PSEG NUCLEAR L.L.C.
SALEM/OPERATIONS

2-EOP-LOPA-1 - Rev. 26

LOSS OF ALL AC POWER

- Biennial Review Performed: Yes ____ No √
- Change Package(s) and Affected Document Number(s) incorporated into this revision: None

---

REVISION SUMMARY

The following changes were incorporated into this revision:

- Revised Table E (Sheet 2 of 4) and Checkoff Sheet 2 to reflect the requirement to check only "2VC5 and 2VC6" versus "2VC1 through 2VC6". This change was incorporated due to Containment Isolation Valves 2VC2 and 2VC3 being replaced with testable flanges 2VCF2 and 2VCF3 IAW DCP 80091075, Replace 2VC2 and 2VC3 Valves with Blind Flanges. **[80091075-0568] [80091075-0569]**

IMPLEMENTATION REQUIREMENTS Effective Date: 04/28/2008

DCP No. 80091075 – Rev. 0, Replace 2VC2 and 2VC3 with Blind Flanges

EMERGENCY OPERATING PROCEDURE
2-EOP-LOPA-1
LOSS OF ALL AC POWER

1.0 Entry Conditions

See Flowchart

2.0 Operator Actions

2.1 Immediate Actions

See Flowchart

2.2 Subsequent Actions

See Flowchart

3.0 Attachment List

3.1 Continuous Action Summary

3.2 Tables

See Checkoff Sheets

3.3 Figures

None

3.4 Graphs

None

3.5 Checkoff Sheets

1 - Phase A Isolation Alignment (Table D)
2 - Containment Vent Isolation Alignment (Table E)
3 - 125 VDC Load Shed
4 - Phase B Valve Isolation Alignment (Table F)

3.6 Attachments

1 - Major Action Categories

CONTINUOUS ACTION SUMMARY

CONDITION	ACTION
RCS PRESSURE LESS THAN 1500 PSIG AND BIT FLOW ESTABLISHED	CLOSE CHG PUMP MINIFLOW
RCS PRESSURE GREATER THAN 2000 PSIG	OPEN CHG PUMP MINIFLOW
"AFWST LEVEL LO-LO" ALARM (10.3%)	SHIFT AFW PUMP SUCTION
ANY SG COMPLETELY DEPRESSURIZED OR DEPRESSURIZING IN AN UNCONTROLLED MANNER	ISOLATE FAULTED SG
ANY RUNNING DG THAT CAN NOT BE SUPPLIED WITH SERVICE WATER	STOP AFFECTED DG

CHECKOFF SHEET 1

PHASE A ISOLATION ALIGNMENT

PHASE A ISOLATION

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
2WL12	RCDT DISCHARGE	CLOSED	
2WL13	RCDT DISCHARGE	CLOSED	
2WL16	CONT SUMP DISCH TO WHUT	CLOSED	
2WL17	CONT SUMP DISCH TO WHUT	CLOSED	
2WL96	RCDT TO GAS ANALYZER	CLOSED	
2WL97	RCDT TO GAS ANALYZER	CLOSED	
2WL98	RCDT-PRT TO GAS COMPR	CLOSED	
2WL99	RCDT-PRT TO GAS COMPR	CLOSED	
2WL108	NITROGEN TO RCDT	CLOSED	
2SS27	ACCUMULATOR SAMPLING	CLOSED	
2SS33	21 AND 23 HOT LEG SAMPLE	CLOSED	
2SS49	PZR LIQUID SAMPLING	CLOSED	
2SS64	PZR STEAM SAMPLING	CLOSED	
2SS103	ACCUMULATOR SAMPLING	CLOSED	
2SS104	21 AND 23 HOT LEG SAMPLE	CLOSED	
2SS107	PZR LIQUID SAMPLING	CLOSED	
2SS110	PZR STEAM SAMPLING	CLOSED	
21SS94	21 SG B/D SAMPLING	CLOSED	
22SS94	22 SG B/D SAMPLING	CLOSED	
23SS94	23 SG B/D SAMPLING	CLOSED	
24SS94	24 SG B/D SAMPLING	CLOSED	
2DR29	CNTMT INLET MAKEUP	CLOSED	
2FP147	CONTAINMENT ISOL	CLOSED	

PHASE A ISOLATION CONT'D

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
2CV3	45 GPM ORIFICE	CLOSED	
2CV4	75 GPM ORIFICE	CLOSED	
2CV5	75 GPM ORIFICE	CLOSED	
2CV7	LETDOWN CONTROL	CLOSED	
2CV116	SEAL WATER TO VCT	CLOSED	
2SJ60	TEST LINE TO CVCS HUT	CLOSED	
2SJ53	21 SI PUMP	CLOSED	
2SJ123	TEST LINE TO CVCS HUT	CLOSED	
2CC113	EXC LHX OUTLET	CLOSED	
2CC215	EXC LHX INLET	CLOSED	
21GB4	21 SG OUTLET	CLOSED	
22GB4	22 SG OUTLET	CLOSED	
23GB4	23 SG OUTLET	CLOSED	
24GB4	24 SG OUTLET	CLOSED	
2VC7	CONT APD REG ISOL	CLOSED	
2VC8	CONT APD REG ISOL	CLOSED	
2VC11	CONT APD REG ISOL	CLOSED	
2VC12	CONT APD REG ISOL	CLOSED	
2WR80	CONT PRI WATER STOP	CLOSED	
2PR17	GAS ANALYZER	CLOSED	
2PR18	GAS ANALYZER	CLOSED	
2NT25	N2 SUPPLY	CLOSED	
2NT32	N2 SUPPLY	CLOSED	

CHECKOFF SHEET 2

CONTAINMENT VENT ISOLATION ALIGNMENT

CONTAINMENT VENT ISOLATION

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
2VC5	ISOLATION	CLOSED	
2VC6	ISOLATION	CLOSED	

CHECKOFF SHEET 3

125VDC LOAD SHED LIST

2A 125V DC BUS

(84 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2ADC1AX9	2EP(REG),2GP(EMERG) PZR HEATER BUS CONTROL POWER	OPEN	
2ADC1AX10	2F,2H 460V BUSSES CONTROL POWER. 2F(REG),2H(EMER)	OPEN	
2ADC1AX12	2F,2G 4KV BUSSES CONTROL POWER. 2F(REG),2G(EMER)	OPEN	
2ADC1AX13	2H,2E 4KV BUSSES CONTROL POWER. 2H(REG),2E(EMER)	OPEN	
2ADC1AX15	2CW 460V BUS REG CONTROL POWER	OPEN	
2ADC1AX29	2E,2G 460V BUSSES CONTROL POWER. 2E(REG),2G(EMER)	OPEN	

2ADC 125V DC DISTRIBUTION PANEL

(84 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2ADC3AX29	2 GENERATOR EXCITER VOLTAGE REGULATOR	OPEN	
2ADC3AX31	2 GENERATOR EXCITER RECTIFIER HIGH TEMP	OPEN	

2AADC 125V DC DISTRIBUTION CABINET

(100 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2ADC2AX16	REACTOR TRIP BYPASS BREAKER B	OPEN	
2ADC2AX22	2 TURBINE REGULATOR RELAYS	OPEN	
2ADC2AX30	2 GENERATOR OVERLOAD REGULAR RELAYS	OPEN	

2B 125V DC BUS

CHECKOFF SHEET 3

125VDC LOAD SHED LIST

(84 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2BDC1AX9	2GP(REG),2EP(EMERG) PZR HEATER BUS CONTROL POWER	OPEN	
2BDC1AX10	2H,2F 460V BUSSES CONTROL POWER. 2H(REG),2F(EMER)	OPEN	
2BDC1AX12	2G,2F 4KV BUSSES CONTROL POWER. 2G(REG),2F(EMER)	OPEN	
2BDC1AX13	2E,2H 4KV BUSSES CONTROL POWER. 2E(REG),2H(EMER)	OPEN	
2BDC1AX29	2G,2E 460V BUSSES CONTROL POWER. 2G(REG),2E(EMER)	OPEN	

2DDC 125V DC DISTRIBUTION PANEL

(84 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2DDC2AX7	ISO PHASE BUS AND GENERATOR TERM ALARMS	OPEN	
2DDC2AX17	22SGFP TURBINE CONTROLS	OPEN	
2DDC2AX27	BORIC ACID EVAPORATOR PANEL 301	OPEN	
2DDC2AX28	SAFETY INJECTION TEST LINE VALVES	OPEN	
2DDC2AX37	2 GENERATOR OVERALL DIFFERENTIAL BACK-UP RELAYS	OPEN	

2BBDC 125V DC DISTRIBUTION CABINET

(100 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2BDC2AX3	22MS167 - 22SG MAIN STEAM STOP VALVE HYDRAULIC PUMP	OPEN	
2BDC2A12	21MS167 - 21SG MAIN STEAM STOP VALVE HYDRAULIC PUMP	OPEN	
2BDC2AX28	TURBINE TRIP BACKUP RELAYS	OPEN	
2BDC2AX36	REACTOR TRIP BYPASS BREAKER	OPEN	
2BDC2AX39	GENERATOR OVERLOAD OUT OF STEP & LOSS OF FIELD	OPEN	

CHECKOFF SHEET 3

125VDC LOAD SHED LIST

2CDC 125V DC DISTRIBUTION PANEL

(84 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2CDC3AX12	2 GENERATOR OVERALL DIFFERENTIAL REGULAR RELAYS	OPEN	
2CDC3AX30	21-25C LP FEEDWATER HEATERS INLET VALVES	OPEN	
2CDC3AX32	21-25C LP FEEDWATER HEATERS BYPASS VALVES	OPEN	
2CDC3AX37	2BF38, 26A-C HP FEEDWATER HEATERS BYPASS VALVES	OPEN	

2CCDC 125V DC DISTRIBUTION PANEL

(100 FT ELEV SWITCHGEAR ROOM)

BREAKER NUMBER	LOAD	REQUIRED POSITION	INITIALS
2CDC2AX24	21BF40 & 22BF40, 21 & 22 SG FW CONTROL AND BYPASS VALVES	OPEN	
2CDC2AX30	21 SGFP TURBINE CONTROLS	OPEN	
2CDC2AX39	23MS167 - 23SG MAIN STEAM STOP VALVE HYDRAULIC PUMP	OPEN	
2CDC2AX41	24MS167 - 24SG MAIN STEAM STOP VALVE HYDRAULIC PUMP	OPEN	

CHECKOFF SHEET 4

PHASE B VALVE ISOLATION

PHASE B ISOLATION

VALVE NUMBER	VALVE NAME	REQUIRED POSITION	BREAKER	INITIALS
2CC117	CCW TO RCP	CLOSED	2CY2AX8A	
2CC118	CCW TO RCP	CLOSED	2AY2EP5A	
2CC131	RCP THERMAL BARRIER	CLOSED	2CY2EP5I	
2CC136	RCP BEARING OUTLET	CLOSED	2CY2AX8E	

NOTE: ALL VALVES LOCATED IN INNER PENETRATION AREA, 78 FT ELEV (AUX BLDG 78 FT ELEV, BIT ROOM)

MAJOR ACTION CATEGORIES

- CHECK PLANT CONDITIONS
- RESTORE AC POWER
- MAINTAIN PLANT CONDITIONS FOR OPTIMAL RECOVERY
- EVALUATE ENERGIZED AC EMERGENCY BUS
- SELECT RECOVERY GUIDELINE AFTER AC POWER RESTORATION

SALEM GENERATING STATION

2-EOP-LOPA-1
LOSS OF ALL AC POWER

BASIS DOCUMENT

<u>EOP Step No:</u> ENTRY CONDITIONS

<u>ERG Step No:</u> ENTRY CONDITIONS

EOP Step:

EOP-TRIP-1, STEP 4

Purpose:

To provide the plant conditions for entry into this procedure.

ERG Basis:

EOP-LOPA-1 is entered from EOP-TRIP-1, when all 4KV vital buses are de-energized. This procedure is also entered any time symptoms indicate that all 4KV vital buses are de-energized.

EOP Basis:

Same as ERG basis, with the following additional information:

The ERG reference plant safeguards arrangement has two electrical trains (AC Emergency Buses A and B) and two safeguards equipment trains. Each electrical train can supply one independent and redundant safeguards train. This plant design has three electrical trains (4KV Vital Buses A, B, and C) and two safeguards equipment trains. Three vital buses can supply both safeguards equipment trains. Any two vital buses can supply one safeguards train. A single vital bus can only supply a partial equipment train (which will always include at least one SI or centrifugal charging pump). As a result, for the purposes of determining if a loss of all AC power exists, the ERG phrase "*at least one AC emergency bus energized*" is equivalent to "*at least one 4KV vital bus energized*" for this plant. Refer to DW-92-033 for more information on these differences.

