CONTROL ROOM DOSE CALCULATIONS ARE CONSISTENT WITH SINGLE FAILURE BASIS (EG. 10 MIN INJECTION MODE SPRAY, 1 REF WTR PUMP AND NO CREDIT FOR HVAC FILTER UNIT)	RESTART
18.6	REVISE CONTROL ROOM DOSE CALCULATIONS TO BE CONSISTENT WITH SINGLE FAILURE AND CONTROL ROOM HABITABILITY UPGRADE CRITERIA AS PART OF UFSAR CHAPTER 15 REANALYSIS, AS NEEDED	CYCLE 12
19.1	EVALUATE ISOLATION ADEQUACY FOR UNQUALIFIED LOADS ON 125VDC BUS AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-7.C.2	CYCLE 12
19.2	REVISE BATTERY LOADING CALCULATION TO ACCOUNT FOR HIGH IMPEDANCE FAULTS OF UNQUALIFIED EQUIPMENT AS NEEDED	CYCLE 12
19.3	SUBMIT LICENSE AMENDMENT REQUEST TO DEFER MODIFICATIONS ADDRESSING SPURIOUS AUTO-TRANSFER OF VITAL BUSES UNTIL INTEGRATED RESOLUTION OF SEP TOPIC VI-7.C.2	RESTART
20.1	IMPLEMENT MMP 1-3633 TO PROVIDE BACKUP OVERCURRENT PROTECTION FOR RCP PENETRATIONS	RESTART
20.2	EVALUATE POTENTIAL FAULT PROPAGATION DUE TO COMMON-CAUSE FAULTS WITH CONCURRENT 125VDC FAILURE (EG. EXCITER DURING MSLB) AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-7.C.2	CYCLE 12
21.1	IMPLEMENT MMP 1-3634 TO CHANGE DG LOADING LOGIC FROM SISLOP TO SISLOB	RESTART
21.2	PERFORM CALCULATION TO DETERMINE CONDITIONS (EG. GRID VOLTAGE) UNDER WHICH SIS LOADING IS ACCEPTABLE WITH CURRENT-LIMITING REACTOR BYPASS BREAKER OPEN	RESTART
21.3	ISSUE TECH SPEC CLARIFICATION ON CURRENT-LIMITING REACTOR BYPASS BREAKER REQUIREMENTS	RESTART
22	VERIFY THAT PROCEDURES EXIST TO BRING ADDITIONAL DG FUEL ONSITE BEFORE 7 DAY ONSITE SUPPLY COULD BE EXHAUSTED POST-ACCIDENT	RESTART
23.1	VERIFY WHETHER NRC BTP 9.5-1 AND APPENDIX R EXCLUDE BOTH FIRES AND EXPLOSIONS MECHANISTICALLY CAUSED BY AN ACCIDENT (EG. OF HYDROGEN DUE TO LUBE OIL/SEAL OIL FAILURE OR XFMR DUE TO FAULT WITH PROTECTION FAILURE, POST-SIS/SISLOP)	RESTART
23.2	ADDRESS MECHANISTICALLY CAUSED FIRES AND EXPLOSIONS NOT EXCLUDED BY NRC BTP 9.5-1 OR APPENDIX R AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-7.C.2, IF NEEDED	CYCLE 12
24.1	REVISE SGTR DOSE CALCULATIONS (AS NEEDED TO PRECLUDE CREDIT FOR RCPs) AS PART OF UFSAR CHAPTER 15 REANALYSIS	CYCLE 12

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
ACTION ITEM LIST

ACTION ITEM #	REVISION 1 ACTION ITEM	SCHEDULE
24.2	ESTABLISH SCE POSITION ON SINGLE FAILURE APPLICABILITY TO RHR, PORV AND STEAM DUMP FUNCTIONS AND OBTAIN RELIEF FROM NRC AS NEEDED	RESTART
25.1	IDENTIFY EXISTING BASIS OF UFSAR SECTION 6.2.5 FOR ADEQUACY OF POST-ACCIDENT CONTAINMENT HYDROGEN MIXING VIA CONTAINMENT SPRAY	RESTART
25.2	REVIEW POST-LOCA CONTAINMENT HYDROGEN MIXING AS PART OF DBD	CYCLE 12
26	VERIFY SEQ/CSAS SURVEILLANCE PROCEDURES DETECT INDIVIDUAL RELAY (CONTACT) FAILURES	RESTART
27	REVIEW EOIs AND REVISE TO CLOSE SAMPLE VALVES IF NEEDED POST-ACCIDENT	RESTART
29	INCLUDE CONTACTOR STATUS INDICATING LIGHTS AND SURVEILLANCE REQUIREMENTS FOR MOV-883 IN MMP 1-3619 TO PREVENT AN UNDETECTED LOSS OF CONTACTOR REDUNDANCY	RESTART
31	IMPLEMENT MMP 1-3636 TO MODIFY CCW PUMP CONTROL LOGIC SO THAT SIS/SISLOP WILL START THE PUMP IRRESPECTIVE OF WHETHER THE CONTROL SWITCH IS IN AUTO	RESTART
32.1	SUBMIT PCN 151 INCLUDING CV-517/518 REQUIREMENTS	RESTART
32.2	REVISE MMP 1-3582 TO INCLUDE APPROPRIATE VALVE DRIFT SURVEILLANCE REQUIREMENTS FOR CV-517/518	RESTART
32.3	REVISE IST PROGRAM AS NEEDED TO INCLUDE VALVE DRIFT CRITERIA FOR CV-517/518	RESTART
32.4	MODIFY CONTAINMENT SPRAY PENETRATION ISOLATION CONFIGURATION TO COMPLY WITH SEP TOPIC VI-4 ISOLATION CRITERIA OR PROVIDE OTHER JUSTIFICATION (EG. FORMAL CALC TO DEMONSTRATE RECIRC PP LOOP SEAL AT PENETRATION), AND FORWARD ANY UFSAR CHANGES TO LICENSING	RESTART
32.5	OBTAIN NRC CONCURRENCE WITH DEVIATIONS OF CONTAINMENT SPRAY PENETRATION ISOLATION CONFIGURATION FROM SEP TOPIC VI-4 CRITERIA AS NEEDED	RESTART
34.1	REVISE PROCEDURES AS NEEDED TO ADDRESS RE-ENERGIZING THE UTILITY BUS FROM MCC-1 VIA MTS-7	RESTART
34.2	IDENTIFY VITAL AND UTILITY BUS TRANSFER SWITCH SURVEILLANCE REQUIREMENTS	RESTART
34.3	PROVIDE TECH SPEC CLARIFICATION TO IMPLEMENT VITAL/UTILITY BUS AND TRANSFER SWITCH LCO AND SURVEILLANCE REQUIREMENTS UNTIL TECH SPEC CHANGE IS PROCESSED	RESTART
34.4	IMPLEMENT VITAL/UTILITY BUS AND TRANSFER SWITCH REQUIREMENTS IN APPLICABLE PROCEDURES (INCLUDING EOIs)	RESTART

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFRE UNIT 1
ACTION ITEM LIST

ACTION ITEM #	REVISION 1 ACTION ITEM	SCHEDULE
35.1	VERIFY LICENSING BASIS REQUIREMENTS FOR ALTERNATE OFFSITE SOURCE RE: CAPABILITY TO START/POWER ECCS LOADS, AND OBTAIN TECH SPEC RELIEF IF REQUIRED	RESTART
35.2	ISSUE TECH SPEC CLARIFICATION TO REQUIRE ACTION STATEMENT ENTRY FOR BUS 1C OR 2C INOPERABLE WHENEVER ENERGIZED FROM A/B XFMR	RESTART
35.3	PERFORM CALCULATION TO DETERMINE CONDITIONS (EG. GRID VOLTAGE AND BUS LOAD) UNDER WHICH RCPs MAY BE RESTARTED FROM BUS 1C/2C WITH ECCS LOADS ALREADY RUNNING	RESTART
35.4	REVISE EOIs AS NEEDED TO REFLECT ELECTRICAL CALCULATION RESULTS FOR RCP RESTART LIMITATIONS	RESTART
35.5	EVALUATE EOI CHANGES TO PRECLUDE DG DROOP IN ISOLATED MODE	RESTART
35.6	EVALUATE CONTINUED ACCEPTABILITY OF NO MAINTAINED LOCKOUT ON SIS AND SISLOP FOR NSR LOADS AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-7.C.2. (CONFIGURATION ACCEPTABLE UNTIL THEN BASED ON AMENDMENT 38 SECTION 1.3.7.1)	CYCLE 12
36.1	IDENTIFY CALCULATION WHICH DEMONSTRATES 480V BREAKER COORDINATION	RESTART
36.2	IDENTIFY CALCULATION WHICH JUSTIFIES MAIN FW PUMP FAN COOLER OPERATION IN A STEAM ENVIRONMENT (EG. POST-MSLB)	RESTART
36.3	ISSUE CLARIFICATION TO IDENTIFY 52-1200 AS A TIE BRKR WITHIN DEFINITION OF TECH SPEC 3.7 LCO	RESTART
37.1	EVALUATE: 125VDC BUS % GROUND CRITERIA FOR TECH SPEC ACTION ENTRY AND/OR MODIFICATIONS TO ELIMINATE TRAIN-COMMON 125VDC DEVICES AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-7.C.2	CYCLE 12
37.2	VERIFY EQDPs FOR 125VDC LOADS BOUND CONDITIONS OF EQUALIZING CHARGE	RESTART
37.3	IDENTIFY SR/NSR ISOLATION DEVICE SURVEILLANCE REQUIREMENTS FOR MCCs, 125VDC AND 120VAC BUSES	RESTART
37.4	VERIFY RMOs EXIST WHICH IMPLEMENT SR/NSR ISOLATION DEVICE SURVEILLANCE REQUIREMENTS IDENTIFIED BY ELECTRICAL	RESTART
37.5	VERIFY LCOAR PROCESS AND RELATED PROCEDURES REQUIRE TECH SPEC ACTION ENTRY WITH FAILURE OF BUS/MCC SR/NSR ISOLATION DEVICE (EG. UNTIL AFFECTED LOAD IS ISOLATED)	RESTART

NOTES FOR TABLE OF ACTION ITEMS FOR SIGNIFICANT FINDINGS

1. The table of Action Items for significant findings tabulates which action item(s) address specific line item findings from the Revision 0 FMEA.
2. The table is a composite of two DBASE III databases: that for the Revision 0 FMEA, and another for Action Items. The databases are related using the DBASE III View function so that 1 or more Action Item records are related to each of the 472 Revision 0 FMEA records flagged as a finding. The first 6 fields of each line item in the composite table are printed from the Revision 0 FMEA, and the last 3 fields from the related Action Item records. The FMEA line item is repeated where there is more than applicable Action Item.
3. To limit the Action Item database to a manageable size, "(SAME AS XX.X.XX.XX.X)" notation is used. With this notation, the Action Items are fully spelled out for the first FMEA line item to which they apply in each section. For subsequent FMEA line items in that section, the Report Item number is used but the description is condensed to refer to the first FMEA line item number. This permits subsequent reference to a specific group of related Action Items (YY.1, YY.2, etc) with a single record using the group Action Item number (YY).

For example: In Section 12.1/12.2 (4kV Auxiliary Power), Action Item 21.1 is identified for FMEA line item 12.1.01.01.1, and Action Items 21.2 and 21.3 (but not 21.1) for FMEA line item 12.1.02.01.1. Subsequent FMEA line item 12.1.02.02.1 references (group) Action Item 21 and "(SAME AS 12.1.2.1.1)" to invoke Action Items 21.2 and 21.3.

4. As identified in the Appendix B Errata, line items for common-cause failures of HCV-1117 (EQ) and breakers 1RX1 and 1RY1 (seismic) were inadvertently omitted from the Revision 0 FMEA database. These errata items are addressed by Action items 04.3 and 21.2/21.3, respectively.

NOTE: The common-cause seismic failure of 1RX1 and 1RY1 requires that the Technical Specification Action for an inoperable offsite source be entered WHENEVER the grid voltage and other applicable conditions would not support SIS loading with the breakers open, IRRESPECTIVE of initial breaker position. This restriction applies until the breakers are upgraded to Seismic Interaction B/A criteria or other modifications are implemented to eliminate this susceptibility.

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB 040982 UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
01.1.02.01.1	MANUAL VALVES TRAIN A BOUNDARY		OPEN	*INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, DIVERSION OF RWST INVENTORY	*SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. DIVERSION BOUNDED BY CV-36/37 FAILURE WITH LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS	01.1	VERIFY: A) VALVE LOCKING PROGRAM CRITERIA DO NOT EXCLUDE CRITICAL MANUAL VALVES, AND B) OTHER ADMINISTRATIVE CONTROLS ARE SUFFICIENT TO PREVENT MISPOSITIONING OF MANUAL VALVES WHICH ARE NOT COVERED BY THE VALVE LOCKING PROGRAM	OPERATIONS
01.1.04.01.1	HV-853B	VALVE/ACTUATOR	OPEN	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIG/SISLOP. NO EFFECT IF AFTER	INCLUDES SV-1, SV-2, SV-320. TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST	05	RE-EVALUATE NSLR FOR 2 TRAIN SI AND THIS DILUTION FAILURE	NUCLEAR
01.1.04.05.1	HV-853B	83-5 (RBLAY)	ON	*(SAME AS 1.1.4.1.1)	RBLAY ENERGIZED BY HV-853B NOT CLOSED LIMIT SWITCHES	05	(SAME AS 1.1.4.1.1)	
01.1.04.05.2	HV-853B	83-5 (RBLAY)	OFF	*PARTIAL DIVERSION OF SI FLOW FROM TRAIN A AFTER SEQ BLOCK/RSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03.1	DETERMINE THE SOURCE TERM DOSE RATES FOR APPLICABLE MANUAL ACTION LOCATIONS, INCLUDING ACCESS/EGRESS ROUTES	NUCLEAR
01.1.04.05.2	HV-853B	83-5 (RBLAY)	OFF	*PARTIAL DIVERSION OF SI FLOW FROM TRAIN A AFTER SEQ BLOCK/RSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03.2	EVALUATE SHIELDING OR BEST-ESTIMATE SOURCE TERM TO RESOLVE MANUAL ACTION LOCATIONS AND ACCESS/EGRESS ROUTES WITH UNACCEPTABLE THE-SOURCE TERM DOSE RATES	NUCLEAR
01.1.04.05.2	HV-853B	83-5 (RBLAY)	OFF	*PARTIAL DIVERSION OF SI FLOW FROM TRAIN A AFTER SEQ BLOCK/RSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03.3	OBTAIN REGULATORY RELIEF FROM THE SOURCE TERMS FOR LICENSING SINGLE FAILURE EVENTS IF WESDRO BASED ON DOSE CALCULATION RESULTS	
01.1.04.05.2	HV-853B	83-5 (RBLAY)	OFF	*PARTIAL DIVERSION OF SI FLOW FROM TRAIN A AFTER SEQ BLOCK/RSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	04.1	REVISE RWST AND SI/PW LO-LO SETPOINT CALCULATIONS TO ADDRESS INVENTORY DIVERSIONS	NUCLEAR
01.1.04.06.2	HV-853B	SRQ 1 (19-1, 3)	CONTACTS CLOSED (ON)	*(SAME AS 1.1.4.1.1)		05	(SAME AS 1.1.4.1.1)	
01.1.05.03.2	HV-854B	SV-3900	ON (OPEN)	NONE	*CONTAINMENT ISOLATION FUNCTION EVALUATED IN RSP SPA. NOV-850A/B/C ARE REDUNDANT CONTAINMENT ISOLATION VALVES TO HV-851A/B AND SV-2900/3900, BUT PENETRATIONS AND VALVES NOT TYPE C LEAK TESTED PER 10CFR50 APPENDIX J	02.1	DETERMINE APPLICABLE LEAK TEST REQUIREMENTS FOR CONTAINMENT ISOLATION FUNCTION OF SI VALVES AND INCLUDE ALLOWANCE IN DOSE CALCULATIONS	NUCLEAR
01.1.05.03.2	HV-854B	SV-3900	ON (OPEN)	NONE	*CONTAINMENT ISOLATION FUNCTION EVALUATED IN RSP SPA. NOV-850A/B/C ARE REDUNDANT CONTAINMENT ISOLATION VALVES TO HV-851A/B AND SV-2900/3900, BUT PENETRATIONS AND VALVES NOT TYPE C LEAK TESTED PER 10CFR50 APPENDIX J	02.2	REVISE IST AND OTHER PROCEDURES AS NEEDED FOR SI/RECIRC LEAKAGE TESTING	STATION TECH
01.1.06.03.1	G-3B	83-5 (RBLAY)	OFF	*PARTIAL DIVERSION OF TRAIN A SI FLOW AFTER SEQ BLOCK/RSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	04	(SAME AS 1.1.4.5.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
01.1.06.08.2 G-38		83-5 (RBLAY)	ON	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER.	TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 05	(SAME AS 1.1.4.1.1)		
01.1.06.09.1 G-38		CV-875B	OPEN	*(SAME AS 1.1.6.8.2)	*INCLUDES SV-875B, LG-2 (ZSC-1875B)	05	(SAME AS 1.1.4.1.1)	
01.1.06.10.1 G-38		CV-37	OPEN	*PARTIAL DIVERSION OF TRAIN A FW PUMP FLOW TO CONDENSER VIA MINIFLOW VALVE CV-37	*INCLUDES SV-18, 18A. RWST INVENTORY CALCULATION INCLUDES LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03	(SAME AS 1.1.4.5.2)	
01.1.06.10.1 G-38		CV-37	OPEN	*PARTIAL DIVERSION OF TRAIN A FW PUMP FLOW TO CONDENSER VIA MINIFLOW VALVE CV-37	*INCLUDES SV-18, 18A. RWST INVENTORY CALCULATION INCLUDES LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	04	(SAME AS 1.1.4.5.2)	
01.1.06.13.1 G-38		SRQ 1 (53-1, 3)	CONTACTS OPEN (OFF)	*(SAME AS 1.1.6.10.1)	NORMAL POSITION	03	(SAME AS 1.1.4.5.2)	
01.1.06.13.1 G-38		SRQ 1 (53-1, 3)	CONTACTS OPEN (OFF)	*(SAME AS 1.1.6.10.1)	NORMAL POSITION	04	(SAME AS 1.1.4.5.2)	
01.1.06.14.2 G-38		SRQ 1 (38-9, 11)	CONTACTS CLOSED (ON)	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 05	(SAME AS 1.1.4.1.1)		
01.1.06.15.1 G-38		BUS #1C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN A FLOW TO CONDENSER VIA CV-37	*RWST CALCULATIONS INCLUDE CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03	(SAME AS 1.1.4.5.2)	
01.1.06.15.1 G-38		BUS #1C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN A FLOW TO CONDENSER VIA CV-37	*RWST CALCULATIONS INCLUDE CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	04	(SAME AS 1.1.4.5.2)	
01.1.06.18.1 G-38		GMI	PRESSURE LOW	*INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN A FLOW TO CONDENSER	*TRAIN A FW PUMP MAY FAIL DURING SBLOCA OR HOLD IF CV-875B CLOSED. RWST INVENTORY CALCULATIONS INCLUDE CV-36/37 FAILURE OPEN, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS	03	(SAME AS 1.1.4.5.2)	
01.1.06.18.1 G-38		GMI	PRESSURE LOW	*INOPERABILITY OF TRAIN A PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN A FLOW TO CONDENSER	*TRAIN A FW PUMP MAY FAIL DURING SBLOCA OR HOLD IF CV-875B CLOSED. RWST INVENTORY CALCULATIONS INCLUDE CV-36/37 FAILURE OPEN, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS	04	(SAME AS 1.1.4.5.2)	
01.1.08.01.1 HV-852B		VALVE/ACTUATOR	OPEN	*SI DELIVERY TIME INCREASED, SI RELIABILITY REDUCED (VIA NON-SEISMIC POSITION OF FW HEADS).	NORMAL POSITION. INCLUDES SV-1, SV-2, SV-529. BACKUP VALVES ARE SAFETY RELATED, SEISMIC CATEGORY A. VALVE OPEN NORMAL FOR SECONDARY RECIRC		NO FURTHER ACTION REQUIRED. THIS CONFIGURATION WAS APPROVED AS PART OF SEP TOPIC III-6 LONG TERM SEISMIC SCOPE	
01.1.08.02.1 HV-852B		SRQ 1 (17-5, 7)	CONTACTS OPEN (OFF)	*(SAME AS 1.1.8.1.1)	NORMAL POSITION		(SAME AS 1.1.8.1.1)	
01.1.08.03.1 HV-852B		125VDC BUS #1 (72-13)	VOLTS LOW	*SI DELIVERY TIME INCREASED, SI RELIABILITY REDUCED (VIA NON-SEISMIC POSITION OF FW HEADS)	VALVE OPEN NORMAL FOR SECONDARY RECIRC		(SAME AS 1.1.8.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONEFB UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

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ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RSBP DISCIPLINE
01.2.02.01.1	MANUAL VALVES TRAIN B BOUNDARY		OPEN	*IMPERABILITY OF TRAIN B SI PUMPING, DIVERGENCE OF RWST INVENTORY	*SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. DIVERGENCE BOUNDED BY CV-36/37 FAILURE WITH LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS	01	(SAME AS 1.1.2.1.1)	
01.2.04.01.1	HV-853A	VALVE/ACTUATOR	OPEN	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	INCLUDES SV-1, SV-2, SV-526. TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST	05	(SAME AS 1.1.4.1.1)	
01.2.04.05.1	HV-853A	83-5 (RBLAT)	ON	* (SAME AS 1.2.4.1.1)	RBLAT ENERGIZED BY HV-853A NOT CLOSED LIMIT SWITCHES	05	(SAME AS 1.1.4.1.1)	
01.2.04.05.2	HV-853A	83-5 (RBLAT)	OFF	*PARTIAL DIVERGENCE OF SI FLOW FROM TRAIN B AFTER SEQ BLOCK/RBSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03	(SAME AS 1.1.4.5.2)	
01.2.04.05.2	HV-853A	83-5 (RBLAT)	OFF	*PARTIAL DIVERGENCE OF SI FLOW FROM TRAIN B AFTER SEQ BLOCK/RBSBT VIA MINIFLOW VALVE CV-37 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	01	(SAME AS 01.1.4.5.2)	
01.2.04.06.2	HV-853A	SEQ 2 (19-6, 8)	CONTACTS CLOSED (ON)	* (SAME AS 1.2.4.1.1)		05	(SAME AS 1.1.4.1.1)	
01.2.05.03.2	HV-854A	SV-2900	ON (OPEN)	NONE	*CONTAINMENT ISOLATION FUNCTION EVALUATED IN RSP SPA. NOV-850A/B/C ARE REDUNDANT CONTAINMENT ISOLATION VALVES TO HV-851A/B AND SV-2900/3900, BUT PENETRATIONS AND VALVES NOT TYPE C LEAK TESTED PER 10CFR50-APPENDIX J	02	(SAME AS 1.1.5.3.2)	
01.2.06.08.1	G-3A	83-5 (RBLAT)	OFF	*PARTIAL DIVERGENCE OF TRAIN B SI FLOW AFTER SEQ BLOCK/RBSBT VIA MINIFLOW VALVE CV-36 TO CONDENSER	*NORMAL POSITION. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	04	(SAME AS 1.1.4.5.2)	
01.2.06.08.2	G-3A	83-5 (RBLAT)	ON	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER.	TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST	05	(SAME AS 1.1.4.1.1)	
01.2.06.09.1	G-3A	CV-875A	OPEN	* (SAME AS 1.2.6.8.2)	INCLUDES SV-875A, LS-2 (Z9C-1875A)	05	(SAME AS 1.1.4.1.1)	
01.2.06.10.1	G-3A	CV-36	OPEN	*PARTIAL DIVERGENCE OF TRAIN B FW PUMP FLOW TO CONDENSER VIA MINIFLOW VALVE CV-36	INCLUDES SV-17, 17A. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03	(SAME AS 1.1.4.5.2)	
01.2.06.10.1	G-3A	CV-36	OPEN	*PARTIAL DIVERGENCE OF TRAIN B FW PUMP FLOW TO CONDENSER VIA MINIFLOW VALVE CV-36	*INCLUDES SV-17, 17A. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	04	(SAME AS 1.1.4.5.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB CONDENSER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
01.2.06.13.1	G-3A	SBQ 2 (53-1, 3)	CONTACTS OPEN (OFF)	*(SAMB AS 1.2.6.10.1)	NORMAL POSITION	03	(SAMB AS 1.1.4.5.2)	
01.2.06.13.1	G-3A	SBQ 2 (53-1, 3)	CONTACTS OPEN (OFF)	*(SAMB AS 1.2.6.10.1)	NORMAL POSITION	04	(SAMB AS 1.1.4.5.2)	
01.2.06.14.2	G-3A	SBQ 2 (38-9, 11)	CONTACTS CLOSED (ON)	*REDUCTION IN RWST BORON CONCENTRATION IF PRIOR TO SIS/SISLOP. NO EFFECT IF AFTER	TECHNICAL SPECIFICATIONS 3.3.3 AND 4.1.1 GOVERN THE RWST	05	(SAMB AS 1.1.4.1.1)	
01.2.06.15.1	G-3A	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN B FLOW TO CONDENSER VIA CV-36	*RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	03	(SAMB AS 1.1.4.5.2)	
01.2.06.15.1	G-3A	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN B FLOW TO CONDENSER VIA CV-36	*RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION NOT ACCESSIBLE WITH THE SOURCE TERMS	04	(SAMB AS 1.1.4.5.2)	
01.2.06.18.1	G-3A	GHI	PRESSURE LOW	*INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN B SI FLOW TO CONDENSER	*TRAIN B PW PUMP MAY FAIL DURING SBLOCA OR NSLB IF CV-875A CLOSED. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE OPEN, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS	03	(SAMB AS 1.1.4.5.2)	
01.2.06.18.1	G-3A	GHI	PRESSURE LOW	*INOPERABILITY OF TRAIN B PUMPING FOR SI AND SECONDARY RECIRC, OR PARTIAL DIVERSION OF TRAIN B SI FLOW TO CONDENSER	*TRAIN B PW PUMP MAY FAIL DURING SBLOCA OR NSLB IF CV-875A CLOSED. RWST INVENTORY CALCULATION INCLUDES CV-36/37 FAILURE OPEN, LOCAL MANUAL BACKUP ISOLATION AFTER 30 MINUTES. LOCATION INACCESSIBLE WITH THE SOURCE TERMS	04	(SAMB AS 1.1.4.5.2)	
01.2.08.01.1	HV-852A	VALVE/ACTUATOR	OPEN	*SI DELIVERY TIME INCREASED, SI RELIABILITY REDUCED (VIA NON-SEISMIC PORTION OF PW HEADERS).	NORMAL POSITION. INCLUDES SV-1, SV-2, SV-525. BACKUP VALVES ARE SAFETY RELATED, SEISMIC CATEGORY A. VALVE OPEN NORMAL FOR SECONDARY RECIRC		(SAMB AS 1.1.8.1.1)	
01.2.08.02.1	HV-852A	SBQ 2 (18-2, 4)	CONTACTS OPEN (OFF)	*(SAMB AS 1.2.8.1.1)	NORMAL POSITION		(SAMB AS 1.1.8.1.1)	
01.2.08.03.1	HV-852A	125VDC BUS #2 (72-211)	VOLTS LOW	*SI DELIVERY TIME INCREASED, SI RELIABILITY REDUCED (VIA NON-SEISMIC PORTION OF PW HEADERS)	VALVE OPEN NORMAL FOR SECONDARY RECIRC		(SAMB AS 1.1.8.1.1)	
01.4.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	*PARTIAL DIVERSION OF 2 TRAIN SI FLOW, BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW, CV-36/37 FAILURE FOR RWST INVENTORY	SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	01	(SAMB AS 1.1.2.1.1)	
01.4.02.02.1	CHASE AND BSLIBP VALVES, COMMON BOUNDARY		NORMAL (PASSIVE)	*NONE FOR SI FLOW RATE. HOWEVER, LOSS OF INVENTORY NOT INCLUDED IN RWST CALCULATION	SEE TABLE 1-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. INCLUDES S19-385 AND RV-868. S19-385 IS A SPRING CHECK VALVE	04	(SAMB AS 1.1.4.5.2)	
01.4.05.05.5	PCV-456 CV-142	LT-453 LOOP	BQ	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-454 AND LT-455	*NON-BQ S/G NR LEVEL INTS ASSUMED COMMON-CAUSE FAILURES DURING NSLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE DELAYS LC-453B-E2, LC-454B-E2G AND LC-455B-E2G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERRIDE PROTECTION MODIFICATIONS	12.1	REVERSE SECONDARY RECIRC ROI TO POSITION CV-142/143/144 LOCALLY IF UNSUCCESSFUL FROM CONTROL ROOM	OPERATIONS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BCCS	REMARKS	REPORT ITEM	ACTION ITEM	RISP DISCIPLINE
01.4.06.05.5	PCV-156 CV-142	LT-453 LOOP	BQ	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-454 AND LT-455	*NONE-BQ S/G NR LEVEL INTBS ASSUMED COMMON-CAUSE FAILURES DURING NSLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS	12.2	RETRND TEMPORARY MODIFICATION TFM-1-90-FWS-001 (DISCONNECTION OF S/G OVERFILL SIGNALS FROM PCVs/CVs) UNTIL PERMANENT OVERFILL MODIFICATIONS ARE INSTALLED IN CYCLE 12	MECHANICAL
01.4.07.05.5	PCV-157 CV-141	LT-454 LOOP	BQ	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-455	*NONE-BQ S/G NR LEVEL INTBS ASSUMED COMMON-CAUSE FAILURES DURING NSLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS	12	(SAME AS 1.4.6.5.5)	
01.4.08.05.5	PCV-158 CV-143	LT-455 LOOP	BQ	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C WITH CONCURRENT COMMON-CAUSE FAILURE OF LT-453 AND LT-454	*NONE-BQ S/G NR LEVEL INTBS ASSUMED COMMON-CAUSE FAILURES DURING NSLB INSIDE CONTAINMENT. UPSCALE FAILURE WOULD ENERGIZE RELAYS LC-453B-12, LC-454B-12G AND LC-455B-12G, HOWEVER CIRCUIT TO BE DISCONNECTED PENDING CYCLE 12 OVERFILL PROTECTION MODIFICATIONS	12	(SAME AS 1.4.6.5.5)	
01.4.09.01.2	PCV-156 CV-142,143,144	SBQ 1 (16-9, 11)	CONTACTS CLOSED (ON)	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C	*LOW FRED FLOW WILL BE INDICATED. EVALUATION OF MANUAL BYPASS PATH OR LEAD LIFTING REQUIRED TO MITIGATE EFFECTS ON SECONDARY RECIRCULATION	12	(SAME AS 1.4.6.5.5)	
01.4.09.02.2	PCV-157,158 CV-142,143,144	SBQ 2 (17-1, 3)	CONTACTS CLOSED (ON)	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C	*LOW FRED FLOW WILL BE INDICATED. EVALUATION OF MANUAL BYPASS PATH OR LEAD LIFTING REQUIRED TO MITIGATE EFFECTS ON SECONDARY RECIRCULATION	12	(SAME AS 1.4.6.5.5)	
01.4.09.05.1	PCV-156,157,158 CV-142,143,144	APWAS-A	TRIPPED (CONTACTS CLOSED)	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER HPW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR HPW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY RECIRC	12	(SAME AS 1.4.6.5.5)	
01.4.09.06.1	PCV-156,157,158 CV-142,143,144	APWAS-B	TRIPPED (CONTACTS CLOSED)	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER HPW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR HPW PUMP BREAKER BACKOUT/RECLOSE TO MITIGATE THIS FAILURE FOR SECONDARY RECIRC	12	(SAME AS 1.4.6.5.5)	
01.4.09.07.1	PCV-156,157,158 CV-142,143,144	152-11C04 ("b"CONTACT) 152-12C04 ("b"CONTACT)	CONTACT CLOSED	NONE FOR SI AND SECONDARY RECIRC	*SECONDARY RECIRC UNAFFECTED BECAUSE S/G LEVEL RESTORED TO 70% BY APW FLOW PER BOI, PRIOR TO INITIATING SECONDARY RECIRC FLOW. RESET OF APWAS (WITH LEVEL > 5%) DISARMS CHECK VALVE BACKUP MODE FOR PCVs AND CVs. BOI VERIFICATION REQUIRED		NO FURTHER ACTION REQUIRED. REV 5 OF S01-1.0-12 ALREADY INCLUDES THIS REQUIREMENT	
01.4.09.08.2	PCV-156,157,158 CV-142,143,144	TT12, TT12-190 TT13-190 (RELAYS)	CONTACTS CLOSED (ON)	NONE FOR SI AND SECONDARY RECIRC	*SECONDARY RECIRC UNAFFECTED BECAUSE S/G LEVEL RESTORED TO 70% BY APW FLOW PER S01, PRIOR TO INITIATING SECONDARY RECIRC FLOW. RESET OF APWAS (WITH LEVEL > 5%) DISARMS CHECK VALVE BACKUP MODE FOR PCVs AND CVs. BOI VERIFICATION REQUIRED		(SAME AS 1.4.9.7.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRS UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
01.4.09.10.1	PCV-456,457,458 CV-142,143,144	VITAL BUS #3A (8-3315V)	VOLTS LOW	*NONE FOR SI, LOSS OF SECONDARY RBCIRC TO S/G A/B/C AFTER RFW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR RFW PUMP BREAKER BACKOUT/RBCLOSE TO MITIGATE THIS FAILURE FOR SECONDARY RBCIRC. ANNUNCIATION OCCURS FROM APVAs-A ACTUATION OR TROUBLE	12	(SAME AS 1.4.6.5.5)	
01.4.09.11.1	PCV-456,457,458 CV-142,143,144	VITAL BUS #5 (8-2901V)	VOLTS LOW	*NONE FOR SI, LOSS OF SECONDARY RBCIRC TO S/G A/B/C AFTER RFW PUMPS TRIPPED	*EVALUATION REQUIRED FOR LEAD LIFTING, USE OF MANUAL BYPASS VALVES OR RFW PUMP BREAKER BACKOUT/RBCLOSE TO MITIGATE THIS FAILURE FOR SECONDARY RBCIRC. ANNUNCIATION OCCURS ON APVAs-B ACTUATION OR TROUBLE	12	(SAME AS 1.4.6.5.5)	
01.4.09.12.1	PCV-456,457,458 CV-142,143,144	ISA	PRESSURE LOW	*NONE FOR SI (ISA NOT CREDITED FOR PCV CLOSURE), LOSS OF SECONDARY RBCIRC TO S/G A/B/C	*EACH PCV HAS SEPARATE BACKUP N2 (GW1) SUPPLY FOR CLOSURE. COMMON-CAUSE FAILURE NOT POSTULATED DURING SECONDARY RBCIRC, BUT SINGLE FAILURE OF ISA-960 COULD ISOLATE ISA TO CVs. EVALUATION OF MANUAL BYPASS PATHS REQD FOR MITIGATING EFFECTS ON SECONDARY RBCIRC	12	(SAME AS 1.4.6.5.5)	
01.4.10.01.1	NOV-1204	VALVE/ACTUATOR	OPEN	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION AND INJECTION OF CONDENSATE	*CROSS-TIE VALVE FROM APW PUMP C-105 TO MAIN PW HEADER. ACCEPTABILITY REQUIRES: 1) APW LOGIC TO PREVENT TRAIN A START UNLESS TRAIN B FAILED, 2) DUAL FAILURE OF NOV-1204 OPEN PLUS APW TRAIN B IS OUTSIDE DESIGN BASIS. APW CHECK VALVE NOT SEAT LEAK TESTED		NO FURTHER ACTION REQUIRED. DIVERSION/CONDENSATE INJECTION REQUIRES DOUBLE FAILURES WHICH ARE OUTSIDE SIS/SISLOP DESIGN BASIS	
01.4.10.02.1	NOV-1204	SBQ 1 (49-1,3)	CONTACTS OPEN (OFF)	(SAME AS 1.4.10.1.1)	*CROSS-TIE FROM APW PUMP C-105 TO MAIN PW HEADER. ACCEPTABILITY REQUIRES: 1) APW LOGIC TO PREVENT TRAIN A START UNLESS TRAIN B FAILED AND 2) DUAL FAILURE OF NOV-1204 OPEN PLUS APW TRAIN B IS OUTSIDE DESIGN BASIS. APW CHECK VALVE NOT SEAT LEAK TESTED		(SAME AS 1.4.10.1.1)	
01.4.10.04.1	NOV-1204	BCC-1 (42-1127)	VOLTS LOW	REDUCED REDUNDANCY AGAINST SI FLOW DIVERSION AND INJECTION OF CONDENSATE TO RCS	*CROSS-TIE FROM APW PUMP C-105 TO MAIN PW HEADER. ACCEPTABILITY REQUIRES: 1) APW LOGIC TO PREVENT TRAIN A START UNLESS TRAIN B FAILED AND 2) DUAL FAILURE OF NOV-1204 OPEN PLUS APW TRAIN B IS OUTSIDE DESIGN BASIS. APW CHECK VALVE NOT SEAT LEAK TESTED		(SAME AS 1.4.10.1.1)	
01.4.16.01.1	CV-202	VALVE/ACTUATOR	OPEN	*PARTIAL DIVERSION OF 2 TRAIN SI FLOW, BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW, CV/36/37 FAILURE FOR RWST INVENTORY	*INCLUDES BV-1202. BOI REV REQUIRED TO SPECIFY CLOSING CV-525 AND CV-525 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC REV REQUIRED TO ADDRESS UNISOLABLE FLOW FROM RCS TO PRT VIA BV-206	04.1	(SAME AS 1.1.4.5.2)	
01.4.16.01.1	CV-202	VALVE/ACTUATOR	OPEN	*PARTIAL DIVERSION OF 2 TRAIN SI FLOW, BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW, CV/36/37 FAILURE FOR RWST INVENTORY	*INCLUDES BV-1202. BOI REV REQUIRED TO SPECIFY CLOSING CV-525 AND CV-525 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC REV REQUIRED TO ADDRESS UNISOLABLE FLOW FROM RCS TO PRT VIA BV-206	04.2	MODIFY LBTDOWN ISOLATION VALVES (INCLUDING LCV-1112) AS REQUIRED BY RWST INVENTORY, RBCIRC FLOW RATE OR DOSE LIMITATIONS	NUCLBAS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
01.4.16.02.1	CV-203	VALVE/ACTUATOR	OPEN	*(SAME AS 1.4.16.1.1)	NORMAL POSITION. INCLUDES HY-1203. BOI 04 REV REQUIRED TO SPECIFY CLOSING CV-525 AND CV-526 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC REV REQUIRED TO ADDRESS UNISOLABLE FLOW FROM RCS TO PRT VIA RV-206	(SAME AS 1.4.16.1.1)		
01.4.16.03.1	CV-204	VALVE/ACTUATOR	OPEN	*(SAME AS 1.4.16.1.1)	*INCLUDES HY-1204. BOI REV REQUIRED TO 04 SPECIFY CLOSING CV-525 AND CV-526 IMMEDIATELY UPON SIS/SISLOP. RWST INVENTORY CALC REV REQUIRED TO ADDRESS UNISOLABLE FLOW FROM RCS TO PRT VIA RV-206	(SAME AS 1.4.16.1.1)		
01.4.16.04.1	CV-287	VALVE/ACTUATOR	OPEN	*PARTIAL DIVERSION OF 2 TRAIN SI FLOW BOUNDED BY SINGLE TRAIN INJECTION FOR FLOW RATE, CV-36/37 FAILURE FOR RWST INVENTORY	INCLUDES HY-1287. MAY BE OPEN DURING STARTUP. BOI REV REQUIRED TO SPECIFY CLOSING RCV-1117 UPON SIS/SISLOP IF ECCS LTRDOWN IS IN SERVICE	04.3	MODIFY ECCS LTRDOWN ISOLATION VALVES AS REQUIRED NUCLEAR BY RWST INVENTORY, RECIRC FLOW RATE OR DOSE LIMITATIONS	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRES UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
02.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CLR, HEB AND SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	01.1	VERIFY: A) VALVE LOCKING PROGRAM CRITERIA DO NOT EXCLUDE CRITICAL MANUAL VALVES, AND B) OTHER ADMINISTRATIVE CONTROLS ARE SUFFICIENT TO PREVENT MISPOSITIONING OF MANUAL VALVES WHICH ARE NOT COVERED BY THE VALVE LOCKING PROGRAM	OPERATIONS
02.1.03.01.1	G-45A	PUMP/MOTOR	LOW FLOW	INOPERABILITY OF TRAIN A RECIRC PUMPING	*PUMP 1ST DRY BUMP AND REBURLING INTERVAL MINIFLOW TESTS INADEQUATE TO VERIFY PERFORMANCE RELATIVE TO MINIMAL SYSTEM MARGINS. TECH SPEC MUST ALSO BE REVISED TO REQUIRE OPERABILITY OF BOTH RECIRC PUMPS	11.1	IMPLEMENT CYCLE 12 RECIRC MODES	NUCLEAR
02.1.03.01.1	G-45A	PUMP/MOTOR	LOW FLOW	INOPERABILITY OF TRAIN A RECIRC PUMPING	*PUMP 1ST DRY BUMP AND REBURLING INTERVAL MINIFLOW TESTS INADEQUATE TO VERIFY PERFORMANCE RELATIVE TO MINIMAL SYSTEM MARGINS. TECH SPEC MUST ALSO BE REVISED TO REQUIRE OPERABILITY OF BOTH RECIRC PUMPS	11.2	INCLUDE TECH SPEC CHANGE FOR OPERABILITY OF BOTH RECIRC PUMPS IN PCN 151	LICENSING
02.1.04.01.1	MOV-866A	VALVE/ACTUATOR	OPEN	*LOSS OF INJECTION MODE CONTAINMENT SPRAY AND CHARGING AND POTENTIAL LOSS OF RECIRC MODE CHARGING DUE TO GAS BINDING OF COMMON SUCTION PIPING	POWER LOCK OUT OF MOV-866A AND MOV-866B REQUIRED PER NRC BRANCH TECHNICAL POSITION ICSB-18	06	IMPLEMENT NRP 1-3619 (INSTALL ICSB-18 POWER LOCK-OUT ON MOV-866A/B)	NUCLEAR
02.1.08.01.1	MOV-356	VALVE/ACTUATOR	OPEN	NONE FOR CLR ALIGNMENT	*NOT ACCEPTABLE FOR INJECTION WITH CONCURRENT FAILURE OF CHARGING (EG. DUE TO MOV-1100C). TECH SPEC ACTION ENTRY REQUIRED WITH VALVE OPEN DURING NORMAL OPERATION		NO FURTHER ACTION REQUIRED. MOV-356/7/8 MAINTAINED CLOSED PER EXISTING PROCEDURES	
02.2.02.01.1	MANUAL BOUNDARY VALVES, TRAIN B		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CLR, HEB AND SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	01	(SAME AS 2.1.2.1.1)	
02.2.03.01.1	G-45B	PUMP/MOTOR	LOW FLOW	INOPERABILITY OF TRAIN B RECIRC PUMPING	*PUMP 1ST DRY BUMP AND REBURLING INTERVAL MINIFLOW TESTS INADEQUATE TO VERIFY PERFORMANCE RELATIVE TO MINIMAL SYSTEM MARGINS. TECH SPEC MUST ALSO BE REVISED TO REQUIRE OPERABILITY OF BOTH PUMPS	11	(SAME AS 2.1.3.1.1)	
02.2.04.01.1	MOV-866B	VALVE/ACTUATOR	OPEN	*LOSS OF INJECTION MODE CONTAINMENT SPRAY AND CHARGING AND POTENTIAL LOSS OF RECIRC MODE CHARGING DUE TO GAS BINDING OF COMMON SUCTION PIPING	POWER LOCK OUT OF MOV-866A AND MOV-866B REQUIRED PER NRC BRANCH TECHNICAL POSITION ICSB-18	06	(SAME AS 2.1.4.1.1)	
02.2.08.01.1	MOV-357	VALVE/ACTUATOR	OPEN	NONE FOR CLR ALIGNMENT	*NOT ACCEPTABLE FOR INJECTION WITH CONCURRENT FAILURE OF CHARGING (EG. DUE TO MOV-1100C). TECH SPEC ACTION ENTRY REQUIRED WITH VALVE OPEN DURING NORMAL OPERATION		(SAME AS 2.1.8.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
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ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
02.3.01.01.1	MOV-358	VALVE/ACTUATOR	OPEN	NONE FOR CLR ALIGNMENT	*NOT ACCEPTABLE FOR INJECTION WITH CONCURRENT FAILURE OF CHARGING (EG. DUE TO MOV-1100C). TECH SPIC ACTION ENTRY REQUIRED WITH VALVE OPEN DURING NORMAL OPERATION	(SAME AS 2.1.0.1.1)		
02.4.01.01.2	MANUAL VALVES, COMMON FLOW		CLOSED	*LOSS OF CHARGING PUMP CAPABILITY FOR CLR AND BLR	VCC-343 AND -344 MUST BE LOCKED OPEN	01.2	EVALUATE MAIN FLOW PATH VALVES VCC-343 AND -344 AND ADD TO VALVE LOCKING PROGRAM AS NEEDED	OPERATIONS
02.4.01.03.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CLR, BLR AND SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	*SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. RECIRC BOUNDARY VALVES NOT SEAT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	01	(SAME AS 2.1.2.1.1)	
02.4.01.03.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CLR, BLR AND SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	*SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. RECIRC BOUNDARY VALVES NOT SEAT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02.2	REVISE IST AND OTHER PROCEDURES AS NEEDED FOR SI/RECIRC LEAKAGE TESTING	STATION TECH
02.4.01.03.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CLR, BLR AND SPRAY DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	*SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. RECIRC BOUNDARY VALVES NOT SEAT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02.3	DETERMINE APPLICABLE LEAK TEST REQUIREMENTS FOR RECIRC SYSTEM AND INCLUDE ALLOWANCE IN DOSE CALCULATIONS	NUCLEAR
02.4.01.04.1	CHECK AND RELIEF VALVES, COMMON BOUNDARY		NORMAL (PASSIVE)	*LOSS OF INVENTORY NOT INCLUDED IN RWST CALCULATION	*SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. RECIRC BOUNDARY VALVES NOT SEAT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02	(SAME AS 2.4.1.3.1)	
02.4.01.04.1	CHECK AND RELIEF VALVES, COMMON BOUNDARY		NORMAL (PASSIVE)	*LOSS OF INVENTORY NOT INCLUDED IN RWST CALCULATION	*SEE TABLE 2-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. RECIRC BOUNDARY VALVES NOT SEAT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	04.1	REVISE RWST AND SI/FW LO-LO SETPOINT CALCULATIONS TO ADDRESS INVENTORY DIVERSIONS	NUCLEAR
02.4.02.01.1	MOV-883	VALVE/ACTUATOR	OPEN	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*REDUNDANT CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02	(SAME AS 2.4.1.3.1)	
02.4.02.02.1	MOV-883	RMS-2054	CONTACTS OPEN	(SAME AS 2.4.2.1.1)	(SAME AS 2.4.2.1.1)	02	(SAME AS 2.4.1.3.1)	
02.4.02.03.1	MOV-883	RMS-2047	OPEN (CONTACTS B/C CLOSED)	(SAME AS 2.4.2.1.1)	(SAME AS 2.4.2.1.1)	02	(SAME AS 2.4.1.3.1)	
02.4.02.04.1	MOV-883	42CC OR 42CCA (CONTACTORS)	OFF (CONTACTOR OPEN)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02	(SAME AS 2.4.1.3.1)	
02.4.02.04.2	MOV-883	42CC OR 42CCA (CONTACTORS)	ON (CONTACTOR CLOSED)	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	*VERIFICATION NEEDED THAT EXISTING SURVEILLANCES WOULD DETECT THIS FAILURE	29	INCLUDE CONTACTOR STATUS INDICATING LIGHTS AND SURVEILLANCE REQUIREMENTS FOR MOV-883 IN MHP 1-3619 TO PREVENT AN UNDETECTED LOSS OF CONTACTOR REDUNDANCY	ELECTRICAL
02.4.02.05.1	MOV-883	MCC-3 (42-1396)	VOLTS LOW	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02	(SAME AS 2.4.1.3.1)	
02.4.03.01.1	MOV-1100C	VALVE/ACTUATOR	OPEN	*POTENTIAL LOSS OF BOTH CHARGING PUMPS FOR RECIRCULATION IN SBLOCA IF SECOND CHARGING PUMP AUTO-STARTS BEFORE SI/SISLOP. LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING RECIRCULATION FOR SBLOCA, MSLB,	*EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS	07.1	IMPLEMENT MHP 1-3625 (INSTALL TRIP OF CHARGING PUMP C-2B ON REDUNDANT LOW-LOW-LOW VCT LEVEL SIGNAL)	NUCLEAR

