PSEG NUCLEAR L.L.C.
SALEM/OPERATIONS

2-EOP-TRIP-1 - Rev. 27

REACTOR TRIP OR SAFETY INJECTION

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

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REVISION SUMMARY

The following changes were incorporated into this revision:

- Revised Table C (Sheet 2 of 5) and Checkoff Sheet 1 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.
  [80091075-0572] [80091075-0573]

IMPLEMENTATION REQUIREMENTS Effective Date: 04/28/2008

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

EMERGENCY OPERATING PROCEDURE
2-EOP-TRIP-1
REACTOR TRIP OR SAFETY INJECTION

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 - Safeguards Valve Alignment (Table C)
2 - CS Actuation Alignment (Table E)

3.6 Attachments

1 - Major Action Categories

CONTINUOUS ACTION SUMMARY

CONDITION	ACTION
RCS PRESSURE LESS THAN 1350 PSIG AND ECCS FLOW ESTABLISHED	STOP RCPs
SINGLE SG FAULTED OR RUPTURED	CLOSE AF11 AND AF21 FOR AFFECTED SG
RCS PRESSURE LESS THAN 1500 PSIG AND BIT FLOW ESTABLISHED	CLOSE CHG PUMP MINIFLOW
RCS PRESSURE GREATER THAN 2000 PSIG	OPEN CHG PUMP MINIFLOW
RCPs WITHOUT CCW	STOP RCPs
"AFWST LEVEL LO-LO" ALARM (10.3%)	SHIFT AFW PUMP SUCTION

CHECK OFF SHEET 1

SAFEGUARDS VALVE ALIGNMENT

SAFETY INJECTION

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
2SJ4	BIT INLET	OPEN	
2SJ5	BIT INLET	OPEN	
2SJ12	BIT OUTLET	OPEN	
2SJ13	BIT OUTLET	OPEN	
2CV68	CHARGING DISCHARGE	CLOSED	
2CV69	CHARGING DISCHARGE	CLOSED	
21SJ54	21 ACCUMULATOR OUTLET	OPEN	
22SJ54	22 ACCUMULATOR OUTLET	OPEN	
23SJ54	23 ACCUMULATOR OUTLET	OPEN	
24SJ54	24 ACCUMULATOR OUTLET	OPEN	
2SJ1	RWST TO CHARGING	OPEN	
2SJ2	RWST TO CHARGING	OPEN	
2CV40	DISCHARGE STOP	CLOSED NOTE 1	
2CV41	DISCHARGE STOP	CLOSED NOTE 1	
21SW20	TURBINE AREA	CLOSED	
23SW20	TURBINE AREA	CLOSED	
2SW26	TURBINE AREA	CLOSED	
21SW122	SW TO 21 CC HX	CLOSED NOTE 2	
22SW122	SW TO 22 CC HX	CLOSED NOTE 2	

NOTE 1: CV40 AND CV41 WILL NOT CLOSE UNLESS SJ1 OR SJ2 FULL OPEN

NOTE 2: SW VALVES TO CCHX CLOSE ONLY ON SEC MODE 3

CHECK OFF SHEET 1

SAFEGUARDS VALVE ALIGNMENT

FEEDWATER ISOLATION

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
21BF13	FW INLET STOP	CLOSED	
22BF13	FW INLET STOP	CLOSED	
23BF13	FW INLET STOP	CLOSED	
24BF13	FW INLET STOP	CLOSED	
21BF19	FW CONTROL	CLOSED	
22BF19	FW CONTROL	CLOSED	
23BF19	FW CONTROL	CLOSED	
24BF19	FW CONTROL	CLOSED	
21BF40	BYPASS	CLOSED	
22BF40	BYPASS	CLOSED	
23BF40	BYPASS	CLOSED	
24BF40	BYPASS	CLOSED	

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	

CHECK OFF SHEET 1

SAFEGUARDS VALVE ALIGNMENT

PHASE A ISOLATION CONT'D

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
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	
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	
2CV284	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	