In addition to the explicit <u>entry condition</u> from EOP-TRIP-1, this EOP is also entered per the rules of usage <u>anytime</u> from <u>anywhere</u> on the <u>symptom</u> of a loss of all AC power (all 4KV group and vital buses de-energized).

Supplemental Information:

DW-92-033: EOP-LOPA-1 is applicable only if <u>all</u> 4KV vital buses are de-energized. If <u>any</u> 4KV vital bus is energized, then at least one ECCS pump is available for RCS makeup. In this case, the non-LOPA ORPs and the FRPs are capable of dealing with the accident even with less than minimum safeguards capability.

EOP Step No: ENTRY CONDITIONS (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: CAS

ERG Step No: N/A

EOP Step:

CONTINUOUS ACTION SUMMARY

Purpose:

To remind the operator to monitor certain parameters or conditions and respond as directed if any of these parameters or conditions are exceeded.

ERG Basis:

N/A

EOP Basis:

The flowcharts utilize a Continuous Action Summary (CAS) table in place of the ERG foldout page. The CAS contains the important items that should be continuously monitored during the performance of the EOP. The CAS is located in the upper left corner on each flowchart sheet and is the same for all flowchart sheets in a given procedure. Though ERG ECA-0.0 has no foldout page, a CAS has been added to the EOP since there are certain items that warrant inclusion in a CAS. Bases for the CAS items are as follows:

- To prevent completely filling the VCT with water during an SI, FSAR 6.3.2.16 requires closing the centrifugal charging pump miniflow valves when RCS pressure is less than 1500 psig and flow through the BIT has been verified. The miniflow valves may be re-opened when RCS pressure rises above 2000 psig.

- AFST level lo-lo requires an alternate suction to be aligned to the AFW pumps to prevent loss of NPSH and pump damage. This is a typical ERG FOP item.

- FSAR 15.4.8.2.2 (steamline break analysis) requires that AFW be isolated to a faulted SG within 10 minutes of SG fault initiation. In addition, the BIT boron concentration reduction from 21,000 ppm to 2000 ppm also assumes that AFW is isolated to a faulted SG within 10 minutes.

- DG cooling is provided by SW pumps powered from the 4KV vital buses. If a DG is started and can NOT be promptly supplied with SW cooling, it is tripped to prevent damage until SW cooling is available.

EOP Step No: CAS (CONTINUED)

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Number	Description
1500 psig	B.10	RCS pressure for closing charging pump miniflow valves when charging pumps are injecting through the BIT.
2000 psig	B.11	RCS pressure for opening charging pump miniflow valves.
10.3%	U.01	AFST low-low level switchover setpoint.

ERG Deviations:

DEV.1 Added a CAS even though the corresponding ERG has no foldout page.

JUST. Refer to EOP basis. [SD-60]

EOP Step No: N/A

ERG Step No: Note 1-1

EOP Step:

N/A

Purpose:

To inform the operator that the first 2 steps are immediate actions.

ERG Basis:

Immediate actions are those actions that the operator should be able to perform from memory before opening and reading the emergency procedures. In general, immediate actions are limited to time critical actions that verify automatic protection features of the plant but are not so complex or extensive that reliance on procedures is prefered to reliance on memory. Although the immediate actions should be memorized by the operator, they need not be memorized verbatim. The operator should know them well enough to complete the intent of each step, which is to verify that the automatic actions have occurred. The order in which they should be performed should also be consistent with the step sequence requirements, i.e., the order of the first two steps is important.

EOP Basis:

N/A

Supplemental Information:

ERG Knowledge Item: The intent of the immediate action steps should be committed to memory.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG note on immediate action steps.

JUST. Flowchart design identifies the immediate action steps by a zone title (bracket label) instead of a note in order to streamline the procedure flowpath by minimizing reading delays.

EOP Step No: Steps 1 and 2

ERG Step No: Note 1-2

EOP Step:

(Step 1) NOTE CFSTs SHOULD BE MONITORED FOR INFORMATION ONLY

(Step 2) NOTE FRPs SHOULD NOT BE IMPLEMENTED UNTIL DIRECTED

Purpose:

To inform the operator that this procedure should not be exited to perform any FRP in response to an identified CSF challenge.

ERG Basis:

This procedure has priority over all FRPs and is written to implicitly monitor and maintain critical safety functions. This priority is necessary since all FRPs are written on the premise that at least one 4 KV vital bus is energized.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Procedure EOP-LOPA-1 has priority over the FRPs.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Split ERG note into two EOP notes.

JUST. Although CFST monitoring and FRP implementation are related, the intent of monitoring the CFSTs for information only (and NOT implementing the FRPs) is more clearly emphasized by presenting this information in two individual procedure notes. [SD-69]

EOP Step No: Step 3

ERG Step No: Step 1

EOP Step:

TRIP REACTOR
[IMMEDIATE ACTIONS]

Purpose:

To ensure that the reactor is tripped.

ERG Basis:

EOP-LOPA-1 may be entered directly (without implementing EOP-TRIP-1) as a result of the operator observing the symptoms of a loss of all 4 KV vital buses. Therefore, the verification of reactor trip is included as an immediate action. Reactor trip must be verified to ensure that the only heat being added to the RCS following a loss of all 4 KV vital buses is from decay heat. The safeguards systems that protect the plant during major accidents are designed assuming that only decay heat (and RCP heat when appropriate) is being added to the RCS.

EOP Steps 3 and 4 of EOP-LOPA-1 are similar to EOP Steps 1 through 3 of EOP-TRIP-1 with an exception. A transition is not provided to procedure EOP-FRSM-1 if reactor trip is not confirmed since FRSM-1 assumes a 4 KV vital bus is available and that the operator can perform actions to trip the reactor or borate the RCS. Such actions are not appropriate following a loss of all 4 KV vital buses.

EOP Basis:

As indicated in the sidebox to this step, TRIP REACTOR means to do the following action sequence:

1. Operate the reactor trip switch(es).
2. IF NOT successful, THEN open the reactor trip breakers using the control console bezels.
3. IF NOT successful, THEN open 2E and 2G 460V bus supply breakers 2E6D AND 2G6D.

De-energizing the 2E and 2G 460V buses will de-energize the rod drive MG sets, but will also de-energize the pressurizer backup heaters since they share the 2E6D and 2G6D feeder breakers. Refer to Electrical Diagrams 203061, 203062, 203063, and 601395.

Supplemental Information:

None

EOP Step No: Step 3 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted the four bulleted reactor trip indications.

JUST. Intent of these indications is to determine if the ERG RNO action (trip reactor) should be performed. EOP performs the RNO action directly, so listing these indications is unnecessary. The operator is also trained to recognize indications of reactor trip. Refer to Generic Deviation - *Streamlining*. [SD-79]

EOP Step No: Step 4

ERG Step No: Step 2

EOP Step:

TRIP TURBINE
[IMMEDIATE ACTIONS]

Purpose:

To ensure that the turbine is tripped.

ERG Basis:

Procedure EOP-LOPA-1 may be entered directly (without implementing EOP-TRIP-1) as a result of the operator observing the symptoms of a loss of all 4 KV vital buses. Therefore, the verification of turbine trip is included as an immediate action. This is consistent with EOP-TRIP-1 which includes verification of turbine trip as the third step.

The turbine is tripped to prevent an uncontrolled cooldown of the RCS due to steam flow that the turbine would require.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Steps 5 and 6

ERG Step No: Step 3

EOP Step:

(Step 5) ARE BOTH PZR PORVs CLOSED
[PZR PORV CHECK]

(Step 6) CLOSE THE FOLLOWING:

- 2CV277 (LETDOWN CONTROL)
- 2CV2 (LETDOWN CONTROL)
- 2CV278 (EXCESS LETDOWN)
- 2CV131 (EXCESS LETDOWN)

[LETDOWN ISOLATION]

Purpose:

To ensure all RCS outflow paths are isolated.

ERG Basis:

A check for RCS isolation is performed to ensure that RCS inventory loss is minimized. The valves itemized are those in major RCS outflow lines that could contribute to rapid depletion of RCS inventory. This step is written for plants which utilize air-operated valves (AOVs) in the itemized locations. The step structure assumes that the AOVs fail closed on loss of all AC power (i.e., loss of air supply). The operator, therefore, checks that the valves are closed. If any valve is open, the operator should attempt to close the valve. Reasons for a valve remaining open are plant specific, for example the valves may have a legitimate or spurious open signals and air pressure could be available due to air receivers or air bottles located in the Air Supply System. Plants with air receivers may take up to 30 minutes to lose air pressure. If nitrogen bottles are provided for specific valves, such as PORVs, pneumatic pressure may be available for more than 30 minutes.

The sequence for checking valves is based on capacity of the outflow lines and potential for RCS inventory loss:

1) The PZR PORVs are checked first. Since 23 AFW Pump should be running, the secondary side is removing decay heat and RCS pressure should be under the PZR PORV setpoint.

2) The letdown line isolation valves adjacent to the RCS loop are checked second. These valves are normally open and receive a low PZR level isolation signal. If these valves, in conjunction with the letdown orifice isolation valves, remain open, a leak path to the PZR relief tank (PRT) via the letdown line relief valve may exist. These valves, including the letdown orifice isolation valves, if necessary, should be manually closed as soon as possible to isolate the letdown line and minimize RCS inventory loss prior to automatic isolation on low PZR level. Note that isolating the letdown line at the containment penetration will not isolate the letdown relief valve leak path to the PRT.

EOP Step No: Steps 5 and 6 (CONTINUED)

ERG Basis: (CONTINUED)

3) The excess letdown line isolation valves adjacent to the RCS loop are checked third. These valves are normally closed and do not receive a low PZR level isolation signal. If these valves are open a leak path to the PRT via the RCP seal return relief valve may exist. These valves should be closed to isolate the excess letdown line. Note that isolating the seal return line at the containment penetration will not isolate excess letdown inventory loss to the PRT via the seal return relief valve.

4) Any additional plant specific RCS outflow lines should be included.

Following completion of this step, the only RCS inventory leakage path should be the RCP controlled leakage seals. Plants which utilize motor-operated valves (MOVs) for letdown or excess letdown isolation will not be able to remotely close these valves to isolate these RCS outflow paths. These plants should isolate these lines at containment. The secondary depressurization in EOP Step 37 will minimize RCS inventory loss by reducing RCS pressure which will terminate or minimize relief valve flow. For example, reducing RCS pressure to 400 psig would permit the letdown line relief valve to close and would minimize flow through the excess letdown relief valve. An alternative which can be evaluated based on plant specific considerations is to dispatch personnel inside containment to manually close the subject isolation valves.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Need to minimize RCS inventory depletion during loss of all AC power event to maximize time to core uncovery.

Setpoints and Numerical Values:

Value	Number	Description
2335 psig	A.02	Pressurizer PORV pressure setpoint.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 7

ERG Step No: Step 4

EOP Step:

IS TOTAL AFW FLOW GREATER THAN 22E04 LB/HR
[ADEQUATE SECONDARY FEED VERIFICATION]

Purpose:

To ensure AFW flow to the SGs.

ERG Basis:

Following loss of all 4 KV vital buses, the steam supply valve to the 23 AFW pump should automatically open and the pump should start to supply AFW to the SGs. All AFW valves should be in or should fail to their proper emergency positions to support 23 AFW pump operation.

This step verifies proper response of the AFW System by verifying that AFW flow to the SGs is equal to the minimum safeguards AFW flow requirement for heat removal. This flow is sufficient to insure that an effective secondary heat sink can be maintained. If this flow is not verified, the operator is instructed to check the alignment of the 23 AFW pump steam supply valves and AFW valves in order to establish the required flow.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
22×10^4 lb/hr	S.02	The minimum safeguards AFW flow requirement for heat removal plus allowances for normal channel accuracy (typically one AFW pump capacity at SG design pressure).

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 8

ERG Step No: N/A

EOP Step:

ANNOUNCE TWICE ON STATION PA "UNIT 2 REACTOR TRIP," OR "UNIT 2 REACTOR TRIP, SAFETY INJECTION" AS APPROPRIATE

Purpose:

To inform station personnel that a reactor trip or a reactor trip and safety injection has occurred at Unit 2.

ERG Basis:

N/A

EOP Basis:

After completion of the immediate actions and actions to minimize RCS inventory loss and ensure adequate secondary heat sink, the operator should announce that a reactor trip or reactor trip and SI has occurred to alert station personnel to the plant status. This will also facilitate local support actions.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added step to announce reactor trip or reactor trip and safety injection as appropriate.