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONEPWR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

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ITRM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
02.4.03.01.1	NOV-1100C	VALVE/ACTUATOR	OPN	*POTENTIAL LOSS OF BOTH CHARGING PUMPS FOR RECIRCULATION IN SBLOCA IF SECOND CHARGING PUMP AUTO-STARTS BEFORE SIS/SISLOP. LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING RECIRCULATION FOR LBLOCA, NSLB, SCTR	*EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS	07.2	IMPLEMENT MWP 1-3652 (INSTALL REDUNDANT AUTO-CLOSED VCT ISOLATION VALVE) TO PREVENT GAS BINDING IN COMMON PORTION OF CHARGING PUMP SUCTION BRASS	NUCLEAR
02.4.03.01.2	NOV-1100C	VALVE/ACTUATOR	CLOSED	LOSS OF SEISMIC CATEGORY A SUCTION TO BOTH CHARGING PUMPS PRIOR TO SIS/SISLOP	*FCV-5051 CONTROL SYSTEM AND NITROGEN SUPPLY ARE NSRFP	07.3	IMPLEMENT MWP 1-3639 (UPGRADE FCV-5051 ACTUATION TO SAFETY RELATED)	NUCLEAR
02.4.03.02.1	NOV-1100C	LC-1100BE (RELAY)	HIGH LEVEL	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING RECIRCULATION	*LC-1100BE LO-LO-LO TRIP IS NOT EQ'D		NO FURTHER ACTION REQUIRED. LEVEL CONTROLLER FUNCTION COMPLETED PRIOR TO BEGINNING OF SIS(LOP)/HAZAR ENVIRONMENT	
02.4.03.09.3	NOV-1100C	SS (POWER SRL. SW.)	CONTACTS OPEN (OR OFF)	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING RECIRC	*EFFECT OF GAS-BINDING IN PORTION OF COMMON SUCTION PIPING ON RECIRC OPERATION OF REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED	07	(SAME AS 2.4.3.1.1)	
02.4.03.09.5	NOV-1100C	SS (POWER SRL. SW.)	CONTACTS GROUNDED	(SAME AS 2.4.3.9.3)	*[SAME AS 2.4.3.9.3] BOUNDS SHORT IN RELAYS 03-1 OR 03-2	07	(SAME AS 2.4.3.1.1)	
02.4.03.12.1	NOV-1100C	MCC-1 (8-1198)	VOLTS LOW	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING CLR AND NLR	*EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS	07	(SAME AS 2.4.3.1.1)	
02.4.03.13.1	NOV-1100C	MCC-2A (42-12A76)	VOLTS LOW	LOSS OF CHARGING CAPABILITY DURING INJECTION AND ONE CHARGING PUMP DURING CLR AND NLR	*EFFECT OF GAS BINDING IN PORTION OF COMMON SUCTION LINE TO REDUNDANT CHARGING PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS	07	(SAME AS 2.4.3.1.1)	
02.4.04.01.1	LC-1100B LOOP	LC-1100BE (RELAY)	HIGH LEVEL	*POTENTIAL LOSS OF BOTH CHARGING PUMPS FOR SBLOCA IF SECOND CHARGING PUMP AUTO-STARTS PRIOR TO SIS/SISLOP. NONE FOR LBLOCA, NSLB OR SCTR IF NOV-1100B/C/D PLACED IN MANUAL PRIOR TO SBQ BLOCK/RESBY	*INCLUDES LT-1100, POWER SUPPLY. NORMAL POSITION OF CONTROLLER OUTPUT. PRA REQUIRED TO JUSTIFY THIS CONDITION UNTIL CYCLE 12 ECCS UPGRADES	07	(SAME AS 2.4.3.1.1) PRA NOT REQUIRED WITH ACTION 07.2 MODIFICATIONS	
02.4.09.03.1	FCV-1112	SV-1112	ON (OPEN)	(SAME AS 2.4.9.1.1)	*SV-1112 POWER MUST BE LOCKED OUT AT C-18 PANEL AND OSD SWGR TO PRECLUDE SIMILAR FAILURE DUE TO EQ		NO FURTHER ACTION REQUIRED. SV-1112 POWER ALREADY LOCKED OUT PER PROCEDURE 501-10-7	
02.4.14.01.1	FCV-1115D	VALVE/ACTUATOR	OPEN	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH HLR UNTIL FAILED FCV ISOLATED	*BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING	09.1	PERFORM HYDRAULIC CALCULATION TO VERIFY MAXIMUM CHARGING PUMP FLOW POST-SIS/SISLOP	NUCLEAR
02.4.14.01.1	FCV-1115D	VALVE/ACTUATOR	OPEN	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH HLR UNTIL FAILED FCV ISOLATED	*BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING	09.2	MODIFY CHARGING AND/OR SEAL INJECTION VALVES TO LIMIT CHARGING PUMP FLOW AS NEEDED	NUCLEAR
02.4.14.01.1	FCV-1115D	VALVE/ACTUATOR	OPEN	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH HLR UNTIL FAILED FCV ISOLATED	*BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING	11.3	REVISE 801: AS REQUIRED TO: A) RUN BOTH RECIRC PUMPS UNTIL SPRAY SECURED (BOTH REP MTR PP TRIPPED), B) ENSURE THAT TRIPPED PUMPS ARE ON SAME TRAIN, AND C) DO NOT RESET THE CHARGING PUMP LOCKOUT RELAY AFTER MANUAL TRIP (IN ORDER TO PREVENT AUTO-RESTART)	OPERATIONS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR CHOPER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RISP DISCIPLINE
02.4.15.01.1	PCV-1115A PCV-1115D	PT-1115A PT-1115D LOOP	SIGNAL HIGH	(SAME AS 2.4.14.1.1)	* (SAME AS 2.4.14.1.1) COMMON SPLIT-RANGE 11 CONTROL LOOP FOR PCV-1115A AND PCV-1115D (TRAIN A)	(SAME AS 2.4.14.1.1)		
02.4.17.01.1	PCV-1115B	VALVE/ACTUATOR	OPEN	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH HLR UNTIL FAILED FCV ISOLATED	* BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING	11	(SAME AS 2.4.14.1.1)	
02.4.18.01.1	PCV-1115B PCV-1115B	PT-1115B PT-1115B LOOP	SIGNAL HIGH	(SAME AS 2.4.17.1.1)	* (SAME AS 2.4.17.1.1) COMMON SPLIT-RANGE 11 CONTROL LOOP FOR PCV-1115B AND PCV-1115B (TRAIN A)	(SAME AS 2.4.14.1.1)		
02.4.20.01.1	PCV-1115P	VALVE/ACTUATOR	OPEN	LOSS OF CLR FLOW BALANCE AND REDUCED PRIMARY PATH HLR UNTIL FAILED FCV ISOLATED	* BOTH RECIRC PUMPS MUST BE RUN DURING RECIRC IF AVAILABLE, AS CONSEQUENCES OF THIS SINGLE FAILURE ARE UNACCEPTABLE WITH LESS THAN 2 RECIRC PUMPS RUNNING	11	(SAME AS 2.4.14.1.1)	
02.4.21.01.1	PCV-1115C PCV-1115P	PT-1115C PT-1115P LOOP	SIGNAL HIGH	(SAME AS 2.4.20.1.1)	* (SAME AS 2.4.20.1.1) COMMON SPLIT-RANGE 11 CONTROL LOOP FOR PCV-1115C AND PCV-1115P (TRAIN A)	(SAME AS 2.4.14.1.1)		
02.4.22.01.1	PCV-1115A/D PCV-1115B/B PCV-1115C/P	VITAL BUS #4 (8-1416V)	VOLTS LOW	LOSS OF TRAIN A CLR FLOW CONTROL TO RCS LOOPS A, B AND C, AND INABILITY TO THROTTLE CLR FLOW BELOW ABOUT 80 GPM PER LOOP FOR COMBINED CLR/HLR	* HYDRAULIC CALC REQUIRED TO VERIFY FLOW THROUGH WIDE OPEN FCV-1115A/B/C AND UPPER LIMIT FOR PRIMARY PATH HLR FLOW TO REMAIN WITHIN RECIRC PUMP FLOW CAPABILITY	09	(SAME AS 2.4.14.1.1)	
02.4.22.02.1	PCV-1115A/D PCV-1115B/B PCV-1115C/P	ISA	PRESSURE LOW	INABILITY TO CONTROL CLR FLOW ON ISA OR THROTTLE CLR FLOW BELOW 80 GPM PER RCS LOOP FOR COMBINED CLR/HLR	* HYDRAULIC CALC REQUIRED TO VERIFY FLOW THROUGH WIDE OPEN FCV-1115A/B/C, AND UPPER LIMIT FOR PRIMARY PATH HLR FLOW TO REMAIN WITHIN THE CAPABILITY OF A SINGLE RECIRC PUMP FOR THIS POTENTIAL COMMON-CAUSE FAILURE	09	(SAME AS 2.4.14.1.1)	
02.4.24.01.1	PT-3114A LOOP	PI-3114A	SIGNAL HIGH	CLR FLOW TO LOOP A MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-356 TO PREVENT RECIRCING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	* VERIFY PROCEDURE REQUIRES NOV-356 CLOSURE. CLOSURE REQUIRED SINCE FCV-1115D FAILURE AND PI-3114A FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP	08.1	PERFORM EVENT-SPECIFIC ANALYSIS OF CLR/HLR FLOW BALANCING	NUCLEAR
02.4.24.01.1	PT-3114A LOOP	PI-3114A	SIGNAL HIGH	CLR FLOW TO LOOP A MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-356 TO PREVENT RECIRCING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	* VERIFY PROCEDURE REQUIRES NOV-356 CLOSURE. CLOSURE REQUIRED SINCE FCV-1115D FAILURE AND PI-3114A FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP	08.2	REVISE NO. 1 AS NEEDED BASED ON ANALYSIS RESULTS	OPERATIONS
02.4.24.01.2	PT-3114A LOOP	PI-3114A	SIGNAL LOW	* CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECIRCING RECIRC PUMP LIMITATIONS	* FCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 2.4.24.1.1)	
02.4.24.02.1	PT-3114A LOOP	C70 WEST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	* (SAME AS 2.4.24.1.2)	* (SAME AS 2.4.24.1.2)	08	(SAME AS 2.4.24.1.1)	
02.4.24.03.1	PT-3114A LOOP	VITAL BUS #5 (8-2503V)	VOLTS LOW	* CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECIRCING RECIRC PUMP LIMITATIONS	* FCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT EQ FIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 2.4.24.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
02.4.25.01.1	PT-2114B LOOP	PI-2114B	SIGNAL HIGH	CLR FLOW TO LOOP B MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-3570 TO PREVENT RECHARGING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-357 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115B FAILURE AND PI-2114B FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT BQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	00	(SAME AS 2.4.24.1.1)	
02.4.25.01.2	PT-2114B LOOP	PI-2114B	SIGNAL LOW	*CLR FLOW TO RCS LOOP B WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECIRC PUMP LIMITATIONS	*PCV-1115B FAILURE AND PI-2114B FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT BQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	00	(SAME AS 2.4.24.1.1)	
02.4.25.02.1	PT-2114C LOOP	PI-2114C	SIGNAL HIGH	CLR FLOW TO LOOP C MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-3580 TO PREVENT RECHARGING RECIRC PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-358 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115F FAILURE AND PI-2114C FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT BQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	00	(SAME AS 2.4.24.1.1)	
02.4.25.02.2	PT-2114C LOOP	PI-2114C	SIGNAL LOW	*CLR FLOW TO RCS LOOP C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECIRC PUMP LIMITATIONS	*PCV-1115F FAILURE AND PI-2114C FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT BQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	00	(SAME AS 2.4.24.1.1)	
02.4.25.03.1	PT-2114B LOOP PT-2114C LOOP	C69 WEST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECIRC PUMP LIMITATIONS	*PCV-1115B/F FAILURE AND PI-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT BQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	00	(SAME AS 2.4.24.1.1)	
02.4.25.04.1	PT-2114B LOOP PT-2114C LOOP	VITAL BUS #3A (8-3313V)	VOLTS LOW	*CLR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECIRC PUMP LIMITATIONS	*PCV-1115B/F FAILURE AND PI-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT BQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	00	(SAME AS 2.4.24.1.1)	
02.4.26.01.1	CV-2145	VALVE/ACTUATOR	OPEN (OR NORMAL)	*DIVERSSION OF CLR AND HLR FLOW/INVENTORY TO NON-SAFETY RELATED SAMPLE SYSTEM	BACKUP ISOLATION VALVE NOT ACCESSIBLE DURING RECIRCULATION WITH THE SOURCE TERM	03.1	DETERMINE THE SOURCE TERM DOSE RATES FOR APPLICABLE MANUAL ACTION LOCATIONS, INCLUDING ACCESS/EGRESS ROUTES	NUCLEAR
02.4.26.01.1	CV-2145	VALVE/ACTUATOR	OPEN (OR NORMAL)	*DIVERSSION OF CLR AND HLR FLOW/INVENTORY TO NON-SAFETY RELATED SAMPLE SYSTEM	BACKUP ISOLATION VALVE NOT ACCESSIBLE DURING RECIRCULATION WITH THE SOURCE TERM	03.2	EVALUATE SHIELDING OR BEST-ESTIMATE SOURCE TERM TO NUCLEAR RESOLVE MANUAL ACTION LOCATIONS AND ACCESS/EGRESS ROUTES WITH UNACCEPTABLE THE SOURCE TERM DOSE RATES	NUCLEAR
02.4.26.01.1	CV-2145	VALVE/ACTUATOR	OPEN (OR NORMAL)	*DIVERSSION OF CLR AND HLR FLOW/INVENTORY TO NON-SAFETY RELATED SAMPLE SYSTEM	BACKUP ISOLATION VALVE NOT ACCESSIBLE DURING RECIRCULATION WITH THE SOURCE TERM	03.3	OBTAIN REGULATORY RELIEF FROM THE SOURCE TERMS FOR LICENSING SINGLE FAILURE EVENTS IF NEEDED BASED ON DOSE CALCULATION RESULTS	NUCLEAR
02.4.26.01.1	CV-2145	VALVE/ACTUATOR	OPEN (OR NORMAL)	*DIVERSSION OF CLR AND HLR FLOW/INVENTORY TO NON-SAFETY RELATED SAMPLE SYSTEM	BACKUP ISOLATION VALVE NOT ACCESSIBLE DURING RECIRCULATION WITH THE SOURCE TERM	27	REVIEW BOI AND REVISE TO CLOSE SAMPLE VALVE IF NEEDED POST-ACCIDENT	OPERATIONS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BCCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
02.4.27.01.1	CV-406A	VALVE/ACTUATOR	OPEN	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	*INCLUDES SV-406A. REDUNDANT VALVE CV-406B NORMALLY OPEN, DOES NOT AUTO-CLOSE ON SIS/SISLOP OR LOW VCT LEVEL. EFFECT OF GAS BINDING IN COMMON PART OF SUCTION LINE TO REDUNDANT PUMP HAS NOT BEEN VERIFIED FOR SUBSEQUENT RECIRC BY TEST OR ANALYSIS	07.4	LOCK CV-406A OR B CLOSED AS PER RESOLUTION OF MCR OPERATIONS 1-P-7467 AND LRR 1-30-96 TO PREVENT CHARGING PUMP GAS BINDING DUE TO LOSS OF UTILITY BUS	
02.4.27.02.1	CV-406B	VALVE/ACTUATOR	OPEN	REDUCED REDUNDANCY FOR VCT ISOLATION POST-SIS/SISLOP	*NORMAL POSITION. INCLUDES SV-406B. DOES NOT AUTO-CLOSE ON SIS/SISLOP OR LOW VCT LEVEL. UPGRADE TO SR AND ADD TO 1ST PRGM REQD FOR VCT ISOL FUNCTION. BOIs MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP		(SAME AS 2.4.27.1.1)	
02.4.27.03.3	CV-406A CV-406B	CONTROL SWITCH	CONTACTS OPEN	*(SAME AS 2.4.27.1.1)	*(SAME AS 2.4.27.1.1)	07	(SAME AS 2.4.27.1.1)	
02.4.27.03.5	CV-406A CV-406B	CONTROL SWITCH	CONTACTS GROUNDED	*(SAME AS 2.4.27.1.1)	*(SAME AS 2.4.27.1.1)	07	(SAME AS 2.4.27.1.1)	
02.4.27.04.1	CV-406A CV-406B	UTILITY BUS (8-151B)	VOLTS LOW	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	*AT LEAST ONE OF CV-406A/B MUST BE FAIL CLOSED AND/OR LOCKED CLOSED. BOIs MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP	07	(SAME AS 2.4.27.1.1)	
02.4.27.05.1	CV-406A CV-406B	ISA	PRESSURE LOW	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, PRE-SELECTED CHARGING PUMP FOR OTHER EVENTS	*AT LEAST ONE OF CV-406A/B MUST BE FAIL-CLOSED AND/OR LOCKED CLOSED. BOIs MUST BE REVISED TO REQUIRE VALVE CLOSED AND PRECLUDE START OF LOCKED-OUT PUMP	07	(SAME AS 2.4.27.1.1)	
02.4.28.01.1	BCV-427A	VALVE/ACTUATOR	OPEN	*UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. NONE ON SI OR CLR FLOW DUE TO CONTINUED RCP SEAL FUNCTIONING	*RWSST INVENTORY AND SI/PN LO-LO RWSST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT	04	(SAME AS 2.4.1.4.1)	
02.4.28.02.1	BCV-427B	VALVE/ACTUATOR	OPEN	*UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. NONE ON SI OR CLR FLOW DUE TO CONTINUED RCP SEAL FUNCTIONING	*RWSST INVENTORY AND SI/PN LO-LO RWSST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT	04	(SAME AS 2.4.1.4.1)	
02.4.28.03.1	BCV-427C	VALVE/ACTUATOR	OPEN	*UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. NONE ON SI OR CLR FLOW DUE TO CONTINUED RCP SEAL FUNCTIONING	*RWSST INVENTORY AND SI/PN LO-LO RWSST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT	04	(SAME AS 2.4.1.4.1)	
02.4.28.04.1	BCV-427A BCV-427B BCV-427C	UTILITY BUS (8-150Z)	VOLTS LOW	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, NONE FOR INJECTION OR CLR FLOW DUE TO CONTINUED FUNCTIONING OF RCP SEALS	*RWSST INVENTORY AND SI/PN LO-LO RWSST LEVEL TRIP SETPOINT CALCS MUST BE REVISED TO INCLUDE POTENTIAL INVENTORY DIVERSIONS TO RCDT	04	(SAME AS 2.4.1.4.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM ONEFB2 UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
03.1.02.01.1	MANUAL VALVES, PRIMARY PATH BOUNDARY		OPEN	HLR PRIMARY PATH DISABLED	*SEE TABLE 3-2, NORMAL THROTTLED POSITION OF PZR-020, -021 CONSIDERED IN ANALYSIS OF HLR FLOW REQUIREMENTS. ADMINISTRATIVE CONTROLS OR VALVE LOCKING REQUIRED, SINCE MISPOSITIONING IS NOT DETECTABLE DURING NORMAL OPERATION	01.1	VERIFY: A) VALVE LOCKING PROGRAM CRITERIA DO NOT EXCLUDE CRITICAL MANUAL VALVES, AND B) OTHER ADMINISTRATIVE CONTROLS ARE SUFFICIENT TO PREVENT MISPOSITIONING OF MANUAL VALVES WHICH ARE NOT COVERED BY THE VALVE LOCKING PROGRAM	OPERATIONS
03.1.02.01.1	MANUAL VALVES, PRIMARY PATH BOUNDARY		OPEN	HLR PRIMARY PATH DISABLED	*SEE TABLE 3-2, NORMAL THROTTLED POSITION OF PZR-020, -021 CONSIDERED IN ANALYSIS OF HLR FLOW REQUIREMENTS. ADMINISTRATIVE CONTROLS OR VALVE LOCKING REQUIRED, SINCE MISPOSITIONING IS NOT DETECTABLE DURING NORMAL OPERATION	01.3	PREPARE PCNs TO ADD LOCKING DEVICES TO PZR-020, 021 AND OTHER VALVES AS NEEDED	NUCLEAR
03.1.03.01.1	PIT-1112 LOOP	PT-1112	SIGNAL HIGH	POTENTIAL LOSS OF HLR PRIMARY PATH	*METHOD OF DETECTION (COMPARISON OF PCV-1112 POSITION DEMAND, PIT-1112 FLOW INDICATION, CHARGING PUMP MOTOR AMPS, PI-3114A/2114B/2114C FLOW INDICATION AND PCV-1115D/B/P POSITION DEMAND) CANNOT DISTINGUISH BETWEEN PCV AND INDICATION FAILURES	08.1	PERFORM EVENT-SPECIFIC ANALYSIS OF CLR/HLR FLOW BALANCING	NUCLEAR
03.1.03.01.1	PIT-1112 LOOP	PT-1112	SIGNAL HIGH	POTENTIAL LOSS OF HLR PRIMARY PATH	*METHOD OF DETECTION (COMPARISON OF PCV-1112 POSITION DEMAND, PIT-1112 FLOW INDICATION, CHARGING PUMP MOTOR AMPS, PI-3114A/2114B/2114C FLOW INDICATION AND PCV-1115D/B/P POSITION DEMAND) CANNOT DISTINGUISH BETWEEN PCV AND INDICATION FAILURES	08.2	REVISE ROIs AS NEEDED BASED ON ANALYSIS RESULTS	OPERATIONS
03.1.03.01.2	PIT-1112 LOOP	PT-1112	SIGNAL LOW	POTENTIAL IMBALANCE IN CLR/HLR FLOW	*(SAME AS 3.1.3.1.1)	08	(SAME AS 3.1.3.1.1)	
03.1.03.01.3	PIT-1112 LOOP	PT-1112	BQ	POTENTIAL IMBALANCE IN CLR/HLR FLOW OR LOSS OF HLR PRIMARY PATH	*(SAME AS 3.1.3.1.1)	08	(SAME AS 3.1.3.1.1)	
03.1.03.02.1	PIT-1112 LOOP	RBG BUS #1 (8-1489)	VOLTS LOW	LOSS OF HLR PRIMARY PATH	*RANGE INADEQUATE FOR HLR PRIMARY PATH FUNCTION, BACKUP FLOW DETERMINATION METHOD REQUIRED IN ROIs IRRESPECTIVE OF PIT-1112 FAILURE	08	(SAME AS 3.1.3.1.1)	
03.1.04.03.1	PCV-1112	SV-1112	ON (OPEN)	(SAME AS 3.1.4.1.1)	*SV-5112 POWER MUST BE LOCKED OUT AT C-38 PANEL AND DSD SWCH TO PRECLUDE SIMILAR FAILURE DUE TO BQ		NO FURTHER ACTION REQUIRED. SV-5112 POWER ALREADY LOCKED OUT PER PROCEDURES SOI-10-7	
03.1.07.01.1	CV-304 CV-305	UTILITY BUS (8-1508)	VOLTS LOW	LOSS OF CHARGING PUMP INJECTION PATH TO RCS LOOP A AND HLR PRIMARY PATH, NONE FOR CLR	*CHARGING NOT CREDITED FOR INJECTION. REALIGNMENT OF UTILITY BUS VIA TRANSFER SW AT REQUIRED TO PRECLUDE COMMON-MODE FAILURE OF HLR (DUE TO LOSS OF TRIM B POWER) BY RESTORING SAFETY-RELATED POWER TO UTILITY BUS	34.1	REVISE PROCEDURES AS NEEDED TO ADDRESS RE-ENERGIZING THE UTILITY BUS FROM MCC-1 VIA MTS-7	OPERATIONS
03.1.08.01.1	PCV-430C	VALVE/ACTUATOR	OPEN	LOSS OF HLR PRIMARY PATH	*INCLUDES HY-1430C. PCV-1112 SETTING MUST INCLUDE MARGIN FOR UNDETECTABLE PARTIAL OPENING OF VALVE WITHIN LIMIT SWITCH HYSTERESIS		NO FURTHER ACTION REQUIRED. MARGIN ALREADY INCLUDED PER ROi 301-1.0-24	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRS UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITRN	ACTION ITEM	REGSP DISCIPLINE
03.1.09.01.1	PCV-430H	VALVE/ACTUATOR	OPEN	LOSS OF HLR PRIMARY PATH	*INCLUDES BY-1430H. PCV-1112 SETTING MUST INCLUDE MARGIN FOR UNDETECTABLE PARTIAL OPENING OF VALVE WITHIN LIMIT SWITCH HYSTERSIS	(SAME AS 3.1.8.1.1)		
03.1.10.01.3	PCV-430C PCV-430H	PC-430C/H LOOP	RQ	*LOSS OF HLR PRIMARY FLOW PATH	RQ UPGRADE OF BOTH HLR FLOW PATHS REQUIRED	10.4	VERIFY THAT QUALIFIED I/Ps ARE NOT REQUIRED FOR PV-1430C/H TO PRECLUDE FUNCTIONAL (b)(2) INTERACTION WITH PRIMARY PATH HLS	ELECTRICAL (RQ)
03.1.11.01.1	PI-3114A LOOP	PI-3114A	SIGNAL HIGH	CLR FLOW TO LOOP A MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-356 TO PREVENT RECHARGING RECHRG PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-356 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115D FAILURE AND PI-3114A FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP	08	(SAME AS 3.1.3.1.1)	
03.1.11.01.2	PI-3114A LOOP	PI-3114A	SIGNAL LOW	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECHRG PUMP LIMITATIONS	*PCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	
03.1.11.02.1	PT-3114A LOOP	C70 NBST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	(SAME AS 2.4.24.1.2)	(SAME AS 2.4.24.1.2)	03	(SAME AS 3.1.3.1.1)	
03.1.11.03.1	PT-3114A LOOP	VITAL BUS #5 (8-2303V)	VOLTS LOW	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECHRG PUMP FLOW LIMITATIONS	*PCV-1115D FAILURE AND PI-3114A FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	
03.1.12.01.1	PI-2114B LOOP	PI-2114B	SIGNAL HIGH	CLR FLOW TO LOOP B MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-357 TO PREVENT RECHARGING RECHRG PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-357 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115B FAILURE AND PI-2114B FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	
03.1.12.01.2	PI-2114B LOOP	PI-2114B	SIGNAL LOW	*CLR FLOW TO RCS LOOP B WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECHRG PUMP LIMITATIONS	*PCV-1115B FAILURE AND PI-2114B FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	
03.1.12.02.1	PI-2114C LOOP	PI-2114C	SIGNAL HIGH	CLR FLOW TO LOOP C MUST BE ISOLATED PER PROCEDURE BY CLOSING NOV-358 TO PREVENT RECHARGING RECHRG PUMP AND CHARGING PUMP FLOW LIMITS	*VERIFY PROCEDURE REQUIRES NOV-358 CLOSURE. CLOSURE REQUIRED SINCE PCV-1115P FAILURE AND PI-2114C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	
03.1.12.02.2	PI-2114C LOOP	PI-2114C	SIGNAL LOW	*CLR FLOW TO RCS LOOP C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY RECHARGING RECHRG PUMP LIMITATIONS	*PCV-1115P FAILURE AND PI-2114C FAILURE CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONEPFB UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	REGULATORY DISCIPLINE
03.1.12.03.1	FT-2114B LOOP FT-2114C LOOP	C69 MEST 4 15VDC SUPPLY	OUTPUT VOLTS LOW	FCR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY REDUCING RECIRC PUMP LIMITATIONS	*FCV-1115B/F FAILURE AND FI-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	
03.1.12.04.1	FT-2114B LOOP FT-2114C LOOP	VITAL BUS #3A (B-3313V)	VOLTS LOW	FCR FLOW TO RCS LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, AND POTENTIALLY REDUCING RECIRC PUMP LIMITATIONS	*FCV-1115B/F FAILURE AND FI-2114B/C FAILURES CANNOT BE DISTINGUISHED DURING COMBINED CLR/HLR WITHOUT RQ PIT-1112 LOOP. CHARGING PUMP AMMETER USED TO DETERMINE TOTAL CHARGING PUMP FLOW	08	(SAME AS 3.1.3.1.1)	
03.2.03.01.1	MOV-822A	VALVE/ACTUATOR	CLOSED	REDUCED RELIABILITY OF ALTERNATE HLR PATH	*MOV-822A OR B MUST BE OPEN WITH POWER-LOCKOUT DURING NORMAL OPERATION DUE TO POST-LOCA FLOODING OF ACTUATOR, WHICH IS NOT QUALIFIED FOR SUBMERGENCE	10.1	REVISE DCP 1-3548 TO SPECIFY APPROPRIATE ADMINISTRATIVE CONTROLS ON MOV-822A/B	NUCLEAR
03.2.03.01.2	MOV-822A	VALVE/ACTUATOR	CLOSED	REDUCED RELIABILITY OF ALTERNATE HLR PATH	*MOV-822A OR B MUST BE OPEN WITH POWER-LOCKOUT DURING NORMAL OPERATION DUE TO POST-LOCA FLOODING OF ACTUATOR, WHICH IS NOT QUALIFIED FOR SUBMERGENCE	10.2	REVISE PROCEDURES (INCLUDING BOLs) AS REFERRED TO INCLUDE DCP 1-3548 REQUIREMENTS	OPERATIONS
03.2.03.01.3	MOV-822A	VALVE/ACTUATOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BRKBRKR AND CONTROL POWER PUSE PROVIDE (b)(2) PROTECTION OF ECC	10	(SAME AS 3.2.3.1.2)	
03.2.04.01.2	MOV-822B	VALVE/ACTUATOR	CLOSED	REDUCED RELIABILITY OF ALTERNATE HLR PATH	*MOV-822A OR B MUST BE OPEN WITH POWER-LOCKOUT DURING NORMAL OPERATION DUE TO POST-LOCA FLOODING OF ACTUATOR, WHICH IS NOT QUALIFIED FOR SUBMERGENCE	10	(SAME AS 3.2.3.1.2)	
03.2.04.01.3	MOV-822B	VALVE/ACTUATOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BRKBRKR AND CONTROL POWER PUSE PROVIDE (b)(2) PROTECTION OF ECC	10	(SAME AS 3.2.3.1.2)	
03.2.05.01.3	MOV-813	VALVE/ACTUATOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BRKBRKR AND CONTROL POWER PUSE PROVIDE (b)(2) PROTECTION OF ECC. ACTUATOR WILL BE REPLACED WITH BQ MODEL BY DCP 3548.00	10.3	IMPLEMENT DCP 1-3548 HLR MODIFICATIONS	NUCLEAR
03.2.06.01.3	MOV-914	VALVE/ACTUATOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH	BRKBRKR AND CONTROL POWER PUSE PROVIDE (b)(2) PROTECTION OF ECC. ACTUATOR WILL BE REPLACED WITH BQ MODEL BY DCP 3548.00	10	(SAME AS 3.2.5.1.3)	
03.2.13.01.3	CV-413	VALVE/ACTUATOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR PATH TO RCDT WITH CV-288 BQ FAILURE	PUSE PROVIDES (b)(2) PROTECTION OF OTHER VITAL BUS LOADS. CHECK VALVE TO BE INSTALLED BY DCP 3548 WILL PREVENT FLOW DIVERSION WITH THIS FAILURE	10	(SAME AS 3.2.5.1.3)	
03.2.14.01.3	CV-412	VALVE/ACTUATOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR FLOW TO RCP SBAL WATER RETURN	PUSE PROVIDES (b)(2) PROTECTION OF OTHER VITAL BUS LOADS. DCP 3548 WILL INSTALL CHECK VALVE TO PREVENT FLOW DIVERSION VIA THIS PATH	10	(SAME AS 3.2.5.1.3)	
03.2.15.01.3	CV-288	VALVE/ACTUATOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF ALTERNATE HLR FLOW TO RCDT	PUSE PROVIDES (b)(2) PROTECTION OF OTHER UTILITY BUS LOADS. CHECK VALVE TO BE INSTALLED BY DCP 3548 WILL PREVENT FLOW DIVERSION WITH THIS FAILURE	10	(SAME AS 3.2.5.1.3)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ON9988 UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	ASPECT ITEM	ACTION ITEM	RESP DISCIPLINE
04.3.01.01.1	MANUAL VALVES, COMMON FLOW PATH		OPEN	*POTENTIAL DIVERSION OF CONTAINMENT SPRAY FLOW AND LOSS OF SECONDARY RECIRC SUMP INVENTORY TO RWST	*INCLUDES CRS-319, PWS-455 OR 492, PWS-377 AND 381 (S/G A), PWS-372 AND 376 (S/G B), PWS-415 AND 419 (S/G C). BOI DOES NOT INCLUDE ALIGNMENT VERIFICATION FOR APPLICABLE VALVES. REDUNDANT ISOLATION VALVE AND FLOW PATH REQUIRED	12.3	EVALUATE ALTERNATE SECONDARY RECIRC FLOW PATH CAPABILITY FROM REPUBLIC WATER PUMP DISCHARGE TO RWST	NUCLEAR
04.3.01.01.1	MANUAL VALVES, COMMON FLOW PATH		OPEN	*POTENTIAL DIVERSION OF CONTAINMENT SPRAY FLOW AND LOSS OF SECONDARY RECIRC SUMP INVENTORY TO RWST	*INCLUDES CRS-338, PWS-455 OR 492, PWS-377 AND 381 (S/G A), PWS-372 AND 376 (S/G B), PWS-415 AND 419 (S/G C). BOI DOES NOT INCLUDE ALIGNMENT VERIFICATION FOR APPLICABLE VALVES. REDUNDANT ISOLATION VALVE AND FLOW PATH REQUIRED	12.4	REVISE BOI TO INCLUDE SECONDARY RECIRCULATION ALIGNMENT VERIFICATION, AS NEEDED	OPERATIONS
04.3.01.01.2	MANUAL VALVES, COMMON FLOW PATH		CLOSED	*LOSS OF SECONDARY RECIRC FOR CRS-338 CLOSURE, LOSS OF SECONDARY RECIRC PATH TO ONE OR MORE S/G FOR PWS VALVE CLOSURE	*BOI DOES NOT INCLUDE ALIGNMENT VERIFICATION FOR ALL APPLICABLE VALVES. REQUIRES REDUNDANT PATH AND VALVES OR HYDRAULIC CALCULATION TO VERIFY ADEQUACY OF EXISTING 2 INCH REPUBLIC WATER FILTER PUMP LINES	12	(SAME AS 4.3.1.1.1)	
04.3.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	*LOSS OF SECONDARY RECIRC FLOW/INVENTORY	*SEE TABLE 4-2. BOI DOES NOT INCLUDE ALIGNMENT VERIFICATION OF ALL APPLICABLE VALVES. MUST SPECIFY LOCAL CLOSURE OF VCC-326 (TO PROTECT AGAINST PCV-505) ACTION) AND PROVIDE RESPONSE-NOT-OBTAINED OPTIONS IF MOV-11008/D DOES NOT CLOSE (EG. CLOSE CRS-425)	12.5	EVALUATE STEPS TO COMPENSATE FOR PCV-505 INADVERTANT OPENING DURING SECONDARY RECIRC AND REVISE BOI AS NEEDED	OPERATIONS
04.3.02.01.2	MANUAL VALVES, COMMON BOUNDARY		CLOSED	NONE	*VALVE LOCKING PROGRAM DOES NOT COVER SECONDARY RECIRC FUNCTION	01.1	VERIFY: A) VALVE LOCKING PROGRAM CRITERIA DO NOT EXCLUDE CRITICAL MANUAL VALVES, AND B) OTHER ADMINISTRATIVE CONTROLS ARE SUFFICIENT TO PREVENT MISPOSITIONING OF MANUAL VALVES WHICH ARE NOT COVERED BY THE VALVE LOCKING PROGRAM	OPERATIONS
04.3.02.02.1	CRV OR RELIEF VLV, COMMON BOUNDARY		NORMAL (PASSIVE)		*SEE TABLE 4-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. IST PROGRAM DOES NOT INCLUDE SCP-358, 359, 398		NO FURTHER ACTION REQUIRED. BOI-12.4-2 ALREADY INCLUDES STROBE TEST OF THESE VALVES AND BOI-12.4-11 DOES STATE LBAR TEST	
04.3.06.02.1	CV-142 CV-143 CV-144	HCC-2A (8-2429)	VOLTS LOW	REDUCED RELIABILITY OF MAIN PW BYPASS VALVES FOR SECONDARY RECIRC FLOW CONTROL	*BOI DOES NOT ADDRESS REQUIREMENTS FOR LOCAL CONTROL	12.1	REVISE SECONDARY RECIRC PDI TO POSITION CV-142/143/144 LOCALLY IF UNSUCCESSFUL FROM CONTROL ROOM	OPERATIONS
04.3.06.03.1	CV-142 CV-143 CV-144	125VDC BUS #1 (72-130)	VOLTS LOW	REDUCED RELIABILITY OF MAIN PW BYPASS VALVES FOR SI BOUNDARY, POTENTIAL DIVERSION OF SECONDARY RECIRC INVENTORY FROM SYSTEM UNTIL BLOWDOWN ISOLATION VALVES CLOSED REMOTE-MANUALLY	*BLOWDOWN ISOLATION NOT ADDRESSED IN BOI		NO FURTHER ACTION REQUIRED. EXISTING BOI (301-1.0-30) ALREADY ADDRESSES BLOWDOWN ISOLATION	
04.3.06.04.1	CV-142 CV-143 CV-144	ISA	PRESSURE LOW	*NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G A/B/C	*COMMON-CAUSE FAILURE NOT POSTULATED DURING SECONDARY RECIRC, BUT SINGLE FAILURE OF ISA-950 COULD ISOLATE ISA TO CVs. EVALUATION OF MANUAL BYPASS PATHS REQUIRED FOR MITIGATING EFFECTS ON SECONDARY RECIRC	12	(SAME AS 4.3.6.2.1)	OPERATIONS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RSSP DISCIPLINE
04.3.07.01.1	CV-100	VALVE/ACTUATOR	OPEN	POTENTIAL DIVERSION OF SECONDARY REACTOR INVENTORY FROM SYSTEM UNTIL REDUNDANT VALVE(S) CLOSED LOCALLY	*INCLUDES FWS-590, ZSO/C-2192. REDUNDANT VALVE FWS-526 NORMALLY CLOSED. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI OR VALVE LOCKING PROGRAM	(SAME AS 4.3.6.3.1)		
04.3.07.02.1	CV-100A	VALVE/ACTUATOR	OPEN	REDUCED REDUNDANCY FOR BLOWDOWN ISOLATION (SECONDARY REACTOR BOUNDARY)	*NORMAL POSITION. VALVE IS NON-SAFETY RELATED BACKUP TO CV-100B. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI	(SAME AS 4.3.6.3.1)		
04.3.07.03.1	CV-100B	VALVE/ACTUATOR	OPEN	REDUCED REDUNDANCY FOR BLOWDOWN ISOLATION (SECONDARY REACTOR BOUNDARY)	*NORMAL POSITION. INCLUDES FWS-381 AND ZSO/C-2183. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI	(SAME AS 4.3.6.3.1)		
04.3.07.04.1	CV-100 CV-100A CV-100B	SV-84	ON (OPEN)	POTENTIAL DIVERSION OF SECONDARY REACTOR INVENTORY FROM SYSTEM UNTIL REDUNDANT VALVE(S) CLOSED LOCALLY	*NORMAL POSITION. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI	(SAME AS 4.3.6.3.1)		
04.3.07.05.2	CV-100 CV-100A CV-100B	APW1 (RBLAT)	CONTACTS CLOSED (OFF)	POTENTIAL DIVERSION OF SECONDARY REACTOR INVENTORY FROM SYSTEM UNTIL VALVES CLOSED REMOTE-MANUALLY	*NORMAL POSITION. BLOWDOWN ISOLATION NOT ADDRESSED IN ROI	(SAME AS 4.3.6.3.1)		