CHECK OFF SHEET 1

SAFEGUARDS VALVE ALIGNMENT

PHASE A ISOLATION CONT'D

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
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	

CONTAINMENT VENT ISOLATION

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

CHECK OFF SHEET 2

CS ACTUATION VALVE ALIGNMENT

PHASE B ISOLATION

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
2CC117	RCP COOLING INLET	CLOSED	
2CC118	RCP COOLING INLET	CLOSED	
2CC131	RCP THERMAL BARRIER	CLOSED	
2CC190	RCP THERMAL BARRIER	CLOSED	
2CC136	RCP BEARING OUTLET	CLOSED	
2CC187	RCP BEARING OUTLET	CLOSED	

CONTAINMENT SPRAY

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
21CS2	CS PUMP DISCH	OPEN	
22CS2	CS PUMP DISCH	OPEN	
2CS14	TANK DISCH	OPEN	
2CS16	TANK DISCH	OPEN	
2CS17	TANK DISCH	OPEN	

CHECK OFF SHEET 2

CS ACTUATION VALVE ALIGNMENT

MAIN STEAM ISOLATION

VALVE NUMBER	BEZEL NOMENCLATURE	REQUIRED POSITION	INITIALS
21MS167	STOP	CLOSED	
22MS167	STOP	CLOSED	
23MS167	STOP	CLOSED	
24MS167	STOP	CLOSED	
21MS18	WARMUP	CLOSED	
22MS18	WARMUP	CLOSED	
23MS18	WARMUP	CLOSED	
24MS18	WARMUP	CLOSED	
21MS7	DRAIN	CLOSED	
22MS7	DRAIN	CLOSED	
23MS7	DRAIN	CLOSED	
24MS7	DRAIN	CLOSED	

MAJOR ACTION CATEGORIES

- VERIFY AUTOMATIC ACTIONS AS INITIATED BY THE PROTECTION AND SAFEGUARDS SYSTEMS
- IDENTIFY APPROPRIATE OPTIMAL RECOVERY PROCEDURE
- SHUT DOWN UNNECESSARY EQUIPMENT AND CONTINUE TRYING TO IDENTIFY APPROPRIATE OPTIMAL RECOVERY PROCEDURE

SALEM GENERATING STATION

2-EOP-TRIP-1
REACTOR TRIP OR SAFETY INJECTION

BASIS DOCUMENT

EOP Step No: ENTRY CONDITIONS

ERG Step No: ENTRY CONDITIONS

EOP Step:

REACTOR TRIP
SI
EOP-TRIP-2, STEP 9
EOP-FRCI-2, STEP 5.1

Purpose:

To provide the plant conditions for entry into this procedure.

ERG Basis:

EOP-TRIP-1 is entered when any of the following occur:

1) A reactor trip is required as determined by plant specific setpoints or requirements being exceeded.
2) A reactor trip has occurred as determined by the plant annunciators, neutron flux instrumentation, and control rod position indicators.
3) A safety injection is required as determined by plant specific setpoints or requirements being exceeded.
4) A safety injection has occurred as determined by the plant annunciators, ECCS pump status, or other plant specific means.

EOP Basis:

Same as ERG basis, with the following additional information:

EOP-TRIP-1 is entered when any of the following occur:

1) Reactor Trip is <u>required</u> by any of the following:

   - Any Reactor Trip OHA <u>AND</u> associated bistable coincidence on 2RP4
   - OHA A-34 <u>AND</u> A-42 lit (SSPS Trouble)
   - OHA F-36 lit (Turbine Trip and P-9) <u>AND</u> associated bistable coincidence on 2RP4
   - Operator judgement that a reactor trip is required

2) Reactor Trip is <u>confirmed</u> by <u>all</u> of the following, at the time EOP-TRIP-1 step 2 is read by the NSS:
   - Power range NI indication less than 5%, <u>AND</u>
   - Intermediate range NI indication dropping, <u>AND</u>
   - Intermediate range NI startup rate indication negative