JUST. Added step to provide timely notification of a reactor trip or reactor trip and SI once the plant is placed in a safe condition per Operations policy. [SD-7]

EOP Step No: Step 9

ERG Step No: N/A

EOP Step:

IMPLEMENT THE "EVENT CLASSIFICATION GUIDE"

ERG Basis:

N/A

Purpose:

To initiate the Emergency Plan.

EOP Basis:

The Emergency Plan must be implemented following a reactor trip with or without SI. This step begins the process of identifying the event classification (i.e., Notification of Unusual Event, Alert, Site Area Emergency, General Emergency).

Continued surveillance and assessment of plant conditions is necessary to ensure that an emergency classification is appropriately revised as conditions change, or as more definitive information is obtained.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added step to implement the Event Classification Guide.

JUST. Incorporate EPIP requirements into the EOP per Operations philosophy. [SD-8]

EOP Step No: Steps 10, 11, and 12

ERG Step No: Step 6

EOP Step:

(Step 10) SEND OPERATOR TO DE-ENERGIZE ALL SECs
[VITAL POWER RESTORATION]

(Step 11) NOTE SECs SHOULD NOT BE ENERGIZED UNTIL DIRECTED
[VITAL POWER RESTORATION]

(Step 12) DEPRESS BEZEL STOP PUSHBUTTONS FOR ALL LOADS IN TABLE A
[VITAL POWER RESTORATION]

Purpose:

To defeat automatic loading of large loads on the AC emergency bus.

ERG Basis:

(ERG Step 6) If AC power cannot be restored from the control room, it is necessary to dispatch personnel to locally restore AC power. Local actions to restore AC power may result in AC power restoration by means of a temporary jury-rigged power supply. The longer the duration of the AC power outage, the more likely a plant condition may develop wherein automatic start of equipment upon AC power restoration may have detrimental affects on the restored vital bus, the automatically started equipment or other plant equipment, such as the RCP. Consequently, EOP Steps 10 and 12 instruct the operator to defeat automatic loading of all large loads prior to dispatching personnel to locally restore AC power. For the reference plant, automatic loading is defeated by placing the equipment switches in the pull to lock position.

Defeating automatic blackout or SI loading of as many large loads as practical is intended to avoid potential overload of the energized vital bus. This action permits the operator to evaluate the status of the restored vital bus and sequence loads onto the bus consistent with bus status and plant conditions. A SW pump is loaded on an energized vital bus in EOP Step 14 to provide diesel cooling should the diesel have started. Other small loads, such as the 480 volt buses, are also permitted to automatically load on the restored vital bus. These small loads will aid the operator in diagnosing plant status. Restricting automatic loading to this equipment limits the initial demand on the vital bus. Equipment that are permitted to automatic load are common to both EOP-LOPA-2 and EOP-LOPA-3 recovery and should not result in damage to any plant equipment if they automatically load upon AC power restoration.

Defeating automatic loading of the centrifugal charging pumps in these steps also functions to protect the RCP from damage when AC power is restored. This action prevents the automatic delivery of relatively cold seal injection flow into the RCP number 1 seal chamber and shaft area which has the potential for thermal shock and subsequent damage to the RCP seals and shaft.

EOP Step No: Steps 10, 11, and 12 (CONTINUED)

ERG Basis: (CONTINUED)

Defeating automatic loading of other major equipment in these steps also functions to protect the respective equipment. This permits the operator to verify valve alignments prior to starting pumps.

Another related consideration which should be evaluated on a plant specific basis is the potential ambient temperature in the pump areas. If there are any high energy lines in the vicinity of a pump, such as a steamline in the vicinity of the motor-driven AFW pumps, the potential exists that the ambient temperature increase during the AC power outage may exceed limitations for pump operation. If such a plant specific concern exists, the sequence for manually loading these components on the energized bus can be modified to establish ambient cooling prior to starting the pump.

Although ERG ECA-0.0 defeats automatic loading in ERG Step 6, its possible that some plants may have to defeat automatic loading in ERG Step 5 prior to attempting to load the vital bus on some other AC power supply. This may be necessary in order to override interlocks preventing the operator from closing breakers feeding the vital bus. This consideration should be included in the plant specific evaluation.

EOP Basis:

Same as ERG basis, with the following information:

De-energizing the SECs allows manual control of SEC-controlled equipment, such as the SW pumps and the DG output breaker. It also prevents automatic equipment start by breaker closure, which is equivalent to the pull-to-lock feature. This will defeat automatic blackout or SI loading to avoid potential overloading upon subsequent energizing of the 4 KV vital buses. Note, however, that 21 and 22 AFW Pumps also receive an automatic start on SG low level. This signal does not go through the SECs. Therefore, to place the AFW pumps in "pull-to-lock", their 125 vdc control power must be removed locally at the breaker cubicle.

COPING actions are performed at this time. While the operator is waiting for the SECs to be de-energized an operator is directed to perform COPING actions IAW S2.OP-AB.LOOP-0001(Q) Attachment 2 Part A. This will ensure that the actions will be completed within the required time. The operator is not expected to perform those actions in S2.OP-AB.LOOP-0001(Q) to restore AC power until directed at step 25. EOP LOPA-1 will attempt to restore AC power to the vital buses from the DGs.

Supplemental Information:

ERG Knowledge Item: Capacity of potential power sources.

Setpoints and Numerical Values:

None

EOP Step No: Steps 10, 11, and 12 (CONTINUED)

ERG Deviations:

DEV.1 Swapped sequence of ERG Steps 5 and 6 (deviates from Step Sequence Table).

JUST. Certain equipment (DG output breakers, SW pumps) must be manually controlled in EOP Step 14. Due to plant design differences, the SECs must be de-energized to allow manual control of this equipment. Therefore, actions associated with ERG Step 6 must be performed before those of ERG Step 5. This is permitted per the ERG basis for ERG Step 6.

DEV.2 Directed the operator to de-energize all SECs and strip loads on de-energized 4KV vital buses instead of placing equipment in pull-to-lock.

JUST. Plant design does not provide pull-to-lock capability. De-energizing the SECs allows the operator to manually control equipment associated with the SECs after the vital buses have been re-energized. De-energizing SECs and stripping loads also prevents equipment from automatically starting should a source of power become available. This provides the same function as pull-to-lock for all equipment listed in ERG Step 6 (except for 21 and 22 AFW Pumps).

DEV.3 Added a note addressing re-energizing of SECs.

JUST. Re-energizing the SECs will undo the "pull-to-lock" action called for by the ERG. This note directs the operator to leave the SECs de-energized until the ERG calls for the "pull-to-lock" function to be removed.

DEV.4 21 and 22 AFW Pumps were not placed in "pull-to-lock" at this time.

JUST. De-energizing the SECs will prevent automatic start of all listed ERG equipment due to undervoltage and SI. However, these AFW pumps also receive an automatic start on SG low level. This signal does not go through the SECs. Therefore, to place these AFW pumps in "pull-to-lock", their control power must be removed. It is possible that the operator may exit this EOP at Step 20 if a vital bus is re-energized. In that case, if the AFW pump control power was removed in this step, then there would be an unnecessary delay in restoring them to service since it would be necessary to reapply control power locally. Since all other large loads are de-energized in this step, delaying the disabling of AFW pump auto start capability until after EOP Step 20 (see EOP Step 24) will not result in a challenge to the DG loading capacity.

DEV.5 Added plant specific steps to perform COPING actions.

JUST. The COPING actions are required to be completed within 30 minutes. Adding this step at this location has no impact on the recovery actions of LOPA-1, as the operators are waiting for the SECs to be de-energized.

EOP Step No: Steps 13 thru 20

ERG Step No: Step 5, Caution 25-1

EOP Step:

(Step 13) CAUTION 4 KV VITAL BUS LOADING SHOULD NOT EXCEED POWER SUPPLY CAPACITY, AS FOLLOWS:
- GAS TURBINE - INSTALLED POWER TRIM CURVE
- DG - 2000-HR LIMIT - 2750 KW
- DG - 2-HR LIMIT - 2860 KW
- DG - HALF-HR LIMIT - 3100 KW

[VITAL POWER RESTORATION]

(Step 14) RESTORE POWER TO DE-ENERGIZED 4KV VITAL BUSES AS FOLLOWS:
- START DGs
- CLOSE DG OUTPUT BKRS

[VITAL POWER RESTORATION]

(Step 15) SEND OPERATORS TO START NON-OPERATING DGs AND TO MONITOR OPERATING DGs
[VITAL POWER RESTORATION]

(Step 16) IS ANY 4KV VITAL BUS ENERGIZED
[VITAL POWER RESTORATION]

(Step 17) IS SI ACTUATED

(Step 18) OPEN 2SJ1 AND 2SJ2 (RWST TO CHARGING PUMP VALVE)
[CHARGING PUMP SUCTION ALIGNMENT]

(Step 19) CLOSE TURBINE AREA SW STOP VALVES:
- 2SW26

OR
- 21SW20 AND 23SW20
  [TURBINE BLDG SERVICE WATER ISOLATION]

(Step 20) IS ANY 4KV VITAL BUS ENERGIZED

Purpose:

To restore emergency AC power from the control room.

To inform the operator that in loading the restored AC emergency bus, are should be exercised to not load the bus in excess of power capacity.

EOP Step No: Steps 13 thru 20 (CONTINUED)

ERG Basis:

(ERG Step 5) This step addresses AC power restoration from the control room. EOP Step 14 instructs the operator to direct initial efforts for AC power restoration to loading a vital bus on a DG. If the DG cannot be started normally from the control room, EOP Step 15 attempts to locally start the DG, i.e., start the diesel by bypassing the interlocks on normal diesel start. One method to accomplish this interlock bypass is to activate SI. Other plant specific methods to accomplish interlock bypass may be available. If the DG has started but has not automatically closed on the AC emergency bus, EOP Step 14 attempts to manually load the DG. If a running DG cannot be loaded, it is tripped per plant operating procedures to protect it from damage due to loss of DG support auxiliaries such as cooling water. The generic guideline assumes that the auxiliaries that normally support DG operation are not available following the loss of all AC power. The DG support systems should be reviewed on a plant specific basis to determine if AC power is required to support DG cooling.

If the vital bus cannot be loaded on the DG, EOP Step 16 instructs the operator to attempt to load the emergency bus on any other appropriate plant specific power supply.

If AC power is restored via EOP Steps 14 or 15, it has probably been restored via a stable power supply such as emergency starting and loading a DG. In this case, the power supply should be sufficiently stable to accept automatic sequencing of blackout or safeguards loads on the vital bus without detrimental effects.

EOP Step 20 checks if AC power is restored to at least one 4KV vital bus. If AC power is restored, then that step directs the operator to the procedure and step in effect. If power is not restored, then the procedure directs the operator to the next step for additional guidance to restore 4KV vital bus power.

(ERG Caution 25-1) The operator should be aware of the status of the energized vital bus so that equipment that is manually loaded on the bus does not exceed its capacity and cause failure of the bus. Bus voltage and frequency may be used as indication of a stable bus. The operator should also utilize any information received from the local personnel that restored AC power.

EOP Basis:

Same as ERG basis, with the following additional information:

EOP Step No: Steps 13 thru 20 (CONTINUED)

EOP Basis: (CONTINUED)

Due to plant design differences between the ERG reference plant and this plant in regard to safeguards electrical train arrangement (two emergency buses versus three 4KV vital buses), it is possible that one or two 4KV vital buses could be de-energized when exiting this procedure. This could result in undesirable equipment alignments that could jeopardize plant equipment. Therefore, if at least one 4KV vital bus has been restored, before exiting at this point, certain plant-specific details have been added to place the plant in an appropriate, stable alignment before exiting. When power is restored to any 4KV vital bus the operator starts a SW pump then closes associated turbine area stop valve to prevent SW pump runout. These include the following:

- Ensuring a SW pump is running for DG cooling purposes
- Ensuring safeguards equipment is running as necessary
- Ensuring a long term suction supply to the charging pumps (RWST)
- Starting two switchgear room supply fans and one switchgear room exhaust fan
- Isolating Turbine Building SW to prevent potential SW pump runout concerns
- Explicit direction to implement the FRPs now that the LOPA-series has been exited

Supplemental Information:

ERG Knowledge Item: Interlocks for DG protection.

Setpoints and Numerical Values:

Value	Setpoint	Description
Table	X.08	Maximum load that can be placed on the vital bus when the vital bus is powered by a DG.

ERG Deviations:

DEV.1 Deleted ERG RNO action to trip DGs without SW cooling.

JUST. This is covered by a CAS item, by operator training, and by the DG operating procedures.

DEV.2 Added plant-specific details.

JUST. Refer to EOP basis. This guidance aids operators in performing these actions in a consistent manner. [SD-12]

DEV.3 Duplicated ERG Caution 25-1 here (power source loading).