EMERGENCY CORE COOLING SYSTEM STATUS FAILURE ANALYSIS
SAM ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP. DISCIPLINE
05.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	*LOSS OF TRAIN A HYDRAZINE FLOW OR REDUCTION IN DURATION OF HYDRAZINE FLOW FOR BOTH TRAINS DUE TO INVENTORY LOSS THROUGH UNLOCKED VALVES	SEE TABLE 5-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	01.1	VERIFY: A) VALVE LOCKING PROGRAM CRITERIA DO NOT EXCLUDE CRITICAL MANUAL VALVES, AND B) OTHER ADMINISTRATIVE CONTROLS ARE SUFFICIENT TO PREVENT MISPOSITIONING OF MANUAL VALVES WHICH ARE NOT COVERED BY THE VALVE LOCKING PROGRAM	OPERATIONS
05.1.04.01.1	CV-517	VALVE/ACTUATOR	OPEN	NOISE FOR INJECTION, INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF SINGLE RECIRC PUMP PER BOI	*INCLUDES PV-2517, NORMAL POSITION, BOI 13 DOES NOT CURRENTLY REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED BY HYDRAULIC CALC NCT34-012 SUPPL D	13	REVISE BOI AS REQUIRED TO RUN BOTH RECIRC PUMPS UNTIL CONTAINMENT SPRAY FLOW IS SECURED (IE, BOTH REFUELING WATER PUMPS TRIPPED)	OPERATIONS
05.1.04.02.2	CV-517	AVST (RBLAT)	CONTACTS OPEN (OFF)	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS POTENTIALLY INOPERABLE FOR INJECTION, POTENTIAL INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF ONE RECIRC PUMP, AFFECTING PUMP HEAD FOR ALTERNATE HLR PATH	*NORMAL POSITION, BOI DOES NOT CURRENTLY 13 REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED BY HYDRAULIC CALC NCT34-012 SUPPL D	13	(SAME AS 5.1.4.1.1)	
05.1.04.06.1	CV-517	ISA	PRESSURE LOW	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-518 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP IF CLOSED, BUT TECH SPEC CHANGE REQ. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBLOCA) TO REMAIN BOUNDED BY ANALYSIS		NO FURTHER ACTION REQUIRED. 301-4-41 ALREADY INCLUDES NORMALLY OPEN REQUIREMENT FOR VALVES	
05.1.04.06.1	CV-517	ISA	PRESSURE LOW	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-518 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP IF CLOSED, BUT TECH SPEC CHANGE REQ. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBLOCA) TO REMAIN BOUNDED BY ANALYSIS	32.1	SUBMIT PCN 151 INCLUDING CV-517/518 REQUIREMENTS	LICENSING
05.1.04.06.1	CV-517	ISA	PRESSURE LOW	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-518 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP IF CLOSED, BUT TECH SPEC CHANGE REQ. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBLOCA) TO REMAIN BOUNDED BY ANALYSIS	32.2	REVISE NRP 1-3582 TO INCLUDE APPROPRIATE VALVE DRIFT SURVEILLANCE REQUIREMENTS FOR CV-517/518	NUCLEAR
05.1.04.06.1	CV-517	ISA	PRESSURE LOW	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-518 ALSO AFFECTED. ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP IF CLOSED, BUT TECH SPEC CHANGE REQ. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBLOCA) TO REMAIN BOUNDED BY ANALYSIS	32.3	REVISE IST PROGRAM AS NEEDED TO INCLUDE VALVE DRIFT CRITERIA FOR CV-517/518	STATION TECH
05.1.05.01.1	CV-82	VALVE/ACTUATOR	OPEN	NOISE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*INCLUDES SV-128, Z50/C-1082. BOI 13 PERMIT SPRAY PUMPS TO BE TRIPPED AFTER PRESSURE REDUCTION POST-LOCA. VALVE FAILURE ON LOSS OF AIR NOT CONSISTENT WITH BASIS FOR ACCEPTANCE OF PENETRATION CONFIGURATION UNDER SBP TOPIC VI-4.	32.4	MODIFY CONTAINMENT SPRAY PENETRATION ISOLATION CONFIGURATION TO COMPLY WITH SBP TOPIC VI-4 ISOLATION CRITERIA OR PROVIDE OTHER JUSTIFICATION (EG. FORMAL CALC TO DEMONSTRATE RECIRC PP LOOP SEAL AT PENETRATION), AND FORWARD ANY UFSAR CHANGES TO LICENSING	NUCLEAR

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
05.1.05.01.1	CV-82	VALVE/ACTUATOR	OPEN	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*INCLUDES SV-128, ZSO/C-1082. BOI PERMIT SPRAY PUMPS TO BE TRIPPED AFTER PRESSURE REDUCTION POST-LOCA. VALVE FAILURE ON LOSS OF AIR NOT CONSISTENT WITH BASIS FOR ACCEPTANCE OF PENETRATION CONFIGURATION UNDER SEP TOPIC VI-4.	32.5	OBTAIN NRC CONCURRENCE WITH DEVIATIONS OF CONTAINMENT SPRAY PENETRATION ISOLATION CONFIGURATION FROM SEP TOPIC VI-4 CRITERIA AS NEEDED	LICENSING
05.1.05.04.1	CV-82	VITAL BUS #1 (8-1111V)	VOLTS LOW	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION POST-LOCA. NOT CONSISTENT WITH SEP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF CONTAINMENT ISOLATION CONFIGURATION FOR THE SPRAY PENETRATION	32	(SAME AS 5.1.5.1.1)	
05.1.05.05.1	CV-82	ISA	PRESSURE LOW	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION. NOT CONSISTENT WITH SEP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF THE ISOLATION CONFIGURATION FOR THIS PENETRATION	32	(SAME AS 5.1.5.1.1)	
05.2.02.01.1	MANUAL VALVES, TRAIN B BOUNDARY		OPEN	*LOSS OF TRAIN B HYDRAZINE FLOW OR REDUCTION IN DURATION OF HYDRAZINE FLOW FOR BOTH TRAINS DUE TO INVENTORY LOSS THROUGH UNLOCKED VALVES	SEE TABLE 5-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	01	(SAME AS 5.1.2.1.1)	
05.2.04.01.1	CV-518	VALVE/ACTUATOR	OPEN	NONE FOR INJECTION. INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF SINGLE RECIRC PUMP PER BOI	*INCLUDES PI-3518. NORMAL POSITION. BOI DOES NOT CURRENTLY REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED BY HYDRAULIC NCT34-D12 SUPPL B	13	(SAME AS 5.1.4.1.1)	
05.2.04.02.2	CV-518	BVST (RELAT)	CONTACTS OPEN (OFF)	1 OF 2 REDUNDANT HI-FLOW SPRAY PATHS POTENTIALLY INOPERABLE FOR INJECTION, POTENTIAL INABILITY TO REDUCE SPRAY FLOW TO WITHIN CAPACITY OF ONE RECIRC PUMP, AFFECTING PUMP HEAD FOR ALTERNATE HLR PATH	*NORMAL POSITION. BOI DOES NOT CURRENTLY REQUIRE RUNNING BOTH RECIRC PUMPS AS ASSUMED IN HYDRAULIC CALC NCT34-012 SUPPL D	13	(SAME AS 5.1.4.1.1)	
05.2.04.06.1	CV-518	ISA	PRESSURE LOW	*POTENTIAL COMMON-CAUSE LOSS OF BOTH HI-FLOW SPRAY PATHS DURING INJECTION, NO ADMIN CONTROLS REQUIRE VALVES TO BE OPEN EFFECT ON RECIRCULATION	*REDUNDANT VALVE CV-517 ALSO AFFECTED. NO ADMIN CONTROLS REQUIRE VALVES TO BE OPEN DURING NORMAL OPS OR DECLARED INOP. IF CLOSED. VALVES MUST REMAIN FULLY OPEN FOR AT LEAST 5 HOURS (SMALLEST SBLOCA) TO REMAIN BOUNDED BY ANALYSES. TECH SPEC CHANGE REQUIRED	32	(SAME AS 5.1.4.6.1)	
05.2.05.01.1	CV-114	VALVE/ACTUATOR	OPEN	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*INCLUDES SV-118, ZSO/C-1114. BOI PERMIT SPRAY PUMPS TO BE TRIPPED AFTER PRESSURE REDUCTION POST-LOCA. VALVE FAILURE ON LOSS OF AIR NOT CONSISTENT WITH BASIS FOR ACCEPTANCE OF PENETRATION CONFIGURATION UNDER SEP TOPIC VI-4.	32	(SAME AS 5.1.5.1.1)	
05.2.05.04.1	CV-114	VITAL BUS #2 (8-1214V)	VOLTS LOW	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION POST-LOCA. NOT CONSISTENT WITH SEP TOPIC VI-4 BASIS FOR ACCEPTABILITY OF CONTAINMENT ISOLATION CONFIGURATION FOR THE SPRAY PENETRATION	32	(SAME AS 5.1.5.1.1)	

EMERGENCY COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPFB UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
05.2.05.05.1	CV-114	ISA	PRESSURE LOW	NONE FOR CONTAINMENT SPRAY, LOSS OF CONTAINMENT ISOLATION VALVING FOR SPRAY PENETRATION	*BOI PERMITS SPRAY PUMP TRIP AFTER PRESSURE REDUCTION. NOT CONSISTENT WITH SSP TOPIC M1-4 BASIS FOR ACCEPTABILITY OF THE ISOLATION CONFIGURATION FOR THIS PENETRATION	32	(SAME AS 5.1.5.1.1)	
05.3.01.02.1	CHECK VALVES, COMMON FLOW		NONE (PASSIVE)		*INCLUDES CRS-301, SHA-315, CRS-301 NOT LEAK TESTED FOR RECIRC BOUNDARY FUNCTION IN 1ST PROGRAM	02.2	REVISE 1ST AND OTHER PROCEDURES AS NEEDED FOR SI/RECIRC LEAKAGE TESTING	STATION TECH
05.3.01.02.1	CHECK VALVES, COMMON FLOW		NONE (PASSIVE)		*INCLUDES CRS-301, SHA-315, CRS-301 NOT LEAK TESTED FOR RECIRC BOUNDARY FUNCTION IN 1ST PROGRAM	02.3	DETERMINE APPLICABLE LEAK TEST REQUIREMENTS FOR RECIRC SYSTEM. (CRS-301 CURRENTLY TESTED ONLY FOR CROSS LEAKAGE PER SOI-12.4-15)	NUCLEAR
05.3.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	*LOSS OF BOTH TRAINS OF CONTAINMENT SPRAY DUE TO UNINHOLABLE LOSS OF INVENTORY THROUGH OUTSIDE CONTAINMENT VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SUITABLE BACKUP DEVICES	SEE TABLE 5-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	01	(SAME AS 5.1.2.1.1)	
05.3.03.01.1	MOV-883	VALVE/ACTUATOR	OPEN	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02	(SAME AS 5.3.1.2.1)	
05.3.03.02.1	MOV-883	RMS-2054	CONTACTS OPEN	(SAME AS 5.3.3.1.1)	* (SAME AS 5.3.3.1.1)	02	(SAME AS 5.3.1.2.1)	
05.3.03.03.1	MOV-883	RMS-2047	OPEN POSITION (CONTACTS B/C CLOSED)	(SAME AS 5.3.3.1.1)	* (SAME AS 5.3.3.1.1). HANDSWITCH IS SPRING RETURN TO NEUTRAL POSITION	02	(SAME AS 5.3.1.2.1)	
05.3.03.04.1	MOV-883	42-CC OR 42A-CC (CONTACTORS)	OFF (CONTACTOR OPEN)	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02	(SAME AS 5.3.1.2.1)	
05.3.03.04.2	MOV-883	42-CC OR 42A-CC (CONTACTORS)	ON (CONTACTOR CLOSED)	REDUCED REDUNDANCY AGAINST SPURIOUS VALVE CLOSURE	*VERIFICATION NEEDED THAT EXISTING SURVEILLANCES WOULD DETECT THIS FAILURE	29	INCLUDE CONTACTOR STATUS INDICATING LIGHTS AND SURVEILLANCE REQUIREMENTS FOR MOV-883 IN NRP 1-3612 TO PREVENT AN UNDETECTED LOSS OF CONTACTOR REDUNDANCY	ELECTRICAL
05.3.03.05.1	MOV-883	MCC-3 (42-1390)	VOLTS LOW	REDUCED REDUNDANCY FOR ISOLATION OF RWST FROM RECIRCULATED SUMP WATER	*CHECK VALVE NOT LEAK TESTED AS PART OF RECIRC SYSTEM LEAKAGE MONITORING PROGRAM	02	(SAME AS 5.3.1.2.1)	
05.3.04.01.1	MOV-880	VALVE/ACTUATOR	OPEN	REDUCED RELIABILITY OF CONTAINMENT SPRAY BOUNDARY	*RV-882 MAY DIVERT FLOW TO VCT. ALTERNATE COLD LRG RECIRC NOT CREDITED BECAUSE UNANALYZED FOR FLOW/HEAD ADEQUACY	04.1	REVISE RWST AND SI/PM LO-LO SETPOINT CALCULATIONS TO ADDRESS INVENTORY DIVERGIONS	NUCLEAR

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EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
06.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CCM FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SB BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. HARR-UP SYSTEM IS NON-SAFETY RELATED AND NON-SRISMIC, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT	01.1	VERIFY: A) VALVE LOCKING PROGRAM CRITERIA DO NOT INCLUDE CRITICAL MANUAL VALVES, AND B) OTHER ADMINISTRATIVE CONTROLS ARE SUFFICIENT TO PREVENT MISPOSITIONING OF MANUAL VALVES WHICH ARE NOT COVERED BY THE VALVE LOCKING PROGRAM	OPERATIONS
06.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CCM FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SB BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. HARR-UP SYSTEM IS NON-SAFETY RELATED AND NON-SRISMIC, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT	01.4	DETERMINE ALLOWABLE CCM SYSTEM LEAKAGE VIA CALCULATION	MECHANICAL
06.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CCM FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SB BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. HARR-UP SYSTEM IS NON-SAFETY RELATED AND NON-SRISMIC, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT	01.5	DETERMINE ACTUAL CCM SYSTEM LEAKAGE VIA LOGS OF SYSTEM HARRUP	OPERATIONS
06.1.02.01.1	MANUAL VALVES, TRAIN A BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CCM FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SB BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. HARR-UP SYSTEM IS NON-SAFETY RELATED AND NON-SRISMIC, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT	01.6	EVALUATE ACTUAL VS. ALLOWABLE CCM SYSTEM LEAKAGE AND DETERMINE NEED FOR POST-ACCIDENT HARRUP MODIFICATIONS	MECHANICAL
06.1.03.03.3	G-15A	CS: 52-1121 (CONTROL SWITCH)	MANUAL (OUT OF AUTO)	INOPERABILITY OF TRAIN A CCM PUMP FOR INJECTION, INITIAL RECIRC	*TECH SPEC 3.3.1 ACTION ENTRY REQUIRED IF PUMP IS NOT IN AUTO MODE	31	IMPLEMENT NMP 1-3636 TO MODIFY CCM PUMP CONTROL LOGIC SO THAT SIS/SISLOP WILL START THE PUMP IRRESPECTIVE OF WHETHER THE CONTROL SWITCH IS IN AUTO	MECHANICAL
06.1.03.03.5	G-15A	CS: 52-1121 (CONTROL SWITCH)	SHORT/GROUND (ALL CONTACTS)	INOPERABILITY OF TRAIN A CCM PUMP, POTENTIAL LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP	*125VDC SYSTEMS NORMALLY UNGROUNDED. TECH SPEC ACTION ENTRY REQUIRED IF EITHER SYSTEM NEGATIVE POLE GROUNDED TO PRECLUDE COMMON-MODE LOSS OF CONTROL POWER TO TRAIN A/B DUE TO THIS SINGLE FAILURE	37.1	EVALUATE: 125VDC BUS % GROUND CRITERIA FOR TECH SPEC ACTION ENTRY AND/OR MODIFICATIONS TO ELIMINATE TRAIN-COMMON 125VDC DEVICES AS PART OF INTEGRATED RESOLUTION OF SBP TOPIC VI-7.C.2	ELECTRICAL
06.1.03.06.2	G-15A	CS: 52-1221 (CONTROL SWITCH)	CONTACTS CLOSED (START/AFTER START)	*POTENTIAL COMMON-MODE LOSS OF TRAIN A ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND TRAIN B CCM PUMP OVERLOAD OR BUS UNDERVOLTAGE DURING SISLOP. NONE FOR SIS	NORMAL POSITION.	17	REVISE SISLOP LOADING CALCULATION TO ACCOUNT FOR OUT OF SEQUENCE CCM/SWC PUMP LOADING	ELECTRICAL
06.1.03.07.2	G-15A	27-2 (SWGR2 UV RELAT) 86 (52-1221 OVL RELAT)	CONTACTS CLOSED (UV OFF, OVL ON)	*(SAME AS 6.1.3.6.2)		17	(SAME AS 6.1.3.6.2)	
06.1.03.08.2	G-15A	CS: 52-1305 (CONTROL SWITCH)	CONTACTS CLOSED (START/AFTER START)	*POTENTIAL COMMON-MODE LOSS OF TRAIN A ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND SWING BUS UNDERVOLTAGE FOLLOWING SIS/SISLOP TRIP OF SWGR #3		17	(SAME AS 6.1.3.6.2)	
06.1.03.09.2	G-15A	27-2 (SWGR3 UV RELAT) 86 (52-1305 OVL RELAT)	CONTACTS CLOSED (UV OFF, OVL ON)	*(SAME AS 6.1.3.8.2)		17	(SAME AS 6.1.3.8.2)	

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EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ONOPER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BCCS	REMARKS	REPORT ITEM	ACTION ITEM	RSP DISCIPLINE
06.2.02.01.1	MANUAL VALVES, TRAIN B BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CCM FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. MAKE-UP SYSTEM IS NON-SAFETY RELATED AND NON-BRISMIC, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT	01	(SAME AS 6.1.2.1.1)	
06.2.03.03.3 G-15B	CS: 52-1221 (CONTROL SWITCH)	MANUAL (OUT OF AUTO)	SHORT/GROUND	IMOPERABILITY OF TRAIN B CCM PUMP FOR INJECTION, INITIAL RECIRC	*TRAIN SPEC 3.3.1 ACTION ENTRY REQUIRED IF PUMP IS NOT IN AUTO MODE	31	(SAME AS 6.1.3.3.3)	
06.2.03.03.5 G-15B	CS: 52-1221 (CONTROL SWITCH)	SHORT/GROUND (ALL CONTACTS)		IMOPERABILITY OF TRAIN B CCM PUMP, . POTENTIAL LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP	*125VDC SYSTEMS NORMALLY UNGROUNDED. TECH SPEC ACTION ENTRY REQUIRED IF EITHER SYSTEM NEGATIVE POLE GROUNDED TO PRECLUDE COMMON-MODE LOSS OF CONTROL POWER TO TRAIN A/B DUE TO THIS SINGLE FAILURE	37	(SAME AS 6.1.3.3.5)	
06.2.03.06.2 G-15B	CS: 52-1121 (CONTROL SWITCH)	CONTACTS CLOSED (START/AFTER START)		*POTENTIAL COMMON-MODE LOSS OF TRAIN B ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND TRAIN A CCM PUMP OVERLOAD OR BUS UNDERVOLTAGE DURING SISLOP, MONR FOR SIS	NORMAL POSITION.	17	(SAME AS 6.1.3.6.2)	
06.2.03.07.2 G-15B	27-2 (SWGR1 UV RELAY) 86 (52-1121 OVLD RELAY)	CONTACTS CLOSED (UV OFF, OVLD ON)		*POTENTIAL COMMON-MODE LOSS OF TRAIN B ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND SWING BUS UNDERVOLTAGE FOLLOWING SIS/SISLOP TRIP OF SWGR #3		17	(SAME AS 6.1.3.6.2)	
06.2.03.08.2 G-15B	CS: 52-1305 (CONTROL SWITCH)	CONTACTS CLOSED (START/AFTER START)		*POTENTIAL COMMON-MODE LOSS OF TRAIN B ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND SWING BUS UNDERVOLTAGE FOLLOWING SIS/SISLOP TRIP OF SWGR #3		17	(SAME AS 6.1.3.6.2)	
06.2.03.09.2 G-15B	27-2 (SWGR3 UV RELAY) 86 (52-1305 OVLD RELAY)	CONTACTS CLOSED (UV OFF, OVLD ON)		*POTENTIAL COMMON-MODE LOSS OF TRAIN B ELECTRICAL POWER, DUE TO OUT OF SEQUENCE BUS LOADING AND SWING BUS UNDERVOLTAGE FOLLOWING SIS/SISLOP TRIP OF SWGR #3		17	(SAME AS 6.1.3.6.2)	
06.3.02.01.1	MANUAL VALVES, SOUTH PUMP BOUNDARY		OPEN	*POTENTIAL LOSS OF TRAIN A AND B CCM FOR INJECTION AND RECIRCULATION DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SR BACKUPS	SEE TABLE 6-2 FOR DETAILED BOUNDARY VALVE ANALYSIS. MAKE-UP SYSTEM IS NON-SAFETY RELATED AND NON-BRISMIC, SO THAT IT CANNOT BE CREDITED POST-ACCIDENT	01	(SAME AS 6.1.2.1.1)	
06.3.03.03.5 G-15C	CS: 52-1305 (CONTROL SWITCH)	SHORT/GROUND (ALL CONTACTS)		IMOPERABILITY OF SOUTH CCM PUMP	*125VDC SYSTEMS NORMALLY UNGROUNDED. TECH SPEC ACTION ENTRY REQUIRED IF EITHER SYSTEM NEGATIVE POLE GROUNDED TO PRECLUDE COMMON-MODE LOSS OF CONTROL POWER TO TRAIN A/B DUE TO THIS SINGLE FAILURE	37	(SAME AS 6.1.3.3.5)	
06.4.01.03.1	MANUAL VALVES, COMMON FLOW PATH 351, 352, 353	CCM-301, 350,	OPEN	POTENTIAL REDUCTION OF CCM FLOW TO BCCS LOADS	*SURGE TANK/RAD MONITOR LINE. CCM-350, 352, 353 NOT IN LOCKING PROGRAM	14.1	PROVIDE LIST OF CCM FLOW PATH VALVES TO BE LOCKED TO ENSURE SAFETY RELATED FLOW PATHS ARE NOT DEGRADED (INCLUDING DIVERSION DUE TO EXCESSIVE FLOW THROUGH OTHER FLOW PATHS)	MECHANICAL
06.4.01.03.1	MANUAL VALVES, COMMON FLOW PATH 351, 352, 353	CCM-301, 350,	OPEN	POTENTIAL REDUCTION OF CCM FLOW TO BCCS LOADS	*SURGE TANK/RAD MONITOR LINE. CCM-350, 352, 353 NOT IN LOCKING PROGRAM	14.2	ADD APPROPRIATE CCM VALVES TO THE VALVE LOCKING PROCEDURE	OPERATIONS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONEOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RRSP DISCIPLINE
06.4.01.04.1	MANUAL VALVES, COMMON FLOW PATH 406, 407, 408, 409, 410, 411	CCM-404, 405	OPEN	*POTENTIAL REDUCTION OF CCM FLOW TO ECCS LOADS	*REACTOR CYCLE SAMPLE H2s. CCM-407, 408, 14 409, 410 THROTTLE FLOW BUT NOT IN LOCKING PROGRAM. NO FLOW INDICATION PROVIDED. THEREFORE, SYSTEM HYDRAULIC BALANCE REQUIRED WITH VALVES FULLY OPEN	14	(SAME AS 6.4.1.3.1)	
06.4.01.05.1	MANUAL VALVES, COMMON FLOW PATH 423, 424	CCM-421, 422	OPEN	*POTENTIAL REDUCTION OF CCM FLOW TO OTHER ECCS LOADS	*CHARGING PUMP LUBE OIL COOLING FLOW INDICATION NOT PROVIDED AND VALVES NOT IN LOCKING PROGRAM	14	(SAME AS 6.4.1.3.1)	
06.4.01.05.2	MANUAL VALVES, COMMON FLOW PATH 423, 424	CCM-421, 422	CLOSED	*LOSS OF BOTH CHARGING PUMPS FOR SIS, LOSS OF CHARGING PUMP G-8B FOR SISLOP	*ASSUMED PRE-EXISTING FAILURE IN ABSENCE OF VALVE LOCKING, BECAUSE COOLING DUTY FOR NORMAL OPERATION (VERIFIED BY LUBE OIL TEMPERATURE ALARMS) DOES NOT BOUND POST-ACCIDENT CHARGING PUMP HEAT LOADS	14.3	(SAME AS 6.4.1.3.1)	
06.4.01.05.2	MANUAL VALVES, COMMON FLOW PATH 423, 424	CCM-421, 422	CLOSED	*LOSS OF BOTH CHARGING PUMPS FOR SIS, LOSS OF CHARGING PUMP G-8B FOR SISLOP	*ASSUMED PRE-EXISTING FAILURE IN ABSENCE OF VALVE LOCKING, BECAUSE COOLING DUTY FOR NORMAL OPERATION (VERIFIED BY LUBE OIL TEMPERATURE ALARMS) DOES NOT BOUND POST-ACCIDENT CHARGING PUMP HEAT LOADS	14.3	VERIFY LOW FLOW ALARM SETPOINT PROVIDES ADEQUATE CHARGING PUMP LUBE OIL COOLING POST-ACCIDENT	MECHANICAL
06.4.01.06.1	MANUAL VALVES, COMMON FLOW PATH 416	CCM-412, 415	OPEN	*POTENTIAL REDUCTION IN CCM FLOW TO OTHER ECCS LOADS	*SEAL WATER BK. VALVE CCM-415 PRESET TO THROTTLE FLOW. VALVES NOT IN LOCKING PROGRAM	14	(SAME AS 6.4.1.3.1)	
06.4.01.06.2	MANUAL VALVES, COMMON FLOW PATH 416	CCM-412, 415	CLOSED	*POTENTIAL LOSS OF CHARGING PUMP SUCTION SUBCOOLING PRIOR TO REMOTE-MANUAL ISOLATION OF SEAL WATER RETURN LINE	*SEAL WATER RETURN LINE ISOLATION VALVES NOT AUTOMATICALLY ISOLATED ON SIS/SISLOP OR CIS	14	(SAME AS 6.4.1.3.1)	
06.4.01.07.1	MANUAL VALVES, COMMON FLOW PATH 429-434, 436-440, 442, 495, 497	CCW 425-427	OPEN	*POTENTIAL REDUCTION OF CCM FLOW TO ECCS LOADS	*RWL LOADS (WASTE GAS COMPRESSORS, AFTERCOOLERS, SAMPLE COOLERS, ETC). FLOW INDICATION NOT PROVIDED AND VALVES NOT IN LOCKING PROGRAM. THEREFORE, SYSTEM HYDRAULIC BALANCE REQUIRED WITH VALVES FULLY OPEN	14	(SAME AS 6.4.1.3.1)	
06.4.01.08.1	MANUAL VALVES, COMMON FLOW PATH 017, 019, 453, 476, 477	CCW-003, 009	OPEN	*POTENTIAL REDUCTION OF CCM FLOW TO OTHER ECCS LOADS	*RCP-A MOTOR AND THERMAL BARRIER COOLING. VALVES NOT IN LOCKING PROGRAM	14	(SAME AS 6.4.1.3.1)	
06.4.01.09.1	MANUAL VALVES, COMMON FLOW PATH 096, 098, 457, 486, 487	CCW-086, 090	OPEN	*POTENTIAL REDUCTION OF CCM FLOW TO OTHER ECCS LOADS	*RCP-B MOTOR AND THERMAL BARRIER COOLING. VALVES NOT IN LOCKING PROGRAM	14	(SAME AS 6.4.1.3.1)	
06.4.01.10.1	MANUAL VALVES, COMMON FLOW PATH 016, 018, 455, 481, 482	CCW-006, 010	OPEN	*POTENTIAL REDUCTION OF CCM FLOW TO OTHER ECCS LOADS	*RCP-C MOTOR AND THERMAL BARRIER COOLING. VALVES NOT IN LOCKING PROGRAM	14	(SAME AS 6.4.1.3.1)	
06.4.01.12.1	MANUAL VALVES, COMMON FLOW PATH 470	CCW-450, 469	OPEN	*POTENTIAL REDUCTION IN CCM FLOW TO ECCS LOADS	*RBCSS LSTDOWN H2, NOT NORMALLY IN SERVICE. CCM-469 PRESET TO THROTTLE FLOW. VALVES NOT IN LOCKING PROGRAM	14	(SAME AS 6.4.1.3.1)	
06.4.01.13.1	MANUAL VALVES, COMMON FLOW PATH 070, 073, 443, 445, 459, 461, 463	CCW 041-046	OPEN	*POTENTIAL REDUCTION IN CCM FLOW TO ECCS LOADS	*RHR H2s AND RHR PUMP COOLING. RHR H2s CCM FLOW CONTROLLED BY TCV-601A/B. VALVES NOT IN LOCKING PROGRAM	14	(SAME AS 6.4.1.3.1)	

7-201 Supply Training Manual

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP. DISCIPLINE
06.4.01.14.1	MANUAL VALVES, COMMON FLOW PATH 058, 063,065,067,069, 447,463	CCW-050,052,054, OPRM		*POTENTIAL REDUCTION IN CCM FLOW TO ECCS LOADS	*REACTOR SHIELD COOLING COILS. FLOW INDICATION NOT PROVIDED AND VALVES NOT IN LOCKING PROGRAM. THEREFORE SYSTEM HYDRAULIC BALANCE REQUIRED WITH VALVES FULLY OPEN	14	(SAME AS 6.4.1.3.1)	
06.4.01.15.1	CHECK VALVES, COMMON FLOW PATH 025, 035	CCM-001, 011, NONE (PASSIVE)			*RCP-A THERMAL BARRIER COOLING/EMERGENCY 14.4 THERMAL BARRIER PATH. CCM-001 AND 025 NOT IN 1ST PROGRAM		DETERMINE FUNCTIONAL REQUIREMENTS AND APPROPRIATE MECHANICAL SURVEILLANCES FOR CCM CHECK VALVES, AND IMPLEMENT MODIFICATIONS AS NEEDED	
06.4.01.15.1	CHECK VALVES, COMMON FLOW PATH 025, 035	CCM-001, 011, NONE (PASSIVE)			*RCP-A THERMAL BARRIER COOLING/EMERGENCY 14.5 THERMAL BARRIER PATH. CCM-001 AND 025 NOT IN 1ST PROGRAM		REVISE 1ST PROGRAM TO INCLUDE CCM CHECK VALVES AS STATION TRCH NEEDED	
06.4.01.16.1	CHECK VALVES, COMMON FLOW PATH 082, 092	CCW-024, 040, NONE (PASSIVE)			*RCP-B THERMAL BARRIER COOLING/EMERGENCY 14 THERMAL BARRIER PATH. CCM-024 AND 082 NOT IN 1ST PROGRAM		(SAME AS 6.4.1.15.1)	
06.4.01.17.1	CHECK VALVES, COMMON FLOW PATH 026, 032	CCW-002, 012, NONE (PASSIVE)			*RCP-C THERMAL BARRIER COOLING/EMERGENCY 14 THERMAL BARRIER PATH. CCM-002 AND 026 NOT IN 1ST PROGRAM		(SAME AS 6.4.1.15.1)	
06.4.02.01.1	MANUAL VALVES, COMMON BOUNDARY		OPEN	*POTENTIAL LOSS OF BOTH TRAINS OF CCM PUMPING DUE TO UNISOLABLE LOSS OF INVENTORY THROUGH VALVES WHICH ARE NOT LOCKED CLOSED OR PROVIDED WITH SAFETY RELATED BACKUPS	SEE TABLE E-2 FOR DETAILED BOUNDARY VALVE ANALYSIS	01	(SAME AS 6.1.2.1.1)	
06.4.03.01.1	TCV-601A	VALVE/ACTUATOR	OPEN	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT CCM FLOW RATE	*INCLUDES PCV-1601A. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING, DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14.6	IMPLEMENT DCP 1-3553	MECHANICAL
06.4.03.02.2	TCV-601A	TC-601A LOOP	OUTPUT LOW (VALVE OPEN)	(SAME AS 6.4.3.1.1)	*ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	
06.4.03.02.3	TCV-601A	TC-601A LOOP	BQ	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	
06.4.03.03.1	TCV-601A	ISA	PRESSURE LOW	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*INCLUDES VALVE ISA-1242. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	
06.4.04.01.1	TCV-601B	VALVE/ACTUATOR	OPEN	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT CCM FLOW RATE	*INCLUDES PCV-1601B. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING, DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	

A. The word "standing room"

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB GNOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
06.4.04.02.2	TCV-601B	TC-601B LOOP	OUTPUT LOW (VALVE OPEN)	(SAME AS 6.4.4.1.1)	*ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	
06.4.04.02.3	TCV-601B	TC-601B LOOP	EQ	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	
06.4.04.03.1	TCV-601B	ISA	PRESSURE LOW	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*INCLUDES VALVE ISA-1243. ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	
06.4.05.01.1	TCV-601A TCV-601B	VITAL BUS #4 (8-1402V)	VOLTS LOW	FLOW TO ECCS LOADS REDUCED TO MINIMUM ACCEPTABLE WITH ONE CCM PUMP AND REDUCED SPENT FUEL PIT HEAT LOAD	*ONE OF TCV-601A/B ISOLATED BY BLOCK VALVE, OTHER FLOW LIMITED BY STEM TRAVEL COLLAR. CONFIGURATION NOT ACCEPTABLE AFTER CYCLE 11 REFUELING DUE TO INCREASED SPENT FUEL PIT HEAT LOAD	14	(SAME AS 6.4.3.1.1)	
06.4.06.01.1	PC-605 LOOP	PC-605	CONTACTS OPEN (LO HDR PRESS)	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	NORMAL RESPONSE FOLLOWING BUS UNDERVOLTAGE TRIPS FOR SISLOP EVENT	17	(SAME AS 6.1.3.6.2)	
06.4.06.01.3	PC-605 LOOP	PC-605	EQ	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	EQ FAILURE (INCLUDING OPEN, SHORT OR GROUND) COULD MIMIC NORMAL RESPONSE FOLLOWING BUS UNDERVOLTAGE TRIPS FOR SISLOP EVENT	17	(SAME AS 6.1.3.6.2)	
06.4.06.02.4	PC-605 LOOP	PC-605E (RELAT)	OUTPUT SHORT OR GROUND	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	*COMMON-MODE LOSS OF BOTH ELECTRICAL TRAINS COULD OCCUR WITH PRE-HEATING GROUND ON NEGATIVE POLE OF DC SYSTEM. TECH SPEC ACTION ENTRY REQUIRED WITH DC SYSTEM GROUNDED	17	(SAME AS 6.1.3.6.2)	
06.4.06.02.4	PC-605 LOOP	PC-605I (RELAT)	OUTPUT SHORT OR GROUND	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS	*COMMON-MODE LOSS OF BOTH ELECTRICAL TRAINS COULD OCCUR WITH PRE-HEATING GROUND ON NEGATIVE POLE OF DC SYSTEM. TECH SPEC ACTION ENTRY REQUIRED WITH DC SYSTEM GROUNDED	37	(SAME AS 6.1.3.3.5)	
06.4.06.03.1	PC-605 LOOP	VITAL BUS #4 (8-1415V)	VOLTS LOW	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING DURING SISLOP, NONE FOR SIS		17	(SAME AS 6.1.3.6.2)	
06.4.07.03.1	CV-722A CV-722B CV-722C	ISA	PRESSURE LOW	NONE	*VALVES NORMALLY OPEN. THIS FAILURE WOULD PREVENT REMOTE-MANUALLY CLOSING FOR THERMAL BARRIER COIL FAILURE. VERIFICATION REQUIRED THAT FLOW RATE INTO CCM SYSTEM FOR THIS EVENT IS LESS THAN LOCA THRESHOLD	14.7	VERIFY BY HEATING OR NEW CALCULATION THAT RCS FLOW INTO FAILED THERMAL BARRIER COIL IS LESS THAN 300 GPM LOCA THRESHOLD	MECHANICAL

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
06.4.06.01.2	C-964	PUMP/MOTOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF TRAIN A 125VDC CONTROL POWER FOR LOCA, HSLB OR FWLB. WITH CONCURRENT SINGLE FAILURE OF TRAIN B, RESULTS IN LOSS OF ALL AC POWER	*PUMP/MOTOR AND CABLING NOT QUALIFIED FOR IN-CONTAINMENT ENVIRONMENT, CIRCUIT NOT ISOLATED ON SIS/SISLOP, EFFECT NOT ANALYZED IN DESIGN BASIS BATTERY LOADING CALCULATION	19.1	EVALUATE ISOLATION ADEQUACY FOR UNQUALIFIED LOADS ON 125VDC BUS AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-7.C.2	ELECTRICAL
06.4.08.01.2	C-964	PUMP/MOTOR	BQ	*POTENTIAL COMMON-CAUSE LOSS OF TRAIN A 125VDC CONTROL POWER FOR LOCA, HSLB OR FWLB. WITH CONCURRENT SINGLE FAILURE OF TRAIN B, RESULTS IN LOSS OF ALL AC POWER	*PUMP/MOTOR AND CABLING NOT QUALIFIED FOR IN-CONTAINMENT ENVIRONMENT, CIRCUIT NOT ISOLATED ON SIS/SISLOP, EFFECT NOT ANALYZED IN DESIGN BASIS BATTERY LOADING CALCULATION	19.2	REVISE BATTERY LOADING CALCULATION TO ACCOUNT FOR HIGH IMPEDANCE FAULTS OF UNQUALIFIED EQUIPMENT AS MERGED	ELECTRICAL