JUST. Since the EOP swapped the sequence of ERG Steps 5 and 6, this caution was added here to remind the operator of these limits prior to taking actions to energize vital buses from DGs per ERG Step 5.

EOP Step No: Step 21

ERG Step No: Caution 6-2

EOP Step:

HAS SI ACTUATED
[SI ACTUATION AND RESET]

Purpose:

To alert the operator to reset the SI signal so that ECCS equipment (i.e., pumps and valves) will not automatically actuate upon AC power restoration.

ERG Basis:

Resetting the SI signal is consistent with the loss of all AC power philosophy of defeating automatic loading of the 4KV vital bus. SI signal reset is also necessary to permit recovery as detailed in procedure EOP-LOPA-2 for as wide a range of RCS conditions as possible, i.e., those conditions wherein RCS pressure or secondary pressures are below their SI actuation setpoints but the recovery procedure selection criteria (RCS subcooling and PZR level) are above minimum values which permit recovery per EOP-LOPA-2. Since EOP-LOPA-2 attempts to recover nominal RCS conditions utilizing normal operational systems, automatic safeguards equipment actuation must be prevented if RCS or secondary pressures are reduced below the SI actuation setpoints.

SI signal reset is limited by the time delay on the reset logic. Should AC power be restored after SI signal initiation but prior to reset, the SI equipment will automatically load on the 4KV vital bus. This possibility is addressed in the recovery procedure selection criteria.

See also the ERG Basis for EOP Step 48.

EOP Step No: Step 21 (CONTINUED)

EOP Basis:

Same as ERG basis, with the following additional information:

Due to plant design differences, the SECs were previously de-energized to obtain a "pull-to-lock" effect. This will prevent safeguards pumps and fans from automatically starting on a subsequent SI, but will NOT prevent valve re-alignments. DW-92-043 raised some concerns about untimely SI actuations early in EOP-LOPA-2 (SI not required) and the lack of specific ERG guidance in this case. In particular, between ERG ECA-0.1 Steps 3 and 9, if an SI occurred and realigned the BIT valves with a charging pump running, an SI would technically be in service in an EOP that assumes it is not in service. EOP-LOPA-2 would be inappropriate if this untimely SI actuation were to occur. This is particularly applicable to this plant design since the SI signal on SG differential pressure is not blockable by normal means (unlike other SI signals). One of the recommended actions was to actuate and then reset the SI signal in EOP-LOPA-1, thereby preventing any automatic SI actuations from occurring in EOP-LOPA-2 before that EOP has completed its lineup and checked for a properly controlled transition to EOP-LOPA-3. The EOP has incorporated this recommended action for this purpose. Therefore, SI actuation is ensured at this point.

Supplemental Information:

ERG Knowledge Item: SI signal should be reset to permit manual loading of equipment on 4KV vital bus.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Caution 6-2 (SI reset to allow manual loading of equipment).

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, the ERG Caution was converted into an action step to actuate and then reset SI. [SD-20]
This is one of several recommended fixes to concerns raised in DW-92-043. Refer to EOP basis for more information.

EOP Step No: N/A

ERG Step No: Caution 6-3

EOP Step:

N/A

Purpose:

To alert the operator that a SW pump should be loaded on a vital bus when power is restored.

ERG Basis:

A SW pump is started to provide cooling to the DG should the DG start as a result of local operator actions. The reference plant requires SW for DG cooling.

EOP Basis:

N/A

Supplemental Information:

ERG Plant-Specific Information: Evaluate cooling provisions for diesel generator. Automatic start of service water pumps is not necessary if the diesel generator does not require service water cooling.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Caution 6-3 (keep SW pump available for auto start).

JUST. Plant design does not provide pull-to-lock capability. Earlier in this EOP, the operator de-energized the SECs and stripped loads to obtain a "pull-to-lock" effect. However, this also prevents auto start of the SW pumps. Therefore, continuous action Step 14.1 was added to explicitly direct starting an SW pump when available to meet the intent of the ERG caution. There is also a CAS item to trip DGs if all SW pumps are stopped.

EOP Step No: Step 22

ERG Step No: Step 19

EOP Step:

CAUTION 2CV284 (SEAL WATER TO VCT) IS IN CONTAINMENT AND IS CONSIDERED INACCESSIBLE
[SI ACTUATION AND RESET]

Purpose:

To isolate Phase A containment penetrations.

ERG Basis:

Containment Phase A Isolation is actuated concurrent with SI actuation. This step requires that the operator verify that Phase A is actuated and Phase A Isolation valves are in the closed position. Any valves that are not closed should be closed by manual or local operator action. Local action may be required on some plants to close any Phase A Isolation valves that are MOVs. Isolating containment at this time is consistent with the intent of the SI signal and functions to prepare the plant for mitigation of potential radioactivity release.

The containment Phase A Isolation signal is latched in and not reset by reset of SI. Separate reset is provided for the containment isolation Phase A signal.

EOP Basis:

Same as ERG basis, with the following additional information:
(Refer to validation comment VA-624.)

Valves that close on Phase A are all fail-closed, air-operated valves except for 2CV116 and 2CV284, which are motor-operated. Since 2CV284 is in Containment and may be inaccessible during adverse containment conditions, it has NOT been included in Table D. The caution in EOP Step 22 advises the operator that this valve is considered inaccessible (for adverse containment). 2CV116 is in series with 2CV284 and can be closed locally to isolate this line.

If any Phase A valves fail to close, the operator should attempt to close them from the control console since the 28VDC and 125VDC power supplies that operate these valves should be available.

Supplemental Information:

None

EOP Step No: Step 22 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Restructured step.

JUST. Added a caution regarding accessibility of 2CV284 since it can NOT be operated due to loss of AC power. For other changes, refer to Generic Deviation - *Streamlining*. [SD-79]

DEV.2 Relocated step contrary to Step Sequence Table allowable sequence.

JUST. EOP Steps 22 and 23 were relocated just prior to the "Reset SI" step to accommodate plant design differences. Prior to SI reset, Panel RP4 has status monitor lights that show at a glance that all Phase A and Containment Ventilation Isolation valves are closed (i.e., all lights lit). However, once SI is reset, all these status monitor lights go out. In that case, the operator would have to now verify all the individual valve position lights scattered among the control consoles, which would be labor intensive and time-consuming. To expedite movement through the EOP by avoiding this situation, these steps were relocated to do these checks before SI reset extinguishes the status monitor lights. Refer to validation comment VA-529.

EOP Step No: Step 23

ERG Step No: Step 20

EOP Step:

CLOSE CONTAINMENT VENT ISOLATION VALVES
[SI ACTUATION AND RESET]

Purpose:

To isolate containment ventilation penetrations.

ERG Basis:

Containment ventilation isolation is actuated concurrent with SI actuation. This step requires that the operator verify containment ventilation dampers are in the closed position. Any dampers that are not closed should be closed by manual or local operator action. Isolating containment at this time is consistent with the intent of the SI signal and functions to prepare the plant for mitigation of potential radioactivity release.

The containment ventilation isolation signal is latched in and not reset by reset of SI. Separate reset is provided for the containment ventilation isolation signal.

EOP Basis:

Same as ERG basis.

Supplemental Information:

21 and 22 CA330 are opened at this time to restore control air to containment. Control air pressure will be significantly higher than containment pressure thus containment isolation would still be met.

Setpoints and Numerical Values:

None

EOP Step No: Step 23 (CONTINUED)

ERG Deviations:

DEV.1 Restructured step.

JUST. Refer to Generic Deviation - *Streamlining*. [SD-79]

DEV.2 Relocated step contrary to Step Sequence Table allowable sequence.

JUST. EOP Steps 22 and 23 were relocated just prior to the "Reset SI" step to accommodate plant design differences. Prior to SI reset, Panel RP4 has status monitor lights that show at a glance that all Phase A and Containment Ventilation Isolation valves are closed (i.e., all lights lit). However, once SI is reset, all these status monitor lights go out. In that case, the operator would have to now verify all the individual valve position lights scattered among the control consoles, which would be labor intensive and time-consuming. To expedite movement through the EOP by avoiding this situation, these steps were relocated to do these checks before SI reset extinguishes the status monitor lights. Refer to validation comment VA-529.

DEV.2 Added actions to reset containment Phase A Isolation and open containment control air isolation valves.

JUST. This prepares instrument air to supply air-operated equipment in subsequent recovery actions when vital bus power is restored. Refer to DW-92-018 for more information about the ERG philosophy on resetting safeguards signals.

EOP Step No: Step 24

ERG Step No: Step 6

EOP Step:

SEND OPERATOR TO REMOVE 125VDC CONTROL POWER FROM 21 AND 22 AFW PUMPS

Purpose:

To defeat automatic starting of the 21 and 22 AFW Pumps.

ERG Basis:

Refer to ERG Basis for EOP Steps 10, 11, and 12.

EOP Basis:

Since plant design does not provide pull-to-lock capability, the SECs were de-energized earlier to obtain a "pull-to-lock" effect on major loads. This will defeat automatic blackout or SI loading to avoid potential overloading upon subsequent energizing of the 4KV vital buses. However, 21 and 22 AFW Pumps also receive an automatic start on SG low level. This signal does not go through the SECs. Therefore, to place the AFW pumps in "pull-to-lock", their 125 vdc control power must be removed locally at the breaker cubicle.

Supplemental Information:

None

Setpoints and Numerical Values:

None

EOP Step No: Step 24 (CONTINUED)

ERG Deviations:

DEV.1 Directed the operator to remove 125VDC control power from 21 and 22 AFW Pumps instead of placing them in pull-to-lock per the ERG.

JUST. Refer to EOP basis. [SD-60]

DEV.2 Placing MD AFW pumps (21 and 22 AFW Pumps) in "pull-to-lock" was delayed until this point in the EOP.

JUST. De-energizing the SECs will prevent automatic start of all listed ERG equipment due to undervoltage and SI. However, these AFW pumps also receive an automatic start on SG low level. This signal does not go through the SECs. Therefore, to place these AFW pumps in "pull-to-lock", their control power must be removed locally. It is possible that the operator may have exited this EOP at Step 20 if a vital bus was re-energized. In that case, if the AFW pump control power was removed in EOP Steps 10 thru 13, then there could be an unnecessary delay in restoring them to service since it would be necessary to re-apply control power locally. Since all other large loads are de-energized in this step, delaying the disabling of AFW pump auto start capability until after EOP Step 20 (i.e., this step) will not result in a challenge to the DG loading capacity.

EOP Step No: Step 25

ERG Step No: Step 7

EOP Step:

RESTORE OFFSITE POWER

Purpose:

To initiate local actions to restore AC power.

ERG Basis:

If the operator cannot restore AC power from the control room, it must be restored by local actions. This step instructs the operator to dispatch personnel to locally restore power using a plant-specific procedure for AC power restoration.

EOP Basis:

Procedure S2.OP-AB.LOOP-0001(Q) provides guidance and supplemental information for restoring 4KV vital bus power. It also includes Blackout Coping Actions and instructions for placing DGs in service, energizing the North 13 KV Bus Ring, and energizing the Group Buses.

Plant design includes a gas turbine (Unit No. 3). The gas turbine has the capability to provide power to the 13 KV ring bus during peak demands periods and also provides power to the units during a blackout. The above procedure will also attempt to use the gas turbine to energize the ring bus if necessary.

Supplemental Information:

ERG Knowledge Item: Potential AC power restoration sources.

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 26

ERG Step No: Caution 6-1

EOP Step:

WHEN AT LEAST ONE 4KV VITAL BUS IS ENERGIZED, THEN GO TO STEP 42

Purpose:

To alert the operator to go to EOP Step 42 as soon as AC power is restored.

ERG Basis:

Until AC power is restored, plant conditions will deteriorate due to RCP seal leakage. To minimize the deterioration of plant conditions, recovery actions should be started as soon as AC power is restored, starting with EOP Step 42. EOP-LOPA-1 is written such that EOP Step 42 can be entered from any step that follows this step. Procedures EOP-LOPA-1, EOP-LOPA-2, and EOP-LOPA-3 are written to establish the appropriate systems operation and alignments before transitioning the operator to other procedures.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Caution 6-1 (go to ERG Step 24 when power restored).

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, the ERG caution was converted into a continuous action step. [SD-20]

EOP Step No: Step 27

ERG Step No: Step 8

EOP Step:

DO NOT START ANY CHARGING PUMP UNTIL DIRECTED
[RCP SEAL COOLING ISOLATION]

Purpose:

To isolate the RCP seals.