CDM "M" No. M-4128

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ACCS	REMARKS	REPORT ITEM	ACTION ITEM	ERSP DISCIPLINE
07.1.03.05.2 G-13A	63 (52-1214 DISCH PRESS RELAY)	LOW (ON)	CONTACTS CLOSED	POTENTIAL INOPERABILITY OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	*SVC PUMPS MUST BE MAINTAINED OUT OF AUTO, OR BUS VOLTAGE CALCULATIONS REVISED TO INCLUDE SVC PUMP START CONCURRENT WITH DG BRKR CLOSURE	17	REVISE SISLOP LOADING CALCULATION TO ACCOUNT FOR OUT OF SEQUENCE CCW/SVC PUMP LOADING	ELECTRICAL
07.1.03.06.2 G-13A	86 (52-1214 OVLDR RELAY)	LOW (ON)	CONTACTS CLOSED	(SAME AS 7.1.3.5.2)	(SAME AS 7.1.3.5.2)	17	(SAME AS 7.1.3.5.2)	
07.1.03.09.1 G-13A	86 (52-1114 OVLDR RELAY)	LOW (ON)	CONTACTS CLOSED	*POTENTIAL LOSS OF SVC FUNCTION FOR SISLOP DUE TO LOSS OF TRAIN A SMC PUMP (SIS/SISLOP) AND POTENTIAL CONCURRENT LOSS OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING (SISLOP ONLY)	*SVC PUMPS MUST BE MAINTAINED OUT OF AUTO OR BUS VOLTAGE CALCULATIONS REVISED TO CONSIDER SMC PUMP START CONCURRENT WITH DG BRKR CLOSURE	17	(SAME AS 7.1.3.5.2)	
07.1.03.11.1 G-13A	SERVICE WATER	PRESSURE LOW		*POTENTIAL INOPERABILITY OF SMC FOR LONG-TERM POST-SIS/SISLOP OPERATION	*COMMON-CAUSE FAILURE MAY OCCUR DUE TO POSTULATED CONCURRENT SEISMIC EVENT. BACKUP BEARING COOLING STEPS REQUIRED IN NOLA. ALSO, FAILURE REDUCES PUMP OUTPUT UNTIL BOUNDARY VALVES LOCALLY CLOSED, SO THAT PUMP IS REQUIRED WITH BACKFLOW CONDITIONS		NO FURTHER ACTION REQUIRED. EXISTING PROCEDURES 801-7-12, 801-7-19 AND 801-2.4-1 (401) HAVE BEEN REVISED TO ADDRESS THIS FINDING CONSISTENT WITH UPSAR SECTION 9.2.1	
07.2.03.05.2 G-13B	63 (52-1114 DISCH PRESS RELAY)	LOW (ON)	CONTACTS CLOSED	POTENTIAL INOPERABILITY OF TRAIN B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING FOR SISLOP, NONE FOR SIS	*SVC PUMPS MUST BE MAINTAINED OUT OF AUTO, OR BUS VOLTAGE CALCULATIONS REVISED TO INCLUDE SMC PUMP START CONCURRENT WITH DG BRKR CLOSURE	17	(SAME AS 7.1.3.5.2)	
07.2.03.06.2 G-13B	86 (52-1114 OVLDR RELAY)	LOW (ON)	CONTACTS CLOSED	(SAME AS 7.2.3.5.2)	(SAME AS 7.2.3.5.2)	17	(SAME AS 7.1.3.5.2)	
07.2.03.09.1 G-13B	86 (52-1214 OVLDR RELAY)	LOW (ON)	CONTACTS CLOSED	*POTENTIAL LOSS OF SVC FUNCTION FOR SISLOP DUE TO LOSS OF TRAIN B SMC PUMP (SIS/SISLOP) AND POTENTIAL CONCURRENT LOSS OF TRAIN A ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING (SISLOP ONLY)	*SVC PUMPS MUST BE MAINTAINED OUT OF AUTO OR BUS VOLTAGE CALCULATIONS REVISED TO CONSIDER SMC PUMP START CONCURRENT WITH DG BRKR CLOSURE	17	(SAME AS 7.1.3.5.2)	
07.2.03.11.1 G-13B	SERVICE WATER	PRESSURE LOW		*POTENTIAL INOPERABILITY OF SMC FOR LONG-TERM POST-SIS/SISLOP OPERATION	*COMMON-CAUSE FAILURE MAY OCCUR DUE TO POSTULATED CONCURRENT SEISMIC EVENT. BACKUP BEARING COOLING STEPS REQUIRED IN NOLA. ALSO, FAILURE REDUCES PUMP OUTPUT UNTIL BOUNDARY VALVES LOCALLY CLOSED, SO THAT PUMP IS REQUIRED WITH BACKFLOW CONDITIONS		(SAME AS AS 7.1.3.11.1)	
07.4.03.01.2 NOV-9	VALVE/ACTUATOR	CLOSED		*LOSS OF SUCTION HEAD TO BOTH TRAINS OF SMC PUMPS, POTENTIALLY CAUSING LOSS OF BOTH PUMPS FOR SIS EVENTS (NO CIRC WATER PUMP TRIP) OR IF PRIOR TO SISLOP	*CIRC WATER PUMP SUCTION NOT LOCATED SUFFICIENTLY ABOVE SMC PUMP SUCTION TO PREVENT LOSS OF SMC PP NPSH. AUX SMC PUMP IS NON-SAFETY RELATED AND POWERED FROM SWGR #3, WHICH IS ISOLATED ON SIS/SISLOP	16.1	PROVIDE ADMINISTRATIVE POWER LOCKOUT TO NOV-9, 11 OPERATIONS	
07.4.05.01.2 NOV-11	VALVE/ACTUATOR	CLOSED		*LOSS OF SUCTION HEAD TO BOTH TRAINS OF SMC PUMPS, POTENTIALLY CAUSING LOSS OF BOTH PUMPS FOR SIS EVENTS (NO CIRC WATER PUMP TRIP) OR IF PRIOR TO SISLOP	*CIRC WATER PUMP SUCTION NOT LOCATED SUFFICIENTLY ABOVE SMC PUMP SUCTION TO PREVENT LOSS OF SMC PUMP NPSH. AUX SMC PUMP IS NON-SAFETY RELATED AND POWERED FROM SWGR #3, WHICH IS ISOLATED ON SIS/SISLOP	16	(SAME AS 7.4.3.1.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
07.4.07.01.3	NOV-9 NOV-10 NOV-11 NOV-12	VALVE ACTUATOR	SEISMIC	LOSS OF SUCTION HEAD TO BOTH TRAINS OF SMC PUMPS, POTENTIALLY CAUSING LOSS OF BOTH PUMPS FOR BIR EVENTS (NO CIRC WATER PUMP TRIP) OR IF PRIOR TO SISLOP	GATE ACTUATORS ARE NON-SEISMIC. CIRC WATER PUMP SUCTION NOT LOCATED SUFFICIENTLY ABOVE SMC PUMP SUCTION TO PREVENT LOSS OF SMC PUMP NPSH	16.2	REQUALIFY NOV-9 AND 11 ACTUATORS AND GATES TO SEISMIC CATEGORY A	CIVIL

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EMERGENCY COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR SHOWER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BCCS	REMARKS	REPORT ITEM	ACTION ITEM	RISP DISCIPLINE
08.1.09.02.2	SEQ 1 SI BLOCK	AI	INPUT SHORT	*SEQ 1 AND SI BLOCK FOR SEQ 2 DISABLED	SEQ 1 AND 2 SI BLOCK PERMISSIVE CETS USE 12.6 ADJACENT CONTACTS FROM SAME PZR PRESSURE RELAYS. 100A BRKR RATING TOO HIGH TO PROTECT RELAYS		INSTALL MFP 1-3623 TO PROVIDE ISOLATION BETWEEN REDUNDANT SEQ BLOCK CIRCUITS	CONTROLS
08.1.11.02.1	SEQ 1	BS-2166 (SIS RESET)	CONTACTS OPEN	*TRAIN A SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	CV-142/143/144 ACTUATED CLOSED BY REDUNDANT SOLENOID VALVES (ONE PER SEQ/TRAIN PER CV). CLR AND BLR UNAPPECTED BY THIS FAILURE SINCE PCV-1112 (SV-1112) HAS AN OVERRIDE SWITCH/RELAY TO PERMIT MODULATION/CLOSURE EVEN WITH SIS/SISLOP STILL PRESENT	12.1	REVISE SECONDARY RECIRC NOI TO POSITION CV-142/143/144 LOCALLY IN UNSUCCESSFUL FROM CONTROL ROOM	OPERATIONS
08.1.11.03.1	SEQ 1	SIS TRIP/NORMAL/RESET (SWITCH)	CONTACTS OPEN	*REDUCED RELIABILITY OF TRAIN A FOR SIS/SISLOP, TRAIN A SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	ROTARY SWITCH ON SLSR SURVEILLANCE PANEL 12		(SAME AS 0.1.11.2.1)	
08.2.09.02.2	SEQ 2 SI BLOCK	BI	INPUT SHORT	*SEQ 2 AND SI BLOCK FOR SEQ 1 DISABLED	SEQ 1 AND 2 SI BLOCK PERMISSIVE CETS USE 12 ADJACENT CONTACTS FROM SAME PZR PRESSURE RELAYS. 100A BRKR RATING TOO HIGH TO PROTECT RELAYS		(SAME AS 0.1.9.2.2)	
08.2.11.02.1	SEQ 2	BS-3166 (SIS RESET)	CONTACTS OPEN	*TRAIN B SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	CV-142/143/144 ACTUATED CLOSED BY REDUNDANT SOLENOID VALVES (ONE PER SEQ/TRAIN PER CV). CLR AND BLR UNAPPECTED BY THIS FAILURE SINCE PCV-1112 (SV-1112) HAS AN OVERRIDE SWITCH/RELAY TO PERMIT MODULATION/CLOSURE EVEN WITH SIS/SISLOP STILL PRESENT	12	(SAME AS 0.1.11.2.1)	
08.2.11.03.1	SEQ 2	SIS TRIP/NORMAL/RESET (SWITCH)	CONTACTS OPEN	*REDUCED RELIABILITY OF TRAIN B FOR SIS/SISLOP, TRAIN B SECONDARY RECIRC PUMPING DISABLED, LOSS OF SECONDARY RECIRC FLOW PATH	ROTARY SWITCH ON SLSR SURVEILLANCE PANEL 12		(SAME AS 0.1.11.2.1)	

EMERGENCY COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
09.1.08.01.2	CSAS TRAIN A (SRQ 1 TEST)	APXA (RBLAT)	UNTRIPPED (OFF)	REDUCED RELIABILITY OF TRAIN A CSAS PUMP ACTUATION	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APXA	26	VERIFY SRQ/CSAS SURVEILLANCE PROCEDURES DETECT INDIVIDUAL RELAY (CONTACT) FAILURES	CONTROLS
09.1.08.01.3	CSAS TRAIN A (SRQ 1 TEST)	APXA (RBLAT)	INPUT OPEN	(SAME AS 9.1.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APXA	26	(SAME AS 9.1.8.1.2)	
09.1.08.03.2	CSAS TRAIN A (SRQ 1 TEST)	AVXA (RBLAT)	UNTRIPPED (OFF)	TRAIN A CSAS VALVE ACTUATION INOPERABLE	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVXA	26	(SAME AS 9.1.8.1.2)	
09.1.08.03.3	CSAS TRAIN A (SRQ 1 TEST)	AVXA (RBLAT)	INPUT OPEN	(SAME AS 9.1.8.3.2)	*FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVXA	26	(SAME AS 9.1.8.1.2)	
09.1.08.05.2	CSAS TRAIN A (SRQ 1 TEST)	APYA (RBLAT)	UNTRIPPED (OFF)	(SAME AS 9.1.8.1.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APYA	26	(SAME AS 9.1.8.1.2)	
09.1.08.05.3	CSAS TRAIN A (SRQ 1 TEST)	APYA (RBLAT)	INPUT OPEN	(SAME AS 9.1.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY APYA	26	(SAME AS 9.1.8.1.2)	
09.1.08.07.2	CSAS TRAIN A (SRQ 1 TEST)	AVYA (RBLAT)	UNTRIPPED (OFF)	(SAME AS 9.1.8.3.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVYA	26	(SAME AS 9.1.8.1.2)	
09.1.08.07.3	CSAS TRAIN A (SRQ 1 TEST)	AVYA (RBLAT)	INPUT OPEN	(SAME AS 9.1.8.3.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY AVYA	26	(SAME AS 9.1.8.1.2)	
09.1.09.01.4	CSAS TRAIN A (UV TEST)	APDR (TDR RELAT)	INPUT SHORT	*TRAIN A CSAS INOPERABLE, POTENTIAL IMPACT TO REDUNDANT VITAL BUSES #1 AND #3A	BREAKERS COORDINATED WITH VITAL BUS FEEDERS, HOWEVER FAILURE (SHORT OF BOTH +15VDC AND -15VDC ON APDA AND APDB) MAY CAUSE AUTO-TRANSFER OF BOTH VITAL BUSES PRIOR TO TRIP OF APDA/APDB LOAD BREAKERS	19.3	SUBMIT LICENSE AMENDMENT REQUEST TO DEFER MODIFICATIONS ADDRESSING SPURIOUS AUTO-TRANSFER OF VITAL BUSES UNTIL INTEGRATED RESOLUTION OF SRP TOPIC VI-7.C.2	LICENSING
09.1.09.03.4	CSAS TRAIN A (UV TEST)	AVDR (TDR RELAT)	INPUT SHORT	*TRAIN A CSAS INOPERABLE, POTENTIAL IMPACT TO REDUNDANT VITAL BUSES #1 AND #3A	BREAKERS COORDINATED WITH VITAL BUS FEEDERS, HOWEVER FAILURE (SHORT OF BOTH +15VDC AND -15VDC ON AVDA AND AVDB) MAY CAUSE AUTO-TRANSFER OF BOTH VITAL BUSES PRIOR TO TRIP OF AVDA/AVDB LOAD BREAKERS	19	(SAME AS 9.1.9.1.4)	
09.1.10.01.1	CSAS TRAIN A (LOGIC)	APH1A, APH2A (RBLATS)	TRIPPED (ONE RBLAT)	CSAS LOGIC FOR TRAIN A PUMPS BECOMES 1/1 ON REMAINING MATRIX OUTPUT RELAY	*RBLATS ARE DE-ENERGIZE TO ACTUATE. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RBLATS APH1B OR APH2B	26	(SAME AS 9.1.8.1.2)	
09.1.10.01.3	CSAS TRAIN A (LOGIC)	APH1A, APH2A (RBLATS)	INPUT OPEN (ONE RBLAT)	(SAME AS 9.1.10.1.1)	(SAME AS 9.1.10.1.1)	26	(SAME AS 9.1.8.1.2)	
09.1.10.03.1	CSAS TRAIN A (LOGIC)	AVH1A, AVH2A (RBLATS)	TRIPPED (ONE RBLAT)	CSAS LOGIC FOR TRAIN A VALVES BECOMES 1/1 ON REMAINING MATRIX OUTPUT RELAY	*RBLATS ARE DE-ENERGIZE TO ACTUATE. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RBLATS AVH1B OR AVH2B	26	(SAME AS 9.1.8.1.2)	
09.1.10.03.3	CSAS TRAIN A (LOGIC)	AVH1A, AVH2A (RBLATS)	INPUT OPEN (ONE RBLAT)	(SAME AS 9.1.10.3.1)	(SAME AS 9.1.10.3.1)	26	(SAME AS 9.1.8.1.2)	

3-11-1997 REVISED

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP. DISCIPLINE
09.2.08.01.2	CSAS TRAIN B (SEQ 2 TEST)	BP1A (RBLAT)	UNTRIPPED (OFF)	REDUCED RELIABILITY OF TRAIN B CSAS PUMP ACTUATION	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BP1B	26	(SAME AS 9.1.8.1.2)	
09.2.08.01.3	CSAS TRAIN B (SEQ 2 TEST)	BP1A (RBLAT)	INPUT OPEN	(SAME AS 9.2.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BP1B	26	(SAME AS 9.1.8.1.2)	
09.2.08.01.2	CSAS TRAIN B (SEQ 2 TEST)	BV1A (RBLAT)	UNTRIPPED (OFF)	TRAIN B CSAS VALVE ACTUATION INOPERABLE	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BV1B	26	(SAME AS 9.1.8.1.2)	
09.2.08.01.3	CSAS TRAIN B (SEQ 2 TEST)	BV1A (RBLAT)	INPUT OPEN	(SAME AS 9.2.8.3.2)	*FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BV1B	26	(SAME AS 9.1.8.1.2)	
09.2.08.01.2	CSAS TRAIN B (SEQ 2 TEST)	BP1A (RBLAT)	UNTRIPPED (OFF)	(SAME AS 9.2.8.1.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BP1B	26	(SAME AS 9.1.8.1.2)	
09.2.08.01.3	CSAS TRAIN B (SEQ 2 TEST)	BP1A (RBLAT)	INPUT OPEN	(SAME AS 9.2.8.1.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BP1B	26	(SAME AS 9.1.8.1.2)	
09.2.08.01.2	CSAS TRAIN B (SEQ 2 TEST)	BV1A (RBLAT)	UNTRIPPED (OFF)	(SAME AS 9.2.8.3.2)	*NORMAL POSITION. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BV1B	26	(SAME AS 9.1.8.1.2)	
09.2.08.01.3	CSAS TRAIN B (SEQ 2 TEST)	BV1A (RBLAT)	INPUT OPEN	(SAME AS 9.2.8.3.2)	*RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAY BV1B	26	(SAME AS 9.1.8.1.2)	
09.2.10.01.1	CSAS TRAIN B (LOGIC)	BP11A, BP12A (RBLATS)	TRIPPED (ONE RELAY)	CSAS LOGIC FOR TRAIN B PUMPS BECOMES 1/1 ON REMAINING MATRIX OUTPUT RELAY	*RELAYS ARE DE-ENERGIZE TO ACTUATE. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAYS BP11B OR BP12B	26	(SAME AS 9.1.8.1.2)	
09.2.10.01.3	CSAS TRAIN B (LOGIC)	BP11A, BP12A (RBLATS)	INPUT OPEN (ONE RELAY)	(SAME AS 9.2.10.1.1)	*[SAME AS 9.2.10.1.1]	26	(SAME AS 9.1.8.1.2)	
09.2.10.03.1	CSAS TRAIN B (LOGIC)	BV11A, BV12A (RBLATS)	TRIPPED (ONE RELAY)	CSAS LOGIC FOR TRAIN B VALVES BECOMES 1/1 ON REMAINING MATRIX OUTPUT RELAY	*RELAYS ARE DE-ENERGIZE TO ACTUATE. RELAY FAILURE NOT DETECTABLE FROM CSAS CABINET INDICATION PROVIDED BY PARALLEL RELAYS BV11B OR BV12B	26	(SAME AS 9.1.8.1.2)	
09.2.10.03.3	CSAS TRAIN B (LOGIC)	BV11A, BV12A (RBLATS)	INPUT OPEN (ONE RELAY)	(SAME AS 9.2.10.3.1)	*[SAME AS 9.2.10.3.1]	26	(SAME AS 9.1.8.1.2)	
09.2.11.01.3	CSAS TRAIN B (POWER)	BPSA (15VDC PWR SUPL)	INPUT SHORT	INOPERABILITY OF TRAIN B CSAS	*OUTPUT RELAYS ARE ENERGIZE TO ACTUATE. TRAIN B CSAS RELIABILITY COULD BE IMPROVED BY SEPARATELY FUSING INPUTS TO 15VDC SUPPLIES BPSA AND BPSB, SIMILAR TO TRAIN A		NO FURTHER ACTION REQUIRED. REDUNDANT TRAIN PROTECTS AGAINST FAILURE	
09.2.11.02.3	CSAS TRAIN B (POWER)	BPSB (15VDC PWR SUPL)	INPUT SHORT	(SAME AS 9.2.11.1.3)	*[SAME AS 9.2.11.1.3]		(SAME AS 9.2.11.2.3)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPER UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BECS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
10.1.02.01.2	DG #1 BREAKER	BUS #1C (11C14)	CLOSED	*DEGRADED TRAIN A RESPONSE AND FAILURE OF TRAIN B FOR SIS WITH LOSS OF OFFSITE POWER	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOP LOGIC CHANGED TO SISLOB	21.1	IMPLEMENT MHP 1-3634 TO CHANGE DG LOADING LOGIC FROM SISLOP TO SISLOB	CONTROLS
10.1.02.03.1	DG #1 BREAKER	SBQ 1 (14-5, 7)	CONTACTS OPEN (OFF)	*(SAME AS 10.1.2.1.2)	*NORMAL POSITION. (SAME AS 10.1.2.1.2)	21	(SAME AS 10.1.2.1.2)	
10.1.02.05.1	DG #1 BREAKER	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN A FOR SIS AND SISLOP, WITH CONCURRENT INOPERABILITY OF TRAIN B DUE TO DELAYED OR PREVENTED BUS #1C UNDERVOLTAGE, IF BRKR INITIALLY CLOSED. TRAIN B UNAFFECTED FOR SIS	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOB LOGIC CHANGED TO SISLOB	21	(SAME AS 10.1.2.1.2)	
10.2.02.01.2	DG #2 BREAKER	BUS #2C (12C15)	CLOSED	*DEGRADED TRAIN B RESPONSE AND FAILURE OF TRAIN A FOR SIS WITH LOSS OF OFFSITE POWER	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOB LOGIC CHANGED TO SISLOB	21	(SAME AS 10.1.2.1.2)	
10.2.02.03.1	DG #2 BREAKER	SBQ 2 (14-5, 7)	CONTACTS OPEN (OFF)	*(SAME AS 10.2.2.1.2)	*NORMAL POSITION. (SAME AS 10.2.2.1.2)	21	(SAME AS 10.1.2.1.2)	
10.2.02.05.1	DG #2 BREAKER	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN B FOR SIS AND SISLOP, WITH CONCURRENT INOPERABILITY OF TRAIN A DUE TO DELAYED OR PREVENTED BUS #2C UNDERVOLTAGE, IF BRKR INITIALLY CLOSED. TRAIN A UNAFFECTED FOR SIS	*REQUIRES ENTRY TO TECH SPEC ACTION FOR SINGLE FAILURE RELIEF DURING DG TESTING UNLESS SISLOB LOGIC CHANGED TO SISLOB	21	(SAME AS 10.1.2.1.2)	

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EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP. DISCIPLINE
11.1.01.02.1	VITAL BUS #1	AUTO XFER SW #1	NORMAL	REDUCED RELIABILITY OF VITAL BUS #1 AND REGULATED BUS #1 ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE	34.2	IDENTIFY VITAL AND UTILITY BUS TRANSFER SWITCH REQUIREMENTS	ELECTRICAL
11.1.01.02.1	VITAL BUS #1	AUTO XFER SW #1	NORMAL	REDUCED RELIABILITY OF VITAL BUS #1 AND REGULATED BUS #1 ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE	34.3	PROCESS TECH. SPEC CHANGE TO ADD VITAL/UTILITY BUS AND TRANSFER SWITCH LCO AND SURVEILLANCE REQUIREMENTS	LICENSING
11.1.01.02.1	VITAL BUS #1	AUTO XFER SW #1	NORMAL	REDUCED RELIABILITY OF VITAL BUS #1 AND REGULATED BUS #1 ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE	34.4	IMPLEMENT VITAL/UTILITY BUS AND TRANSFER SWITCH REQUIREMENTS IN APPLICABLE PROCEDURES (INCLUDING BOIs)	OPERATIONS
11.1.01.02.4	VITAL BUS #1	AUTO XFER SW #1	CONTACTS CLOSED	(SAME AS 11.1.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	34	(SAME AS 11.1.1.2.2)	
11.1.01.02.5	VITAL BUS #1	AUTO XFER SW #1	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF SI/ECS INVENTORY TO RCYT AND LOSS OF CLR CAPABILITY FOR SBLOCA. INOP OF 1/2 HI-FLOW CONTAINMENT SPRAY VALVES, SEQ #1, HLR PRIMARY PATH. REDUCED REDUNDANCY AGAINST SI BLOCK PRM, OP OF 2 CHG PP DURING INJ	(SAME AS 11.1.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1. 1/2 PORVs AND ITS BLOCK VALVE ALSO INOP FOR SCYR. PORVs NOT CREDITED FOR HBLB OR LOCA	04.1	REVISE RWST AND SI/PW LO-LO SETPOINT CALCULATIONS TO ADDRESS INVENTORY DIVERSIONS	NUCLEAR
11.1.01.02.5	VITAL BUS #1	AUTO XFER SW #1	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF SI/ECS INVENTORY TO RCYT AND LOSS OF CLR CAPABILITY FOR SBLOCA. INOP OF 1/2 HI-FLOW CONTAINMENT SPRAY VALVES, SEQ #1, HLR PRIMARY PATH. REDUCED REDUNDANCY AGAINST SI BLOCK PRM, OP OF 2 CHG PP DURING INJ	(SAME AS 11.1.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1. 1/2 PORVs AND ITS BLOCK VALVE ALSO INOP FOR SCYR. PORVs NOT CREDITED FOR HBLB OR LOCA	07.4	LOCK CV-406A OR B CLOSED AS PER RESOLUTION OF MCR 1-P-7467 AND LER 1-90-06 TO PREVENT CHARGING PUMP GAS BINDING DUE TO LOSS OF UTILITY BUS	OPERATIONS
11.1.01.02.5	VITAL BUS #1	AUTO XFER SW #1	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF SI/ECS INVENTORY TO RCYT AND LOSS OF CLR CAPABILITY FOR SBLOCA. INOP OF 1/2 HI-FLOW CONTAINMENT SPRAY VALVES, SEQ #1, HLR PRIMARY PATH. REDUCED REDUNDANCY AGAINST SI BLOCK PRM, OP OF 2 CHG PP DURING INJ	(SAME AS 11.1.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1. 1/2 PORVs AND ITS BLOCK VALVE ALSO INOP FOR SCYR. PORVs NOT CREDITED FOR HBLB OR LOCA	34	(SAME AS 11.1.1.2.2)	
11.1.01.10.1	VITAL BUS #1	8-1107V (888A888)	OPEN	INOPERABILITY OF HLR PRIMARY PATH, REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G A	*SEB ITEMS 1.4.6.5.3, 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1, 8.1.1.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS	12.1	REVISE SECONDARY RECIRC BOI TO POSITION CV-142/143/144 LOCALLY IF UNSUCCESSFUL FROM CONTROL ROOM	OPERATIONS
11.1.01.10.1	VITAL BUS #1	8-1107V (888A888)	OPEN	INOPERABILITY OF HLR PRIMARY PATH, REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G A	*SEB ITEMS 1.4.6.5.3, 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1, 8.1.1.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS	12.2	EXTEND TEMPORARY MODIFICATION TFM-1-90-FWS-001 (DISCONNECTION OF S/G OVERFILL SIGNALS FROM FCVs/CVs) UNTIL PERMANENT OVERFILL MODIFICATIONS ARE INSTALLED IN CYCLE 12	MECHANICAL
11.1.02.01.1	REGULATED BUS #1	REGULATOR #1 (TWINCO)	INPUT OPEN	INOPERABILITY OF HLR PRIMARY PATH, REDUCED REDUNDANCY AGAINST SEQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SEQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G A	*SEB ITEMS 1.4.6.5.3, 2.4.9.6.1, 3.1.4.6.1, 3.1.10.2.1, 8.1.1.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS	12	(SAME AS 11.1.1.10.1)	

4. 20. 1990 15:00:00

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM GNOPER UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP. DISCIPLINE
11.1.02.02.1	REGULATED BUS #1	8-11R1 (PUSH)	OPEN	NONE FOR S1, LOSS OF SECONDARY RECIRC TO S/G A	*SEE ITEM 1.4.6.5.3. NO ECCS EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS. SEE SECTION 8 OF M39405 FOR EPS EFFECTS	12 (SAME AS 11.1.1.10.1)		
11.2.01.02.1	VITAL BUS #2	AUTO IFR SW #2	NORMAL	REDUCED RELIABILITY OF VITAL BUS #2 AND REGULATED BUS #2 ECCS LOADS (SAME AS 11.2.1.2.2)	*TECH SPIC ACTION ENTRY REQUIRED FOR THIS FAILURE	34 (SAME AS 11.1.1.2.1)		
11.2.01.02.4	VITAL BUS #2	AUTO IFR SW #2	CONTACTS CLOSED		*TECH SPIC ACTION ENTRY REQUIRED WITH THIS FAILURE	34 (SAME AS 11.1.1.2.1)		
11.2.01.02.5	VITAL BUS #2	AUTO IFR SW #2	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF S1/BCS INVENTORY TO RCDT AND LOSS OF CLR CAPABILITY FOR SBLOCA. REDUCED RELIABILITY FOR SRQ #1 SIS/SISLOP AND AGAINST SRQ #1 AND #2 BLOCK PERMISSIVE. 1/2 PORVs AND ITS BLOCK VALVE INOPERABLE	(SAME AS 11.2.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1 PORVs NOT CREDITED FOR HSLB OR LOCA	04 (SAME AS 11.1.1.2.5)		
11.2.01.02.5	VITAL BUS #2	AUTO IFR SW #2	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF S1/BCS INVENTORY TO RCDT AND LOSS OF CLR CAPABILITY FOR SBLOCA. REDUCED RELIABILITY FOR SRQ #1 SIS/SISLOP AND AGAINST SRQ #1 AND #2 BLOCK PERMISSIVE. 1/2 PORVs AND ITS BLOCK VALVE INOPERABLE	(SAME AS 11.2.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1 PORVs NOT CREDITED FOR HSLB OR LOCA	07 (SAME AS 11.1.1.2.5)		
11.2.01.02.5	VITAL BUS #2	AUTO IFR SW #2	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF S1/BCS INVENTORY TO RCDT AND LOSS OF CLR CAPABILITY FOR SBLOCA. REDUCED RELIABILITY FOR SRQ #1 SIS/SISLOP AND AGAINST SRQ #1 AND #2 BLOCK PERMISSIVE. 1/2 PORVs AND ITS BLOCK VALVE INOPERABLE	(SAME AS 11.2.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1 PORVs NOT CREDITED FOR HSLB OR LOCA	34 (SAME AS 11.1.1.2.1)		
11.2.01.10.1	VITAL BUS #2	8-120TV (BRAKBR)	OPEN	REDUCED REDUNDANCY AGAINST SRQ #1 SIS/SISLOP AND S1 BLOCK PERMISSIVE FOR SRQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G B	*SEE ITEMS 1.4.7.5.3, 8.1.2.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS	12 (SAME AS 11.1.1.10.1)		
11.2.02.01.1	REGULATED BUS #2	REGULATOR #2 (TWINCO)	INPUT OPEN	REDUCED REDUNDANCY AGAINST SRQ #1 SIS/SISLOP AND S1 BLOCK PERMISSIVE FOR SRQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G B	*SEE ITEMS 1.4.7.5.3, 8.1.2.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS	12 (SAME AS 11.1.1.10.1)		
11.2.02.02.1	REGULATED BUS #2	8-12R1 (PUSH)	OPEN	NONE FOR S1, LOSS OF SECONDARY RECIRC TO S/G B	*SEE ITEM 1.4.7.5.3. NO ECCS EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS. SEE SECTION 8 OF M39405 FOR EPS EFFECTS	12 (SAME AS 11.1.1.10.1)		
11.3.01.02.1	VITAL BUS #3	AUTO IFR SW #3	NORMAL	REDUCED RELIABILITY OF VITAL BUS #3, 3A AND REGULATED BUS #3 ECCS LOADS	*TECH SPIC ACTION ENTRY REQUIRED FOR THIS FAILURE	34 (SAME AS 11.1.1.2.1)		
11.3.01.02.3	VITAL BUS #3	AUTO IFR SW #3	CONTACTS OPEN	*LOSS OF CLR AND CLR/HLR FLOW BALANCE CAPABILITY, REDUCED RELIABILITY OF SRQ #1 SIS/SISLOP AND AGAINST SRQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2 FOR ECCS) FOR R.G. 1.97 AND THE SYSTEMS, REDUNDANT TRAIN B SYSTEMS PROVIDE SAFETY FUNCTION	08.1	PERFORM EVENT-SPECIFIC ANALYSIS OF CLR/HLR FLOW BALANCING	NUCLEAR

* See "Safety Reporting Agency"

EMERGENCY COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RISP DISCIPLINE
11.3.01.02.3	VITAL BUS #3	AUTO IFRB SW #3	CONTACTS OPEN	*LOSS OF CLR AND CLR/HLR FLOW BALANCE CAPABILITY, REDUCED RELIABILITY OF SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2 FOR ECCS) FOR B.G. 08.2 1.97 AND THE SYSTEMS, REDUNDANT TRAIN B SYSTEMS PROVIDE SAFETY FUNCTION	08.2	REVISE BOIs AS NEEDED BASED ON ANALYSIS RESULTS	OPERATIONS
11.3.01.02.3	VITAL BUS #3	AUTO IFRB SW #3	CONTACTS OPEN	*LOSS OF CLR AND CLR/HLR FLOW BALANCE CAPABILITY, REDUCED RELIABILITY OF SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2 FOR ECCS) FOR B.G. 12 1.97 AND THE SYSTEMS, REDUNDANT TRAIN B SYSTEMS PROVIDE SAFETY FUNCTION	12	(SAME AS 11.1.1.10.1)	
11.3.01.02.4	VITAL BUS #3	AUTO IFRB SW #3	CONTACTS CLOSED	(SAME AS 11.3.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	34	(SAME AS 11.1.1.2.1)	
11.3.01.02.5	VITAL BUS #3	AUTO IFRB SW #3	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR AND CLR/HLR FLOW BALANCE, AND (FOR SBLOCA) CLR PUMPING. REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	04	(SAME AS 11.1.1.2.5)	
11.3.01.02.5	VITAL BUS #3	AUTO IFRB SW #3	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR AND CLR/HLR FLOW BALANCE, AND (FOR SBLOCA) CLR PUMPING. REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	08	(SAME AS 11.3.1.2.3)	
11.3.01.02.5	VITAL BUS #3	AUTO IFRB SW #3	CONTACTS GROUNDED	*POTENTIAL UNISOL DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR AND CLR/HLR FLOW BALANCE, AND (FOR SBLOCA) CLR PUMPING. REDUCED RELIABILITY FOR SEQ #1 SIS/SISLOP AND AGAINST SEQ #1 AND #2 BLOCK PERMISSIVE, LOSS OF SECONDARY RECIRC TO S/G A/B/C	(SAME AS 11.3.1.2.2). ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	12	(SAME AS 11.1.1.10.1)	
11.3.02.01.1	REGULATED BUS #3 (TWINCO)	REGULATOR #3	INPUT OPEN	REDUCED REDUNDANCY AGAINST SRQ #1 SIS/SISLOP AND SI BLOCK PERMISSIVE FOR SRQ #1 AND #2, LOSS OF SECONDARY RECIRC TO S/G C	*SEE ITEMS 1.4.8.5.3, 8.1.3.5.1. NO SECONDARY RECIRC EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS	12	(SAME AS 11.1.1.10.1)	
11.3.02.02.1	REGULATED BUS #3 8-13R1 (EUSR)		OPEN	NONE FOR SI, LOSS OF SECONDARY RECIRC TO S/G C	*SEE ITEM 1.4.8.5.3. NO ECCS EFFECTS IF S/G OVERFILL PROTECTION CIRCUIT DISCONNECTED PENDING CYCLE 12 MODIFICATIONS. SEE SECTION 8 OF M39405 FOR RPS EFFECTS	12	(SAME AS 11.1.1.10.1)	
11.3.03.01.1	VITAL BUS #3A	VITAL BUS #3A ACB	OPEN	*CLR FLOW TO 2/3 RCS LOOP WOULD BE INCREASED PER PROCEDURES, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY OVERHEATING RECIRC PUMP LIMITATIONS	SEE ITEMS 1.4.9.10.1, 1.4.19.3.1, 2.4.25.4.1, 3.1.12.4.1, 3.2.16.2.1, 4.1.3.2.1 FOR ECCS LOADS. FOR B.G. 1.97 AND THE SYSTEMS, REDUNDANT TRAIN B SYSTEM PROVIDES SAFETY FUNCTION	08	(SAME AS 11.3.1.2.3)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
11.3.03.14.1	VITAL BUS #3A	8-3313 (88BA88B)	OPEN	*CLR FLOW TO RCG LOOPS B AND C WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	SEE ITEMS 2.4.25.4.1 AND 3.1.12.4.1	08	(SAME AS 11.3.1.2.3)	
11.3.03.16.1	VITAL BUS #3A	8-3315 (88BA88B)	OPEN	*STRAIN A NR LEVEL INDICATION AND AFN FLOW DISABLED, BLOWDOWN ISOLATED, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER RHM PUMPS TRIPPED	SEE ITEMS 1.4.9.10.1, 4.1.3.2.1, 5TH GRN 12 BLOWDOWN ISOLATION VALVE SAFETY FUNCTION IS FAIL-CLOSED	12	(SAME AS 11.1.1.10.1)	
11.4.01.01.1	VITAL BUS #4	INVERTER #4	INPUT OPEN	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605	SEE ITEMS 1.4.9.9.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1. FAILURE MODE CONSERVATIVELY ASSUMED. NORMAL OPERATION OF STATIC IFFR SWITCH DOES NOT RESULT IN INTERRUPTION	17	REVISE SISLOP LOADING CALCULATION TO ACCOUNT FOR OUT OF SEQUENCE CCM/SWC PUMP LOADING	ELECTRICAL
11.4.01.01.2	VITAL BUS #4	INVERTER #4	INPUT SHORT	*(SAME AS 11.4.1.1.1)	(SAME AS 11.4.1.1.1)	17	(SAME AS 11.4.1.1.1)	
11.4.01.01.3	VITAL BUS #4	INVERTER #4	OUTPUT VOLTS LOW	*(SAME AS 11.4.1.1.1)	(SAME AS 11.4.1.1.1)	17	(SAME AS 11.4.1.1.1)	
11.4.01.01.4	VITAL BUS #4	INVERTER #4	OUTPUT SHORT OR GROUND	*(SAME AS 11.4.1.1.1)	(SAME AS 11.4.1.1.1)	17	(SAME AS 11.4.1.1.1)	
11.4.01.02.1	VITAL BUS #4	AUTO IFFR SW (INVERTER #4)	NORMAL	REDUCED RELIABILITY OF VITAL BUS #4 AND REGULATED BUS #4 ECCS LOADS	*TRCH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE	34	(SAME AS 11.1.1.2.1)	
11.4.01.02.2	VITAL BUS #4	AUTO IFFR SW (INVERTER #4)	ALTERNATE	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605	SEE ITEMS 1.4.9.9.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1	17	(SAME AS 11.4.1.1.1)	
11.4.01.02.3	VITAL BUS #4	AUTO IFFR SW (INVERTER #4)	CONTACTS OPEN	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST	*(SAME AS 11.4.1.2.2). ROI REV REQD FOR BACKUP PRIMARY PATH PLO DETERMINATION OR JUMPER ACROSS PT-425X CONTACTS IN NOV-813 CONTROLS TO MITIGATE LOSS OF HLR FUNCTION. ROI CHANGE REQD IRRESPECTIVE OF THIS FAILURE DUE TO INADEQUACY OF FIT(PT)-1112 RANGE	10.2	REVISE PROCEDURES (INCLUDING ROI) AS NEEDED TO INCLUDE DCP 1-3548 REQUIREMENTS	OPERATIONS
11.4.01.02.3	VITAL BUS #4	AUTO IFFR SW (INVERTER #4)	CONTACTS OPEN	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST	*(SAME AS 11.4.1.2.2). ROI REV REQD FOR BACKUP PRIMARY PATH PLO DETERMINATION OR JUMPER ACROSS PT-425X CONTACTS IN NOV-813 CONTROLS TO MITIGATE LOSS OF HLR FUNCTION. ROI CHANGE REQD IRRESPECTIVE OF THIS FAILURE DUE TO INADEQUACY OF FIT(PT)-1112 RANGE	10.3	IMPLEMENT DCP 1-3548 HLR MODIFICATIONS (REPOWER AND EXPAND RANGE OF FIT-1112) TO PRECLUDE COMMON-MODE HLR FAILURE	NUCLEAR
11.4.01.02.3	VITAL BUS #4	AUTO IFFR SW (INVERTER #4)	CONTACTS OPEN	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST	*(SAME AS 11.4.1.2.2). ROI REV REQD FOR BACKUP PRIMARY PATH PLO DETERMINATION OR JUMPER ACROSS PT-425X CONTACTS IN NOV-813 CONTROLS TO MITIGATE LOSS OF HLR FUNCTION. ROI CHANGE REQD IRRESPECTIVE OF THIS FAILURE DUE TO INADEQUACY OF FIT(PT)-1112 RANGE	17	(SAME AS 11.4.1.1.1)	

No. Error, Missing Entry

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS OPERATOR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
11.4.01.02.4	VITAL BUS #4	AUTO IFRB SW (INVERTER #4)	CONTACTS CLOSED	*(SAME AS 11.4.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	34	(SAME AS 11.1.1.2.1)	
11.4.01.02.5	VITAL BUS #4	AUTO IFRB SW (INVERTER #4)	CONTACTS GROUNDED	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCM FLOW REDUCED TO MINIMUM FOR ECCS LOADS	*(SAME AS 11.4.1.2.3). UTILITY BUS LOADS 10 NOT AFFECTED DUE TO SEPARATE FUSE FOR 7.5 kVA IFRB PRIMARY, WHICH PROTECTS 37.5 kVA IFRB SERVING UTILITY BUS AND BACKUP FOR VITAL/REGULATED BUSES #1, 2, 3/3A		(SAME AS 11.4.1.2.3)	
11.4.01.02.5	VITAL BUS #4	AUTO IFRB SW (INVERTER #4)	CONTACTS GROUNDED	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCM FLOW REDUCED TO MINIMUM FOR ECCS LOADS	*(SAME AS 11.4.1.2.3). UTILITY BUS LOADS 17 NOT AFFECTED DUE TO SEPARATE FUSE FOR 7.5 kVA IFRB PRIMARY, WHICH PROTECTS 37.5 kVA IFRB SERVING UTILITY BUS AND BACKUP FOR VITAL/REGULATED BUSES #1, 2, 3/3A		(SAME AS 11.4.1.1.1)	
11.4.01.03.2	VITAL BUS #4	MAN IFRB SW #4	ALTERNATE	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605	SEE ITEMS 1.4.9.9.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1	17	(SAME AS 11.4.1.1.1)	
11.4.01.03.3	VITAL BUS #4	MAN IFRB SW #4	CONTACTS OPEN	*POTENTIAL LOSS OF TRAIN A/B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST	*(SAME AS 11.4.1.3.2). ROI REV REQ FOR BACKUP PRIMARY PATH FLO DETERMINATION OR JUMPER ACROSS PT-425X CONTACTS IN NOV-813 CONTROLS TO MITIGATE LOSS OF HLR FUNCTION. ROI CHANGE REQ IRRESPECTIVE OF THIS FAILURE DUE TO INADEQUATE FIT(PT)-1112 RANGE	10	(SAME AS 11.4.1.2.3)	
11.4.01.03.3	VITAL BUS #4	MAN IFRB SW #4	CONTACTS OPEN	*POTENTIAL LOSS OF TRAIN A/B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST	*(SAME AS 11.4.1.3.2). ROI REV REQ FOR BACKUP PRIMARY PATH FLO DETERMINATION OR JUMPER ACROSS PT-425X CONTACTS IN NOV-813 CONTROLS TO MITIGATE LOSS OF HLR FUNCTION. ROI CHANGE REQ IRRESPECTIVE OF THIS FAILURE DUE TO INADEQUATE FIT(PT)-1112 RANGE	17	(SAME AS 11.4.1.1.1)	
11.4.01.03.4	VITAL BUS #4	MAN IFRB SW #4	CONTACTS CLOSED	*(SAME AS 11.4.1.3.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	34	(SAME AS 11.1.1.2.1)	
11.4.01.03.5	VITAL BUS #4	MAN IFRB SW #4	CONTACTS GROUNDED	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS, UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCM FLOW REDUCED TO MINIMUM FOR ECCS LOADS	*(SAME AS 11.4.1.3.2 AND 11.4.1.3.3.) ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	04	(SAME AS 11.1.1.2.5)	
11.4.01.03.5	VITAL BUS #4	MAN IFRB SW #4	CONTACTS GROUNDED	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS, UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCM FLOW REDUCED TO MINIMUM FOR ECCS LOADS	*(SAME AS 11.4.1.3.2 AND 11.4.1.3.3.) ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	17	(SAME AS 11.4.1.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON RCCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
11.4.01.03.5	VITAL BUS #4	MAN IPBR SW #4	CONTACTS GROUNDED	*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS. UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCM FLOW REDUCED TO MINIMUM FOR RCCS LOADS	*(SAMB AS 11.4.1.3.2 AND 11.4.1.3.3.) ALSO SEE UTILITY BUS LOAD ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.22.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	34	(SAMB AS 11.1.1.2.1)	
11.4.01.04.1	VITAL BUS #4	VITAL BUS #4 ACB OPEN		*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCM FLOW REDUCED TO MINIMUM FOR RCCS LOADS	*SEE ITEMS 1.4.9.9.1, 3.2.9.2.1, 3.2.9.3.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1. ROI REV REQD AS PER ITEM 11.4.1.3.3	10	(SAMB AS 11.4.1.2.3)	
11.4.01.04.1	VITAL BUS #4	VITAL BUS #4 ACB OPEN		*POTENTIAL LOSS OF TRAIN A AND B ELECTRICAL POWER FOR SISLOP DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS RESULTING FROM PC-605. HLR PRIMARY AND ALTERNATE PATHS ALSO LOST AND CCM FLOW REDUCED TO MINIMUM FOR RCCS LOADS	*SEE ITEMS 1.4.9.9.1, 3.2.9.2.1, 3.2.9.3.1, 2.4.4.2.1, 2.4.7.1.1, 2.4.8.3.2, 2.4.22.1.1, 3.1.3.2.1, 3.2.9.2.1, 3.2.9.3.1, 3.2.13.2.1, 3.2.14.4.1, 6.4.5.1.1, 6.4.6.3.1. ROI REV REQD AS PER ITEM 11.4.1.3.3	17	(SAMB AS 11.4.1.1.1)	
11.4.01.04.3	VITAL BUS #4	VITAL BUS #4 ACB INPUT SHORT OR GROUND		*(SAMB AS 11.4.1.4.1)	*(SAMB AS 11.4.1.4.1). FAULT WILL CAUSE UNDERVOLTAGE CONDITION AT INVERTER AUTO-TRANSFER SWITCH, WHICH THEN AUTO-TRANSFERS FAULT TO MCC-2 POWERED 7.5 kVA BACKUP SOURCE. SEPARATE FUSE ON 7.5 kVA IPBR PRIMARY PROTECTS 37.5 kVA IPBR SUPPLYING UTILITY BUS	10	(SAMB AS 11.4.1.2.3)	
11.4.01.04.3	VITAL BUS #4	VITAL BUS #4 ACB INPUT SHORT OR GROUND		*(SAMB AS 11.4.1.4.1)	*(SAMB AS 11.4.1.4.1). FAULT WILL CAUSE UNDERVOLTAGE CONDITION AT INVERTER AUTO-TRANSFER SWITCH, WHICH THEN AUTO-TRANSFERS FAULT TO MCC-2 POWERED 7.5 kVA BACKUP SOURCE. SEPARATE FUSE ON 7.5 kVA IPBR PRIMARY PROTECTS 37.5 kVA IPBR SUPPLYING UTILITY BUS	17	(SAMB AS 11.4.1.1.1)	
11.4.01.12.1	VITAL BUS #4	B-1404V (BRKARR)	OPEN	LOSS OF HLR PRIMARY PATH	*SEE ITEMS 2.1.3.2.1, 3.2.9.2.1. SEE SECTION 8 OF M39405 FOR RPS EFFECTS	10	(SAMB AS 11.4.1.2.3)	
11.4.01.19.1	VITAL BUS #4	B-1415V (BRKARR)	OPEN	*POTENTIAL LOSS OF TRAIN A/B ELECTRICAL POWER DUE TO OUT OF SEQUENCE BUS LOADING OF CCM PUMPS	SEE ITEM 6.4.6.3.1	17	(SAMB AS 11.4.1.1.1)	
11.5.01.01.1	UTILITY BUS	MAN IPBR SW #7	NORMAL (MCC-2)	REDUCED RELIABILITY OF HLR PRIMARY PATH (CY-305 POWER CANNOT BE SWING ALIGNED TO THIS FAILURE SAFETY RELATED POWER)	*TRCH SPIC ACTION ENTRY REQUIRED FOR	34	(SAMB AS 11.1.1.2.1)	
11.5.01.01.2	UTILITY BUS	MAN IPBR SW #7	ALTERNATE (MCC-1)	*POTENTIALLY UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, LOSS OF HLR PRIMARY PATH	SEE ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.22.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1. FUSES REMOVED PER TRCH SPIC 4.1.1 PREVENT POWER VIA MCC-1 EVEN WITH TRANSFER SWITCH IN THIS POSITION	04	(SAMB AS 11.1.1.2.5)	