ERG Basis:

This step groups three actions, with different purposes, aimed at isolating the RCP seals. The actions are grouped since all require an auxiliary operator, dispatched from the control room, to locally close containment isolation valves (the reference plant utilizes motor operated valves for the RCP seal return, RCP thermal barrier CCW return lines and RCP seal injection lines). This grouping assumes that the subject valves are located in the same penetration room area and that they are accessible. Concurrent with dispatching the auxiliary operator, the control room operator should place the valve switches for the motor operated valves in the closed position so that the valves remain closed when AC power is restored.

Isolating the seal return line prevents seal leakage from filling the volume control tank (VCT) (via seal return relief valve outside containment) and subsequent transfer to other Auxiliary Building holdup tanks (via VCT relief valve) with the potential for radioactive release within the Auxiliary Building. Such a release, without Auxiliary Building ventilation available, could limit personnel access for local operations.

Isolating the RCP seal injection lines prepares the plant for recovery while protecting the RCPs from seal and shaft damage that may occur when a centrifugal charging pump is started as part of the recovery. With the RCP seal injection lines isolated, a centrifugal charging pump can be started in the normal charging mode without concern for cold seal injection flow thermally shocking the RCPs. Seal injection can subsequently be established to the RCP consistent with appropriate procedures.

EOP Step No: Step 27 (CONTINUED)

ERG Basis: (CONTINUED)

Isolating the RCP thermal barrier CCW return outside containment isolation valve prepares the plant for recovery while protecting the CCW System from steam formation due to RCP thermal barrier heating. Following the loss of all AC power, hot reactor coolant will gradually replace the normally cool seal injection water in the RCP seal area. As the hot reactor coolant leaks up the shaft, the water in the thermal barrier will heat up and potentially form steam in the thermal barrier and in the CCW lines adjacent to the thermal barrier. Subsequent automatic start of the CCW pump would deliver CCW flow to the thermal barrier, flushing the steam into the CCW System. If abnormal RCP seal leakage had developed in a pump, the abnormally high leakage rate could exceed the cooling capacity of the CCW flow to that pump thermal barrier and tend to generate more steam in the RCP thermal barrier CCW return lines. Isolating theses lines prevents the potential introduction of this steam into the main portion of the CCW System upon CCW pump start. This keeps the main portion of the CCW System available for cooling equipment necessary for recovering the plant when AC power is restored.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: RCP seal integrity concerns following loss of AC power.

Setpoints and Numerical Values:

None

EOP Step No: Step 27 (CONTINUED)

ERG Basis: (CONTINUED)

ERG Deviations:

DEV.1 Added step to alert operator not to start a charging pump or a CCW pump until directed.

JUST. Local actions to isolate the RCP seals may take some time. If a charging pump or CCW pump becomes available before these actions are completed, it should not be started without checking RCP seal isolation status. Charging flow must not be established until RCP seal injection is isolated in order to preclude RCP seal damage by thermal shock. CCW flow must not be established to the RCP thermal barrier until the CCW thermal barrier isolation valve is closed to prevent flushing steam (formed in the thermal barrier through heating by leaking reactor coolant) into the CCW System.

DEV.2 Did not specify to place valve control switches in CLOSED position.

JUST. Due to control switch design (pushbuttons) and circuitry, it is not necessary to match the control switch position to the desired position to be maintained for motor-operated valves. The valves will not self-actuate upon restoration of power.

EOP Step No: N/A

ERG Step No: Step 9

EOP Step:

N/A

Purpose:

To ensure that AFST inventory is conserved for makeup to the SGs.

ERG Basis:

The operator should verify that a dedicated supply of AFW exists for delivery to the SGs. The source of AFW is normally the Auxiliary Feedwater Storage Tank (AFST). However, following loss of all AC power, the AFST may remain unisolated from the condenser hotwell, or other water source. This step isolates the AFST to preserve AFW inventory for continued SG heat removal.

EOP Basis:

N/A

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted the ERG step to check if AFST is isolated from the hotwell.

JUST. Plant design differs from the ERG reference plant in that the CST (hotwell makeup) is separate and distinct from the AFST (AFW supply). The AFST is reserved solely for AFW usage. Therefore, the concerns of this ERG step are not applicable to this plant design.

EOP Step No: Step 28

ERG Step No: Step 10

EOP Step:

INITIATE LOOP 21 THRU 24 MAIN STEAM ISOLATION

Purpose:

To ensure that the SG main steam, main feedwater and blowdown lines are isolated.

ERG Basis:

The SGs are checked to ensure optimal use of AFW for SG heat removal. This step is written for plants which utilize AOVs in the itemized locations, except for the main steamline isolation valves which are hydraulically operated. The step structure addresses the possibility that air pressure could be available due to air receivers or air bottles located in the Air Supply System. The main steamline bypass valves may or may not have received automatic closure signals whereas the main feedwater control and bypass valves and the blowdown isolation valves should have been closed due to the trip of all main feedwater pumps.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added an additional MFW isolation valve (BF13).

JUST. This provides additional isolation capability in case of BF19 or BF40 valve seat leakage.

EOP Step No: Steps 29 and 30

ERG Step No: Caution 11-1

EOP Step:

(Step 29) CAUTION A FAULTED OR RUPTURED SG SHOULD REMAIN ISOLATED
[FAULTED SG IDENTIFICATION]

(Step 30) IF 23 AFW PUMP IS THE ONLY SOURCE OF AFW, THEN MAINTAIN AT LEAST ONE MS45 OPEN
[FAULTED SG IDENTIFICATION]

Purpose:

To alert the operator that any SG that is identified as faulted or ruptured and is isolated should remain isolated throughout further recovery actions. The operator is also alerted to always maintain steam supply to the 23 AFW Pump from at least one SG.

ERG Basis:

Subsequent procedure steps address 1) isolating faulted or ruptured SGs and 2) controlling level and pressure in the intact SGs. This maximizes operator control of secondary pressure and minimizes radioactivity release to the environment.

Since the only source of makeup to the SGs is the 23 AFW Pump, steam supply must be maintained to the pump from at least one SG even if both SGs that supply steam are either ruptured or faulted.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Means to determine which SG should remain aligned to the 23 AFW Pump if both SGs are either faulted or ruptured.

Setpoints and Numerical Values:

None

EOP Step No: Steps 29 and 30 (CONTINUED)

ERG Deviations:

DEV.1 Split the ERG caution into a caution and a continuous action step.

JUST. Split the ERG caution into two parts because the EOP Writer's Guide requires that only one topic be addressed per caution symbol. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, the caution's "must be maintained" action was converted into an action step. [SD-20]

EOP Step No: Steps 31 and 32

ERG Step No: Step 11

EOP Step:

(Step 31) IS ANY SG PRESSURE DROPPING IN AN UNCONTROLLED MANNER
[FAULTED SG IDENTIFICATION]

(Step 32) CLOSE THE FOLLOWING VALVES FOR FAULTED SG:

- AF11 (SG INLET)
- AF21 (SG INLET)
- MS10 (RELIEF)

[FAULTED SG ISOLATION]

Purpose:

To detect and isolate a faulted SG.

ERG Basis:

EOP Step 31 checks for secondary integrity. If any SG is diagnosed to be faulted, it is isolated in EOP Step 32 so that it will not affect subsequent recovery operations to depressurize and stabilize the RCS at conditions consistent with minimizing RCS inventory loss. Isolation of the faulted SG is consistent with operator instructions in procedure EOP-LOSC-1, LOSS OF SECONDARY COOLANT, and addresses the possibility of a loss of secondary coolant concurrent with the loss of all AC power.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: "Uncontrolled" means not under the control of the operator, and incapable of being controlled by the operator using available equipment.

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 33

ERG Step No: Step 12

EOP Step:

IS ANY SG NR OR WR LEVEL RISING IN AN UNCONTROLLED MANNER
[STEAM GENERATOR TUBE RUPTURE EVALUATION]

Purpose:

To detect and isolate a ruptured SG.

ERG Basis:

If condenser air ejector or SG blowdown or steamline radiation is detected, the operator is instructed to attempt to identify and isolate a ruptured SG. Actual identification and isolation of a SG tube rupture may not be accomplished until EOP Step 34 when the operator attempts to control AFW flow to maintain SG level. Isolation of the ruptured SG is consistent with operator instructions in procedure EOP-SGTR-1, SG TUBE RUPTURE, and addresses the possibility of a SG tube rupture concurrent with the loss of all AC power. Secondary depressurization in EOP Step 37 will function to terminate radioactive steam release from the ruptured SG.

EOP Basis:

Same as ERG basis, with the following additional information:

RMS Channels R15, R19A-D, and R46A-E have a 2-minute backup power supply to accommodate bus transfers. Once this power is expended, the channel de-energizes and goes into alarm. As such, they are not valid indicators of a SGTR at this point. A level check has been used as a viable alternative. Refer to validation comment VA-406.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
1045 psig	O.03	Setpoint for SG steam dump to atmospheric controller which will prevent SG safety valve actuation (typically 25 psi below the lowest safety valve set pressure).

EOP Step No: Step 33 (CONTINUED)

ERG Deviations:

DEV.1 Omitted radiation checks and used a check for level rising uncontrolled instead.

JUST. Refer to EOP basis. [SD-60]

EOP Step No: N/A

ERG Step No: Caution 13-1

EOP Step:

N/A

Purpose:

To alert the operator that AFST level should be monitored and that an alternate water supply may be necessary.

ERG Basis:

If AFST level decreases below 10.3%, inadequate suction pressure may result in AFW pump trip. An alternate suction source should be provided.

EOP Basis:

N/A

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
10.3%	U.01	AFST low-low level switchover setpoint.

ERG Deviations:

DEV.1 Deleted ERG caution regarding alternate water sources for AFW pumps.

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, the ERG caution was deleted since it is already covered by a CAS item. [SD-20]

EOP Step No: Step 34

ERG Step No: Step 13

EOP Step:

MAINTAIN MAXIMUM AFW FLOW UNTIL AT LEAST ONE INTACT SG NR LEVEL IS GREATER THAN 9% (15% ADVERSE)
[SG LEVEL CONTROL]

Purpose:

To control intact SG levels and to detect and isolate a ruptured SG.

ERG Basis:

Intact SG levels are checked to verify adequate heat sink. Maximum AFW flow should be maintained until narrow range level is established in at least one SG. Maximum flow is maintained, in lieu of sufficient flow to remove decay heat, to restore narrow range level as soon as possible after reactor trip so that the secondary depressurization in EOP Step 37 (which requires narrow range level in at least one SG) can be performed as soon as possible. Once level is in the narrow range, AFW flow should be controlled to maintain narrow range level.

Control of AFW flow is plant specific and could include speed control of the 23 AFW pump or throttling of AFW valves as appropriate. The procedure assumes that control can be accomplished from the control room following loss of all AC power. However, AFW flow control is plant specific and may require local control on some plants.

If SG level in one SG continues to increase after AFW flow to the SG is isolated, a SG tube rupture may exist. The ruptured SG should be isolated to minimize release of radioactive steam. EOP Step 34.1 is intended to diagnose a large tube rupture and not a small leak. A small leak will be difficult to detect since it will be masked by AFW flow and since ECCS pump flow will not be available to maintain the RCS to secondary leakage.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: "Level increase in an uncontrolled manner" means that the operator cannot control level using available equipment, i.e., level continues to rise even when all feed flow valves to that SG are fully closed.

EOP Step No: Step 34 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
9%	M.02	Value showing S/G level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
15%	M.03	Value showing S/G level just in the narrow range including allowance for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.
33%	M.09	Normal SG narrow range level representing the upper control band limit.

ERG Deviations:

DEV.1 Restructured step.

JUST. Refer to Generic Deviations - *Streamlining.*

EOP Step No: Steps 35 and 36

ERG Step No: Step 14

EOP Step:

(Step 35) SHED NON-ESSENTIAL DC LOADS

(Step 36) MONITOR DC BUS VOLTAGES

Purpose:

To conserve DC power supply by shedding non-essential DC loads from the DC buses as soon as practical.

ERG Basis:

Following loss of all AC power, the station batteries are the only source of electrical power. The station batteries supply the DC buses and the AC vital instrument buses. Since AC emergency power is not available to charge the station batteries, battery power supply must be conserved to permit monitoring and control of the plant until AC power can be restored.

A plant specific procedure should be prepared to prioritize the shedding of DC loads in order to conserve and prolong the station battery power supply. The plant specific evaluation should consider shedding of equipment loads from the DC buses and of instrumentation from the AC vital buses. The intent of load shedding is to remove all large non-essential loads as soon as practical, consistent with preventing damage to plant equipment. Consideration should be given to the priority of shedding additional loads in case AC power cannot be restored within the projected life of the station batteries. Consideration should also be given to securing a portable diesel powered battery charger to ensure DC power availability.

Since the remaining battery life cannot be monitored from the control room, this step requires personnel to be dispatched to locally monitor the DC power supply. This is intended to provide the operator information on remaining battery life and the need to shed additional DC loads. The plant specific procedure should be structured to ensure communications with the control room operator to ensure his knowledge of DC power status.

EOP Basis:

Same as ERG basis, with the following additional information:

Plant design provides the capability to monitor DC bus voltages in the control room, so dispatching personnel to do so locally is unnecessary.

Supplemental Information:

None

EOP Step No: Steps 35 and 36 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Step 14.b (dispatch personnel to monitor DC power supplies locally).

JUST. Refer to EOP basis. [SD-60]

EOP Step No: N/A

ERG Step No: Step 15

EOP Step:

N/A

Purpose:

To ensure an adequate supply of water for AFW System operation.

ERG Basis:

The AFST level is checked to ensure an adequate long term AFW supply. If AFST level is low, the 23 AFW pump suction should be transferred to the appropriate plant specific long term water source. The transfer operation may require local actions following loss of AC power. This long term source should be independent of AC power.

EOP Basis:

N/A

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG step to check CST level (AFST at this plant).

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, the ERG caution was deleted since it is already covered by a CAS item. [SD-20]

EOP Step No: Steps 37 and 38

ERG Step No: Cautions 16-1 and 16-2
Notes 16-1 and 16-2
Steps 16 and 17

EOP Step:

IS AT LEAST ONE INTACT SG LEVEL GREATER THAN 9% (15% ADVERSE)
[INTACT SG DEPRESSURIZATION TO 235 PSIG]

ARE MS10s (RELIEF VALVES) OPERABLE FROM THE CONTROL ROOM

Purpose:

To alert the operator that SG pressures must be maintained above the specified limit.

To inform the operator of the importance of maintaining at least one intact SG narrow range level above the top of the U-tubes during depressurization.

To inform the operator of the desired rate for depressurization of SGs.

To inform the operator of possible reactor vessel upper head voiding during SG depressurization.

To depressurize the intact SGs.

To ensure that the reactor does not return to a critical condition during SG depressurization.

ERG Basis:

(ERG Caution 16-1) SGs should be depressurized to maximize delivery (into the RCS) of the water contained in the SI accumulators while minimizing delivery of nitrogen. Maintaining SG pressures above a value that prevents introduction of a significant volume of nitrogen into the RCS ensures that accumulator nitrogen will not impede natural circulation.

The SG pressure limit is set to preclude significant nitrogen injection into the RCS. To determine the SG pressure limit, an ideal gas expansion calculation should be performed based on nominal plant specific values for initial accumulator tank pressure (P_1), initial nitrogen gas volume (V_1), and final nitrogen gas volume (V_2). The final nitrogen gas volume should be equivalent to the total accumulator tank volume.

EOP Step No: Steps 37 and 38 (CONTINUED)

ERG Basis: (CONTINUED)

The RCS pressure at empty tank conditions (P_2) is determined from:

$$P_1V_1^\gamma = P_2V_2^\gamma$$

where γ = 1.25 for ideal gas expansion. The SG pressure limit is then determined by subtracting the RCS to SG ΔP from P_2. The RCS to SG ΔP should be calculated as described in the RCP TRIP/RESTART section in the Generic Issues of the Executive Volume. Instrument uncertainties are not included in the determination of the SG pressure limit to preclude a bias toward either having more accumulator water injected into the RCS of having less nitrogen injected into the RCS.

(ERG Caution 16-2) During the rapid depressurization performed in this step, SG level could drop out of the narrow range resulting in a loss of adequate heat sink. If this situation occurs, the depressurization should be stopped and AFW flow reestablished until SG narrow range level is increased to greater than 9% [15% FOR ADVERSE CONTAINMENT].

The analysis basis for EOP-LOPA-1 requires that the level in at least one intact SG (SG) be above the top of the SG U-tubes to ensure that sufficient heat transfer capability exists to remove heat from the RCS via either natural circulation or reflux boiling after the RCS saturates. This is accomplished in the procedure by EOP Step 34 (which requires maximum AFW flow be maintained to the intact SGs until level in at least one intact SG is in the narrow range) and this step (which requires that level in at least one intact SG be maintained in the narrow range during SG depressurization). Once these conditions are met, this step directs the operator to dump steam (depressurize the intact SGs) at a maximum rate to reduce RCS temperature and pressure (which in turn will reduce the rate of RCS inventory loss through the RCP seals). This step is structured to provide flexibility in how and at what speed the intact SGs are depressurized. As discussed in the ERG Basis section for ERG Step 16, maximum rate means in a controlled manner subject to plant specific constraints. Depending on plant specific design considerations, the depressurization may be performed using one, more than one, or all intact SGs. This flexibility is intended to permit utilities to structure their EOP step (and train their operators) in the way that best suits their plant design. (DW-91-006)

As discussed in the ERG Basis section for ERG Step 16, the ERG reference plant has air operated atmospheric relief valves (one per steamline) which have DC control power and pneumatic power (i.e., either air reservoirs or nitrogen bottles) available following the loss of all AC power. For a plant like the reference plant that has the ability to control these valves on all intact SGs from the control room, the preferred method to depressurize the intact SGs is to uniformly release steam from all intact SGs at a controlled rate that will not cause the level in the SGs to drop out of the narrow range. (DW-91-006)

EOP Step No: Steps 37 and 38 (CONTINUED)

ERG Basis: (CONTINUED)

The ERG Basis section for ERG Step 16 also notes that some plants may not have the ability to open and control the SG relief valves from the control room and may have to rely on local manual actions to depressurize the intact SGs. Also, some plants (including the ERG reference plant) have only one SG relief valve per steamline. To accommodate local operator actions or the inability to open or control the relief valve on each intact SG steamline, the loss of AC power analysis basis and the structure of this step permits SG depressurization using one, more than one, or all intact SGs. For example, it is acceptable to keep one intact SG isolated (with level in the narrow range) while depressurizing the other (i.e., one or more than one) intact SGs. Depending on plant specific considerations, (e.g., local actions needed to open and control the intact SG relief valves), depressurization in this manner may avoid the potential to lose level in all intact SGs which would require the depressurization to be stopped until level could be restored in at least one intact SG. Starting and stopping the depressurization in this manner may complicate local manual actions and potentially hinder the overall depressurization. If the depressurization is performed with one intact SG isolated, the isolated intact SG should eventually be unisolated and depressurized once the concern for losing level in all intact SGs no longer exists. (DW-91-006)

(ERG Note 16-1) The intact SGs should be depressurized as quickly as possible, to minimize RCS inventory loss, but within the constraint of controllability. Controllability is required to ensure that SG pressures do not undershoot the specified limit.

For the reference plant, the operator can control the secondary depressurization from the control room. In this case, maximum rate means SG relief valves full open. For plants that must control the secondary depressurization by local actions, maximum rate must be determined by the control room and local operators based on plant conditions and available communications. A slower rate is acceptable for locally controlled secondary depressurization. See Subsection 2.3 of the background document for ERG ECA-0.0.

(ERG Note 16-2) Loss of PZR level and reactor vessel upper head voiding may result from the rapid depressurization of the intact SGs. Such a condition is anticipated and should not interfere with operator actions in this step to depressurize the SGs to reduce RCS pressure and temperature and to minimize RCS inventory loss out of the RCP seals.

EOP Step No: Steps 37 and 38 (CONTINUED)

ERG Basis: (CONTINUED)

(ERG Step 16) This step depressurizes the intact SGs, thereby reducing RCS temperature and pressure to reduce RCP seal leakage and minimize RCS inventory loss. The advantages to performing this action, as well as restrictions that apply during the action, are detailed in Subsection 2.3 of the background document for ERG ECA-0.0.

During SG depressurization, SG level must be maintained above the top of the SG U-tubes in at least one SG. Maintaining the U-tubes covered in at least one SG will ensure that sufficient heat transfer capability exists to remove heat from the RCS via either natural circulation or reflux boiling after the RCS saturates. This step requires that SG level be in the narrow range in at least one SG before SG depressurization is initiated. If level is not in the narrow range in at least one SG, this step instructs the operator to maintain maximum AFW flow until narrow range level is established in one SG. When narrow range level is established, SG depressurization can be started or continued.

This step instructs the operator to reduce SG pressures by depressurizing the intact SGs. Depressurization should be accomplished by opening the MS10s on the intact SGs to establish a maximum steam dump rate, consistent with plant specific constraints. The step is structured assuming that the operator can open and control SG atmospheric relief valves from the control room. This structure assumes that the atmospheric relief valves are air-operated and have DC control power and pneumatic power (i.e., either air reservoirs or nitrogen bottles) available. Some plants may not have the capability to open the SG relief valves from the control room. These plants should evaluate their capability to accomplish this step locally via handwheels. Such an evaluation should consider accessibility and communications necessary to accomplish local SG relief valve operation.

Once depressurization is initiated, maintenance of a specified rate is not critical. The depressurization rate should be sufficiently fast to expeditiously reduce SG pressures, but not so fast that SG pressures cannot be controlled. It is important that the depressurization not reduce SG pressures in an uncontrolled manner that undershoots the pressure limit, thus permitting potential introduction of nitrogen from the accumulators into the RCS.

During SG depressurization, AFW flow may have to be increased to maintain the required SG narrow range level. Control of AFW flow will have to be performed from the control room or locally depending on plant specific design. Full AFW flow should be established to any SG in which level drops out of the narrow range.

EOP Step No: Steps 37 and 38 (CONTINUED)

ERG Basis: (CONTINUED)

RCS cold leg temperatures should be monitored during SG depressurization to ensure that the depressurization does not impose a challenge to the Thermal Shock Critical Safety Function. This check is included in this step since procedure EOP-LOPA-1 has priority over the Function Restoration Procedures and the operator is instructed to not implement a Function Restoration Procedure even if a Critical Safety Function challenge is detected by the Critical Safety Function Status Trees. Consequently, this step implicitly protects the Thermal Shock Critical Safety Function. The SG depressurization should not result in a challenge to the Thermal Shock Critical Safety Function since the resultant RCS cold leg temperatures should not approach the temperature limit (i.e., T2 temperature) at which a challenge will exist.

Once the target SG pressure is reached, the MS10s and AFW flow should be controlled to maintain SG pressure at the target value until AC power is restored.

The target SG pressure for this step should ensure that RCS pressure is above the minimum pressure to preclude injection of accumulator nitrogen into the RCS. The target SG pressure should be based on the nominal SG pressure to preclude nitrogen addition, plus margin for controllability (e.g., 100 psi). To determine the SG pressure limit, an ideal gas expansion calculation should be performed based on nominal plant specific values for initial accumulator tank pressure (P_1), initial nitrogen gas volume (V_1), and final nitrogen gas volume (V_2). The final nitrogen gas volume should be equivalent to the total accumulator tank volume.

The RCS pressure at empty tank conditions (P_2) is determined from:

$$P_1 V_1^{\gamma} = P_2 V_2^{\gamma}$$

where $\gamma = 1.25$ for ideal gas expansion. The SG pressure limit is then determined by subtracting the RCS to SG ΔP from P_2 and adding the margin to controllability. The RCS to SG ΔP should be calculated as described in the RCP TRIP/RESTART section in the Generic Issues of the Executive Volume. Instrument uncertainties are not included in the determination of the SG pressure limit to preclude a bias toward either having more accumulator water injected into the RCS of having less nitrogen injected into the RCS.

In addition to the accumulator nitrogen limitation on SG depressurization, Subsection 2.3 of the background document for ERG ECA-0.0 also discusses the core criticality concern that exists when the RCS is cooled down. This concern was evaluated for the reference plant for various fuel burnups, assuming equilibrium xenon, all rods inserted and no addition of borated water (which will occur when RCS pressure is decreased below approximately 650 psig). The evaluation showed that only at the end of core life did the criticality concern (418°F for the reference plant) become more limiting than the accumulator nitrogen concern (410°F saturation for the reference plant). For the assumed conditions, the accumulator nitrogen concern dominated the criticality concern. Consequently, this step is structured to explicitly address the accumulator nitrogen concern. For the majority of circumstances, this will cover the criticality concern. EOP Step 37.6 explicitly addresses the criticality concern by terminating the SG depressurization if core shutdown is lost.

EOP Step No: Steps 37 and 38 (CONTINUED)

ERG Basis: (CONTINUED)

(ERG Step 17) EOP Step 37.6 checks for a zero or negative startup rate on the intermediate and source range channels. If a positive startup rate is detected, the secondary depressurization is terminated and RCS temperature is allowed to increase to shut down the reactor. This step addresses the core criticality concern associated with SG depressurization. See also Subsection 2.3 and Step Description Table in the background document for ERG ECA-0.0, Step 16.