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EMERGENCY COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
11.5.01.01.2	UTILITY BUS	MAN XFER SW #7	ALTERNATE (NCC-1)	*POTENTIALLY UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, LOSS OF HLR PRIMARY PATH	SEE ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1. BUSES REMOVED PER TECH SPEC 4.1.1 PREVENT POWER VIA NCC-1 EVEN WITH TRANSFER SWITCH IN THIS POSITION	07	(SAME AS 11.1.1.2.5)	
11.5.01.01.4	UTILITY BUS	MAN XFER SW #7	CONTACTS CLOSED	*POTENTIAL LOSS OF TRAIN A/B DUE TO PARALLELING THROUGH MANUAL TRANSFER SWITCH	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE		NO FURTHER ACTION REQUIRED. PUSH BLOCK FOR ALTERNATE FEED ALREADY REMOVED	
11.5.01.01.5	UTILITY BUS	MAN XFER SW #7	CONTACTS GROUNDED	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	04	(SAME AS 11.1.1.2.5)	
11.5.01.01.5	UTILITY BUS	MAN XFER SW #7	CONTACTS GROUNDED	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	07	(SAME AS 11.1.1.2.5)	
11.5.01.02.2	UTILITY BUS	AUTO XFER SW #6	ALTERNATE	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	04	(SAME AS 11.1.1.2.5)	
11.5.01.02.2	UTILITY BUS	AUTO XFER SW #6	ALTERNATE	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	07	(SAME AS 11.1.1.2.5)	
11.5.01.02.3	UTILITY BUS	AUTO XFER SW #6	CONTACTS OPEN	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	04	(SAME AS 11.1.1.2.5)	
11.5.01.02.3	UTILITY BUS	AUTO XFER SW #6	CONTACTS OPEN	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	07	(SAME AS 11.1.1.2.5)	
11.5.01.02.4	UTILITY BUS	AUTO XFER SW #6	CONTACTS CLOSED	*(SAME AS 11.5.1.1.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	04	(SAME AS 11.1.1.2.5)	
11.5.01.02.4	UTILITY BUS	AUTO XFER SW #6	CONTACTS CLOSED	*(SAME AS 11.5.1.1.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	07	(SAME AS 11.1.1.2.5)	
11.5.01.02.5	UTILITY BUS	AUTO XFER SW #6	CONTACTS GROUNDED	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	04	(SAME AS 11.1.1.2.5)	
11.5.01.02.5	UTILITY BUS	AUTO XFER SW #6	CONTACTS GROUNDED	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2)	07	(SAME AS 11.1.1.2.5)	
11.5.01.03.1	UTILITY BUS	NCC-1 (8-1101)	VOLTS LOW	REDUCED RELIABILITY OF HLR PRIMARY PATH (CV-305 CANNOT BE SWING ALIGNED TO SAFETY RELATED POWER)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	34	(SAME AS 11.1.1.2.1)	
11.5.01.03.2	UTILITY BUS	NCC-2 (8-1238)	VOLTS LOW	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA. REDUCED RELIABILITY OF HLR PRIMARY PATH	*ROI REVISION REQUIRED TO SPECIFY LOCAL OPERATOR ACTION TO REALIGN MANUAL TRANSFER SWITCH #7 TO RESTORE SAFETY RELATED POWER FROM REDUNDANT TRAIN TO UTILITY BUS IN SUPPORT OF HLR PRIMARY PATH	04	(SAME AS 11.1.1.2.5)	
11.5.01.03.2	UTILITY BUS	NCC-2 (8-1238)	VOLTS LOW	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA. REDUCED RELIABILITY OF HLR PRIMARY PATH	*ROI REVISION REQUIRED TO SPECIFY LOCAL OPERATOR ACTION TO REALIGN MANUAL TRANSFER SWITCH #7 TO RESTORE SAFETY RELATED POWER FROM REDUNDANT TRAIN TO UTILITY BUS IN SUPPORT OF HLR PRIMARY PATH	07	(SAME AS 11.1.1.2.5)	
11.5.01.03.2	UTILITY BUS	NCC-2 (8-1238)	VOLTS LOW	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA. REDUCED RELIABILITY OF HLR PRIMARY PATH	*ROI REVISION REQUIRED TO SPECIFY LOCAL OPERATOR ACTION TO REALIGN MANUAL TRANSFER SWITCH #7 TO RESTORE SAFETY RELATED POWER FROM REDUNDANT TRAIN TO UTILITY BUS IN SUPPORT OF HLR PRIMARY PATH	34	(SAME AS 11.1.1.2.1)	
11.5.02.01.1	UTILITY BUS	UTILITY BUS ACB	OPEN	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA, AND LOSS OF HLR PRIMARY PATH	SEE ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	04	(SAME AS 11.1.1.2.5)	

MOORE BUSINESS FORMS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM ONOFFER UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
11.5.02.01.1	UTILITY BUS	UTILITY BUS ACB	OPEN	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA AND LOSS OF CLR PRIMARY PATH	SEE ITEMS 1.4.16.11.1, 2.4.12.1.1, 2.4.27.4.1, 2.4.28.4.1, 3.1.7.1.1, 3.2.12.11.1, 3.2.15.2.1	07	(SAME AS 11.1.1.2.5)	
11.5.02.01.3	UTILITY BUS	UTILITY BUS ACB	INPUT SHORT OR GROUND	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2). FAULT WILL RESULT IN UNDERVOLTAGE CONDITION, CAUSING IPRR SW #6 TO AUTO-TRANSFER TO NON-SAFETY RELATED LIGHTING SWGR	04	(SAME AS 11.1.1.2.5)	
11.5.02.01.3	UTILITY BUS	UTILITY BUS ACB	INPUT SHORT OR GROUND	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2). FAULT WILL RESULT IN UNDERVOLTAGE CONDITION, CAUSING IPRR SW #6 TO AUTO-TRANSFER TO NON-SAFETY RELATED LIGHTING SWGR	07	(SAME AS 11.1.1.2.5)	
11.5.02.01.3	UTILITY BUS	UTILITY BUS ACB	INPUT SHORT OR GROUND	*(SAME AS 11.5.1.1.2)	(SAME AS 11.5.1.1.2). FAULT WILL RESULT IN UNDERVOLTAGE CONDITION, CAUSING IPRR SW #6 TO AUTO-TRANSFER TO NON-SAFETY RELATED LIGHTING SWGR	34	(SAME AS 11.1.1.2.1)	
11.5.02.03.1	UTILITY BUS	8-1502 (BREAKER)	OPEN	*POTENTIAL UNISOLABLE DIVERSION OF SI/RCS INVENTORY TO RCDT, NON-FOR INJECTION OR CLR FLOW DUE TO CONTINUED FUNCTIONING OF RCP SEALS	SEE ITEM 2.4.28.4.1	04	(SAME AS 11.1.1.2.5)	
11.5.02.19.1	UTILITY BUS	8-1518 (BREAKER)	OPEN	*POTENTIAL LOSS OF CLR PUMPING CAPABILITY FOR SBLOCA	SEE ITEMS 1.4.16.11.1, 2.4.27.4.1, 3.2.12.11.1	07	(SAME AS 11.1.1.2.5)	
11.6.01.02.1	VITAL BUS #5/6	AUTO IPRR SW (INVERTER #5)	NORMAL	REDUCED RELIABILITY OF VITAL BUSES #5/6 ECCS LOADS	*TRCH SPRC ACTION ENTRY REQUIRED FOR THIS FAILURE. MANUAL TRANSFER SWITCH AVAILABLE BUT NOT CREDITED	34	(SAME AS 11.1.1.2.1)	
11.6.01.02.3	VITAL BUS #5/6	AUTO IPRR SW (INVERTER #5)	CONTACTS OPEN	*CLR FLOW TO 1/3 RCS LOOPS WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY REDUCING RECIRC PUMP LIMITATIONS. TRAIN B SEQUENCER AND APW INOPERABLE, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER MFW FP TRIPPED	SEE ITEMS 1.4.9.11.1, 1.4.11.5.1, 2.4.24.3.1, 3.1.11.3.1, 3.2.17.3.1, 4.2.3.2.1, 8.2.0.2.1	08	(SAME AS 11.3.1.2.3)	
11.6.01.02.3	VITAL BUS #5/6	AUTO IPRR SW (INVERTER #5)	CONTACTS OPEN	*CLR FLOW TO 1/3 RCS LOOPS WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY REDUCING RECIRC PUMP LIMITATIONS. TRAIN B SEQUENCER AND APW INOPERABLE, LOSS OF SECONDARY RECIRC TO S/G A/B/C AFTER MFW PP TRIPPED	SEE ITEMS 1.4.9.11.1, 1.4.11.5.1, 2.4.24.3.1, 3.1.11.3.1, 3.2.17.3.1, 4.2.3.2.1, 8.2.0.2.1	12	(SAME AS 11.1.1.10.1)	
11.6.01.02.4	VITAL BUS #5/6	AUTO IPRR SW (INVERTER #5)	CONTACTS CLOSED	(SAME AS 11.6.1.2.2)	*TRCH SPRC ACTION ENTRY REQUIRED WITH THIS FAILURE	34	(SAME AS 11.1.1.2.1)	
11.6.01.02.5	VITAL BUS #5/6	AUTO IPRR SW (INVERTER #5)	CONTACTS GROUNDED	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	08	(SAME AS 11.3.1.2.3)	
11.6.01.02.5	VITAL BUS #5/6	AUTO IPRR SW (INVERTER #5)	CONTACTS GROUNDED	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	12	(SAME AS 11.1.1.10.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFES UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
11.6.01.03.3	VITAL BUS #5/6	MANUAL XFBR SW (INVERTER #5)	CONTACTS OPEN	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	08	(SAME AS 11.3.1.2.3)	
11.6.01.03.3	VITAL BUS #5/6	MANUAL XFBR SW (INVERTER #5)	CONTACTS OPEN	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	12	(SAME AS 11.1.1.10.1)	
11.6.01.03.4	VITAL BUS #5/6	MANUAL XFBR SW (INVERTER #5)	CONTACTS CLOSED	(SAME AS 11.6.1.2.2)	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	34	(SAME AS 11.1.1.2.1)	
11.6.01.03.5	VITAL BUS #5/6	MANUAL XFBR SW (INVERTER #5)	CONTACTS GROUND	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	08	(SAME AS 11.3.1.2.3)	
11.6.01.03.5	VITAL BUS #5/6	MANUAL XFBR SW (INVERTER #5)	CONTACTS GROUND	*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3)	12	(SAME AS 11.1.1.10.1)	
11.6.02.01.1	VITAL BUS #5	VITAL BUS #5 ACB OPEN		*CLR FLOW TO 1/3 RCS LOOPS WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS. TRAIN B SEQUENCER AND AFMAS ALSO INOPERABLE	SEE ITEMS 1.4.9.11.1, 2.4.24.3.1, 3.1.11.3.1, 3.2.11.2.1, 4.2.3.2.1, 8.2.8.2.1	08	(SAME AS 11.3.1.2.3)	
11.6.02.01.3	VITAL BUS #5	VITAL BUS #5 ACB INPUT SHORT OR GROUND		*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.2.1.1). FAULT WILL CAUSE CONCURRENT LOSS OF VITAL BUS #6	08	(SAME AS 11.3.1.2.3)	
11.6.02.01.3	VITAL BUS #5	VITAL BUS #5 ACB INPUT SHORT OR GROUND		*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.2.1.1). FAULT WILL CAUSE CONCURRENT LOSS OF VITAL BUS #6	12	(SAME AS 11.1.1.10.1)	
11.6.02.04.1	VITAL BUS #5	8-2903 (BREAKER)	OPEN	*CLR FLOW TO RCS LOOP A WOULD BE INCREASED PER PROCEDURE, RESULTING IN CLR AND CLR/HLR FLOW IMBALANCE, POTENTIALLY EXCEEDING RECIRC PUMP LIMITATIONS	SEE ITEMS 2.4.24.3.1, 3.1.11.3.1	08	(SAME AS 11.3.1.2.3)	
11.6.03.01.3	VITAL BUS #6	VITAL BUS #6 ACB INPUT SHORT OR GROUND		*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3). FAULT WILL CAUSE CONCURRENT LOSS OF VITAL BUS #5	08	(SAME AS 11.3.1.2.3)	
11.6.03.01.3	VITAL BUS #6	VITAL BUS #6 ACB INPUT SHORT OR GROUND		*(SAME AS 11.6.1.2.3)	(SAME AS 11.6.1.2.3). FAULT WILL CAUSE CONCURRENT LOSS OF VITAL BUS #5	12	(SAME AS 11.1.1.10.1)	
11.7.01.01.1	CSAS INVERTER	INVERTER A/B	INPUT OPEN	TRAIN B CSAS INOPERABLE. TRAIN A CSAS WILL ACTUATE UPON SEQ #1 SIS/SISLOP (DUE TO 2/3 HI-HI CONTAINMENT PRESSURE INPUT SIGNALS FROM FAILED RELAYS). TRAIN B CLR FLOW CONTROL INOPERABLE	*ROI REV REQUIRED TO WARN OPERATORS THAT CONTAINMENT SPRAY WILL ACTUATE PREMATURELY WITH THIS FAILURE. SEE ITEMS 2.4.23.1.1, 5.2.4.5.1, 5.2.6.6.1, 9.2.1.5.1, 9.2.2.5.1, 9.2.11.3.1		NO FURTHER ACTION REQUIRED. SUBSEQUENT ROI REV NOW ADEQUATELY ADDRESSES THIS ISSUE	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.1.01.01.1	I-WINDING CURRENT LIMITING REACTOR		OPEN	INOPERABILITY OF TRAIN A FOR SIS DURING DG TESTING, NONE FOR SIS DURING NORMAL OPERATION OR FOR SISLOP	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING	21.1	IMPLEMENT NHP 1-3634 TO CHANGE DG LOADING LOGIC FROM SISLOP TO SISLOB	CONTROLS
12.1.01.01.2	I-WINDING CURRENT LIMITING REACTOR		SHORT	POTENTIAL INOPERABILITY OF TRAIN A DURING DG TESTING, NONE FOR NORMAL OPERATION	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING	21	(SAME AS 12.1.1.1.1)	
12.1.02.01.1	152-1R11 (BRKABR)	BRKABR	OPEN	INOPERABILITY OF TRAIN A FOR SIS. NO EFFECT FOR SISLOP	*INCLUDES CONTROL ROOM HANDSWITCH BS-123. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION (EG. DURING DG SURVEILLANCE) BECAUSE OF BUS VOLTAGE DEGRADATION WHICH WOULD OCCUR ON SIS	21.2	PERFORM CALCULATION TO DETERMINE CONDITIONS (EG. GRID VOLTAGE) UNDER WHICH SIS LOADING IS ACCEPTABLE WITH REACTOR BYPASS BREAKER OPEN	ELECTRICAL
12.1.02.01.1	152-1R11 (BRKABR)	BRKABR	OPEN	INOPERABILITY OF TRAIN A FOR SIS. NO EFFECT FOR SISLOP	*INCLUDES CONTROL ROOM HANDSWITCH BS-123. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION (EG. DURING DG SURVEILLANCE) BECAUSE OF BUS VOLTAGE DEGRADATION WHICH WOULD OCCUR ON SIS	21.2	ISSUE TECH SPEC CLARIFICATION ON REACTOR BYPASS BREAKER REQUIREMENTS	ONL
12.1.02.02.1	152-1R21 (BRKABR)	152-11C14 "b" CONTACT	OPEN	(SAME AS 12.1.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.1.02.02.2	152-1R21 (BRKABR)	152-11C14 "b" CONTACT	CLOSED	(SAME AS 12.1.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.1.02.03.1	152-1R21 (BRKABR)	152-11C14 CRL SWITCH	OPEN	(SAME AS 12.1.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.1.02.03.2	152-1R21 (BRKABR)	152-11C14 CRL SWITCH	CLOSED	(SAME AS 12.1.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DG LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.1.02.04.1	152-1R21 (BRKABR)	BUS #1C 125VDC CONTROL POWER (#11C14)	VOLTS LOW	INOPERABILITY OF TRAIN A WITH BYPASS BREAKER MISPOSITIONED	*TECH SPEC ACTION ENTRY REQUIRED WITH BYPASS BREAKER MISPOSITIONED	21	(SAME AS 12.1.2.1.1)	
12.1.03.01.1	152-11C02 (BRKABR)	BRKABR	OPEN	INOPERABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP	*NORMAL FEEDER BREAKER FOR BUS #1C. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OFFSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT	35.1	VERIFY LICENSING BASIS REQUIREMENTS FOR ALTERNATE LICENSING OFFSITE SOURCE OR: CAPABILITY TO START/POWER ECCS LOADS, AND OBTAIN TECH SPEC RELIEF IF REQUIRED	LICENSING
12.1.03.01.1	152-11C02 (BRKABR)	BRKABR	OPEN	INOPERABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP	*NORMAL FEEDER BREAKER FOR BUS #1C. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OFFSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT	35.2	ISSUE TECH SPEC CLARIFICATION TO ACQUIRE ACTION STATEMENT ENTRY FOR BUS 1C OR 2C INOPERABLE WHENEVER ENERGIZED FROM A/B 1PBR	ONL
12.1.03.01.2	152-11C02 (BRKABR)	BRKABR	CLOSED	*INOPERABILITY OF TRAIN A FOR SISLOP, INOPERABILITY OF TRAIN B FOR SISLOP WITH DEGRADED GRID CONDITIONS, NONE FOR SIS	NORMAL POSITION	21	(SAME AS 12.1.1.1.1)	
12.1.03.02.1	152-11C02 (BRKABR)	194 (RRLAT)	CONTACTS OPEN (OFF)	(SAME AS 12.1.3.1.2)	RELAY ACTUATED BY SEQ 1 OR BUS #1C UV RELAY 121-911	21	(SAME AS 12.1.1.1.1)	
12.1.03.02.2	152-11C02 (BRKABR)	194 (RRLAT)	CONTACTS CLOSED (ON)	(SAME AS 12.1.3.1.1)	*SURVEILLANCE TESTING MUST SPECIFICALLY CHECK FOR RRLAT CONTACT FAILURE, SINCE TDR PREVENTS RETRIP IF BRKR SUBSEQUENTLY ENCLOSED		NO FURTHER ACTION REQUIRED. RMO# 9600000084 AND 9600000085 ALREADY PERFORM THIS TESTING	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RBSR DISCIPLINE
12.1.03.03.2 (BRKBR)	152-11C02	C-1PBR PROTECTIVE TRIPS	CONTACTS CLOSED	INOPERABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP OR IF BUS #1C ENERGIZED FROM ALTERNATE SOURCE VIA TR BRKBR 11C01	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION	21	(SAME AS 12.1.1.1.1)	
12.1.03.03.2 (BRKBR)	152-11C02	C-1PBR PROTECTIVE TRIPS	CONTACTS CLOSED	INOPERABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP OR IF BUS #1C ENERGIZED FROM ALTERNATE SOURCE VIA TR BRKBR 11C01	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION	35	(SAME AS 12.1.3.1.1)	
12.1.03.05.1 (BRKBR)	152-11C02	"A" CONTACTS	CONTACTS OPEN	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A DG DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO ALTERNATE OR NORMAL OPPOSITE SOURCE WITHOUT LOSS OF ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. DROOP MODE REQUIRED FOR PARALLELED OPERATION TO PREVENT CONTROL OF DG LOADING. DROP AND PICKUP OTHERWISE REQUIRED		NO FURTHER ACTION REQUIRED. EXISTING TECH SPEC MONTHLY LOAD TESTING (901-12.3-10) INCLUDES REEXAMINING OF THIS FEATURE	
12.1.03.05.2 (BRKBR)	152-11C02	"A" CONTACTS	CONTACTS CLOSED	INOPERABILITY OF TRAIN A DG	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. NORMAL POSITION. ISOCRONOUS MODE REQUIRED FOR LOB, LOP OR SISLOP OPERATION TO ENSURE PROPER FREQUENCY FOR LOAD MOTOR PERFORMANCE		(SAME AS 12.1.3.5.1)	
12.1.04.01.1 (BRKBR)	152-11A04	BRKBR	OPEN	TRAIN A ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-1PBR RELATED LOP	*NORMAL POSITION DURING PLANT S/U PRIOR TO SYNCHRONIZING MAIN GEN TO GRID. SCTR DOSE CALC REV (TO PRECLUDE CREDIT FOR RCP#) AND BOI REV REQD SINCE CANNOT START RCP# FROM BUS #1C/2C POST-SIS/SISLOP WITHOUT INTERRUPTION OF ECCS LOADS DUE TO VOLT TRANSIENT	24.1	REVISE SCTR DOSE CALCULATIONS (AS NEEDED TO PRECLUDE CREDIT FOR RCP#) AS PART OF UFSAR CHAPTER 15 REANALYSIS	NUCLEAR
12.1.04.01.1 (BRKBR)	152-11A04	BRKBR	OPEN	TRAIN A ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-1PBR RELATED LOP	*NORMAL POSITION DURING PLANT S/U PRIOR TO SYNCHRONIZING MAIN GEN TO GRID. SCTR DOSE CALC REV (TO PRECLUDE CREDIT FOR RCP#) AND BOI REV REQD SINCE CANNOT START RCP# FROM BUS #1C/2C POST-SIS/SISLOP WITHOUT INTERRUPTION OF ECCS LOADS DUE TO VOLT TRANSIENT	35.3	PERFORM CALCULATION TO DETERMINE CONDITIONS (EG. GRID VOLTAGE AND BUS LOAD) UNDER WHICH RCP# MAY BE RESTARTED FROM BUS 1C/2C WITH ECCS LOADS ALREADY RUNNING	ELECTRICAL
12.1.04.01.1 (BRKBR)	152-11A04	BRKBR	OPEN	TRAIN A ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-1PBR RELATED LOP	*NORMAL POSITION DURING PLANT S/U PRIOR TO SYNCHRONIZING MAIN GEN TO GRID. SCTR DOSE CALC REV (TO PRECLUDE CREDIT FOR RCP#) AND BOI REV REQD SINCE CANNOT START RCP# FROM BUS #1C/2C POST-SIS/SISLOP WITHOUT INTERRUPTION OF ECCS LOADS DUE TO VOLT TRANSIENT	35.4	REVISE BOI# AS NEEDED TO REFLECT ELECTRICAL CALCULATION RESULTS FOR RCP RESTART LIMITATIONS	OPERATIONS
12.1.04.02.2 (BRKBR)	152-11A04	BB1 (RBLAT)	CONTACTS CLOSED (ON)	NONE	*VERIFICATION REQUIRED THAT MAIN GENERATOR UNDERVOLTAGE RELAY 2271 SETPOINT (40X) IS LOW ENOUGH TO PREVENT MOTOR-OPERATED DISCONNECT FAILURE DUE TO FLASHOVER BY RESIDUAL OUTPUT OF GENERATOR		NO FURTHER ACTION REQUIRED. BREAKER ANTI-PUMPING PREVENTS RECLOSURE. EXISTING RHO# ALREADY PERFORM TESTING OF THIS FEATURE	
12.1.04.03.2 (BRKBR)	152-11A04	186-1, 186-2, 186-2A (RELAYS)	ON	TRAIN A ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-1PBR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION		NO FURTHER ACTION REQUIRED. ALREADY COVERED BY EQUIPMENT CONTROL LOCAL/EDMR PROCESS AND OPERABILITY ASSESSMENT FOR H.O.	

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EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.1.04.04.2	152-11A04 (BREAKER)	OTHER MAIN CBM MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED (ON)	(SAME AS 12.1.4.3.2)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. CONTACTS CLOSED ON OUT-OF-STEP, OVERSPEED, LOSS OF FIELD, DIFFERENTIAL, NEGATIVE PHASE SEQUENCE, STATOR GROUND, SUDDEN PRESSURE, OR OVERCURRENT	(SAME AS 12.1.4.3.2)		
12.1.04.05.2	152-11A04 (BREAKER)	194-2 (RELAY)	CONTACTS CLOSED (ON)	(SAME AS 12.1.4.3.2)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION	(SAME AS 12.1.4.3.2)		
12.1.04.06.1	152-11A04 (BREAKER)	"A" CONTACTS	CONTACTS OPEN	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE FOR C-IPMR RELATED LOP, WITHOUT LOSS OF ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. LOWETS AND RCP SLOW COASTDOWN NOT CREDITED IN SIS/SISLOP EVENTS	NO FURTHER ACTION REQUIRED. RMO 96431215006 ALREADY PERFORMS OPERABILITY TESTING OF THIS FEATURE		
12.1.04.06.2	152-11A04 (BREAKER)	"A" CONTACTS	CONTACTS CLOSED	NONE	ROI REV REQD: IPMR FROM DG TO ALT OFFSITE SOURCE MUST OCCUR WITH BUS #1B ENERGIZED BEFORE TIE BRKR CLOSED, WITH THIS FAILURE	35.5 EVALUATE ROI CHANGES TO PRECLUDE DG DROOP IN ISOLATED MODE		
12.1.04.08.1	152-11A04 (BREAKER)	BUS #1A 125VDC CONTROL POWER	VOLTS LOW	TRAIN A ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE WITH C-IPMR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION	(SAME AS 12.1.4.3.2)		
12.1.05.01.2	BUS #1A MSR LOADS	BREAKER(S)	CLOSED	REDUCED ELRC MARGIN ON TRAIN A FOR SIS DURING PLANT S/U (W/ TIE BRKR 11C01 CLOSED). TRAIN A ALT OFFSITE SOURCE ALSO INOP, RESULTING IN POTENTIAL LONG-TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE W/C-IPMR LOP	*NORMAL POSITION DURING POWER OPERATION. TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE. FAILURE TO TRIP RCPs SHOWN FOR SIS BY BUS VOLTAGE CALC DC-3225 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)	(SAME AS 12.1.4.3.2)		
12.1.05.05.2	BUS #1A MSR LOADS	194-2 (RELAY)	CONTACTS CLOSED (ON)	NONE FOR SIS/SISLOP	*SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPs. ROI REVISION REQUIRED TO ADDRESS POTENTIAL INABILITY TO RESTART RCPs IN UNAFFECTED LOOPS	24 (SAME AS 12.1.4.1.1)		
12.1.05.05.2	BUS #1A MSR LOADS	194-2 (RELAY)	CONTACTS CLOSED (ON)	NONE FOR SIS/SISLOP	*SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPs. ROI REVISION REQUIRED TO ADDRESS POTENTIAL INABILITY TO RESTART RCPs IN UNAFFECTED LOOPS	35 (SAME AS 12.1.4.1.1)		
12.1.05.06.2	BUS #1A MSR LOADS	186-S13 (RELAY)	CONTACTS CLOSED (ON)	NONE FOR SIS/SISLOP	*SGTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPs	24 (SAME AS 12.1.4.1.1)		
12.1.05.07.1	BUS #1A MSR LOADS	BUS #1A 125VDC CONTROL POWER	VOLTS LOW	REDUCED TRAIN A ELECTRICAL MARGIN FOR SIS DURING PLANT S/U (W/ TIE BRKR 11C01 CLOSED). TRAIN A ALT OFFSITE SOURCE ALSO INOP, CAUSING POTENTIAL LONG TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE W/ C-IPMR LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR INOP ALTERNATE OFFSITE SOURCE ON TRAIN A. FAILURE TO TRIP RCPs SHOWN ACCEPTABLE FOR SIS BY VOLTAGE CALCULATION DC-3225 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)	(SAME AS 12.1.4.3.2)		

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.1.06.01.2	BUS #1A CONTROLS	194-2 (RELAY)	CONTACTS CLOSED (ON)	TRAIN A ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE WITH C-IPMR RELATED LOP. NONE FOR SIS WITH NORMAL OFFSITE SOURCE ALIGNED	*TECH SPEC ACTION ENTRY REQUIRED WHENEVER BUS #1C OR 2C ENERGIZED FROM ALTERNATE OFFSITE SOURCE	21	(SAME AS 12.1.1.1.1)	
12.1.07.01.1	152-11C01 (BREAKER)	BREAKER	OPEN	TRAIN A ALTERNATE OFFSITE SOURCE INOP, RESULTING IN POTENTIAL LONG-TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE FOR C-IPMR RELATED LOP. RCP A AND C CANNOT BE RE-ENERGIZED FROM MAIN/A-IPMR POST-SCTR	*BOI REVISION REQUIRED TO PRECLUDE RCP RESTART FROM BUS #1C/2C POST-SIS/SISLOP TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT. SCTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCP OPERATION	24	(SAME AS 12.1.4.1.1)	
12.1.07.01.1	152-11C01 (BREAKER)	BREAKER	OPEN	TRAIN A ALTERNATE OFFSITE SOURCE INOP, RESULTING IN POTENTIAL LONG-TERM INOP OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE FOR C-IPMR RELATED LOP. RCP A AND C CANNOT BE RE-ENERGIZED FROM MAIN/A-IPMR POST-SCTR	*BOI REVISION REQUIRED TO PRECLUDE RCP RESTART FROM BUS #1C/2C POST-SIS/SISLOP TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT. SCTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCP OPERATION	35	(SAME AS 12.1.4.1.1)	
12.1.07.01.2	152-11C01 (BREAKER)	BREAKER	CLOSED	TRAIN A INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	*NORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OFFSITE SOURCE TO BUS #1C. BOI CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT	21	(SAME AS 12.1.1.1.1)	
12.1.07.01.2	152-11C01 (BREAKER)	BREAKER	CLOSED	TRAIN A INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	*NORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OFFSITE SOURCE TO BUS #1C. BOI CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT	24	(SAME AS 12.1.4.1.1)	
12.1.07.01.2	152-11C01 (BREAKER)	BREAKER	CLOSED	TRAIN A INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	*NORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OFFSITE SOURCE TO BUS #1C. BOI CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT	35	(SAME AS 12.1.4.1.1)	
12.1.07.01.2	152-11C01 (BREAKER)	SBQ 1 (13-9,11)	CONTACTS CLOSED (ON)	INOPERABILITY OF TRAIN A ALTERNATE OFFSITE SOURCE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OFFSITE SOURCE WITH C-IPMR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE		(SAME AS 12.1.4.3.2)	
12.1.07.08.2	152-11C01 (BREAKER)	194 (RELAY)	CONTACTS CLOSED (ON)	REDUCED RELIABILITY OF TRAIN A FOR SIS DURING PLANT STARTUP (WITH BUS #1A/1C TIE BRKR CLOSED). NONE FOR SISLOP DUE TO SEPARATE SISLOP TRIP OF TIE BRKR	*TECH SPEC ACTION ENTRY REQUIRED WITH BUS #1C ENERGIZED FROM ALTERNATE OFFSITE SOURCE	35	(SAME AS 12.1.3.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAM ONOPFR UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.1.07.09.1	152-11C01 (BREAKER)	"A" CONTACTS	OPEN	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN A FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #1C FROM DG TO OPPOSITE SOURCE WITH C-IPFR RELATED LOP. NONE FOR SIS	*NORMAL POSITION DURING POWER OPERATION. TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. DROOP MODE REQUIRED TO CONTROL DG LOAD WHEN PARALLELED TO OPPOSITE SOURCE. OTHERWISE DROP AND PICKUP REQUIRED	(SAME AS 12.1.4.6.1)		
12.1.07.12.1	152-11C01 (BREAKER)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN A FOR SISLOP, AND TRAIN B FOR SISLOP WITH TRAIN A ALIGNED TO ALTERNATE OPPOSITE SOURCE	*SINCE MAIN GENERATOR COASTDOWN ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ACTION ENTRY IS REQUIRED WHENEVER BUS #1C OR 2C IS ALIGNED TO THE ALTERNATE OPPOSITE SOURCE	21	(SAME AS 12.1.1.1.1)	
12.1.07.12.1	152-11C01 (BREAKER)	BUS #1C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN A FOR SISLOP, AND TRAIN B FOR SISLOP WITH TRAIN A ALIGNED TO ALTERNATE OPPOSITE SOURCE	*SINCE MAIN GENERATOR COASTDOWN ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ACTION ENTRY IS REQUIRED WHENEVER BUS #1C OR 2C IS ALIGNED TO THE ALTERNATE OPPOSITE SOURCE	35	(SAME AS 12.1.3.1.1)	
12.1.09.01.1	152-11C10 (BREAKER)	BREAKER	OPEN	*TRAIN A ECCS INOPERABLE, TRAIN B CLR HEAT REMOVAL DEGRADED DUE TO UNISOLABLE BYPASS THROUGH IDLE CCM HI	*SST #1 4KV FREDER BREAK. SEE ITEMS 6.1.1.3.1 AND 7.1.3.2.1. ADDITIONALLY, ROI REVISION REQUIRED TO TRIP TRAIN A SI/FW PUMPS PRIOR TO LOSS OF 125VDC BUS #1 FOR THIS FAILURE, TO ENSURE SI TERMINATION AT LO-LO RWST LEVEL SETPOINT	04.4	VERIFY CURRENT ROI FLOATING STRPS ADEQUATELY ADDRESS SI/FW TERMINATION WITH 125VDC BUS FAILURE.	OPERATIONS
12.1.09.01.1	152-11C10 (BREAKER)	BREAKER	OPEN	*TRAIN A ECCS INOPERABLE, TRAIN B CLR HEAT REMOVAL DEGRADED DUE TO UNISOLABLE BYPASS THROUGH IDLE CCM HI	*SST #1 4KV FREDER BREAK. SEE ITEMS 6.1.1.3.1 AND 7.1.3.2.1. ADDITIONALLY, ROI REVISION REQUIRED TO TRIP TRAIN A SI/FW PUMPS PRIOR TO LOSS OF 125VDC BUS #1 FOR THIS FAILURE, TO ENSURE SI TERMINATION AT LO-LO RWST LEVEL SETPOINT	15	COMPLETE CALCULATION (DC-3410) TO DETERMINE ACCEPTABILITY OF SWC/CCWH BYPASSED CONFIGURATION	MECHANICAL
12.1.09.01.2	152-11C10 (BREAKER)	BREAKER	CLOSED	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF 480V SWGR #1 ENERGIZED FROM BUS 1-3 TIE BREAKER IN LIEU OF SST #1 VIA THIS BREAKER		NO FURTHER ACTION REQUIRED. CONFIGURATION ELIMINATED BY DCP 1-3552. NEW CONFIGURATION CONTROLLED BY AMENDMENT #134 (PCN-217) PER SOI-9-3	
12.1.12.06.1	BUS #1C UNDERVOLTAGE AND (15-9,11) CONTROL	SEQ 1	CONTACTS OPEN (OFF)	INOPERABILITY OF TRAIN A FOR SISLOP, NONE FOR SIS	*NORMAL POSITION. MAINTAINED TRIP SIGNAL REQUIRED FOR MSR LOADS TO PREVENT START POST-SISLOP. COND PPS, BTR DR PP, TPCW PP AND BUS #1A/1C TIE BRKR ARE LOCKED OUT BY SEPARATE MAINTAINED SEQ CONTACTS OR OVERLOAD LOCKOUT RELAY ACTUATION	35.6	EVALUATE CONTINUED ACCEPTABILITY OF NO MAINTAINED LOCKOUT ON SIS AND SISLOP FOR MSR LOADS AS PART OF INTEGRATED RESOLUTION OF SRP TOPIC VI-7.C.2. (CONFIGURATION ACCEPTABLE UNTIL TRSN BASED ON AMENDMENT 38 SECTION 1.3.1.1)	ELECTRICAL
12.1.12.07.2	BUS #1C UNDERVOLTAGE AND 194-1 CONTROL	194 194-1 (RELAYS)	CONTACTS CLOSED (ON)	INOPERABILITY OF TRAIN A	*LOCKOUT NOT CURRENTLY PROVIDED FOR MSR LOADS, EXCEPT THOSE RECEIVING A SEPARATE MAINTAINED SISLOP SIGNAL (EG. CONDENSATE AND HEATER DRAIN PP) OR SISLOP ACTUATION OF OVERLOAD LOCKOUT (EG. TPCW)	35	(SAME AS 12.1.12.6.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.2.01.01.1	T-WINDING CURRENT LIMITING REACTOR		OPEN	INOPERABILITY OF TRAIN B FOR SIS DURING DC TESTING, NONE FOR SIS DURING NORMAL OPERATION OR FOR SISLOP	*TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING	21	(SAME AS 12.1.1.1.1)	
12.2.01.01.2	T-WINDING CURRENT LIMITING REACTOR		SHORT	POTENTIAL INOPERABILITY OF TRAIN B DURING DC TESTING, NONE FOR NORMAL OPERATION	*TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING	21	(SAME AS 12.1.1.1.1)	
12.2.02.01.1	152-1RT1 (BRKBR)	BRKBR	OPEN	INOPERABILITY OF TRAIN B FOR SIS. NO EFFECT FOR SISLOP	*INCLUDES CONTROL ROOM HANDSWITCH HS-167. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION (EG. DURING DC SURVEILLANCE) BECAUSE OF BUS VOLTAGE DEGRADATION WHICH WOULD OCCUR ON SIS	21	(SAME AS 12.1.2.1.1)	
12.2.02.02.1	152-1RT1 (BRKBR)	152-12C15 "b" CONTACT	OPEN	(SAME AS 12.2.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.2.02.02.2	152-1RT1 (BRKBR)	152-12C15 "a" CONTACT	CLOSED	(SAME AS 12.2.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.2.02.03.1	152-1RT1 (BRKBR)	152-12C15 CBL SWITCH	OPEN	(SAME AS 12.2.2.1.1)	*TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.2.02.03.2	152-1RT1 (BRKBR)	152-12C15 CBL SWITCH	CLOSED	(SAME AS 12.2.2.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQUIRED FOR DC LOAD TESTING	21	(SAME AS 12.1.2.1.1)	
12.2.02.04.1	152-1RT1 (BRKBR)	BUS #2C 125VDC CONTROL POWER (012C15)	VOLTS LOW	INOPERABILITY OF TRAIN B WITH BYPASS BRKBR MISPOSITIONED	*TECH SPEC ACTION ENTRY REQUIRED WITH BRKBR MISPOSITIONED	21	(SAME AS 12.1.1.1.1)	
12.2.03.01.1	152-12C02 (BRKBR)	BRKBR	OPEN	INOPERABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	*NORMAL FREDER BREAKER FOR BUS #2C. TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OPPOSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT	35	(SAME AS 12.1.3.1.1)	
12.2.03.01.2	152-12C02 (BRKBR)	BRKBR	CLOSED	*INOPERABILITY OF TRAIN B FOR SISLOP, INOPERABILITY OF TRAIN A FOR SISLOP WITH DEGRADED GRID CONDITIONS, NONE FOR SIS	NORMAL POSITION	21	(SAME AS 12.1.1.1.1)	
12.2.03.02.1	152-12C02 (BRKBR)	194-4 (RBLV)	CONTACTS OPEN (OFF)	(SAME AS 12.2.3.1.2)	RELAY ACTUATED BY SEQ 2 OR BUS #2C UV RELAY 127-611	21	(SAME AS 12.1.1.1.1)	
12.2.03.02.2	152-12C02 (BRKBR)	194-4 (RBLV)	CONTACTS CLOSED (ON)	(SAME AS 12.2.3.1.1)	*SURVEILLANCE TESTING MUST SPECIFICALLY CHECK FOR RELAY CONTACT FAILURE, SINCE TRIP PREVENTS RETRIP IF BRER SUBSEQUENTLY RECLOSED		(SAME AS 12.1.3.2.2)	
12.2.03.03.2	152-12C02 (BRKBR)	C-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED	INOPERABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OPPOSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT	21	(SAME AS 12.1.1.1.1)	
12.2.03.03.2	152-12C02 (BRKBR)	C-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED	INOPERABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION DUE TO INABILITY OF ALTERNATE OPPOSITE SOURCE TO MAINTAIN ADEQUATE BUS VOLTAGE DURING SIS LOADING TRANSIENT	35	(SAME AS 12.1.3.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRR UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.2.03.05.1	152-12C02 (BREAKER)	"a" CONTACTS	CONTACTS OPEN	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO ALTERNATE OR NORMAL OFFSITE SOURCE WITHOUT LOSS OF ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. DROOP MODE REQUIRED FOR PARALLELED OPERATION TO PERMIT CONTROL OF DG LOADING. DROP AND PICKUP OTHERWISE REQUIRED	(SAME AS 12.1.3.5.1)		
12.2.03.05.2	152-12C02 (BREAKER)	"a" CONTACTS	CONTACTS CLOSED	INOPERABILITY OF TRAIN B DG	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. NORMAL POSITION. ISOCRONOUS MODE REQUIRED FOR LOB, LOP OR SISLOP OPERATION TO ENSURE PROPER FREQUENCY FOR LOAD MOTOR PERFORMANCE	(SAME AS 12.1.3.5.1)		
12.2.04.01.1	152-11B04 (BREAKER)	BREAKER	OPEN	TRAIN B ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OFFSITE SOURCE WITH C-IPMR RELATED LOP	*NORMAL POSITION DURING PLANT S/U PRIOR TO SYNCHRONIZING MAIN GEN TO GRID. SCTR DOSE CALC REV (TO PRECLUDE CREDIT FOR RCPs) AND ROI REV REQ SINCE CANNOT START RCPs FROM BUS #1C/2C	(SAME AS 12.1.4.1.1)		
12.2.04.01.2	152-11B04 (BREAKER)	BREAKER	OPEN	TRAIN B ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OFFSITE SOURCE WITH C-IPMR RELATED LOP	*NORMAL POSITION DURING PLANT S/U PRIOR TO SYNCHRONIZING MAIN GEN TO GRID. SCTR DOSE CALC REV (TO PRECLUDE CREDIT FOR RCPs) AND ROI REV REQ SINCE CANNOT START RCPs FROM BUS #1C/2C	(SAME AS 12.1.4.1.1)		
12.2.04.02.2	152-11B04 (BREAKER)	BB1 (RELAY)	CONTACTS CLOSED (ON)	NONE	*VERIFICATION REQUIRED THAT MAIN GENERATOR UNDERVOLTAGE RELAY 2271 SETPOINT (40%) IS LOW ENOUGH TO PREVENT MOD FAILURE DUE TO FLASHOVER BY RESIDUAL GENERATOR OUTPUT	(SAME AS 12.1.4.2.2)		
12.2.04.03.2	152-11B04 (BREAKER)	186-3, 186-3A, 186-4 (RELAYS)	ON	TRAIN B ALTERNATE OFFSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OFFSITE SOURCE WITH C-IPMR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION	(SAME AS 12.1.4.3.2)		
12.2.04.04.2	152-11B04 (BREAKER)	OTHER MAIN GEN MAIN/A/B-IPMR PROTECTIVE TRIPS	CONTACTS CLOSED (ON)	(SAME AS 12.2.4.3.2)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. CONTACTS CLOSED ON OUT-OF-STEP, OVERSPEED, LOSS OF FIELD, DIFFERENTIAL, NEGATIVE PHASE SEQUENCE, STATOR GROUND, SUDDEN PRESSURE, OR OVERCURRENT	(SAME AS 12.1.4.3.2)		
12.2.04.05.2	152-11B04 (BREAKER)	194-3 (RELAY)	CONTACTS CLOSED (ON)	(SAME AS 12.2.4.3.2)	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION	(SAME AS 12.1.4.3.2)		
12.2.04.06.1	152-11B04 (BREAKER)	"a" CONTACTS	CONTACTS OPEN	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OFFSITE SOURCE FOR C-IPMR RELATED LOP, WITHOUT LOSS OF ECCS LOADS	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION. LOVATS AND RCP SLOW COASTDOWN NOT CREDITED IN SIS/SISLOP EVENTS	(SAME AS 12.1.4.6.1)		

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFER UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP. DISCIPLINE
12.2.04.06.2	152-11B04 (BREAKER)	"A" CONTACTS	CONTACTS CLOSED	NONE	*ROI REVISION REQ: IFR FROM DG TO ALT OFFSITE SOURCE MUST OCCUR WITH BUS #1B ENERGIZED BEFORE TIE BRKR CLOSED, WITH THIS FAILURE	35 (SAME AS 12.1.4.6.2)		
12.2.04.08.1	152-11B04 (BREAKER)	BUS #1B 125VDC CONTROL POWER	VOLTS LOW	TRAIN B ALTERNATE OPPOSITE SOURCE INOPERABLE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE WITH C-IPMR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR THIS CONDITION		(SAME AS 12.1.4.3.2)	
12.2.05.01.2	BUS #1B MSR LOADS	BREAKER(S)	CLOSED	REDUCED TRAIN B ELECTRICAL MARGIN FOR SIS DURING PLANT S/U (W/ TIE BRKR 12C01 CLOSED). TRAIN B ALT OPPOSITE SOURCE ALSO INOP, CAUSING POTENTIAL LONG-TERM INOP OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE W/ C-IPMR LOP	*NORMAL POSITION DURING POWER OPERATION. TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE. FAILURE TO TRIP RCP AND RECITER SHOWN ACCEPTABLE FOR SIS BY VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)		(SAME AS 12.1.4.3.2)	
12.2.05.05.2	BUS #1B MSR LOADS	194-3 (RELAY)	CONTACTS CLOSED (ON)	NONE FOR SIS/SISLOP	*SCTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPs. ROI REVISION REQUIRED TO ADDRESS POTENTIAL INABILITY TO RESTART RCPs IN UNAFFECTED LOOPS	24 (SAME AS 12.1.4.1.1)		
12.2.05.05.2	BUS #1B MSR LOADS	194-3 (RELAY)	CONTACTS CLOSED (ON)	NONE FOR SIS/SISLOP	*SCTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPs. ROI REVISION REQUIRED TO ADDRESS POTENTIAL INABILITY TO RESTART RCPs IN UNAFFECTED LOOPS	35 (SAME AS 12.1.4.1.1)		
12.2.05.06.2	BUS #1B MSR LOADS	186-SIS (RELAY)	CONTACTS CLOSED (ON)	NONE FOR SIS/SISLOP	*SCTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCPs	24 (SAME AS 12.1.4.1.1)		
12.2.05.07.1	BUS #1B MSR LOADS	BUS #1B 125VDC CONTROL POWER	VOLTS LOW	REDUCED ELCC MARGINS ON BOTH TRAINS FOR SIS DURING PLANT S/U (W/ TIE BRKR 11C01, 12C01 CLOSED). TRAIN B ALT OPPOSITE SOURCE INOP, CAUSING POTENTIAL LONG-TERM INOP OF TRAIN B FOR SISLOP DUE TO INABILITY TO IFR BUS #2C FROM DG TO OPPOSITE W/ C-IPMR LOP	*TECH SPEC ACTION ENTRY REQUIRED FOR INOP ALTERNATE OPPOSITE SOURCE ON TRAIN B. FAILURE TO TRIP RCPs SHOWN ACCEPTABLE FOR SIS BY BUS VOLTAGE CALCULATION DC-3325 (DC-3225 FOR POST-DCP 3552 CONFIGURATION)		(SAME AS 12.1.4.3.2)	
12.2.06.01.2	BUS #1B CONTROLS	194-3 (RELAY)	CONTACTS CLOSED (ON)	NONE FOR SIS/SISLOP. TRAIN B ALTERNATE OPPOSITE AVAILABLE AFTER MOTOR OPERATED DISCONNECT OPENED, AS NORMAL	*TECH SPEC ACTION ENTRY REQUIRED WHENEVER BUS #1C OR 2C ENERGIZED FROM ALTERNATE OPPOSITE SOURCE	21 (SAME AS 12.1.1.1.1)		
12.2.07.01.1	152-12C01 (BREAKER)	BREAKER	OPEN	TRAIN B ALT OPPOSITE SOURCE INOPERABLE, CAUSING POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE FOR C-IPMR RELATED LOP. RCP B CANNOT BE RE-ENERGIZED FROM MAIN/B-IPMR POST-SCTR	*ROI REVISION REQUIRED TO PRECLUDE RCP RESTART FROM BUS #1C/2C POST-SIS/SISLOP TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT. SCTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCP OPERATION	24 (SAME AS 12.1.4.1.1)		
12.2.07.01.1	152-12C01 (BREAKER)	BREAKER	OPEN	TRAIN B ALT OPPOSITE SOURCE INOPERABLE, CAUSING POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OPPOSITE SOURCE FOR C-IPMR RELATED LOP. RCP B CANNOT BE RE-ENERGIZED FROM MAIN/B-IPMR POST-SCTR	*ROI REVISION REQUIRED TO PRECLUDE RCP RESTART FROM BUS #1C/2C POST-SIS/SISLOP TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT. SCTR DOSE CALC REVISION REQUIRED TO PRECLUDE CREDIT FOR RCP OPERATION	35 (SAME AS 12.1.4.1.1)		

EMERGENCY COER COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.2.07.01.2	152-12C01 (BREAKER)	BREAKER	CLOSED	TRAIN B INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	*NORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OFFSITE SOURCE TO BUS #2C. ROI CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT	21	(SAME AS 12.1.1.1.1)	
12.2.07.01.2	152-12C01 (BREAKER)	BREAKER	CLOSED	TRAIN B INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	*NORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OFFSITE SOURCE TO BUS #2C. ROI CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT	24	(SAME AS 12.1.4.1.1)	
12.2.07.01.2	152-12C01 (BREAKER)	BREAKER	CLOSED	TRAIN B INOPERABLE FOR SISLOP, REDUCED RELIABILITY FOR SIS	*NORMAL DURING PLANT STARTUP OR ALIGNMENT OF ALTERNATE OFFSITE SOURCE TO BUS #2C. ROI CHANGE REQUIRED TO PRECLUDE RCP RESTART POST-SIS/SISLOP IN THIS ALIGNMENT TO PREVENT LOSS OF ECCS LOADS DUE TO SEVERE BUS UNDERVOLTAGE TRANSIENT	35	(SAME AS 12.1.4.1.1)	
12.2.07.07.2	152-12C01 (BREAKER)	SEQ 2 (13-9,11)	CONTACTS CLOSED (ON)	INOPERABILITY OF TRAIN B ALTERNATE OFFSITE SOURCE, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OFFSITE SOURCE WITH C-IPRR RELATED LOP	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE		(SAME AS 12.1.4.3.2)	
12.2.07.08.2	152-12C01 (BREAKER)	194-4 (RELAT)	CONTACTS CLOSED (ON)	REDUCED RELIABILITY OF TRAIN B FOR SIS DURING PLANT STARTUP (WITH BUS #1B/2C TIE BREAK CLOSED). NONE FOR SISLOP DUE TO SEPARATE SISLOP TRIP SIGNAL	*TECH SPEC ACTION ENTRY REQUIRED WITH BUS #2C ENERGIZED FROM ALTERNATE OFFSITE SOURCE	35	(SAME AS 12.1.3.1.1)	
12.2.07.09.1	152-12C01 (BREAKER)	"A" CONTACTS	OPBN	POTENTIAL LONG-TERM INOPERABILITY OF TRAIN B FOR SISLOP DUE TO INABILITY TO TRANSFER BUS #2C FROM DG TO OFFSITE SOURCE WITH C-IPRR RELATED LOP. NONE FOR SIS	*NORMAL POSITION DURING POWER OPERATION. TECH SPEC ACTION ENTRY REQUIRED FOR THIS FAILURE. DROOP MODE REQUIRED TO CONTROL DG LOAD WHEN PARALLELED TO OFFSITE SOURCE. OTHERWISE DROP AND PICKUP REQUIRED		(SAME AS 12.1.4.6.1)	
12.2.07.12.1	152-12C01 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN B FOR SISLOP, AND TRAIN A FOR SISLOP WITH TRAIN B ALIGNED TO ALTERNATE OFFSITE SOURCE	*SINCE MAIN GENERATOR COASTDOWN ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ENTRY IS REQUIRED WHENEVER BUS #1C OR 2C IS ALIGNED TO THE ALTERNATE OFFSITE SOURCE	21	(SAME AS 12.1.1.1.1)	
12.2.07.12.1	152-12C01 (BREAKER)	BUS #2C 125VDC CONTROL POWER	VOLTS LOW	*INOPERABILITY OF TRAIN B FOR SISLOP, AND TRAIN A FOR SISLOP WITH TRAIN B ALIGNED TO ALTERNATE OFFSITE SOURCE	*SINCE MAIN GENERATOR COASTDOWN ON AFFECTED BUSES PREVENTS SISLOP DETECTION, WITH OR WITHOUT A CONCURRENT SINGLE FAILURE, TECH SPEC 3.0.3 ENTRY IS REQUIRED WHENEVER BUS #1C OR 2C IS ALIGNED TO THE ALTERNATE OFFSITE SOURCE	35	(SAME AS 12.1.3.1.1)	

EMERGENCY COBB COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RSSP DISCIPLINE
12.2.09.01.1	152-12C10 (BRKBR)	BRKBR	OPEN	TRAIN B ECCS INOPERABLE, TRAIN A CLR HEAT REMOVAL DEGRADED	*SST #2 (LV PROBR BRK. SEE ITEMS 6.2.4.3.1 AND 7.2.3.2.1. ADDITIONALLY, NOI REVISION REQUIRED TO TRIP TRAIN B SI/PM PUMPS PRIOR TO LOSS OF 125VDC BUS #2 FOR THIS FAILURE, TO ENSURE BI TERMINATION AT LO-LO RMST LEVEL SETPOINT	04	(SAME AS 12.1.9.1.1)	
12.2.09.01.1	152-12C10 (BRKBR)	BRKBR	OPEN	TRAIN B ECCS INOPERABLE, TRAIN A CLR HEAT REMOVAL DEGRADED	*SST #2 (LV PROBR BRK. SEE ITEMS 6.2.4.3.1 AND 7.2.3.2.1. ADDITIONALLY, NOI REVISION REQUIRED TO TRIP TRAIN B SI/PM PUMPS PRIOR TO LOSS OF 125VDC BUS #2 FOR THIS FAILURE, TO ENSURE BI TERMINATION AT LO-LO RMST LEVEL SETPOINT	15	(SAME AS 12.1.9.1.1)	
12.2.09.01.2	152-12C10 (BRKBR)	BRKBR	CLOSED	NONE	*TRC SPEC ACTION ENTRY REQUIRED IF 180V SWCR #2 ENERGIZED FROM BUS 2-3 TIE BRKBR IN LIEU OF SST #2 VIA THIS BRKBR		(SAME AS 12.1.9.1.2)	
12.2.12.06.1	BUS #2C UNDERVOLTAGE AND (13-9,11) CONTROL	SEQ 2	CONTACTS OPEN (OFF)	INOPERABILITY OF TRAIN B FOR SISLOP, NONE FOR SIS	*NORMAL POSITION. MAINTAINED TRIP SIGNAL 35 REQUIRED FOR MSR LOADS TO PREVENT START POST-SISLOP. COND PPS, HTR DR PP, TPCW PP AND BUS #1B/2C TIE BRK ARE LOCKED OUT BY SEPARATE MAINTAINED SEQ CONTACTS OR OVERLOAD LOCKOUT RELAY ACTUATION		(SAME AS 12.1.12.6.1)	
12.2.12.07.2	BUS #2C UNDERVOLTAGE AND 194-5 CONTROL	194-4 (RELAYS)	CONTACTS CLOSED (ON)	INOPERABILITY OF TRAIN B	*LOCKOUT NOT CURRENTLY PROVIDED FOR MSR LOADS, EXCEPT THOSE RECEIVING A SEPARATE MAINTAINED SISLOP SIGNAL (EG. CONDENSATE AND HEATER DRAIN PP) OR SISLOP ACTUATION OF OVERLOAD LOCKOUT (EG. TPCW)	35	(SAME AS 12.1.12.6.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DC AND MFW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VERIF OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IFMR HAS 2 TRAINS OF FORCED AIR CLNG	03.1	DETERMINE THI-SOURCE TERM DOSE RATES FOR APPLICABLE MANUAL ACTION LOCATIONS, INCLUDING ACCESS/EGRESS ROUTES (INCLUDING 4KV SWGR ROOM, 480V SWGR ROOM AND REACTOR AUX BLDG)	NUCLEAR
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DC AND MFW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VERIF OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IFMR HAS 2 TRAINS OF FORCED AIR CLNG	03.2	EVALUATE SHIELDING OR BEST-ESTIMATE SOURCE TERM TO NUCLEAR RESOLVE MANUAL ACTION LOCATIONS AND ACCESS/EGRESS ROUTES WITH UNACCEPTABLE THI-SOURCE TERM DOSE RATES	NUCLEAR
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DC AND MFW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VERIF OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IFMR HAS 2 TRAINS OF FORCED AIR CLNG	03.3	OBTAIN REGULATORY RELIEF FROM THI SOURCE TERMS FOR LICENSING SINGLE FAILURE EVENTS IF NEEDED BASED ON DOSE CALCULATION RESULTS	NUCLEAR
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DC AND MFW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VERIF OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IFMR HAS 2 TRAINS OF FORCED AIR CLNG	18.1	DETERMINE LICENSING BASIS FOR HVAC RE: POST-ACCIDENT FUNCTION, AND RE: SINGLE FAILURE	LICENSING
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DC AND MFW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VERIF OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IFMR HAS 2 TRAINS OF FORCED AIR CLNG	18.2	VALIDATE OR REVISE APPLICABLE POST-ACCIDENT TEMPERATURE CALCS FOR: CONTROL ROOM, CNG PP ROOM, 4KV AND 480V SWGR ROOMS, AND DETERMINE DURATION, IF ANY, THAT CONTROL ROOM TRMP WOULD EXCEED SEQ OR CSAS INST/LOGIC LIMITS AFTER FAILURE OF NORMAL HVAC	MECHANICAL
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DC AND MFW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VERIF OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IFMR HAS 2 TRAINS OF FORCED AIR CLNG	18.3	OBTAIN REGULATORY RELIEF TO DEFER HVAC MODIFICATIONS, IF ANY, DETERMINED TO BE NEEDED BY MECHANICAL CALCULATIONS	LICENSING
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DC AND MFW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #1. CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLNG. VERIF OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IFMR HAS 2 TRAINS OF FORCED AIR CLNG	18.4	REVISE PROCEDURES (INCLUDING TECH SPEC ACTION ENTRY CRITERIA) AS NEEDED TO JUSTIFY OPERATION UNTIL COMPLETION OF ANY REQUIRED HVAC MODIFICATIONS	OPERATIONS

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITR#	ACTION ITR#	RESP DISCIPLINE
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DG AND HPW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE	*1480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 TO CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLMG. VERIP OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IPWR HAS 2 TRAINS OF FORCED AIR CLMG	18.5	VERIFY IF CONTROL ROOM DOSE CALCULATIONS ARE CONSISTENT WITH SINGLE FAILURE BASIS (EG. 10 MIN INJECTION MODE SPRAY, 1 BFP WTR PUMP AND NO CREDIT FOR HVAC FILTER UNIT)	NUCLEAR
12.3.01.01.1 (BREAKER)	52-1102	BREAKER	OPEN	*TRAIN A ECCS INOP FOR INJECTION, TRAIN A DG AND HPW PUMP POTENTIALLY INOP DUE TO INTERRUPTION OF AUXILIARIES INCLUDING COOLING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF C/R COOLING. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE	*1480V ACB FROM SST #1. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 TO CONTAINMENT P/T CALC REV REQD TO INCL 10 MIN INTERRUPT OF CLMG. VERIP OF B/U C/R VENT ADEQUACY ALSO REQD. MAIN IPWR HAS 2 TRAINS OF FORCED AIR CLMG	18.6	REVISE CONTROL ROOM DOSE CALCULATIONS AS PART OF UPSAR CHAPTER 15 REANALYSIS USING CONTROL ROOM HABITABILITY UPGRADE CRITERIA	NUCLEAR
12.3.01.02.1 (BREAKER)	52-1102	52-1103 "b" CONTACT	OPEN	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF SWGR #1 NOT EMERGIZED VIA BREAK 52-1102 FROM SST #1		NO FURTHER ACTION REQUIRED. CONFIGURATION ELIMINATED BY DCP 1-3552. NEW CONFIGURATION CONTROLLED BY AMENDMENT #134 (PCM 217) PER SOI-9-3	
12.3.01.06.1 (BREAKER)	52-1102	86 (RELAY)	ON	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOP DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN A SI/PW, LOSS OF C/R COOLING FOR ECCS ACTUATION AND CONTROL. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAIL	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. BOI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. DOSE CALC REV REQD FOR 10 MIN INJ MODE SPRAY W/ ONE BFP WTR PP AND NO FILTERED HVAC. VERIP OF B/U C/R VENT ADEQUACY ALSO REQD	04.4	VERIFY CURRENT BOI FLOATING STRPS ADEQUATELY ADDRESS SI/PW TERMINATION WITH 125VDC BUS FAILURE	OPERATIONS
12.3.01.06.1 (BREAKER)	52-1102	86 (RELAY)	ON	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOP DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN A SI/PW, LOSS OF C/R COOLING FOR ECCS ACTUATION AND CONTROL. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAIL	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. BOI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. DOSE CALC REV REQD FOR 10 MIN INJ MODE SPRAY W/ ONE BFP WTR PP AND NO FILTERED HVAC. VERIP OF B/U C/R VENT ADEQUACY ALSO REQD	15	COMPLETE CALCULATION (DC-3410) TO DETERMINE ACCEPTABILITY OF SWGR/CCME BYPASSED CONFIGURATION	Mechanical
12.3.01.06.1 (BREAKER)	52-1102	86 (RELAY)	ON	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOP DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN A SI/PW, LOSS OF C/R COOLING FOR ECCS ACTUATION AND CONTROL. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAIL	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. BOI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. DOSE CALC REV REQD FOR 10 MIN INJ MODE SPRAY W/ ONE BFP WTR PP AND NO FILTERED HVAC. VERIP OF B/U C/R VENT ADEQUACY ALSO REQD	18	(SAME AS 12.3.1.1.1)	
12.3.01.06.1 (BREAKER)	52-1102	86 (RELAY)	ON	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOP DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN A SI/PW, LOSS OF C/R COOLING FOR ECCS ACTUATION AND CONTROL. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAIL	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. BOI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. DOSE CALC REV REQD FOR 10 MIN INJ MODE SPRAY W/ ONE BFP WTR PP AND NO FILTERED HVAC. VERIP OF B/U C/R VENT ADEQUACY ALSO REQD	24.1	REVISE SGR DOSE CALCULATIONS (AS NEEDED TO PRECLUDE CREDIT FOR RCPs) AS PART OF UPSAR CHAPTER 15 REANALYSIS	NUCLEAR
12.3.02.01.2 (BREAKER)	52-1103	BREAKER	CLOSED	*TRAIN A POTENTIALLY INOP DUE TO VOLTAGE DEGRADATION AND SST #1/BBER OVERLOAD DURING SIS/SISLOP LOADING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF CONTROL ROOM COOLING. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE	*TECH SPEC ACTION ENTRY REQD WITH SWGR #1-3 OR SWGR #2-3 TIE BREAK CLOSED DURING NORMAL OPS. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL LOADS AND RE-ENERGIZE SWGR #1. LO-LO RWST LEVEL TRIP OF SI/PW AFFECTED BY 48-VAC AND 125VDC BUST W/ 6V DIFFERENCE		(SAME AS 12.3.1.2.1) FOR ELECTRICAL ALIGNMENT	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BCCS	REMARKS	REPORT ITEM	ACTION ITEM	RESPT DISCIPLINE
12.3.02.01.2 (BREAKER)	52-1103 (BREAKER)	BREAKER	CLOSED	*TRAIN A POTENTIALLY INOP DUE TO VOLTAGE DEGRADATION AND SST #1/BREK OVERLOAD DURING SIS/SISLOP LOADING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF CONTROL ROOM COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*TECH SPRC ACTION ENTRY REQD WITH SWGR #1-3 OR SWGR #2-3 TIE BREK CLOSED DURING NORMAL OPS. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL LOADS AND RE-ENERGIZE SWGR #1. LO-LO RWST LEVEL TRIP OF SI/PW AFFECTED IF 480VAC AND 125VDC LOST W/ 4KV EMERGIZED	01	(SAME AS 12.3.1.6.1)	
12.3.02.01.2 (BREAKER)	52-1103 (BREAKER)	BREAKER	CLOSED	*TRAIN A POTENTIALLY INOP DUE TO VOLTAGE DEGRADATION AND SST #1/BREK OVERLOAD DURING SIS/SISLOP LOADING. TRAIN B POTENTIALLY INOP DUE TO INTERRUPTION OF CONTROL ROOM COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*TECH SPRC ACTION ENTRY REQD WITH SWGR #1-3 OR SWGR #2-3 TIE BREK CLOSED DURING NORMAL OPS. BOI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL LOADS AND RE-ENERGIZE SWGR #1. LO-LO RWST LEVEL TRIP OF SI/PW AFFECTED IF 480VAC AND 125VDC LOST W/ 4KV EMERGIZED	18	(SAME AS 12.3.1.1.1)	
12.3.02.03.2 (BREAKER)	52-1103 (BREAKER)	52-1203 "b" CONTACT OR 133 CONTACT	CLOSED	LOSS OF AUTOMATIC PROTECTION AGAINST PARALLELING REDUNDANT TRAINS A AND B 480V SWGR	*TECH SPRC ACTION ENTRY REQD FOR THIS CONDITION SINCE SIS/SISLOP TRIP SIGNALS ARE MOMENTARY ONLY (VIA TDRs) AND DO NOT PREVENT PARALLELING BY A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR AFTER TRIP		(SAME AS 12.3.1.2.1)	
12.3.02.07.1 (BREAKER)	52-1103 (BREAKER)	SBQ 1 (18-G, D)	CONTACTS OPEN (OFF)	NONE IF BREK INITIALLY OPEN	*NORMAL POSITION. TECH SPRC ACTION ENTRY REQUIRED IF TIE BREK CLOSED IN MODES 1 - 4		(SAME AS 12.3.1.2.1)	
12.3.02.09.1 (BREAKER)	52-1103 (BREAKER)	133 CONTACTS	OPEN	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP WITHOUT INTERRUPTION OF TRAIN B 480V POWER, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE NOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CRS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION		(SAME AS 12.3.1.2.1) FOR ELECTRICAL ALIGNMENT	
12.3.02.09.1 (BREAKER)	52-1103 (BREAKER)	133 CONTACTS	OPEN	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP WITHOUT INTERRUPTION OF TRAIN B 480V POWER, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE NOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CRS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION	02.3	DETERMINE APPLICABLE LEAK TEST REQUIREMENTS FOR RECIRC SYSTEM (CRS-301 CURRENTLY TESTED ONLY FOR GROSS LEAKAGE PER SOI-12.4-15)	NUCLEAR
12.3.02.10.1 (BREAKER)	52-1103 (BREAKER)	SWGR #1 125VDC CONTROL POWER	VOLTS LOW	NONE IF BREK INITIALLY OPEN. SWGR #3 CANNOT BE RE-ENERGIZED FROM TRAIN A VIA 52-1303 OR TRAIN B VIA 52-1203	*TECH SPRC ACTION ENTRY REQUIRED IF SWGR #1-3 TIE BREK CLOSED DURING NORMAL OPERATION		(SAME AS 12.3.1.2.1)	
12.3.03.01.1 (BREAKER)	HCC-1 (BREAKER)	52-1118 (BREAKER)	OPEN	*TRAIN A BCCS INOPERABLE, TRAIN B POTENTIALLY INOPERABLE DUE TO INTERRUPTION OF CONTROL ROOM COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE. RCPS ALSO UNAVAILABLE FOR SCRB	*HCC-1 480V ACB. C/R DOSE CALC REV REQD TO PRECLUDE CREDIT FOR BVAC FILTER UNIT. ALSO, VERIFICATION REQD THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING FOR C/R EQUIPMENT. CHARGING PUMPS ALSO UNAVAILABLE FOR INJECTION IF NOV-1100C ON TRAIN A	18	(SAME AS 12.3.1.1.1)	
12.3.03.01.1 (BREAKER)	HCC-1 (BREAKER)	52-1118 (BREAKER)	OPEN	*TRAIN A BCCS INOPERABLE, TRAIN B POTENTIALLY INOPERABLE DUE TO INTERRUPTION OF CONTROL ROOM COOLING. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE. RCPS ALSO UNAVAILABLE FOR SCRB	*HCC-1 480V ACB. C/R DOSE CALC REV REQD TO PRECLUDE CREDIT FOR BVAC FILTER UNIT. ALSO, VERIFICATION REQD THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING FOR C/R EQUIPMENT. CHARGING PUMPS ALSO UNAVAILABLE FOR INJECTION IF NOV-1100C ON TRAIN A	24	(SAME AS 12.3.1.6.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.3.03.01.2	HCC-1	52-1118 (BRKBR)	CLOSED	NONE	*NORMAL POSITION. NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. BRKBS MUST COORDINATE TO PREVENT FURTHER TRIP UNDER SIS AS WELL AS SISLOP. MCC BUS FAULT PLUS BRK FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS	36.1	IDENTIFY CALCULATION WHICH DEMONSTRATES 480V BRKBR COORDINATION	ELECTRICAL
12.3.03.02.1	HCC-1	NSR LOADS	ON (BRK CLOSED)	*(SAME AS 12.3.3.1.1)	INCLUDES C/R COOLING, RCP MOTOR COOLING AND 1 OF 2 TRAINS OF MAIN IFMR FORCED AIR COOLING	18	(SAME AS 12.3.1.1.1)	
12.3.03.02.2	HCC-1	NSR LOADS	OFF (BRK OPEN)	*POTENTIAL IMPROBABILITY OF BOTH TRAINS DUE TO INTERRUPTION OF CONTROL ROOM COOLING, REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE, RCPs UNAVAILABLE FOR SGR	*VERIFICATION REQUIRED OF BACKUP CONTROL ROOM VENTILATION ADEQUACY. MAIN IFMR HAS 2 TRAINS OF FORCED AIR COOLING	18	(SAME AS 12.3.1.1.1)	
12.3.03.02.2	HCC-1	NSR LOADS	OFF (BRK OPEN)	*POTENTIAL IMPROBABILITY OF BOTH TRAINS DUE TO INTERRUPTION OF CONTROL ROOM COOLING, REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE, RCPs UNAVAILABLE FOR SGR	*VERIFICATION REQUIRED OF BACKUP CONTROL ROOM VENTILATION ADEQUACY. MAIN IFMR HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAME AS 12.3.1.6.1)	
12.3.03.02.3	HCC-1	NSR LOADS	EQ/SBISMIC	*POTENTIAL COMMON-CAUSE IMPROBABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IRR 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1R LOADS ON A SAFETY SIGNAL (1R, SIS AND SISLOP)	35.6	EVALUATE CONTINUED ACCEPTABILITY OF NO MAINTAINED LOCKOUT ON SIS AND SISLOP FOR NSR LOADS AS PART OF INTEGRATED RESOLUTION OF SRP TOPIC VI-7.C.2. (CONFIGURATION ACCEPTABLE UNTIL THEN BASED ON AMENDMENT 38 SECTION 1.3.1.1)	ELECTRICAL
12.3.04.01.2	HCC-1A	52-1123 (BRKBR)	CLOSED	NONE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. BRKBS MUST COORDINATE TO PREVENT FURTHER TRIP. MCC BUS FAULT PLUS BRK FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS	36	(SAME AS 12.3.3.1.2)	
12.3.04.02.3	HCC-1A	NSR LOADS	EQ/SBISMIC	LOSS OF TRAIN A MPW PP LUBE OIL PAN COOLER FOR NSLB OUTSIDE CONTAINMENT	*CALCULATION REQUIRED TO DEMONSTRATE THAT OPERATION OF PAN COOLER WOULD NOT ADVERSELY AFFECT MPW PUMP FUNCTION FOR NSLB VIA RECURSIVE LUBE OIL TEMPERATURE IN THIS EVENT, CAUSED BY INDUCTION OF STEAM THROUGH PAN/COIL UNIT	36.2	IDENTIFY CALCULATION WHICH JUSTIFIES MAIN FW PUMP PAN COOLER OPERATION IN A STEAM ENVIRONMENT (EG. POST-NSLB)	MECHANICAL
12.3.05.01.2	HCC-1B	52-1129 (BRKBR)	CLOSED	NONE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. HOWEVER, BRKBS COORDINATE TO PREVENT FURTHER TRIP. MCC BUS FAULT PLUS BRK FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS	36	(SAME AS 12.3.3.1.2)	
12.3.05.02.3	HCC-1B	NSR LOADS	EQ/SBISMIC	*POTENTIAL COMMON-CAUSE IMPROBABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT TRIPPED/LOCKED OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IRR 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1R LOADS ON A SAFETY SIGNAL (1R, SIS AND SISLOP)	35	(SAME AS 12.3.3.2.3)	
12.3.06.01.3	SWGR #1 NSR LOADS	BRKBR(S)	EQ/SBISMIC	*POTENTIAL COMMON-CAUSE IMPROBABILITY OF TRAIN A DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IRR 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1R LOADS ON A SAFETY SIGNAL (1R, SIS AND SISLOP)	35	(SAME AS 12.3.3.2.3)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS OPERATOR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RBSF DISCIPLINE
12.3.09.01.1	SWGR #1	SEQ 1	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO SWGR #1 VOLTAGE DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF S1/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. ECCS ALSO UNAVAILABLE DUE TO LOSS OF MOTOR COOLING WITH THIS FAILURE. MAIN IPMB HAS 2 TRAINS OF FORCED AIR COOLING	04	(SAME AS 12.3.1.6.1)	
12.3.09.01.1	SWGR #1	SEQ 1	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO SWGR #1 VOLTAGE DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF S1/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. ECCS ALSO UNAVAILABLE DUE TO LOSS OF MOTOR COOLING WITH THIS FAILURE. MAIN IPMB HAS 2 TRAINS OF FORCED AIR COOLING	15	(SAME AS 12.3.1.6.1)	
12.3.09.01.1	SWGR #1	SEQ 1	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO SWGR #1 VOLTAGE DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF S1/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. ECCS ALSO UNAVAILABLE DUE TO LOSS OF MOTOR COOLING WITH THIS FAILURE. MAIN IPMB HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAME AS 12.3.1.6.1)	
12.3.09.01.2	SWGR #1	SEQ 1	CONTACTS CLOSED (ON)	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOPERABLE DUE TO: CCM FLOW BYPASS VIA NOV-720B AND LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A S1/PW	SISLOP SIGNAL TO UV RELAYS IS NORMALLY MOMENTARY. MAINTAINED SIGNAL DUE TO RELAY FAILURE PREVENTS RESTART OF AFFECTED LOADS	04	(SAME AS 12.3.1.6.1)	
12.3.09.01.2	SWGR #1	SEQ 1	CONTACTS CLOSED (ON)	*TRAIN A ECCS INOPERABLE, TRAIN B POTENTIALLY INOPERABLE DUE TO: CCM FLOW BYPASS VIA NOV-720B AND LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A S1/PW	SISLOP SIGNAL TO UV RELAYS IS NORMALLY MOMENTARY. MAINTAINED SIGNAL DUE TO RELAY FAILURE PREVENTS RESTART OF AFFECTED LOADS	15	(SAME AS 12.3.1.6.1)	
12.3.09.02.1	SWGR #1	27-1	ON (VOLTS LOW)	*(SAME AS 12.3.9.1.2)	*NOI REV REQD TO CLOSE AFFECTED CCM HE NOV TO RECOVER CCM HEAT REMOVAL CAPABILITY WITH FAILURE OF ONE SWC PUMP, AND TRIP AFFECTED S1/PW PUMPS BEFORE DC POWER IS LOST	04	(SAME AS 12.3.1.6.1)	
12.3.09.02.1	SWGR #1	27-1	ON (VOLTS LOW)	*(SAME AS 12.3.9.1.2)	*NOI REV REQD TO CLOSE AFFECTED CCM HE NOV TO RECOVER CCM HEAT REMOVAL CAPABILITY WITH FAILURE OF ONE SWC PUMP, AND TRIP AFFECTED S1/PW PUMPS BEFORE DC POWER IS LOST	15	(SAME AS 12.3.1.6.1)	
12.3.09.03.1	SWGR #1	SEQ 1	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/HCC VOLTAGE DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF S1/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*NORMAL POSITION. INCLUDES RESET SWITCH. ECCS ALSO LOST. VERIP REQD THAT PORTABLE B/U VENTILATION FOR C/B PROVIDES ADEQUATE COOLING. DOSE CALC REV REQD TO ELIMINATE CREDIT FOR FILTERED BVAC AND ECCS POST-8GTR. MAIN IPMB HAS 2 TRAINS OF FORCED AIR COOLING	04	(SAME AS 12.3.1.6.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.3.09.03.1	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (10-10,12)	CONTACTS OPEN (OFF)	POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	NORMAL POSITION. INCLUDES RESET SWITCH. RCP# ALSO LOST. VERIFY REQD THAT PORTABLE B/U VENTILATION FOR C/R PROVIDES ADEQUATE COOLING. DOSE CALC REV REQD TO ELIMINATE CREDIT FOR FILTERED HVAC AND RCP# POST-SCTR. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	15	(SAME AS 12.3.1.6.1)	
12.3.09.03.1	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (10-10,12)	CONTACTS OPEN (OFF)	POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	NORMAL POSITION. INCLUDES RESET SWITCH. RCP# ALSO LOST. VERIFY REQD THAT PORTABLE B/U VENTILATION FOR C/R PROVIDES ADEQUATE COOLING. DOSE CALC REV REQD TO ELIMINATE CREDIT FOR FILTERED HVAC AND RCP# POST-SCTR. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	16	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
12.3.09.04.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-1 (RELAY)	RESET	(SAME AS 12.3.9.3.1)		04	(SAME AS 12.3.1.6.1)	
12.3.09.04.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-1 (RELAY)	RESET	(SAME AS 12.3.9.3.1)		15	(SAME AS 12.3.1.6.1)	
12.3.09.04.2	SWGR #1 UNDERVOLTAGE AND CONTROL	86-1 (RELAY)	RESET	(SAME AS 12.3.9.3.1)		16	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
12.3.09.05.1	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (11-5,7) (11-9,11)	CONTACTS OPEN (OFF)	POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 1 PREVENT THIS FAILURE UNLESS SEQ 1 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. RCP# ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	04	(SAME AS 12.3.1.6.1)	
12.3.09.05.1	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (11-5,7) (11-9,11)	CONTACTS OPEN (OFF)	POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 1 PREVENT THIS FAILURE UNLESS SEQ 1 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. RCP# ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	15	(SAME AS 12.3.1.6.1)	
12.3.09.05.1	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (11-5,7) (11-9,11)	CONTACTS OPEN (OFF)	POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 1 PREVENT THIS FAILURE UNLESS SEQ 1 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. RCP# ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	16	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
12.3.09.05.2	SWGR #1 UNDERVOLTAGE AND CONTROL	SEQ 1 (11-5,7) (11-9,11)	CONTACTS CLOSED (ON)	POTENTIAL INOP OF TRAIN A AND B DUE TO LOSS OF CONTROL ROOM COOLING AFFECTING BOTH TRAINS OF ECCS ACTUATION AND CONTROL. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE. RCP# UNAVAILABLE FOR SCTR	CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 1 BLOCK/RESET. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	18	(SAME AS 12.3.1.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.3.09.06.1	SWGR #1	SD-1-3 (RELAY)	ON	*(SAME AS 12.3.9.5.1)	LOCKOUT RESET RELAY FOR 86-N1-1, 86-N1-2, 86-N1-3. INCLUDES HANDSWITCH	04	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.06.1	SWGR #1	SD-1-3 (RELAY)	ON	*(SAME AS 12.3.9.5.1)	LOCKOUT RESET RELAY FOR 86-N1-1, 86-N1-2, 86-N1-3. INCLUDES HANDSWITCH	15	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.06.1	SWGR #1	SD-1-3 (RELAY)	ON	*(SAME AS 12.3.9.5.1)	LOCKOUT RESET RELAY FOR 86-N1-1, 86-N1-2, 86-N1-3. INCLUDES HANDSWITCH	18	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.06.2	SWGR #1	SD-1-3 (RELAY)	OFF	*(SAME AS 12.3.9.5.2)	NORMAL POSITION. MAIN XPMR HAS 2 TRAINS OF FORCED AIR COOLING	18	(SAME AS 12.3.1.1.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.07.1	SWGR #1	86-6 (RELAY)	ON	*(SAME AS 12.3.9.5.2)	MAIN XPMR HAS 2 TRAINS OF FORCED AIR COOLING	18	(SAME AS 12.3.1.1.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.07.2	SWGR #1	86-6 (RELAY)	OFF	REDUCED RELIABILITY OF TRAIN A FOR SIS, NONE FOR SISLOP	*NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF MSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT AS PER BC 1.75 AND IRR 384	35	(SAME AS 12.3.3.2.3)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.08.2	SWGR #1	86-N1-1 (LOCKOUT RELAY)	RESET	*(SAME AS 12.3.9.5.1)	NORMAL POSITION	04	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.08.2	SWGR #1	86-N1-1 (LOCKOUT RELAY)	RESET	*(SAME AS 12.3.9.5.1)	NORMAL POSITION	15	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.08.2	SWGR #1	86-N1-1 (LOCKOUT RELAY)	RESET	*(SAME AS 12.3.9.5.1)	NORMAL POSITION	18	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.09.1	SWGR #1	86-N1-2 (LOCKOUT RELAY)	TRIP	*LOSS OF CONTROL ROOM COOLING, POTENTIALLY DISABLING BOTH TRAINS OF ECCS ACTUATION AND CONTROL	*VERIFICATION REQUIRED THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING. DOSE CALC REV REQD TO ELIMINATE CREDIT FOR FILTERED HVAC AND POST-BCR ECP OFF	18	(SAME AS 12.3.1.1.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.09.2	SWGR #1	86-N1-2 (LOCKOUT RELAY)	RESET	*(SAME AS 12.3.9.5.1)	NORMAL POSITION	04	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.09.2	SWGR #1	86-N1-2 (LOCKOUT RELAY)	RESET	*(SAME AS 12.3.9.5.1)	NORMAL POSITION	15	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.09.2	SWGR #1	86-N1-2 (LOCKOUT RELAY)	RESET	*(SAME AS 12.3.9.5.1)	NORMAL POSITION	18	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
	UNDERVOLTAGE AND CONTROL							
12.3.09.10.2	SWGR #1	86-N1-3 (LOCKOUT RELAY)	RESET	*(SAME AS 12.3.9.5.1)	NORMAL POSITION	04	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND CONTROL							