EOP Basis:

Same as ERG basis , with the following additional information:

It is NOT intended to try to maximize AFW flow by exceeding the maximum speed demand on 23 AFW Pump. Causing the AFW pump to trip on overspeed would be self-defeating since AFW flow would then be reduced, maybe to zero if it is the only feed source. Refer to validation comment VA-410.

The MS10 controllers contain Lunkenheimer valves, which can swap between CA-A and CA-B headers to supply air to their associated valves. Therefore, for a loss of an air header due to failure of one unit's emergency air compressor, the other air header (which is supplied from the opposite unit's emergency air compressor) should provide sufficient air pressure to operate these valves. Refer to validation comment VA-625.

Supplemental Information:

ERG Knowledge Items:

- PTS concerns
- RCP seal integrity concerns
- Relationship of RCP seal leakage to RCS pressure
- Basis for SG pressure limit on SG depressurization
- Basis for maintaining SG level above U-tubes.
- SG depressurization should proceed as quickly as possible and should not be limited by the Technical Specification RCS cooldown limit of 100°F/hr.

DW-91-006: Although the preferred method to perform the depressurization in this step is to use all intact SGs, it is acceptable to leave one intact SG isolated and to use the remaining intact SGs for the depressurization.

EOP Step No: Steps 37 and 38 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
310°F	I.02	RCS cold leg temperature corresponding to temperature T2, including allowances for normal channel accuracy. Refer to background document for status tree F-04, INTEGRITY.
9%	M.02	Value showing S/G level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
15%	M.03	Value showing S/G level just in the narrow range including allowance for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.
135 psig	O.07	Minimum S/G pressure to preclude injection of accumulator nitrogen into the RCS.
235 psig	O.08	Minimum S/G pressure to preclude injection of accumulator nitrogen into the RCS plus a margin for controllability.

ERG Deviations:

DEV.1 Deleted ERG Caution 16-2.

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, the ERG caution was converted into an action step and a continuous action step. [SD-20]

EOP Step No: N/A

ERG Step No: Note 18-1

EOP Step:

N/A

Purpose:

To inform the operator why SI is reset.

ERG Basis:

The SI signal is reset to permit manual loading of equipment on the AC emergency bus following AC power restoration. This provides bus overload protection in case power is restored from a low capacity power source. If the operator is not informed why SI is reset, the operator may hesitate or fail to reset SI.

EOP Basis:

N/A

Supplemental Information:

ERG Knowledge Item: SI signal is reset to permit manual loading of equipment on AC emergency bus.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG note (reset SI when actuated during SG depressurization).

JUST. EOP Step 21 ensured that SI was actuated and reset at that point. Therefore, since this note's concern has already been addressed, the note was deleted.

EOP Step No: N/A

ERG Step No: Step 18

EOP Step:

N/A

Purpose:

To check if an SI signal exists.

ERG Basis:

The secondary depressurization initiated in EOP Step 38 will result in SI actuation, if not already actuated, on low PZR pressure or low steamline pressure. The operator should check SI actuation status and reset SI as soon as the reset delay time has expired. This reset action is consistent with the guideline philosophy of defeating automatic loading of the emergency bus upon AC power restoration. Resetting SI will open the individual output relays from the solid state protection cabinets, thus permitting the operator to manually load SI equipment as instructed in the recovery procedures.

If SI has not been actuated, the operator is directed to ERG Step 22, skipping the steps that check containment isolation. If SI has been actuated, the operator is directed to the steps that verify containment isolation Phase A and check for containment isolation Phase B. This step structure is consistent with plant design features in that an SI signal precedes the need for containment isolation.

EOP Basis:

N/A

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted the ERG step to check SI signal status.

JUST. EOP Step 21 ensured that SI was actuated and reset at that point. Therefore, ERG Step 18 has been deleted and ERG Steps 19, 20, and 21 are performed unconditionally.

EOP Step No: Step 39

ERG Step No: Step 21

EOP Step:

HAS CONTAINMENT PRESSURE EXCEEDED 15 PSIG
[CONTAINMENT PRESSURE CHECK]

Purpose:

To check if Phase B containment penetrations should be isolated.

ERG Basis:

Phase B Isolation is actuated on High-High containment pressure. EOP Step 39 requires that the operator check if Phase B Isolation is required. If required the operator verifies that the actuation signal (i.e., containment spray signal) is actuated and the Phase B valves are closed. Any valves that are not closed should be closed by manual or local operator action. Isolating containment at this time is consistent with the intent of the High-High containment pressure signal and functions to prepare the plant for mitigation of potential radioactivity release.

Phase B valves may be closed as part of ERG Step 19 or 20 if this is desirable on a plant specific application. Since the RCPs are not running and the Phase B penetration piping is not pressurized, there is no technical reason for not isolating Phase B valves with Phase A valves. Phase B valve closure is separate from Phase A valve closure to permit plants to stagger the local actions necessary to close containment isolation valves, thereby spreading the work load on local operators.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Containment spray signal is reset to prevent automatic loading of containment spray pumps on AC emergency bus following AC power restoration.

Setpoints and Numerical Values:

Value	Setpoint	Description
15 psig	T.02	Containment pressure setpoint for spray actuation.

EOP Step No: Step 39 (CONTINUED)

ERG Deviations:

DEV.1 Added a list (Table F) of Phase B Isolation valves.

JUST. This guidance aids operators in performing step actions in a consistent manner. [SD-72]

EOP Step No: Step 40

ERG Step No: Step 20

EOP Step:

ARE 5 OR MORE CETs GREATER THAN 1200°F
[SAMG TRANSITION]

Purpose:

To determine if severe conditions exist that require a transition to the SAMGs

ERG Basis:

The Severe Accident Management Guidelines (SAMGs) are entered from the ERGs by the control room operators when core damage occurs. The ERG to SAMG transition uses, as part of the transition criteria, a core exit thermocouple temperature indication of greater than 1200°F to indicate the need to transition from the ERGs to the SAMGs. The 1200°F criteria for transition from the ERGs to the SAMGs is identical to the 1200°F criteria on the Core Cooling Critical Safety Function Status Tree.

If the operator enters this step and core exit TC temperatures are greater than 1200°F and increasing, the operator should transition to the SAMGs. This condition indicates that all attempts to restore core cooling have failed, core damage can not be prevented, and the operator should go to the SAMGs.

If the operator enters this step and core exit TC temperatures are less than 1200°F or core exit TC temperatures are greater than 1200°F and decreasing, the operator will stay in the loop between steps 29 and 41 in guideline EOP-LOPA-1 performing steps, as appropriate, until AC power is restored.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
1200°F	G.04	Core exit temperature indicative of superheat conditions.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 41

ERG Step No: Step 23

EOP Step:

CHECK STATUS OF LOCAL ACTIONS:
- AC POWER RESTORATION
- RCP SEAL AND THERMAL BARRIER ISOLATION
- DC POWER SUPPLIES

[POWER RESTORATION STATUS CHECKS]

Purpose:

To determine if plant recovery can be initiated and to monitor the status of Plant Auxiliary Systems.

ERG Basis:

Having performed EOP Step 38 (secondary depressurization to maximize the time to core uncovery) and EOP Steps 22, 23, and 39 (containment isolation to mitigate the consequences of core uncovery), the operator can do no more to prevent core damage and recover the plant until AC power is restored. EOP Step 41 functions as the transition between maintaining the plant without AC power and plant recovery with AC power. If the operator determines that AC power is restored to one 4 KV vital bus, the operator should proceed to EOP Step 42 to start recovering the plant.

If it is determined that AC power is not restored, EOP Step 41 directs the operator to control RCS pressure and temperature conditions and monitor plant status in preparation for eventual plant recovery. Status monitoring should be addressed and augmented on a plant specific basis, but should include the following considerations:

1) The operator should check the status of local actions being performed by personnel dispatched from the control room. The three major categories of local actions include the status of the following:

   a. AC power restoration
   b. RCP seal isolation
   c. DC power supply

   This information is necessary to permit efficient plant recovery following AC power restoration.

2) Plant auxiliary boration systems should be monitored to ensure that tanks and piping systems that contain high weight percent boric acid solutions remain at temperatures above their solubility limits. This will ensure that these sources of boron and the associated piping paths remain available for eventual plant recovery.

EOP Step No: Step 41 (CONTINUED)

ERG Basis: (CONTINUED)

Generally, the concern of boric acid precipitation exists where boric acid solutions exceed approximately 4 weight percent (7000 ppm boron). These solutions are generally contained in electrically or steam heated tanks and heat traced piping systems that maintain fluid temperatures above ambient room temperatures. For the reference plant, this concern is restricted to the boric injection tank (BIT) and associated subsystem, which contains 12 weight percent (21000 ppm boron) boric acid. For some plants, this concern may also include the boric acid tank (BAT) and associated subsystem, which contains 4 weight percent (7000 ppm boron) boric acid.

Plants should evaluate available means to prevent boric acid precipitation should fluid temperatures approach the solubility limits for the contained fluids. These means may include consideration of (1) draining the tank as necessary to permit dilution of the contained fluid or (2) diluting the contained fluid through the addition of water. In performing this evaluation, the objective should be to ensure that boration sources and boration flow paths remain available for eventual plant recovery.

3) Spent fuel cooling should be monitored to ensure that adequate level remains in the spent fuel pit. Following the loss of all AC power the Spent Fuel Cooling System will be inoperative and the spent fuel pit water temperature will start to increase. Heat removal will occur primarily through evaporation of the water in the spent fuel pit.

The rate of temperature increase and the rate of evaporation will depend upon the spent fuel pit water volume and the spent fuel pit heat load. The water temperature will continue to increase until the surface temperature reaches 212°F and boiling occurs. Boiling will continue to dissipate heat while depleting spent fuel pit water inventory. A means should be identified for the operator to initiate makeup to the spent fuel pit to ensure that adequate water inventory remains for continued heat removal. Each plant should evaluate the available sources of makeup and the time (i.e., spent fuel pit level) that makeup should be initiated to the spent fuel pit. A related consideration that should be reviewed is the maximum design temperature of the spent fuel pit structure.

Since local actions may be required to initiate spent fuel pit makeup, it is likely that Spent Fuel Building accessibility may establish the limit for spent fuel pit level. The evaluation of Spent Fuel Building accessibility should consider temperature, humidity and radiation shielding (height of water above the top of fuel), with radiation shielding likely being the determining consideration.

Spent fuel heat removal and criticality should not be limiting concerns during a loss of all AC power since the minimum inventory required for personnel shielding will ensure sufficient inventory for heat removal and the evaporative heat removal mechanism does not deplete the boron content in the spent fuel pit.

EOP Step No: Step 41 (CONTINUED)

ERG Basis: (CONTINUED)

4) In conjunction with monitoring plant status and maintaining plant systems available for eventual recovery, the operator should return to EOP Step 29. The operator will stay in the loop between EOP Steps 29 and 41, performing steps as appropriate, until AC power is restored. This allows for isolation of a faulted SG and monitors plant status through continuous action steps. Also, continual control of SG pressure controls RCS pressure and temperature, minimizing RCS inventory loss.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Items:

- Relationship of temperature to boron concentration and boron precipitation.
- Means to address potential boron precipitation concern.
- Relationship of spent fuel pit level to spent fuel cooling.
- Means to address potential loss of spent fuel cooling.

Setpoints and Numerical Values:

Value	Setpoint	Description
63°F	X.03	Minimum temperature to prevent solidification of boric acid solution in the Boric Acid Storage Tank.
SFP LVL LO alarm clear	U.04	Spent fuel pit level in plant specific units for start of makeup. Refer to background document for guideline ECA-0.0, Loss of All AC Power.

<u>EOP Step No:</u> Step 41 (CONTINUED)

<u>ERG Deviations:</u>

DEV.1 Deleted ERG action to check BIT temperature.

JUST. The BIT has been retired in place. It is essentially a large diameter pipe in the ECCS containing borated water with a boric acid concentration no higher than that of the RWST. Because of the lower concentration, boric acid precipitation is not a concern in the BIT.

DEV.2 Used the low level alarm to determine if Spent Fuel Pool level is adequate instead of a spent fuel pit level per ERG footnote (14).

JUST. ERG step intent is to ensure that the Spent Fuel Pool has adequate water inventory for continued heat removal. Use of the low level alarm is consistent with this intent.

DEV.3 Deleted ERG Step 23.a.AER (check at least one AC emergency bus energized).

JUST. This step returns to EOP Step 29 per ERG Step 23.a.RNO. The only way to reach EOP Step 42 is via the continuous action transition in EOP Step 26. This change was done per validation comment VA-605.

EOP Step No: Step 42

ERG Step No: Step 24

EOP Step:

CONTROL INTACT SG MS10s (RELIEF VALVES) TO STABILIZE SG PRESSURE

Purpose:

To stabilize SG pressures.