EMERGENCY COBB COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM 090988 UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON RCCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.3.09.10.2	SWGR #1	86-M1-3	BRST	*(SAME AS 12.3.9.9.1)	NORMAL POSITION	15	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL							
12.3.09.10.2	SWGR #1	86-M1-3	BRST	*(SAME AS 12.3.9.9.1)	NORMAL POSITION	16	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
	UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL							
12.3.09.11.1	SWGR #1	125VDC BUS #1	VOLTS LOW	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	RCP# ALSO UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	04	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (12-118) CONTROL							
12.3.09.11.1	SWGR #1	125VDC BUS #1	VOLTS LOW	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	RCP# ALSO UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	15	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (12-118) CONTROL							
12.3.09.11.1	SWGR #1	125VDC BUS #1	VOLTS LOW	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN B DUE: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	RCP# ALSO UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	16	(SAME AS 12.3.1.1.1 AND 12.3.3.1.1)	
	UNDERVOLTAGE AND (12-118) CONTROL							
12.4.01.01.1	52-1202 (BREAKER)	BREAKER	OPEN	*TRAIN B RCCS INOP FOR INJECTION, TRAIN B DG AND MPW PP POTENTIALLY INOP DUE TO INTERRUPT OF AUXILIARIES, INCL CLMG. TRAIN A POTENTIALLY INOP FOR RECIRC DUE TO LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*480V ACB FROM SST #2. ROI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #2 TO RESTORE POWER TO NOV-850A AND DC BUS #2 BATTERY CHARGERS FOR TRAIN B SI/PW TERMINATION. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	03	(SAME AS 12.3.1.1.1)	
12.4.01.01.1	52-1202 (BREAKER)	BREAKER	OPEN	*TRAIN B RCCS INOP FOR INJECTION, TRAIN B DG AND MPW PP POTENTIALLY INOP DUE TO INTERRUPT OF AUXILIARIES, INCL CLMG. TRAIN A POTENTIALLY INOP FOR RECIRC DUE TO LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*480V ACB FROM SST #2. ROI REV REQD TO PROMPTLY TRIP NON-ESSENTIAL SWGR #3 LOADS AND RE-ENERGIZE SWGR #2 TO RESTORE POWER TO NOV-850A AND DC BUS #2 BATTERY CHARGERS FOR TRAIN B SI/PW TERMINATION. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	18	(SAME AS 12.3.1.1.1)	
12.4.01.02.1	52-1202 (BREAKER)	52-1203 "b" CONTACT	OPEN	NONE	*TRCH SPBC ACTION ENTRY REQUIRED IF SWGR #2 NOT ENERGIZED VIA BRER 52-1202 FROM SST #2		(SAME AS 12.3.1.2.1)	
12.4.01.04.1	52-1202 (BREAKER)	52-1200 "b" CONTACT	OPEN	NONE	*SWGR #2 EMERGENCY POWER VIA IPHR FROM SDGAB 12 KV LINE VS. SONGS 220 KV SMD. TRCH SPBC ACTION ENTRY REQUIRED IF SWGR #2 NOT ENERGIZED VIA BRER 52-1202 FROM SST #2	36.3	ISSUE CLARIFICATION TO IDENTIFY 52-1200 AS A TRCH BRER WITHIN DEFINITION OF TRCH SPBC 3.1 LCO	OWL

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRE UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITRN	ACTION ITRN	RESP DISCIPLINE
12.4.01.08.1 (BRBAKBB)	52-1202	86 (RELAY)	ON	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOP DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAILABLE FOR SCTR	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. ROI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. SWGR 12 EMERGENCY POWER FROM SDGAR 12 LV SOURCE NOT ANALYZED/CREDITED. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	15	(SAME AS 12.3.1.6.1)	
12.4.01.08.1 (BRBAKBB)	52-1202	86 (RELAY)	ON	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOP DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAILABLE FOR SCTR	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. ROI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. SWGR 12 EMERGENCY POWER FROM SDGAR 12 LV SOURCE NOT ANALYZED/CREDITED. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	18	(SAME AS 12.3.1.1.1)	
12.4.01.08.1 (BRBAKBB)	52-1202	86 (RELAY)	ON	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOP DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP FOR TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE. RCPs ALSO UNAVAILABLE FOR SCTR	*DELAYED FAILURES RESULT FROM LOSS OF COOLING OR BATTERY CHARGING. ROI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST. SWGR 12 EMERGENCY POWER FROM SDGAR 12 LV SOURCE NOT ANALYZED/CREDITED. MAIN IPWR HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAME AS 12.3.1.6.1)	
12.4.02.01.2 (BRBAKBB)	52-1203	BRBAKBB	CLOSED	*TRAIN B POTENTIALLY INOP DUE TO VOLTAGE DEGRADATION AND SST 12/BRER OVERLOAD DURING SIS/SISLOP LOADING. TRAIN A POTENTIALLY INOP FOR RECIRC DUE TO LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW. REDUCED RELIABILITY OF ALTERNATE OPPOSITE SOURCE	*TECH SPRC ACTION ENTRY REQD WITH EITHER SWGR 11-3 OR SWGR 12-3 TIE BRER CLOSED DURING NORMAL OPS. ROI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE DC POWER LOST IF CANNOT RE-ENERGIZE 480V SWGR. LO-LO RWST LEVEL TRIP AFFECTED IF 48V POWER NOT LOST WITH 480V		(SAME AS 12.3.1.2.1)	
12.4.02.03.2 (BRBAKBB)	52-1103	52-1103 "b" CONTACT OR 133 CONTACT	CLOSED	LOSS OF AUTOMATIC PROTECTION AGAINST PARALLELING REDUNDANT TRAINS A AND B 480V SWGR	*TECH SPRC ACTION ENTRY REQD FOR THIS CONDITION SINCE SIS/SISLOP TRIP SIGNALS ARE MOMENTARY ONLY (VIA TORs) AND DO NOT PREVENT PARALLELING BY A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR AFTER TRIP		(SAME AS 12.3.1.2.1)	
12.4.02.08.1 (BRBAKBB)	52-1203	BRQ 2 (21-5,7)	CONTACTS OPEN (OFF)	NONE IF BRER INITIALLY OPEN	*NORMAL POSITION. TECH SPRC ACTION ENTRY REQUIRED IF TIE BRER CLOSED IN MODES 1 - 4		(SAME AS 12.3.1.2.1)	
12.4.02.09.2 (BRBAKBB)	52-1203	"a" CONTACTS	CLOSED	NONE	*TECH SPRC ACTION ENTRY REQUIRED FOR THIS CONDITION, SINCE A SUBSEQUENT SINGLE FAILURE COULD RESULT IN CROSS-TRAIN POWER/CONTROL AT SWGR 13 AND LOSS OF ELECTRICAL SEPARATION BETWEEN REDUNDANT TRAINS A AND B		(SAME AS 12.3.1.2.1)	
12.4.02.10.1 (BRBAKBB)	52-1203	"b" CONTACTS	OPEN	NONE FOR SHORT TERM. FOR LONG TERM, SWGR 13 CAN BE RE-ENERGIZED WITH THIS FAILURE BY LOCALLY RACKING-OUT SWGR 12-3 TIE BRER 52-1203 IN 480V ROOM AND THEN CONNECTING TO TRAIN A VIA 52-1303 OR 52-1103 TO PREVENT LOSS OF NOV-358/NOV-850C UPS	*NOV-358/NOV-850C UPS DUTY CYCLE > 30 MINUTES TO PERMIT CREDIT FOR OPERATOR ACTION LOCALLY IN THE 48V ROOM OR 480V ROOM. ROI CHANGE REQUIRED TO INCLUDE PLACING SWGR 13 CONTROL POWER SELECTOR IN MANUAL TO RE-ESTABLISH 125VDC CONTROL POWER TO SWGR 13 BRERS		(SAME AS 12.3.1.2.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRR UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RISP DISCIPLINE
12.4.02.10.2	52-1203 (BRBAERB)	"b" CONTACTS	CLOSED	NONE	*NORMAL POSITION. TECH SPIC ACTION ENTRY REQUIRED FOR THIS CONDITION SINCE A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR COULD RESULT IN CROSS-TRAIN POWER AND CONTROL AT SWGR #3 AND LOSS OF ELECTRICAL SEPARATION BETWEEN REDUNDANT TRAINS	(SAME AS 12.3.1.2.1)		
12.4.02.11.1	52-1203 (BRBAERB)	133 CONTACTS	OPEN	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP WITHOUT INTERRUPTION OF TRAIN B 480V POWER, DISABLING 1/3 SI VALVES FOR LO-LO HYST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE MOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CBS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION	(SAME AS 12.3.1.2.1)	FOR ELECTRICAL ALIGNMENT	
12.4.02.11.1	52-1203 (BRBAERB)	133 CONTACTS	OPEN	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP WITHOUT INTERRUPTION OF TRAIN B 480V POWER, DISABLING 1/3 SI VALVES FOR LO-LO HYST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE MOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CBS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION	(SAME AS 12.3.2.9.1)		
12.4.02.12.1	52-1203 (BRBAERB)	SWGR #2 125VDC CONTROL POWER	VOLTS LOW	NONE IF BRER INITIALLY OPEN. SWGR #3 CAN BE RE-ENERGIZED FROM TRAIN A VIA 52-1303 AND HST #3 ON 52-1103 AND SWGR #1	*TECH SPIC ACTION ENTRY REQUIRED IF SWGR #2-3 TIE BRER CLOSED DURING NORMAL OPERATION	(SAME AS 12.3.1.2.1)		
12.4.03.01.1	MCC-2 (BRBAERB)	52-1218	OPEN	TRAIN B ECCS INOPERABLE. REDUCED RELIABILITY OF ALL OFFSITE SOURCE. RCPs UNAVAILABLE FOR SCTR	*MCC-2 480V ACB. ROI REV REQD TO RE-ENERGIZE UTILITY BUS FROM MCC-1 VIA HTS-7 TO RECOVER HLR PRIMARY PATH WITH THIS FAILURE. CHARGING PUMPS ALSO UNAVAILABLE FOR INJECTION IF MOV-1100C IS ON TRAIN B. MAIN IFMR HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAME AS 12.3.1.6.1)	
12.4.03.01.1	MCC-2 (BRBAERB)	52-1218	OPEN	TRAIN B ECCS INOPERABLE. REDUCED RELIABILITY OF ALL OFFSITE SOURCE. RCPs UNAVAILABLE FOR SCTR	*MCC-2 480V ACB. ROI REV REQD TO RE-ENERGIZE UTILITY BUS FROM MCC-1 VIA HTS-7 TO RECOVER HLR PRIMARY PATH WITH THIS FAILURE. CHARGING PUMPS ALSO UNAVAILABLE FOR INJECTION IF MOV-1100C IS ON TRAIN B. MAIN IFMR HAS 2 TRAINS OF FORCED AIR COOLING	34.1	REVISE PROCEDURES AS NEEDED TO ADDRESS RE-ENERGIZING THE UTILITY BUS FROM MCC-1 VIA HTS-7	OPERATIONS
12.4.03.01.2	MCC-2 (BRBAERB)	52-1218	CLOSED	NONE	*NORMAL POSITION. NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. BRERS MUST COORDINATE TO PREVENT FRODER TRIP UNDER SIS AS WELL AS SISLOP. MCC BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS	36	(SAME AS 12.3.3.1.2)	
12.4.03.02.2	MCC-2	NSR LOADS	OFF (BRER OPEN)	NONE FOR SIS/SISLOP, REDUCED RELIABILITY OF ALL OFFSITE SOURCE. RCPs UNAVAILABLE FOR SCTR	*DOSE CALC REV REQD TO ELIMINATE CREDIT FOR RCP OPERATION POST-SCTR. MAIN IFMR HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAME AS 12.3.1.6.1)	
12.4.03.02.3	MCC-2	NSR LOADS	RQ/SRISMIC	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IB LOADS ON A SAFETY SIGNAL (IB, SIS AND SISLOP)	35	(SAME AS 12.3.3.2.3)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAS ONOPER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.4.04.01.1	MCC-2A	52-1223 (BREAKER)	OPEN	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOPERABLE FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	*MCC-2A 480V ACB VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERMS	03	(SAME AS 12.3.1.1.1)	
12.4.04.01.1	MCC-2A	52-1223 (BREAKER)	OPEN	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOPERABLE FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	*MCC-2A 480V ACB VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERMS	18	(SAME AS 12.3.1.1.1)	
12.4.04.01.2	MCC-2A	52-1123 (BREAKER)	CLOSED	NONE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. BRERS MUST COORDINATE TO PREVENT FREDER TRIP. MCC BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS	36	(SAME AS 12.3.3.1.2)	
12.4.04.02.2	MCC-2A	NSR LOADS	OFF (BRER OPEN)	*POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	*VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM COOLING AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERMS	03	(SAME AS 12.3.1.1.1)	
12.4.04.02.2	MCC-2A	NSR LOADS	OFF (BRER OPEN)	*POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	*VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM COOLING AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERMS	18	(SAME AS 12.3.1.1.1)	
12.4.04.02.3	MCC-2A	NSR LOADS	RQ/SEISMIC	*LOSS OF TRAIN A HYDRATING PUMP, AND POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	*(SAME AS 12.4.4.2.2)	18	(SAME AS 12.3.1.1.1)	
12.4.05.01.2	MCC-2B	52-1229 (BREAKER)	CLOSED	NONE	*NORMAL POSITION. NON-SR LOADS NOT TRIPPED/LOCKED-OUT ON SISLOP. HOWEVER, BRERS COORDINATE TO PREVENT FREDER TRIP. MCC BUS FAULT PLUS BRER FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS	36	(SAME AS 12.3.3.1.2)	
12.4.05.02.3	MCC-2B	NSR LOADS	RQ/SEISMIC	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*NON-SR LOADS NOT TRIPPED/LOCKED OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IR LOADS ON A SAFETY SIGNAL (IR, SIS AND SISLOP)	35	(SAME AS 12.3.3.2.3)	
12.4.08.01.3	SWGR #2 NSR LOADS	BRER(S)	RQ/SEISMIC	*POTENTIAL COMMON-CAUSE INOPERABILITY OF TRAIN B DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IR LOADS ON A SAFETY SIGNAL (IR, SIS AND SISLOP)	35	(SAME AS 12.3.3.2.3)	
12.4.09.01.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SRQ 2 (11-2,4)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO SWGR #2 VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RMST LEVEL TRIP OF S1/PW. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*NORMAL POSITION. RCPS UNAVAILABLE DUE TO LOSS OF MOTOR CLMG WITH THIS FAILURE. RELAY 27-114 PROVIDES SISLOP UV TRIP OF SWGR #3 LOADS. HOWEVER, SWGR #3 IS ISOLATED ON SIS/SISLOP VIA SEPARATE SEQUENCER CONTACTS. MAIN IFMR HAS 2 TRAINS OF FORCED AIR COOLING	04	(SAME AS 12.3.1.6.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRB UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	BBS DISCIPLINE
12.4.09.01.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (11-2,4)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO SWGR #2 VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	NORMAL POSITION. RCPS UNAVAILABLE DUE TO 15 LOSS OF MOTOR CLMG WITH THIS FAILURE. RELAY 27-114 PROVIDES SISLOP UV TRIP OF SWGR #3 LOADS. HOWEVER, SWGR #3 IS ISOLATED ON SIS/SISLOP VIA SEPARATE SEQUENCER CONTACTS. MAIN IPRR HAS 2 TRAINS OF FORCED AIR COOLING	(SAME AS 12.3.1.6.1)		
12.4.09.01.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (11-2,4)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO SWGR #2 VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	NORMAL POSITION. RCPS UNAVAILABLE DUE TO 24 LOSS OF MOTOR CLMG WITH THIS FAILURE. RELAY 27-114 PROVIDES SISLOP UV TRIP OF SWGR #3 LOADS. HOWEVER, SWGR #3 IS ISOLATED ON SIS/SISLOP VIA SEPARATE SEQUENCER CONTACTS. MAIN IPRR HAS 2 TRAINS OF FORCED AIR COOLING	(SAME AS 12.3.1.6.1)		
12.4.09.01.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (11-2,4)	CONTACTS CLOSED (ON)	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOPERABLE DUE TO: CCM FLOW BYPASS VIA NOV-720A AND LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW	SISLOP SIGNAL TO SWGR #2 UV RELAYS IS 04 NORMALLY MOMENTARY. MAINTAINED SIGNAL DUE TO RELAY FAILURE PREVENTS RESTART OF AFFECTED LOADS. SWGR #3 LOADS OTHER THAN AIR COMPRESSOR AND MCCS WILL ALSO TRIP WITH THIS FAILURE	(SAME AS 12.3.1.6.1)		
12.4.09.01.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (11-2,4)	CONTACTS CLOSED (ON)	*TRAIN B ECCS INOPERABLE, TRAIN A POTENTIALLY INOPERABLE DUE TO: CCM FLOW BYPASS VIA NOV-720A AND LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW	SISLOP SIGNAL TO SWGR #2 UV RELAYS IS 15 NORMALLY MOMENTARY. MAINTAINED SIGNAL DUE TO RELAY FAILURE PREVENTS RESTART OF AFFECTED LOADS. SWGR #3 LOADS OTHER THAN AIR COMPRESSOR AND MCCS WILL ALSO TRIP WITH THIS FAILURE	(SAME AS 12.3.1.6.1)		
12.4.09.02.1	SWGR #2 UNDERVOLTAGE AND CONTROL	27-1 (UV RELAY)	ON (VOLTS LOW)	*(SAME AS 12.4.9.1.2)	*ROI REV REQD TO CLOSE AFFECTED CCM BX NOV TO RECOVER CCM HEAT REMOVAL CAPABILITY WITH FAILURE OF ONE SMC PUMP, AND TRIP AFFECTED SI/PW PUMPS BEFORE DC POWER IS LOST	04 (SAME AS 12.3.1.6.1)		
12.4.09.02.1	SWGR #2 UNDERVOLTAGE AND CONTROL	27-1 (UV RELAY)	ON (VOLTS LOW)	*(SAME AS 12.4.9.1.2)	*ROI REV REQD TO CLOSE AFFECTED CCM BX NOV TO RECOVER CCM HEAT REMOVAL CAPABILITY WITH FAILURE OF ONE SMC PUMP, AND TRIP AFFECTED SI/PW PUMPS BEFORE DC POWER IS LOST	15 (SAME AS 12.3.1.6.1)		
12.4.09.03.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (10-10,12)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*NORMAL POSITION. INCLUDES RESET SWITCH. SOI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE 125VDC CONTROL POWER IS LOST. RCPS ALSO LOST, UNAVAILABLE FOR SGR. MAIN IPRR HAS 2 TRAINS OF FORCED AIR COOLING	04 (SAME AS 12.3.1.6.1)		
12.4.09.03.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (10-10,12)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DC OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*NORMAL POSITION. INCLUDES RESET SWITCH. ROI REV REQD TO TRIP AFFECTED SI/PW PP BEFORE 125VDC CONTROL POWER IS LOST. RCPS ALSO LOST, UNAVAILABLE FOR SGR. MAIN IPRR HAS 2 TRAINS OF FORCED AIR COOLING	15 (SAME AS 12.3.1.6.1)		

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR 060FRB UNIT]
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.4.09.03.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (10-10,12)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLTAGE DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*NORMAL POSITION. INCLUDES RESBT SWITCH. BOI SEV REQD TO TRIP AFFECTED SI/PW PP BEFORE 125VDC CONTROL POWER IS LOST. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAR# AS 12.3.1.6.1)	
12.4.09.04.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-2 (RBLAT)	RESBT	* (SAR# AS 12.4.9.3.1)		04	(SAR# AS 12.3.1.6.1)	
12.4.09.04.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-2 (RBLAT)	RESBT	* (SAR# AS 12.4.9.3.1)		15	(SAR# AS 12.3.1.6.1)	
12.4.09.04.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-2 (RBLAT)	RESBT	* (SAR# AS 12.4.9.3.1)		24	(SAR# AS 12.3.1.6.1)	
12.4.09.05.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (12-1,3) (12-5,7)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 PREVENT THIS FAILURE UNLESS SEQ 2 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	04	(SAR# AS 12.3.1.6.1)	
12.4.09.05.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (12-1,3) (12-5,7)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 PREVENT THIS FAILURE UNLESS SEQ 2 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	15	(SAR# AS 12.3.1.6.1)	
12.4.09.05.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (12-1,3) (12-5,7)	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 PREVENT THIS FAILURE UNLESS SEQ 2 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAR# AS 12.3.1.6.1)	
12.4.09.05.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (12-1,3) (12-5,7)	CONTACTS CLOSED (ON)	SPHERE PURGE UNAVAILABLE FOR POST-LOCA H2 CONTROL, REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 2 BLOCK/RESBT. VERIF REQD OF ADEQUACY OF CONTAINMENT SPRAY W/ H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKET. RCPs ALSO LOST. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	24	(SAR# AS 12.3.1.6.1)	
12.4.09.05.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (12-1,3) (12-5,7)	CONTACTS CLOSED (ON)	SPHERE PURGE UNAVAILABLE FOR POST-LOCA H2 CONTROL, REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 2 BLOCK/RESBT. VERIF REQD OF ADEQUACY OF CONTAINMENT SPRAY W/ H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKET. RCPs ALSO LOST. MAIN IPHR HAS 2 TRAINS OF FORCED AIR COOLING	25.1	IDENTIFY EXISTING BASIS OF UPSAR SECTION 6.2.5 FOR LICENSING ADEQUACY OF POST-ACCIDENT CONTAINMENT HYDROGEN MIXING VIA CONTAINMENT SPRAY	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONECORE UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.4.09.05.2	SWGR #2 UNDERVOLTAGE AND CONTROL	SEQ 2 (12-1,3) (12-5,7)	CONTACTS CLOSED (ON)	SPHERE PURGE UNAVAILABLE FOR POST-LOCA H2 CONTROL, REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 2 BLOCK/RESBT. VERIF REQD OF ADEQUACY OF CONTAINMENT SPRAY W/ H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKETS. RCP# ALSO LOST. MAIN SPHR HAS 2 TRAINS OF FORCED AIR COOLING	25.2	REVIEW POST-LOCA CONTAINMENT HYDROGEN MIXING AS PART OF DBD	DBD
12.4.09.06.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-5 (RELAY)	ON	*(SAME AS 12.4.9.5.1)	LOCKOUT RESBT RELAY FOR 86-H2-1, 86-H2-2, 86-H2-3. INCLUDES HANDSWITCH	04	(SAME AS 12.3.1.6.1)	
12.4.09.06.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-5 (RELAY)	ON	*(SAME AS 12.4.9.5.1)	LOCKOUT RESBT RELAY FOR 86-H2-1, 86-H2-2, 86-H2-3. INCLUDES HANDSWITCH	15	(SAME AS 12.3.1.6.1)	
12.4.09.06.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-5 (RELAY)	ON	*(SAME AS 12.4.9.5.1)	LOCKOUT RESBT RELAY FOR 86-H2-1, 86-H2-2, 86-H2-3. INCLUDES HANDSWITCH	24	(SAME AS 12.3.1.6.1)	
12.4.09.07.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-1 (RELAY)	OFF	REDUCED RELIABILITY OF TRAIN B FOR SIS, NONE FOR SISLOP	*NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF MSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT AS PER RG 1.75 AND IRR 394	35	(SAME AS 12.3.3.2.3)	
12.4.09.08.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-1 (LOCKOUT RELAY)	TRIP	FANS UNAVAILABLE FOR FORCED CIRCULATION OF SPHERE ATMOSPHERE FOR POST-LOCA H2 CONTROL, REDUCED RELIABILITY OF ALTERNATE OFFSITE SOURCE	*VERIFICATION REQD OF ADEQUACY OF CONTAINMENT SPRAY PLUS H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKETS. MAIN SPHR HAS 2 TRAINS OF FORCED AIR COOLING	25	(SAME AS 12.4.9.5.2)	
12.4.09.08.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-1 (LOCKOUT RELAY)	RESBT	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	04	(SAME AS 12.3.1.6.1)	
12.4.09.08.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-1 (LOCKOUT RELAY)	RESBT	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	15	(SAME AS 12.3.1.6.1)	
12.4.09.08.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-1 (LOCKOUT RELAY)	RESBT	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	24	(SAME AS 12.3.1.6.1)	
12.4.09.09.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-2 (LOCKOUT RELAY)	TRIP	FANS UNAVAILABLE FOR FORCED CIRCULATION OF SPHERE ATMOSPHERE FOR POST-LOCA H2 CONTROL	*VERIFICATION REQD OF ADEQUACY OF CONTAINMENT SPRAY PLUS H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKETS	25	(SAME AS 12.4.9.5.2)	
12.4.09.09.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-2 (LOCKOUT RELAY)	RESBT	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	04	(SAME AS 12.3.1.6.1)	
12.4.09.09.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-H2-2 (LOCKOUT RELAY)	RESBT	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	15	(SAME AS 12.3.1.6.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPEE UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.4.09.09.2	SWGR #2	86-N2-2	RESET	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	24	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL							
12.4.09.10.1	SWGR #2	86-N2-3	TRIP	FANS UNAVAILABLE FOR SPHERE PURGE FOR POST-LOCA H2 CONTROL OR FOR RCP MOTOR COOLING	*VERIFICATION REQD OF ADEQUACY OF CONTAINMENT SPRAY PLUS H2 RECOMBINER FOR CONTAINMENT ATMOSPHERE MIXING TO PREVENT POST-LOCA H2 POCKETS	25	(SAME AS 12.4.9.5.2)	
	UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL							
12.4.09.10.2	SWGR #2	86-N2-3	RESET	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	04	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL							
12.4.09.10.2	SWGR #2	86-N2-3	RESET	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	15	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL							
12.4.09.10.2	SWGR #2	86-N2-3	RESET	*(SAME AS 12.4.9.5.1)	NORMAL POSITION	24	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (LOCKOUT RELAY) CONTROL							
12.4.09.11.1	SWGR #2	SEQ 2	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. RCPs UNAVAIL FOR SCTR	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 NOT PROVIDED FOR MCC-2A LOCKOUT ACTUATION	04	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (11-9,11) CONTROL							
12.4.09.11.1	SWGR #2	SEQ 2	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. RCPs UNAVAIL FOR SCTR	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 NOT PROVIDED FOR MCC-2A LOCKOUT ACTUATION	15	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (11-9,11) CONTROL							
12.4.09.11.1	SWGR #2	SEQ 2	CONTACTS OPEN (OFF)	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF SI/PW. RCPs UNAVAIL FOR SCTR	NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 NOT PROVIDED FOR MCC-2A LOCKOUT ACTUATION	24	(SAME AS 12.3.1.6.1)	
	UNDERVOLTAGE AND (11-9,11) CONTROL							
12.4.09.11.2	SWGR #2	SEQ 2	CONTACTS CLOSED (ON)	*POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF CHARGING PUMP ROOM COOLING	*CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 2 BLOCK/RESETE. VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERM	03	(SAME AS 12.3.1.1.1)	
	UNDERVOLTAGE AND (11-9,11) CONTROL							
12.4.09.11.2	SWGR #2	SEQ 2	CONTACTS CLOSED (ON)	*POTENTIAL INOPERABILITY OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF CHARGING PUMP ROOM COOLING	*CONTACTS NORMALLY MAINTAINED ON SISLOP UNTIL SEQ 2 BLOCK/RESETE. VERIFICATION REQD OF ADEQUACY OF PORTABLE BACKUP VENTILATION FOR CHARGING PUMP ROOM AND ACCESSIBILITY OF ROOM WITH THE SOURCE TERM	10	(SAME AS 12.3.1.1.1)	
	UNDERVOLTAGE AND (11-9,11) CONTROL							

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.4.09.12.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-4 (RELAY)	ON	*(SAME AS 12.4.9.11.1)	LOCKOUT RESET RELAY FOR 86-N2A-1, 86-N2A-2. INCLUDES HANDSWITCH	04 (SAME AS 12.3.1.6.1)		
12.4.09.12.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-4 (RELAY)	ON	*(SAME AS 12.4.9.11.1)	LOCKOUT RESET RELAY FOR 86-N2A-1, 86-N2A-2. INCLUDES HANDSWITCH	15 (SAME AS 12.3.1.6.1)		
12.4.09.12.1	SWGR #2 UNDERVOLTAGE AND CONTROL	SD-1-4 (RELAY)	ON	*(SAME AS 12.4.9.11.1)	LOCKOUT RESET RELAY FOR 86-N2A-1, 86-N2A-2. INCLUDES HANDSWITCH	24 (SAME AS 12.3.1.6.1)		
12.4.09.13.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-8 (RELAY)	ON	*POTENTIAL INOP OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	AUXILIARY IPHR A/B HAVE "0A" RATING (1B, 03 WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCP.	(SAME AS 12.3.1.1.1)		
12.4.09.13.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-8 (RELAY)	ON	*POTENTIAL INOP OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM	AUXILIARY IPHR A/B HAVE "0A" RATING (1B, 18 WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCP.	(SAME AS 12.3.1.1.1)		
12.4.09.13.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-8 (RELAY)	OFF	REDUCED RELIABILITY OF TRAIN B AND SWING LOADS (SWGR #3) FOR SIS, NONE FOR SISLOP	NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF MSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT AS PER RG 1.75 AND IRR 384	35 (SAME AS 12.3.3.2.3)		
12.4.09.14.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-1 (LOCKOUT RELAY)	TRIP	*(SAME AS 12.4.9.11.2)	BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS	03 (SAME AS 12.3.1.1.1)		
12.4.09.14.1	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-1 (LOCKOUT RELAY)	TRIP	*(SAME AS 12.4.9.11.2)	BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS	18 (SAME AS 12.3.1.1.1)		
12.4.09.14.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-1 (LOCKOUT RELAY)	RESET	*(SAME AS 12.4.9.11.1)	NORMAL POSITION	04 (SAME AS 12.3.1.6.1)		
12.4.09.14.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-1 (LOCKOUT RELAY)	RESET	*(SAME AS 12.4.9.11.1)	NORMAL POSITION	15 (SAME AS 12.3.1.6.1)		
12.4.09.14.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-1 (LOCKOUT RELAY)	RESET	*(SAME AS 12.4.9.11.1)	NORMAL POSITION	24 (SAME AS 12.3.1.6.1)		
12.4.09.15.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-2 (LOCKOUT RELAY)	RESET	*(SAME AS 12.4.9.11.1)	NORMAL POSITION	04 (SAME AS 12.3.1.6.1)		
12.4.09.15.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-2 (LOCKOUT RELAY)	RESET	*(SAME AS 12.4.9.11.1)	NORMAL POSITION	15 (SAME AS 12.3.1.6.1)		
12.4.09.15.2	SWGR #2 UNDERVOLTAGE AND CONTROL	86-N2A-2 (LOCKOUT RELAY)	RESET	*(SAME AS 12.4.9.11.1)	NORMAL POSITION	24 (SAME AS 12.3.1.6.1)		

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.4.09.16.1	SWGR #2 UNDERVOLTAGE AND (72-226) CONTROL	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PV. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF COOLING		(SAME AS 12.3.1.2.1) FOR ELECTRICAL ALIGNMENT	
12.4.09.16.1	SWGR #2 UNDERVOLTAGE AND (72-226) CONTROL	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PV. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF COOLING	04	(SAME AS 12.3.1.6.1)	
12.4.09.16.1	SWGR #2 UNDERVOLTAGE AND (72-226) CONTROL	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PV. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF COOLING	15	(SAME AS 12.3.1.6.1)	
12.4.09.16.1	SWGR #2 UNDERVOLTAGE AND (72-226) CONTROL	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DC OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PV. REDUCED RELIABILITY OF ALT OPPOSITE SOURCE	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN IPHR HAS 2 TRAINS OF COOLING	24	(SAME AS 12.3.1.6.1)	
12.6.01.03.2	52-1303 (BRKABR)	52-1203 "b" CONTACT OR 133 CONTACT	CLOSED	LOSS OF AUTOMATIC PROTECTION AGAINST PARALLELING REDUNDANT TRAINS A AND B AT 480V SWGR	*TECH SPRC ACTION ENTRY REQD FOR THIS CONDITION SINCE SIS/SISLOP TRIP SIGNALS ARE MOMENTARY ONLY (VIA YDRs) AND DO NOT PREVENT PARALLELING BY A SUBSEQUENT SINGLE FAILURE OR OPERATOR ERROR AFTER TRIP		(SAME AS 12.3.1.2.1)	
12.6.01.05.1	52-1303 (BRKABR)	52-1303 86, 86-1 (RELAYS)	CONTACTS OPEN (ON)	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE MOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CRS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION		(SAME AS 12.3.1.2.1)	
12.6.01.05.1	52-1303 (BRKABR)	52-1303 86, 86-1 (RELAYS)	CONTACTS OPEN (ON)	SWGR #3 CANNOT BE RE-ENERGIZED POST-SIS/SISLOP, DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*SINCE MOV-883 ALSO AFFECTED AND CANNOT BE CLOSED FOR RECIRC, REDUNDANT CHECK VALVE CRS-301 REQUIRES SEAT LEAKAGE TESTING FOR THE RECIRC BOUNDARY FUNCTION	02	(SAME AS 12.3.2.9.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.6.02.01.1	MCC-3	52-1314 (BRKAKR)	OPEN	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC. ALSO RESULTS IN DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*MCC-3 480V ACB. VERIFY REQD THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING FOR SWGR ROOM EQUIPMENT. AUX IPNR A/B HAVE "OA" RATING (1B, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs	03	(SAME AS 12.3.1.1.1)	
12.6.02.01.1	MCC-3	52-1314 (BRKAKR)	OPEN	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC. ALSO RESULTS IN DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*MCC-3 480V ACB. VERIFY REQD THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING FOR SWGR ROOM EQUIPMENT. AUX IPNR A/B HAVE "OA" RATING (1B, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs	18	(SAME AS 12.3.1.1.1)	
12.6.02.01.1	MCC-3	52-1314 (BRKAKR)	OPEN	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC. ALSO RESULTS IN DISABLING 1/3 SI VALVES FOR LO-LO RWST LEVEL TRIP FUNCTION AND 1/3 CLR PATHS	*MCC-3 480V ACB. VERIFY REQD THAT PORTABLE BACKUP VENTILATION PROVIDES ADEQUATE COOLING FOR SWGR ROOM EQUIPMENT. AUX IPNR A/B HAVE "OA" RATING (1B, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs	24	(SAME AS 12.3.1.6.1)	
12.6.02.01.2	MCC-3	52-1314 (BRKAKR)	CLOSED	NONE	*NORMAL POSITION. NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. BRKR MUST COORDINATE TO PREVENT PERDR TRIP UNDER SIS AS WELL AS SISLOP. MCC BUS FAULT PLUS BRKR FAILURE IS OUTSIDE SIS/SISLOP DESIGN BASIS	36	(SAME AS 12.3.3.1.2)	
12.6.02.02.1	MCC-3	NSR LOADS	ON (BRKR CLOSED)	2 (SAME AS 12.6.2.1.1)		03	(SAME AS 12.3.1.1.1)	
12.6.02.02.1	MCC-3	NSR LOADS	ON (BRKR CLOSED)	1 (SAME AS 12.6.2.1.1)		18	(SAME AS 12.3.1.1.1)	
12.6.02.02.1	MCC-3	NSR LOADS	ON (BRKR CLOSED)	1 (SAME AS 12.6.2.1.1)		24	(SAME AS 12.3.1.6.1)	
12.6.02.02.2	MCC-3	NSR LOADS	OFF (BRKR OPEN)	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC	RCPs ALSO UNAVAILABLE FOR SCGR. REBRATER 18 STRAN ISOLATION NOT CREDITED FOR HSLB. AUX IPNR A/B HAVE "OA" RATING (1B, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs	18	(SAME AS 12.3.1.1.1)	
12.6.02.02.2	MCC-3	NSR LOADS	OFF (BRKR OPEN)	*POTENTIAL INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC	RCPs ALSO UNAVAILABLE FOR SCGR. REBRATER 24 STRAN ISOLATION NOT CREDITED FOR HSLB. AUX IPNR A/B HAVE "OA" RATING (1B, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OFFSITE SOURCE DUTY WITHOUT RCPs	24	(SAME AS 12.3.1.6.1)	
12.6.02.02.3	MCC-3	NSR LOADS	EQ/SBISMIC	*POTENTIAL COMMON-CAUSE INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR RM HVAC	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET EC 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-1B LOADS ON A SAFETY SIGNAL (1B, SIS AND SISLOP)		(SAME AS 12.3.1.1.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM OPERATOR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.6.02.02.3	MCC-3	NSR LOADS	EQ/SEISMIC	*POTENTIAL COMMON-CAUSE INOPERABILITY OF BOTH TRAINS DUE TO LOSS OF SWGR BN HVAC	*NON-SR LOADS NOT ALL TRIPPED/LOCKED-OUT ON SISLOP. CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IE LOADS ON A SAFETY SIGNAL (IB, SIS AND SISLOP)	(SAME AS 12.3.3.2.3)		
12.6.03.01.2	MCC-3A	52-1307 (BREAKER)	CLOSED	NONE	*NORMAL POSITION. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL LOADS FROM SWGR #3 BEFORE RE-ENERGIZING POST-SIS/SISLOP	(SAME AS 12.3.1.2.1)		
12.6.06.01.3	SWGR #3 NSR LOADS	BREAKER(S)	EQ/SEISMIC	*POTENTIAL COMMON-CAUSE INOPERABILITY OF SWGR #3, IF RE-ENERGIZED POST-SIS/SISLOP, DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IE LOADS ON SAFETY SIGNAL (IB, SIS AND SISLOP). BOI REV REQD TO ISOLATE ALL NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3. BRER COORD ALSO REQD FOR TIE BRER ALIGN	(SAME AS 12.3.1.2.1)	FOR ELECTRICAL ALIGNMENT	
12.6.06.01.3	SWGR #3 NSR LOADS	BREAKER(S)	EQ/SEISMIC	*POTENTIAL COMMON-CAUSE INOPERABILITY OF SWGR #3, IF RE-ENERGIZED POST-SIS/SISLOP, DUE TO 480V SWGR/MCC DEGRADATION RESULTING FROM FAILURE TO ISOLATE ALL UNQUALIFIED LOADS ON SIS AND SISLOP	*CONFIGURATION DOES NOT MEET RG 1.75 OR IEEE 384 CRITERIA WHICH REQUIRE TRIP OF ALL NON-IE LOADS ON SAFETY SIGNAL (IB, SIS AND SISLOP). BOI REV REQD TO ISOLATE ALL NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3. BRER COORD ALSO REQD FOR TIE BRER ALIGN	(SAME AS 12.3.3.2.3)		
12.6.07.02.2	SWGR #3 UNDERVOLTAGE AND (UV RELAT) CONTROL	27-1	OFF (VOLTS NORMAL)	NONE. SWGR #3 ISOLATED BY SEPARATE SIS/SISLOP TRIP OF 48V SST #3 FEEDER AND 480V TIE BREAKERS	*NORMAL POSITION. BOI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP	(SAME AS 12.3.1.2.1)		
12.6.07.03.1	SWGR #3 UNDERVOLTAGE AND (11-5,7) CONTROL	SRQ 2	CONTACTS OPEN (OFF)	(SAME AS 12.6.7.2.2)	*(SAME AS 12.6.7.2.2)	(SAME AS 12.3.1.2.1)		
12.6.07.05.1	SWGR #3 UNDERVOLTAGE AND (13-1,3) CONTROL	SRQ 2	CONTACTS OPEN (OFF)	NONE. SWGR #3 ISOLATED BY SEPARATE TRIP OF 48V SST #3 FEEDER AND 480V TIE BREAKERS ON SIS/SISLOP	*NORMAL POSITION. REDUNDANT INPUTS FROM SEQ 2 PREVENT THIS FAILURE UNLESS SEQ 2 LOAD GROUP A OUTPUT OR RELAY DRIVER CARD(S) FAIL. BOI REV REQD TO INDIVIDUALLY TRIP/LOCKOUT NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP	(SAME AS 12.3.1.2.1)		
12.6.07.07.1	SWGR #3 UNDERVOLTAGE AND CONTROL	86-B (RELAY)	ON	*POTENTIAL INOP OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM, NONE FOR INJECTION	AUT IPHRS A/B HAVE "0A" RATING (IB, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OPPOSITE SOURCE DUTY WITHOUT RCPs	18	(SAME AS 12.3.1.1.1)	
12.6.07.07.1	SWGR #3 UNDERVOLTAGE AND CONTROL	86-B (RELAY)	ON	*POTENTIAL INOP OF BOTH TRAINS FOR RECIRC DUE TO LOSS OF COOLING FOR CHARGING PUMP ROOM, NONE FOR INJECTION	AUT IPHRS A/B HAVE "0A" RATING (IB, WITHOUT FANS) SUFFICIENT FOR POST-ACCIDENT ALTERNATE OPPOSITE SOURCE DUTY WITHOUT RCPs	24	(SAME AS 12.3.1.6.1)	
12.6.07.07.2	SWGR #3 UNDERVOLTAGE AND CONTROL	86-B (RELAY)	OFF	REDUCED RELIABILITY OF TRAIN B AND SWING (SWGR #3) FOR SIS, NONE FOR SISLOP	*NORMAL POSITION. MANUAL ACTUATION OF SISLOP LOCKOUT RELAYS COULD BE REQUIRED FOR SIS EVENT WITH COMMON-CAUSE FAILURES OF NSR EQUIPMENT DUE TO LACK OF AN AUTOMATIC TRIP/LOCKOUT AS PER RG 1.75 AND IEEE 384	35	(SAME AS 12.3.3.2.3)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.6.07.08.1	SWGR #3	86-M3-1	TRIP	NONE	*VERIFICATION REQUIRED THAT LOSS OF TURBINE-GENERATOR HYDROGEN SEAL OIL OR OTHER AUXILIARIES WILL NOT RESULT IN FIRE OR EXPLOSION CONCURRENT WITH SIS/SISLOP EVENT. BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS	23.1	VERIFY WHETHER MRC BTP 9.5-1 AND APPENDIX B EXCLUDE BOTH FIRES AND EXPLOSIONS MECHANISTICALLY CAUSED BY AN ACCIDENT (EG. OF HYDROGEN DUE TO LUBE OIL/SEAL OIL FAILURE OR IFMR DUE TO FAULT WITH PROTECTION FAILURE, POST-SIS/SISLOP)	MECHANICAL (PP)
12.6.07.08.1	SWGR #3	86-M3-1	TRIP	NONE	*VERIFICATION REQUIRED THAT LOSS OF TURBINE-GENERATOR HYDROGEN SEAL OIL OR OTHER AUXILIARIES WILL NOT RESULT IN FIRE OR EXPLOSION CONCURRENT WITH SIS/SISLOP EVENT. BORIC ACID SYSTEM NOT CREDITED FOR SIS/SISLOP EVENTS	23.2	ADDRESS MECHANISTICALLY CAUSED FIRES AND EXPLOSIONS NOT INCLUDED BY MRC BTP 9.5-1 OR APPENDIX B AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-1.C.2, IF NEEDED	ELECTRICAL
12.6.07.09.1	SWGR #3	86-M3-2	TRIP	NONE	*VERIFICATION REQUIRED THAT LOSS OF GENERATOR HYDROGEN SEAL OIL OR OTHER AUXILIARIES WILL NOT RESULT IN EXPLOSION OR FIRE CONCURRENT WITH SIS/SISLOP EVENT	23	(SAME AS 12.6.7.8.1)	
12.6.07.12.1	SWGR #3	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. RCPS ALSO UNAVAILABLE FOR SCTR	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. ROI REV REQD TO INDIVIDUALLY ISOLATE SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP		(SAME AS 12.3.1.2.1)	
12.6.07.12.1	SWGR #3	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. RCPS ALSO UNAVAILABLE FOR SCTR	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. ROI REV REQD TO INDIVIDUALLY ISOLATE SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP	04	(SAME AS 12.3.1.6.1)	
12.6.07.12.1	SWGR #3	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. RCPS ALSO UNAVAILABLE FOR SCTR	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. ROI REV REQD TO INDIVIDUALLY ISOLATE SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP	15	(SAME AS 12.3.1.6.1)	
12.6.07.12.1	SWGR #3	125VDC BUS #2	VOLTS LOW	*POTENTIAL INOPERABILITY OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. RCPS ALSO UNAVAILABLE FOR SCTR	*SWGR #3 ISOLATED ON SIS/SISLOP INDEPENDENT OF LOCKOUT RELAYS. ROI REV REQD TO INDIVIDUALLY ISOLATE SWGR #3/MCC-3 LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP	24	(SAME AS 12.3.1.6.1)	
12.6.08.01.1	SWGR #3	SSI (SWITCH)	AUTO	NONE. SWGR #3 CONTROL POWER AUTO-SELECTS TO TRAIN A OR B AS REQUIRED	*NORMAL POSITION. TECH SP8C ACTION ENTRY REQD IF SST #3 ENERGIZED VIA 152-12C11 (TRAIN B) IN MODES 1 - 4, SINCE SUCH AN ALIGNMENT COULD RESULT IN CROSS-TRAIN POWER AND CONTROL		(SAME AS 12.3.1.2.1)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOFFR UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.6.08.01.2	SWGR #3 CONTROL POWER	SS1 (SWITCH)	ON	POTENTIAL CROSS-TRAIN ALIGNMENT OF SWGR #3 POWER AND CONTROL IF SWGR #3 RE-ENERGIZED FROM TRAIN B VIA SWGR #2-3 TIE BREAKER POST-SIS/SISLOP.	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE. ROI REV REQD TO PRECLUDE CROSS-TRAIN ALIGNMENT POST-SIS/SISLOP	(SAME AS 12.3.1.2.1)		
12.6.08.01.3	SWGR #3 CONTROL POWER	SS1 (SWITCH)	OFF	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 POST-SIS/SISLOP. ISOLATION OF SWGR #3 LOADS BY SIS/SISLOP TRIP OF 4kV PREDER AND 480V TIE BREAKER ISOLATES COMMON-CAUSE FAULTS FROM REDUNDANT TRAINS A AND B	*TECH SPEC ACTION ENTRY REQD WITH THIS FAILURE. ROI REV REQD TO INDIVIDUALLY ISOLATE NON-ESSENTIAL LOADS PRIOR TO RE-ENERGIZING SWGR #3 POST-SIS/SISLOP	(SAME AS 12.3.1.2.1)		
12.6.08.02.1	SWGR #3 CONTROL POWER	52-1203 "b" CONTACTS	OPEN	NONE FOR SHORT TERM. FOR LONG TERM, CONTROL POWER CAN BE MANUALLY SELECTED TO PERMIT SWGR #3 TO BE RE-ENERGIZED FROM EITHER TRAIN VIA SWGR #1-3 AND SWGR #2-3 TIE BREAKERS	*ROI REV REQD FOR LOCAL OPERATOR ACTION TO MANUALLY SELECT CONTROL POWER VIA SS1 AND SS2. UPS DUTY CYCLE > 30 MINUTES PERMITS CREDIT FOR LOCAL OPERATOR ACTION AT SWGR #3 AND SS1/SS2	(SAME AS 12.3.1.2.1)		
12.6.08.02.2	SWGR #3 CONTROL POWER	52-1203 "b" CONTACTS	CLOSED	(SAME AS 12.6.8.1.2)	*NORMAL POSITION. TECH SPEC ACTION ENTRY REQD WITH THIS FAILURE	(SAME AS 12.3.1.2.1)		
12.6.08.03.1	SWGR #3 CONTROL POWER	C1A (RELAY)	ON	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	(SAME AS 12.3.1.2.1)		
12.6.08.03.2	SWGR #3 CONTROL POWER	C1A (RELAY)	OFF	(SAME AS 12.6.8.1.3)	*(SAME AS 12.6.8.1.3)	(SAME AS 12.3.1.2.1)		
12.6.08.04.1	SWGR #3 CONTROL POWER	C1B (RELAY)	ON	REDUCED REDUNDANCY FOR SEPARATION OF TRAIN A (DC BUS #1) AND TRAIN B (DC BUS #2) CONTROL POWER	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	(SAME AS 12.3.1.2.1)		
12.6.08.04.2	SWGR #3 CONTROL POWER	C1B (RELAY)	OFF	(SAME AS 12.6.8.1.3)	*(SAME AS 12.6.8.1.3)	(SAME AS 12.3.1.2.1)		
12.6.08.05.1	SWGR #3 CONTROL POWER	125VDC BUS #1 (72-116)	VOLTS LOW	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3. ISOLATION OF SWGR #3 LOADS BY SIS/SISLOP TRIP OF 4kV PREDER AND 480V TIE BREAKER PROVIDES ISOLATION OF COMMON-CAUSE FAULTS FROM REDUNDANT TRAINS A AND B	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	(SAME AS 12.3.1.2.1)		
12.6.08.06.2	SWGR #3 CONTROL POWER	SS2 (SWITCH)	ON	REDUCED REDUNDANCY FOR SEPARATION OF TRAIN A (DC BUS #1) AND TRAIN B (DC BUS #2) CONTROL POWER	*TECH SPEC ACTION REQUIRED WITH THIS FAILURE	(SAME AS 12.3.1.2.1)		
12.6.08.06.3	SWGR #3 CONTROL POWER	SS2 (SWITCH)	OFF	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	(SAME AS 12.3.1.2.1)		
12.6.08.07.1	SWGR #3 CONTROL POWER	52-1203 "a" CONTACTS	OPEN	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3 IN SHORT TERM. FOR LONG TERM, CONTROL POWER CAN BE MANUALLY SELECTED TO PERMIT SWGR #3 TO BE RE-ENERGIZED FROM EITHER TRAIN	*ROI REV REQUIRED FOR LOCAL OPERATOR ACTION TO MANUALLY SELECT CONTROL POWER VIA SS1 AND SS2. UPS DUTY CYCLE > 30 MINUTES PERMITS CREDIT FOR OPERATOR ACTION LOCALLY AT SWGR #3 AND SS1/SS2	(SAME AS 12.3.1.2.1)		
12.6.08.07.2	SWGR #3 CONTROL POWER	52-1203 "a" CONTACTS	CLOSED	(SAME AS 12.6.8.6.2)	*(SAME AS 12.6.8.6.2)	(SAME AS 12.3.1.2.1)		
12.6.08.08.1	SWGR #3 CONTROL POWER	C2A (RELAY)	ON	REDUCED REDUNDANCY FOR RE-ENERGIZING SWGR #3. ISOLATION OF SWGR #3 LOADS BY SIS/SISLOP TRIP OF 4kV PREDER AND 480V TIE BREAKER PROVIDES ISOLATION OF COMMON-CAUSE FAULTS FROM REDUNDANT TRAINS A AND B	*TECH SPEC ACTION ENTRY REQUIRED WITH THIS FAILURE	(SAME AS 12.3.1.2.1)		