ERG Basis:

Following restoration of power to one 4KV vital bus, the operator should stabilize plant conditions while selecting the appropriate recovery procedure. If a SG depressurization is in progress when AC power is restored, this step directs the operator to stabilize SG pressures at the values existing when AC power is restored.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Did not specify manual vs. local control of the SG relief valves.

JUST. This step allows the operator to control the SG relief valves using either control room or local actions, whichever is necessary. This is consistent with the intent of the ERG.

DEV.2 Specified the use of intact SG relief valves.

JUST. Per EOP Step 29, faulted or ruptured SGs that are isolated should remain isolated. Therefore, specifying intact SGs reinforces this requirement.

EOP Step No: Step 43

ERG Step No: Caution 25-1

EOP Step:

CAUTION 4KV VITAL BUS LOADING SHOULD NOT EXCEED POWER SUPPLY CAPACITY, AS FOLLOWS:

- GAS TURBINE - INSTALLED POWER TRIM CURVE
- DG - 2000-HR LIMIT - 2750 KW
- DG - 2-HR LIMIT - 2860 KW
- DG - HALF-HR LIMIT - 3100 KW

[AC LOAD RESTORATION]

Purpose:

To inform the operator that in loading the restored AC emergency bus, care should be exercised to not load the bus in excess of power capacity.

ERG Basis:

The operator should be aware of the status of the energized 4KV vital bus so that equipment that is manually loaded on the bus does not exceed its capacity and cause failure of the bus. Bus voltage and frequency may be used as indication of a stable bus. The operator should also utilize any information received from the local personnel that restored AC power.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Capacity of potential power sources.

Setpoints and Numerical Values:

Value	Setpoint	Description
Table	X.08	Maximum load that can be placed on the vital bus when the vital bus is powered by a diesel generator.

ERG Deviations:

DEV.1 Added plant-specific load capacities for the DGs and the gas turbine.

JUST. This guidance aids operators in performing these actions in a consistent manner. [SD-12]

EOP Step No: Step 44

ERG Step No: Step 25

EOP Step:

LOAD THE FOLLOWING EQUIPMENT ON ENERGIZED 4KV VITAL BUSES AS NECESSARY:

- 230 VOLT BUSES
- 460 VOLT BUSES
- BATTERY CHARGERS
- DC LOADS PREVIOUSLY STRIPPED
- ONLY TWO SWGR ROOM SUPPLY FANS
- ONLY ONE SWGR ROOM EXHAUST FAN

[AC LOAD RESTORATION]

Purpose:

To ensure that small essential loads are loaded on the 4 KV vital bus.

ERG Basis:

The operator should verify that the 4 KV vital bus has assumed any plant specific essential loads that are energized simultaneously with the vital bus. These loads typically include instrumentation and control, emergency lighting and communications, etc. The operator should also verify, or manually load, any loads necessary to assess plant conditions (e.g., 480 volt buses to assess valve alignments) and should verify, or manually load, the battery chargers to recharge the station batteries. Depending on plant specific design configuration, loading may require dispatching personnel to locally load equipment.

EOP Basis:

Same as ERG basis, with the following additional information:

Any DC loads previously shed are documented by checkoff sheets in the attachments.

Supplemental Information:

None

Setpoints and Numerical Values:

None

EOP Step No: Step 44 (CONTINUED)

ERG Deviations:

DEV.1 Split ERG Step 25 into EOP Steps 44, 46, and 47.

JUST. EOP Steps 46 and 47 address the restoration of the CFCUs to service. The CFCUs require SW flow to perform their cooling function. Since the SW System was restored in EOP Step 45, the actions to restore the CFCUs are presented after that step.

DEV.2 Deleted emergency lighting and communications from the ERG listing.

JUST. These breakers remain closed during the event, so no further action is necessary once the 230V and 460V buses are re-energized. Refer to validation comment VA-416.

EOP Step No: Step 45

ERG Step No: Step 26

EOP Step:

IS ANY SW PUMP RUNNING
[SERVICE WATER TO NUCLEAR HEADERS]

Purpose:

To verify that the SW System is operating to supply cooling to the DG and other plant equipment.

ERG Basis:

Automatic loading of the SW pump should be verified. Valve alignments should also be verified to ensure cooling flow to the DG (to provide cooling for the DG should it have been started as a result of local actions to restore AC emergency power) and other equipment necessary for recovery.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
25%	X.11	Valve demand for the SW26 valves to reestablish service water to the Turbine Building header.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Steps 46 and 47

ERG Step No: Step 25

EOP Step:

(Step 46) OPEN SW ISOLATION VALVES FOR CFCUs, AS FOLLOWS:

- 21 THRU 25 SW72
- 21 THRU 25 SW58

[CFCU RESTORATION]

(Step 47) IF VALVE POSITION INDICATION IS INOPERABLE,
THEN USE CFCU SW FLOW TO VERIFY CFCU SW VALVE POSITION
[CFCU RESTORATION]

Purpose:

To ensure that small essential loads are loaded on a 4KV vital bus.

ERG Basis:

The operator should verify that the AC emergency bus has assumed any plant specific essential loads that are energized simultaneously with the emergency bus. These loads typically include instrumentation and control, emergency lighting and communications, etc. The operator should also verify, or manually load, any loads necessary to assess plant conditions (e.g., 480 volt buses to assess valve alignments) and should verify, or manually load, the battery chargers to recharge the station batteries. Depending on plant specific design configuration, loading may require dispatching personnel to locally load equipment.

EOP Basis:

Same as ERG basis, with the following information:

One or two 4KV vital buses may still be de-energized. Therefore, certain valve position indications may not be available. CFCU service water flow indication may be used to infer the position of the SW isolation valves for the CFCUs.

Supplemental Information:

None

Setpoints and Numerical Values:

None

EOP Step No: Steps 46 and 47 (CONTINUED)

ERG Deviations:

DEV.1 Split ERG Step 25 into EOP Steps 44, 46 and 47.

JUST. EOP Steps 46 and 47 address the restoration of the CFCUs to service. The CFCUs require SW flow to perform their cooling function. Since the SW System was restored in EOP Step 45, the actions to restore the CFCUs are presented after that step.

DEV.2 Did not specifically direct operators to energize equipment.

JUST. Plant equipment (e.g. 480 volt busses, inverters etc.) would be restored following other plant specific procedures.

EOP Step No: Step 48

ERG Step No: Step 27

EOP Step:

IS RCS SUBCOOLING GREATER THAN 0°F
[RECOVERY PROCEDURE EVALUATION]

Purpose:

To select the appropriate loss of all AC power recovery procedure.

ERG Basis:

This step provides the criteria by which the operator determines which recovery procedure actions to implement. The criteria are (1) the existence of RCS subcooling, (2) the existence of PZR level and (3) the verification that SI equipment is not operating. Two recovery procedures are provided based on these criteria. These are procedures EOP-LOPA-2 and EOP-LOPA-3.

If the operator determines that all criteria are satisfied, EOP-LOPA-2 should be implemented to attempt plant recovery utilizing normal operational systems. If any criterion is not satisfied, procedure EOP-LOPA-3 should be implemented to recover the plant utilizing safeguards systems. By providing two recovery options, the operator is provided with flexibility in recovering the plant based on the status of RCS conditions when AC power is restored.

EOP-LOPA-2 functions to recover the plant based on the existence of stable RCS conditions. This procedure is intended to permit relatively normal recovery for situations where AC power is restored before RCS conditions have degraded due to significant loss of reactor coolant inventory. As long as the RCS is subcooled and PZR level exists, the PZR should be able to control RCS pressure. Saturation conditions in the reactor vessel head and RCS hot legs will not occur until after PZR level drops out of the indicated range. As long as PZR level and RCS subcooling exist, the RCS is in a stable condition where nominal conditions should be restored utilizing normal operational systems.

EOP-LOPA-3 functions to recover the plant based on degraded RCS conditions. This procedure is intended to recover the plant in the SI operational mode following sufficient degradation of RCS conditions that RCS status may not be known. Following the loss of PZR level or RCS subcooling, the RCS conditions have degraded sufficiently that the operator may have insufficient or conflicting indications as to plant status. In this case, Plant Safeguards Systems should be utilized in the SI mode to restore stable RCS conditions and recover the plant.

<u>EOP Step No:</u> Step 48 (CONTINUED)

<u>ERG Basis:</u> (CONTINUED)

If RCS subcooling and PZR level are indicated, the preferred recovery option is procedure EOP-LOPA-2 even though RCS pressure may have been reduced below the SI actuation setpoint during the Step 37 secondary depressurization. As discussed in Subsections 2.2, 2.3, and 2.4 of the ERG background document for ECA-0.0, there is a period of time during the secondary depressurization that RCS pressure or secondary pressure may be below the SI actuation setpoints but RCS subcooling and PZR level may exist. Under this condition, the operator is instructed to implement procedure EOP-LOPA-2 and recover the plant utilizing normal operational systems.

If AC power is restored after SI signal actuation but before the SI signal is reset, the SI signal may automatically load safeguards equipment on the emergency bus. If this occurs, the third recovery selection criterion instructs the operator to implement procedure EOP-LOPA-3 and recover the plant in the SI mode utilizing the automatically actuated equipment.

The operator should attempt to implement procedure EOP-LOPA-2 only if RCS subcooling and PZR level are indicated and SI equipment does not automatically actuate upon AC power restoration. If any of these are not satisfied, procedure EOP-LOPA-3 should be implemented.

<u>EOP Basis:</u>

Same as ERG basis, with the following additional information:

The EOP does not check the status of SI equipment as the ERG does. The intent of this check is to see if any ECCS flow exists. If there is <u>no</u> ECCS flow AND if RCS subcooling and pressurizer level requirements are met, then SI is clearly <u>not</u> required and EOP-LOPA-2 (SI not required) is the appropriate recovery procedure. If any ECCS flow does exist at this point (due to untimely ECCS pump auto starts and valve realignments), then even if RCS subcooling and pressurizer level requirements are met, it <u>may</u> be relying on the ECCS flow for these conditions. Therefore, to be conservative, EOP-LOPA-3 (SI required) would be the appropriate procedure.

Due to plant design differences (SECs, no "pull-to-lock" feature), EOP Step 10 de-energized the SECs, and EOP Steps 21 through 23 ensured SI was actuated and reset. Consequently, ECCS pumps can NOT auto start, nor can SI equipment actuate in this EOP without deliberate manual action (which is not directed in this EOP). Therefore, there can be no ECCS flow at this point in the EOP and the only points to consider are RCS subcooling and pressurizer level. Refer to validation comment VA-366.

<u>Supplemental Information:</u>

DW-89-056: Reference leg process errors attributable to containment heatup should be considered when determining certain normal containment values for instruments subjected to reference leg process errors.

EOP Step No: Step 48 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
0°F	R.01	The sum of temperature and pressure measurement system errors including allowances for normal channel accuracies, translated into temperature using saturation tables - based on Subcooling Margin Monitor.
11%	D.04	Value showing pressurizer level just in range including allowances for normal channel accuracy and reference leg process errors.
19%	D.05	Value showing pressurizer level just in range, including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

ERG Deviations:

DEV.1 Deleted ERG Step 27.c (check SI equipment has not actuated).

JUST. Refer to EOP basis. [SD-60]

APPENDIX A

EOP/ERG CORRELATION

2-EOP-LOPA-1: LOSS OF ALL AC POWER

EOP/ERG CORRELATION

EOP Step	ERG Step
Entry Conditions	Entry Conditions
CAS	N/A
N/A	Note 1-1 (1)
1, 2	Note 1-2 (1)
3	1 (1)
4	2 (2)
5, 6	3 (3)
7	4 (3)
8	N/A
9	N/A
10, 11, 12	6 (5)
13, 14, 15, 16, 17, 18, 19, 20	5 (4) Caution 25-1 (12)
21	Caution 6-2 (5)
N/A	Caution 6-3 (5)
22	19 (10b)
23	20 (10c)
24	6 (5)
25	7 (5)
26	Caution 6-1 (5)
27	8 (5)
N/A	9 (6)
28	10 (6)
29, 30	Caution 11-1 (7)
31, 32	11 (7)

EOP Step	ERG Step
33	12 (7)
N/A	Caution 13-1 (7)
34	13 (7)
35, 36	14 (8)
N/A	15 (9)
37, 38	Caution 16-1 (9) Caution 16-2 (9) Note 16-1 (9) Note 16-2 (9) 16 (9) 17 (9)
N/A	Note 18-1 (10a)
N/A	18 (10a)
39	21 (10d)
40	22 (10)
41	23 (11)
42	24 (12)
43	Caution 25-1 (12)
44	25 (12)
45	26 (12)
46, 47	25 (12)
48	27 (13)