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
 SAN ONOPRR UNIT 1
 ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.7.01.01.3	125VDC BUS #1 BATTERY CHARGER SRT A	CHARGER	OUTPUT VOLTS HIGH	POTENTIAL INOPERABILITY OF TRAIN A 125VDC LOADS DUE TO LOSS OF QUALIFIED LIFE	*CONDITION LIMITED BY CHGR HI-VOLTS SHUTDOWN. VERIFY REQD THAT EQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN A VITAL/REG BUSES 1, 2, 3/3A, 4 DUE TO VOLTS REGULATE CAPABILITY OF INVERTERS	32.2	VERIFY REQDs FOR 125VDC LOADS BOUND CONDITIONS OF EQUALIZING CHARGE ELECTRICAL (89)	
12.7.02.01.3	125VDC BUS #1 BATTERY CHARGER SRT B	CHARGER	OUTPUT VOLTS HIGH	POTENTIAL INOPERABILITY OF TRAIN A 125VDC LOADS DUE TO LOSS OF QUALIFIED LIFE	*CONDITION LIMITED BY CHGR HI-VOLTS SHUTDOWN. VERIFY REQ THAT EQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN A VITAL/REG BUSES 1, 2, 3/3A, 4 DUE TO VOLTS REGULATE CAPABILITY OF INVERTERS	31	(SAME AS 12.7.1.1.3)	
12.7.03.01.1	125VDC BATTERY BANK #1		OUTPUT VOLTS LOW	*NONE FOR SIS (CONTINUED CHGR OPS). INOP OF TRAIN A FOR SISLOP. POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 4 kV ROOM FIRE OR LOSS OF CONTAINMENT INTEGRITY DUE TO COMMON-CAUSE FAULT OF NON-EQ RCPs/BICITER W/ CONCURRENT LOSS OF BUS/LOAD O/C PROTECTION	SEE ITEMS 12.7.5.5.1, 12.7.5.9.1, 12.7.5.14.2, 12.7.6.1.1, 12.7.6.1.2, 12.7.6.2.1, 12.7.6.2.2, 12.7.6.3.1. SEE FOLLOWING ITEM FOR DISCUSSION OF FAULT PROPAGATION SCENARIO. OVERCURRENT TRIP OF SWD BRKR PROTECTS MAIN/C-IPMR FOR PRIMARY SIDE FAULTS ONLY	20.1	IMPLEMENT NMP 1-3633 TO PROVIDE BACKUP OVERCURRENT ELECTRICAL PROTECTION FOR RCP PENETRATIONS	
12.7.03.01.1	125VDC BATTERY BANK #1		OUTPUT VOLTS LOW	*NONE FOR SIS (CONTINUED CHGR OPS). INOP OF TRAIN A FOR SISLOP. POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 4 kV ROOM FIRE OR LOSS OF CONTAINMENT INTEGRITY DUE TO COMMON-CAUSE FAULT OF NON-EQ RCPs/BICITER W/ CONCURRENT LOSS OF BUS/LOAD O/C PROTECTION	SEE ITEMS 12.7.5.5.1, 12.7.5.9.1, 12.7.5.14.2, 12.7.6.1.1, 12.7.6.1.2, 12.7.6.2.1, 12.7.6.2.2, 12.7.6.3.1. SEE FOLLOWING ITEM FOR DISCUSSION OF FAULT PROPAGATION SCENARIO. OVERCURRENT TRIP OF SWD BRKR PROTECTS MAIN/C-IPMR FOR PRIMARY SIDE FAULTS ONLY	20.2	EVALUATE POTENTIAL FAULT PROPAGATION DUE TO COMMON-CAUSE FAULTS WITH CONCURRENT 125VDC FAILURE (EG. BICITER DURING NSLB) AS PART OF INTEGRATED RESOLUTION OF SBP TOPIC VI-7.C.2 ELECTRICAL	
12.7.03.01.2	125VDC BATTERY BANK #1		OUTPUT SHORT	*INOP OF TRAIN A, POTENTIAL INOP OF TRAIN B DUE TO 4 kV ROOM FIRE OR LOSS OF CONTAINMENT INTEGRITY RESULTING FROM COMMON-CAUSE FAULT OF NON-EQ RCPs (LOCA/MSLB) OR BICITER (MSLB O/S CONTAINMENT) W/ CONCURRENT LOSS OF BUS/LOAD OVERCURRENT PROTECTION	*FAILURE CAUSES LOSS OF CONTROL PWR TO ALL BUS #1A/1B/1C BRKR. B/U O/C PROTECTION REQD FOR RCPs AND MAIN GEN BICITER TO PREVENT PROPAGATING COMMON-CAUSE FAULTS OF THESE LOADS USING EMERG OF MAIN GEN/IPMR, FOR WHICH LOW-SIDE PROTECTION CONCURRENTLY LOST	20	(SAME AS 12.7.3.1.1)	
12.7.03.02.1	125VDC BATTERY BANK #1	72-144 (B66A666)	OPEN	*(SAME AS 12.7.3.1.1)	*(SAME AS 12.7.3.1.1)	20	(SAME AS 12.7.3.1.1)	
12.7.04.01.1	125VDC BUS #1 SHUNT		OPEN	*(SAME AS 12.7.3.1.2)	*(SAME AS 12.7.3.1.2)	20	(SAME AS 12.7.3.1.1)	
12.7.04.01.3	125VDC BUS #1 SHUNT		GROUND	NONE	*BOUNDS GROUND OF ANY OTHER 125VDC BUS #1 DEVICE. T/S ACTION ENTRY REQD FOR THIS CONDITION, SINCE A SECOND COMMON-CAUSE GROUND OF NON-EQ LOADS COULD DISABLE 125VDC BUS #1 SR LOADS. VERIFY REQD ON 1 GROUND FOR T/S ENTRY IN THIS NORMALLY UNGROUNDED SYSTEM	37.1	EVALUATE 125VDC BUS 1 GROUND CRITERIA FOR TECH SPEC ACTION ENTRY AND/OR MODIFICATIONS TO ELIMINATE TRAIN-COMMON 125VDC DEVICES AS PART OF INTEGRATED RESOLUTION OF SBP TOPIC VI-7.C.2 ELECTRICAL	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.7.05.01.1	125VDC BUS #1 SR LOADS	72-135 (BREAKER)	OPEN	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #1 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG		NO FURTHER ACTION REQUIRED. AMENDMENT #134 (PCN 217) ALREADY IMPLEMENTS THIS CONTROL	
12.7.05.02.1	125VDC BUS #1 SR LOADS	72-136 (BREAKER)	OPEN	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #2 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG		(SAME AS 12.7.5.1.1)	
12.7.05.03.1	125VDC BUS #1 SR LOADS	72-137 (BREAKER)	OPEN	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #3 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG		(SAME AS 12.7.5.1.1)	
12.7.05.04.1	125VDC BUS #1 SR LOADS	72-131 (BREAKER)	OPEN	NONE	*TECH SPEC ACTION ENTRY REQUIRED IF VITAL BUS NOT ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL/REGULATED BUS #4 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG		(SAME AS 12.7.5.1.1)	
12.7.05.05.1	125VDC BUS #1 SR LOADS	72-103 (BREAKER)	OPEN	*INOP OF TRAIN A, WITH POTENTIAL INOP OF TRAIN B DUE TO 4 kV ROOM FIRE OR LOSS OF CONTAINMENT INTEGRITY, DUE TO COMMON-CAUSE FAULT OF NON-RQ RCP MOTORS FED BY MAIN GEN/A/B-1PBRs W/ LOSS OF BUS #1A/1B CONTROL POWER. SISLOP LOGIC BECOMES 1/2 ON BUS #2C	*SRR ITEMS 1.1.3.10.1, 3.1.5.15.1, 1.1.11.4.1, 1.1.12.4.1, 2.1.6.14.1, 8.3.1.7.1, 10.1.2.5.1, 12.1.2.4.1, 12.1.3.8.1, 12.1.4.8.1, 12.1.5.7.1, 12.1.7.12.1, 12.1.9.2.1, 12.1.10.6.1, 12.1.12.8.1, 12.2.5.7.1. B/U PENETRATION O/C PROTECT REQ FOR RCP MOTORS	20	(SAME AS 12.7.3.1.1)	
12.7.05.08.1	125VDC BUS #1 SR LOADS	72-116 (BREAKER)	OPEN	REDUCED REDUNDANCY FOR RE-ENERGIZING 480V SWGR #3 POST-SIS/SISLOP	*SRR ITEMS 6.3.3.11.1, 7.3.3.7.1, 12.6.8.5.1. TECH SPEC ACTION ENTRY REQUIRED WITH BRKR IN THIS POSITION		NO FURTHER ACTION REQUIRED. CONFIGURATION ELIMINATED BY DCP 1-3552. NEW CONFIGURATION CONTROLLED BY AMENDMENT #134 (PCN-217) PER SOI-9-3	
12.7.05.09.1	125VDC BUS #1 SR LOADS	72-118 (BREAKER)	OPEN	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RMST LEVEL TRIP OF TRAIN A SI/FW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	SEE ITEM 12.3.09.11.1. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN 1PBR HAS 2 TRAINS OF FORCED AIR COOLING	04.4	VERIFY CUERBENT BOT FLOATING STRPS ADEQUATELY ADDRESS SI/FW TERMINATION WITH 125VDC BUS FAILURE	OPERATIONS
12.7.05.09.1	125VDC BUS #1 SR LOADS	72-118 (BREAKER)	OPEN	*POTENTIAL INOP OF TRAIN A FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RMST LEVEL TRIP OF TRAIN A SI/FW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	SEE ITEM 12.3.09.11.1. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN 1PBR HAS 2 TRAINS OF FORCED AIR COOLING	15	COMPLETE CALCULATION (DC-3416) TO DETERMINE ACCEPTABILITY OF SWC/CCWHE BYPASSED CONFIGURATION	MECHANICAL

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM 040628 UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.7.05.09.1	125VDC BUS #1 SR LOADS	72-118 (BREAKER)	OPEN	*POTENTIAL INOP OF TRAIN A FOR SIS/LOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAINS OF PORCHD AIR COOLING TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN A SI/PW. REDUCED RELIABILITY OF ALY OPPOSITE SOURCE	SEE ITEM 12.7.09.11.1. RCPs ALSO LOST, UNAVAILABLE FOR SCTR. MAIN RPNR HAS 2	24.1	REVISE SCTR DOSE CALCULATIONS (AS NEEDED TO PRECLUDE CREDIT FOR RCPs) AS PART OF UPSAR CHAPTER 15 REANALYSIS	NUCLEAR
12.7.05.14.2	125VDC BUS #1 SR LOADS	72-128 (BREAKER)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY FAILURE TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-RPNR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW	*STEAM DUMP SYSTEM AND SOLENOIDS NOT EQ. 04 TECH SPEC ACTION ENTRY REQD WITH THIS	(SAME AS 12.7.5.9.1)		
12.7.05.14.2	125VDC BUS #1 SR LOADS	72-128 (BREAKER)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY FAILURE TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-RPNR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW	*STEAM DUMP SYSTEM AND SOLENOIDS NOT EQ. 15 TECH SPEC ACTION ENTRY REQD WITH THIS	(SAME AS 12.7.5.9.1)		
12.7.05.14.2	125VDC BUS #1 SR LOADS	72-128 (BREAKER)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY FAILURE TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-RPNR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW	*STEAM DUMP SYSTEM AND SOLENOIDS NOT EQ. 22 TECH SPEC ACTION ENTRY REQD WITH THIS		VERIFY THAT PROCEDURES EXIST TO BRING ADDITIONAL DG FUEL ONSITE BEFORE 1 DAY ONSITE SUPPLY COULD BE EXHAUSTED POST-ACCIDENT	MECHANICAL
12.7.05.14.2	125VDC BUS #1 SR LOADS	72-128 (BREAKER)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY FAILURE TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-RPNR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW	*STEAM DUMP SYSTEM AND SOLENOIDS NOT EQ. 37.3 TECH SPEC ACTION ENTRY REQD WITH THIS		IDENTIFY SR/NSR ISOLATION DEVICE SURVEILLANCE REQUIREMENTS FOR MCCs, 125VDC AND 120VAC BUSES	ELECTRICAL
12.7.05.14.2	125VDC BUS #1 SR LOADS	72-128 (BREAKER)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY FAILURE TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-RPNR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW	*STEAM DUMP SYSTEM AND SOLENOIDS NOT EQ. 37.4 TECH SPEC ACTION ENTRY REQD WITH THIS		VERIFY RMOs EXIST WHICH IMPLEMENT SR/NSR ISOLATION MAINTENANCE DEVICE SURVEILLANCE REQUIREMENTS IDENTIFIED BY ELECTRICAL	
12.7.05.14.2	125VDC BUS #1 SR LOADS	72-128 (BREAKER)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY FAILURE TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-RPNR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW	*STEAM DUMP SYSTEM AND SOLENOIDS NOT EQ. 37.5 TECH SPEC ACTION ENTRY REQD WITH THIS		VERIFY LOCAR PROCESS AND RELATED PROCEDURES REQUIRE TECH SPEC ACTION ENTRY WITH FAILURE OF BUS/MCC SR/NSR ISOLATION DEVICE (EG. UNTIL AFFECTED LOAD IS ISOLATED)	OPERATIONS

Kaiser Aluminum Form, Inc.

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAR ONEFBR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITRM	ACTION ITRM	RESP DISCIPLINE
12.7.06.01.1	125VDC BUS #1 NSR LOADS	72-101 72-111 72-113 (BREAKERS)	OPEN	LOSS OF TURBINE TRIP CAPABILITY FOR SIS EVENTS, RESULTING IN EXCESS STEAM DEMAND (SIMILAR TO STEAM LINE BREAK) CONCURRENT WITH SBLOCA OR BCTR. NONE FOR SISLOP DUE TO MECHANICAL TRIPS ON LOW CONDENSER VACUUM OR OVERSPRED	*TURBINE TRIP VALVE IS ENERGIZED TO ACTUATE. ANALYSIS OF AFFECTED TRANSDUCERS MAY BE REQD TO DETERMINE EFFECT OF THIS FAILURE. MANUAL BLOCK VALVES CAN BE CLOSED LOCALLY IF PERMITTED BY RADIOLOGICAL CONDITIONS. DIVERSER TURBINE TRIP TO BE ADDED BY DCP 1-3407		NO FURTHER ACTION REQUIRED. REDUNDANT AC TRIP ACTUATED FROM SCRAM BREAKS WHICH ARE TRIPPED ON SIS OR DC BUS UNDERVOLTAGE	
12.7.06.01.2	125VDC BUS #1 NSR LOADS	72-101 72-111 72-113 (BREAKERS)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-IFMR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/FW	*CONFIGURATION DOES NOT MEET R.G. 1.75 OR IEEE 384 CRITERIA DUE TO LACK OF A SIS/SISLOP TRIP OF THE NON-IE LOADS FROM THIS BUS	04	(SAME AS 12.7.5.9.1)	
12.7.06.01.2	125VDC BUS #1 NSR LOADS	72-101 72-111 72-113 (BREAKERS)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-IFMR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/FW	*CONFIGURATION DOES NOT MEET R.G. 1.75 OR IEEE 384 CRITERIA DUE TO LACK OF A SIS/SISLOP TRIP OF THE NON-IE LOADS FROM THIS BUS	15	(SAME AS 12.7.5.9.1)	
12.7.06.01.2	125VDC BUS #1 NSR LOADS	72-101 72-111 72-113 (BREAKERS)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-IFMR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/FW	*CONFIGURATION DOES NOT MEET R.G. 1.75 OR IEEE 384 CRITERIA DUE TO LACK OF A SIS/SISLOP TRIP OF THE NON-IE LOADS FROM THIS BUS	19.1	EVALUATE ISOLATION ADEQUACY FOR UNQUALIFIED LOADS ON 125VDC BUS AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-1.C.2	ELECTRICAL
12.7.06.01.2	125VDC BUS #1 NSR LOADS	72-101 72-111 72-113 (BREAKERS)	CLOSED	*POTENTIAL INOP OF TRAIN A WITH POTENTIAL INOP OF TRAIN B DUE TO: UNISOLABLE CCM FLOW BYPASS AND INABILITY TO TRANSFER FROM DG TO OPPOSITE SOURCE WITH C-IFMR RELATED (SIS)LOP, LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/FW	*CONFIGURATION DOES NOT MEET R.G. 1.75 OR IEEE 384 CRITERIA DUE TO LACK OF A SIS/SISLOP TRIP OF THE NON-IE LOADS FROM THIS BUS	22	(SAME AS 12.7.5.14.2)	
12.7.06.02.1	125VDC BUS #1 NSR LOADS	72-108 72-109 72-115 (BREAKERS)	OPEN	LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY DUE TO INABILITY TO TRANSFER FROM DG TO OPPOSITE SOURCE FOR SISLOP EVENT INVOLVING C-IFMR RELATED LOP	*SEE ITEM 12.9.8.1.1. VERIFY REQD THAT LOSS OF H2 CNTL DOES NOT CAUSE LOSS OF NEARBY ECCS EQUIP AND CABLING (INCL NOV-350/850C INVERTER, HFW PUMPS) VIA FIRE OR EXPLOSION. SEPARATE 220KV BREAK AND RCP O/C TRIPS PREVENT PROPAGATION OF COMMON-CAUSE FAULTS	22	(SAME AS 12.7.5.14.2)	
12.7.06.02.1	125VDC BUS #1 NSR LOADS	72-108 72-109 72-115 (BREAKERS)	OPEN	LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN POTENTIAL LONG-TERM INOPERABILITY DUE TO INABILITY TO TRANSFER FROM DG TO OPPOSITE SOURCE FOR SISLOP EVENT INVOLVING C-IFMR RELATED LOP	*SEE ITEM 12.9.8.1.1. VERIFY REQD THAT LOSS OF H2 CNTL DOES NOT CAUSE LOSS OF NEARBY ECCS EQUIP AND CABLING (INCL NOV-350/850C INVERTER, HFW PUMPS) VIA FIRE OR EXPLOSION. SEPARATE 220KV BREAK AND RCP O/C TRIPS PREVENT PROPAGATION OF COMMON-CAUSE FAULTS	23.1	VERIFY WHETHER NEC BTP 9.5-1 AND APPENDIX B EXCLUDE BOTH FIRES AND EXPLOSIONS MECHANISTICALLY CAUSED BY AN ACCIDENT (EG. OF HYDROGEN DUE TO LUBE OIL/SBAL OIL FAILURE OR IFMR DUE TO FAULTY WITH PROTECTION FAILURE, PCST-SIS/SISLOP)	MECHANICAL (PP)

SAR ONEFBR UNIT 1

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAM ONOFFER UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BCCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.7.06.02.1	125VDC BUS #1 NSR LOADS	72-108 72-109 72-115 (BREAKERS)	OPEN	LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN POTENTIAL LONG-TERM IMPROBABILITY DUE TO INABILITY TO TRANSFER FROM DCA TO OFFSITE SOURCE FOR SIS/OP EVENT INVOLVING C-IPMR RELATED LOP	SEE ITEM 12.9.8.1.1. VERIFY REQD THAT LOSS OF H2 CNTL DOES NOT CAUSE LOSS OF NEARBY BCCS EQUIP AND CABLING (INCL NOV-358/450C INVERTER, MPM PUMPS) VIA FIRE OR EXPLOSION. SEPARATE 220V BRK AND RCP O/C TRIPS PREVENT PROPAGATION OF COMMON-CAUSE FAULTS	23.2	ADDRESS MECHANISTICALLY CAUSED FIRES AND EXPLOSIONS NOT ENCLOSED BY NRC STP 9.5-1 OR APPENDIX B AS PART OF INTEGRATED RESOLUTION OF SEP TOPIC VI-1.C.2, IF NEEDED	ELECTRICAL
12.7.06.02.2	125VDC BUS #1 NSR LOADS	72-108 72-109 72-115 (BREAKERS)	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	04	(SAME AS 12.7.5.9.1)	
12.7.06.02.2	125VDC BUS #1 NSR LOADS	72-108 72-109 72-115 (BREAKERS)	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	15	(SAME AS 12.7.5.9.1)	
12.7.06.02.2	125VDC BUS #1 NSR LOADS	72-108 72-109 72-115 (BREAKERS)	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	19	(SAME AS 12.7.6.1.2)	
12.7.06.02.2	125VDC BUS #1 NSR LOADS	72-108 72-109 72-115 (BREAKERS)	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	22	(SAME AS 12.7.5.14.2)	
12.7.06.03.1	125VDC BUS #1 NSR LOADS	OTHER	OPEN	LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER FROM DCA TO OFFSITE FOR C-IPMR RELATED (SIS)LOP	SEE ITEMS 6.4.8.5.1, 12.9.7.3.1. MOTOR OPERATED DISCONNECT SWITCH CAN BE OPERATED MANUALLY VIA LOCAL HAND-CRANK, BUT INTERLOCK FROM FAILED RELAYS WILL STILL BLOCK RECLOSING OF BWD BREAKS	22	(SAME AS 12.7.5.14.2)	
12.7.06.03.2	125VDC BUS #1 NSR LOADS	OTHER	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	04	(SAME AS 12.7.5.9.1)	
12.7.06.03.2	125VDC BUS #1 NSR LOADS	OTHER	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	15	(SAME AS 12.7.5.9.1)	
12.7.06.03.2	125VDC BUS #1 NSR LOADS	OTHER	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	19	(SAME AS 12.7.6.1.2)	
12.7.06.03.2	125VDC BUS #1 NSR LOADS	OTHER	CLOSED	*(SAME AS 12.7.6.1.2)	*(SAME AS 12.7.6.1.2)	22	(SAME AS 12.7.5.14.2)	
12.8.01.01.3	125VDC BUS #2 BATTERY CHARGER SET C	CHARGER	OUTPUT VOLTS HIGH	POTENTIAL IMPROBABILITY OF TRAIN B 125VDC LOADS DUE TO LOSS OF QUALIFIED LIFE	*CONDITION LIMITED BY CHARGER HI-VOLTS SHUTDOWN. VERIFY REQD THAT BQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN B VITAL BUS 5, 6 OR CSAS INVERTERS DUE TO VOLTAGE REGULATING CAPABILITY	37	(SAME AS 12.7.1.1.3)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITRN #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON BCCS	REMARKS	REPORT ITRN	ACTION ITRN	RESP DISCIPLINE
12.8.02.01.3	125VDC BUS #2 BATTERY CHARGER SBT D	CHARGER	OUTPUT VOLTS HIGH	POTENTIAL INOPERABILITY OF TRAIN B 125VDC LOADS DUE TO LOSS OF QUALIFIED LIFE	*CONDITION LIMITED BY CHARGER HI-VOLTS SHUTDOWN. VERIFY REQD THAT REQ FOR 125VDC LOADS BOUNDS THIS CONDITION (EG. EQUALIZING CHARGE FOR BATTERY BANK). FAILURE DOES NOT IMPACT TRAIN B VITAL BUS 5, 6 OR CSAS INVERTERS DUE TO VOLTAGE REGULATING CAPABILITY	37	(SAMB AS 12.7.1.1.3)	
12.8.04.01.3	125VDC BUS #2 SHUNT		GROUND	NONE	*BOUNDS GROUND OF ANY OTHER 125VDC BUS #2 DEVICE. T/S ACTION ENTRY REQD FOR THIS CONDITION, SINCE A SECOND COMMON-CAUSE GROUND OF NON-REQ LOADS COULD DISABLE 125VDC BUS #2 SR LOADS IN THIS NORMALLY UNGROUNDED SYSTEM. VERIFY REQD ON % GROUND FOR T/S ENTRY	37	(SAMB AS 12.7.4.1.3)	
12.8.05.01.1	125VDC BUS #2 SR LOADS	72-217 (BREAKER)	OPEN	NONE	*TRCH SPRC ACTION ENTRY REQUIRED IF VITAL BUS NOT RE-ENERGIZED FROM INVERTER. MAY ALSO RESULT IN INTERRUPTION OF VITAL BUSES 5, 6 LOADS BETWEEN TIME OF SISLOP AND RE-ENERGIZING MCC-2 FROM TRAIN B DG		(SAMB AS 12.7.5.1.1)	
12.8.05.03.1	125VDC BUS #2 SR LOADS	72-204 (BREAKER)	OPEN	REDUCED REDUNDANCY FOR RE-ENERGIZING 480V SWGR #3 POST-SIS/SISLOP	*SEE ITRN 12.6.8.10.1. TRCH SPRC ACTION ENTRY REQUIRED WITH BREAK IN THIS POSITION		(SAMB AS 12.7.5.8.1)	
12.8.05.05.1	125VDC BUS #2 SR LOADS	72-206 (BREAKER)	OPEN	*INOP OF TRAIN B, WITH POTENTIAL INOP OF TRAIN A DUE TO LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW PUMPS. TRAIN A SISLOP LOGIC BECOMES 1/2 ON BUS #1C UV	*SEE ITEMS 1.2.3.10.1, 1.2.6.15.1, 1.2.11.4.1, 1.2.12.5.1, 2.2.6.14.1, 8.3.2.7.1, 10.2.2.5.1, 12.2.2.4.1, 12.2.7.12.1, 12.2.9.2.1, 12.2.10.6.1, 12.2.12.8.1. BOI DRV REQD TO TRIP PUMP BREAKER LOCALLY TO ISOL FAULTS DUE TO LOSS-OF-SUCTION MOTOR FAILURES	04	(SAMB AS 12.7.5.9.1)	
12.8.05.12.1	125VDC BUS #2 SR LOADS	72-226 (BREAKER)	OPEN	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*SEE ITEMS 12.4.9.16.1, 12.6.7.12.1. SWGR #4 #3 NON-SR LOADS CAN BE MANUALLY ISOLATED PRIOR TO RE-ENERGIZING THE BUS FROM TRAIN A OR B. MAIN TRMR HAS 2 TRAINS OF FORCED AIR COOLING	04	(SAMB AS 12.7.5.9.1)	
12.8.05.12.1	125VDC BUS #2 SR LOADS	72-226 (BREAKER)	OPEN	*POTENTIAL INOP OF TRAIN B FOR SISLOP DUE TO 480V SWGR/MCC VOLT DEGRADATION AND/OR DG OVERLOAD, W/ POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS, LOSS OF LO-LO RWST LEVEL TRIP OF TRAIN B SI/PW. REDUCED RELIABILITY OF ALT OFFSITE SOURCE	*SEE ITEMS 12.4.9.16.1, 12.6.7.12.1. SWGR #5 #3 NON-SR LOADS CAN BE MANUALLY ISOLATED PRIOR TO RE-ENERGIZING THE BUS FROM TRAIN A OR B. MAIN TRMR HAS 2 TRAINS OF FORCED AIR COOLING	15	(SAMB AS 12.7.5.9.1)	
12.8.06.01.2	125VDC BUS #2 NSE LOADS	72-208 (BREAKER)	CLOSED	*POTENTIAL INOP OF TRAIN B WITH POTENTIAL INOP OF TRAIN A DUE TO: UNISOLABLE CCW FLOW BYPASS AND LOSS OF LO-LO RWST LEVEL TRIP CAPABILITY FOR TRAIN A SI/PW	*CONFIGURATION DOES NOT MEET R.C. 1.75 OR IEEE 384 CRITERIA DUE TO LACK OF A SIS/SISLOP TRIP OF THE NON-IR LOADS FROM THIS BUS	04	(SAMB AS 12.7.5.9.2)	

EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAB ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.9.04.01.2	CB 4012 (PCB-1)	BREAKER	CLOSED	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BUS #1C/2C POST-SISLOP OR OTHER CAUSE OF UNIT TRIP, UNTIL BRKR IS ISOLATED BY DISCONNECTS AND LOCAL RESET OF BFLBU IN SWTD, NONE FOR SIS	*VERIFICATION REQUIRED THAT APPLICABLE PROCEDURES ADDRESS THIS CONDITION POST-SISLOP		NO FURTHER ACTION REQUIRED, SOL-12-10 ALREADY ADDRESSES THIS FAILURE	
12.9.04.02.1	CB 4012 (PCB-1)	BREAKER FAILURE LOCAL BACKUP (BFLBU)	TRIPPED	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BUS #1C/2C POST-SISLOP, NONE FOR SIS	BFLBU PROVIDES FAULT ISOLATION IN THE EVENT THAT BRKR RECEIVES A TRIP SIGNAL BUT DOES NOT TRIP. SPURIOUS BFLBU BOUNDS ACTUATION OF SWTD NR BUS DIFFERENTIAL TRIP, WHICH DOES NOT TRIP BRKR 4032		(SAME AS 12.9.4.1.2)	
12.9.05.01.2	CB 6012 (PCB-2)	BREAKER	CLOSED	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BUS #1C/2C POST-SISLOP OR OTHER CAUSE OF UNIT TRIP, UNTIL BRKR IS ISOLATED BY DISCONNECTS AND LOCAL RESET OF BFLBU IN SWTD, NONE FOR SIS	*VERIFICATION REQUIRED THAT APPLICABLE PROCEDURES ADDRESS THIS CONDITION POST-SISLOP		(SAME AS 12.9.4.1.2)	
12.9.05.02.1	CB 6012 (PCB-2)	BREAKER FAILURE LOCAL BACKUP (BFLBU)	TRIPPED	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BUS #1C/2C POST-SISLOP, NONE FOR SIS	BFLBU PROVIDES FAULT ISOLATION IN THE EVENT THAT BRKR RECEIVES A TRIP SIGNAL BUT DOES NOT TRIP. SPURIOUS BFLBU BOUNDS ACTUATION OF SWTD NR BUS DIFFERENTIAL TRIP, WHICH DOES NOT TRIP BRKR 4032		(SAME AS 12.9.4.1.2)	
12.9.06.01.2	CB 4012 CB 6012	MAIN GEN. MAIN/A/B-IPHR PROTECTIVE TRIPS	CONTACTS CLOSED (ON)	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN ABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPHR RELATED LOP	DISCONNECT SWITCHES IN CONTROL CABINETS 22 CAN ALSO BE USED TO INTERRUPT THE TRIP SIGNALS	22	VERIFY THAT PROCEDURES EXIST TO BRING ADDITIONAL MECHANICAL DG PWR ONSITE BEFORE 7 DAY ONSITE SUPPLY COULD BE REBAUSTED POST-ACCIDENT	
12.9.06.03.2	CB 4012 CB 6012	IR-1 (RELAT)	CONTACTS OPEN (OFF)	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS; RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR C-IPHR RELATED (SIS)LOP, NONE FOR SIS		22	(SAME AS 12.9.6.1.2)	
12.9.07.01.2	MOTOR OPERATED DISCONNECT	SWITCH	CLOSED	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPHR RELATED LOP	NORMAL POSITION	22	(SAME AS 12.9.6.1.2)	
12.9.07.02.2	MOTOR OPERATED DISCONNECT	IR, IR-1 (RELATS)	OFF	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPHR RELATED LOP	RELAY IS LATCHING TYPE	22	(SAME AS 12.9.6.1.2)	
12.9.07.03.1	MOTOR OPERATED DISCONNECT	125VDC BUS #1 (72-132)	VOLTS LOW	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPHR RELATED LOP	MOTOR OPERATED DISCONNECT CAN BE OPERATED MANUALLY VIA ATTACHED HAND-CRANK. HOWEVER, INTERLOCK FROM FAILED RELAYS WILL STILL BLOCK RECLOSURE OF SWTD BRKR	22	(SAME AS 12.9.6.1.2)	
12.9.08.01.1	CB 4012 CB 4032 CB 6012 CB 6032	125VDC BUS #1 (72-108)	VOLTS LOW	*LOSS OF ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS, RESULTING IN POTENTIAL LONG-TERM IMPROBABILITY DUE TO INABILITY TO TRANSFER BUS #1C/2C FROM DG _s FOR SISLOP EVENT INVOLVING C-IPHR RELATED LOP	SEPARATE 220 VV BRKR AND RCP OVERCURRENT TRIPS PREVENT PROPAGATION OF COMMON-CAUSE FAULTS (EG. INTO 4 VV ROOM) WITH THIS FAILURE	22	(SAME AS 12.9.6.1.2)	

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EMERGENCY CORE COOLING SYSTEM SINGLE FAILURE ANALYSIS
SAN ONOPRR UNIT 1
ACTION ITEMS FOR SIGNIFICANT FINDINGS

ITEM #	DEVICE ID	COMPONENT ID	FAILURE MODE	EFFECT ON ECCS	REMARKS	REPORT ITEM	ACTION ITEM	RESP DISCIPLINE
12.9.08.05.1 CB 4012 CB 4032 CB 6012 CB 6032	125VDC PANBL	BDP2	VOLTS LOW	POTENTIAL FOR FIRE OR EXPLOSION AT C-1FHR AND SWTD DUE TO INABILITY TO ISOLATE 220 HV SUPPLY AUTOMATICALLY FROM C-1FHR CAUSED LOP. POTENTIAL DAMAGE TO ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS DUE TO SUSTAINED ROTORING	REALIGNMENT TO ALTERNATE OFFSITE SOURCE NOT REQUIRED IMMEDIATELY, PERMITTING CREDIT FOR LOCAL OPERATION OF SWTD BREAKS AND REPAIRS WITHIN 7 DAY CAPACITY OF DG ESSENTIAL EQUIPMENT AS PER UPRA	23.1	VERIFY WHETHER NRC BTP 9.5-1 AND APPENDIX B EXCLUDE BOTH FIRES AND EXPLOSIONS MECHANISTICALLY CAUSED BY AN ACCIDENT (EG. OF HYDROGEN DUE TO LUBE OIL/HEAL OIL FAILURE OR IFHR DUE TO FAULT WITH PROTECTION FAILURE, POST-318/SISLOP)	MECHANICAL (FP)
12.9.08.05.1 CB 4012 CB 4032 CB 6012 CB 6032	125VDC PANBL	BDP2	VOLTS LOW	POTENTIAL FOR FIRE OR EXPLOSION AT C-1FHR AND SWTD DUE TO INABILITY TO ISOLATE 220 HV SUPPLY AUTOMATICALLY FROM C-1FHR CAUSED LOP. POTENTIAL DAMAGE TO ALTERNATE OFFSITE SOURCE FOR BOTH TRAINS DUE TO SUSTAINED ROTORING	REALIGNMENT TO ALTERNATE OFFSITE SOURCE NOT REQUIRED IMMEDIATELY, PERMITTING CREDIT FOR LOCAL OPERATION OF SWTD BREAKS AND REPAIRS WITHIN 7 DAY CAPACITY OF DG ESSENTIAL EQUIPMENT AS PER UPRA	23.2	ADDRESS MECHANISTICALLY CAUSED FIRES AND/OR EXPLOSIONS NOT EXCLUDED BY NRC BTP 9.5-1 OR APPENDIX B AS PART OF INTEGRATED RESOLUTION OF SRP TOPIC VI-1.C.2, IF NEEDED	ELECTRICAL

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