EOP Step No: ENTRY CONDITIONS (CONTINUED)

EOP Basis: (CONTINUED)

3) Safety Injection is required by any SI First Out OHA AND associated bistable coincidence on 2RP4

4) Safety Injection is confirmed by SI Actuation as indicated on 2RP4 equipment status

Supplemental Information:

DW-92-042: The entry from EOP-TRIP-2 returns the operator to EOP-TRIP-1, Step 1, to be consistent with the SI Reinitiation Criteria in the EOP-TRIP series Continuous Action Summary. This transition is made when SI has not previously been actuated, but is required when PZR pressure is below the SI actuation setpoint.

DW-93-032: The entry from EOP-FRCI-2 returns the operator to EOP-TRIP-1, Step 1, to be consistent with the SI Reinitiation Criteria in the EOP-TRIP series Continuous Action Summary. This transition is made when SI has not previously been actuated, but is required when PZR level cannot be maintained

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted reactor trip and safety injection setpoints from the entry conditions.

JUST. Reactor trip and SI actuation signals are indicated by annunciators and status lights on Panel 2RP4. Actual setpoints are covered by operator training. The NIS is used for reactor trip confirmation instead of IRPI because: (1) The NIS instruments are used at the initiation of any accident sequence, before post-accident inaccuracy becomes gross, and (2) The NIS instruments are used for monitoring the Subcriticality CSF status tree. Since this procedure is referenced after a reactor trip or SI has occurred or been determined to be required, numerical setpoint values are of no practical benefit.

EOP Step No: CAS

ERG Step No: FOLDOUT PAGE

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:

The CONTINUOUS ACTION SUMMARY provides a mechanism to address potential unexpected plant responses and multiple/subsequent failures that may occur at any time during the performance of a specific Emergency Operating Procedure (EOP) and which potentially require a transition to another procedure. The CONTINUOUS ACTION SUMMARY also provides a vehicle to identify operator actions that should be performed at any time that certain symptoms appear during the performance of a procedure.

EOP Basis:

Same as ERG basis, with the following additional information:

The flowcharts use a CONTINUOUS ACTION SUMMARY (CAS) table in place of a 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.

Supplemental Information:

None

EOP Step No: CAS (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
1350 psig	W.05	RCP trip parameter and setpoint including allowances for normal channel accuracy and post-accident transmitter errors.
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.

EOP Step No: CAS (CONTINUED)

ERG Deviations:

DEV.1 Added an item requiring opening and closing the centrifugal charging pump miniflow valves based on RCS and SI conditions.

JUST. Centrifugal charging pump miniflow valve guidance is required by FSAR 6.3.2.16 to prevent completely filling the VCT with water during safety injection. [SD-3]

DEV.2 Added an item requiring the RCPs to be stopped if CCW cooling is lost.

JUST. Stopping the RCPs quickly upon loss of CCW cooling is required by the RCP Technical Manual to avoid severe RCP damage. [SD-4]

DEV.3 Added an item requiring isolation of AFW feed flow to a faulted or ruptured SG.

JUST. Refer to validation comment VA-285(B). As part of the steam line break accident analysis, FSAR 15.4.8.2.2 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.

DEV.4 Changed RCP Trip Criteria from "Charging/SI pumps or high-head SI pumps - AT LEAST ONE RUNNING" to "ECCS FLOW ESTABLISHED".

JUST. Per the ERG Executive Volume discussion of Generic Issue RCP TRIP/RESTART, the intent of this RCP trip criterion is "Successful operation of the Safety Injection System". Use of the criterion "ECCS flow established" is more indicative of flow delivery to the RCS than verification of pump operating status. [SD-2]

EOP Step No: N/A

ERG Step No: Note 1-1

EOP Step:

N/A

Purpose:

To remind the operator that the first 4 steps are immediate actions.

ERG Basis:

Immediate actions are those actions which the operator should be able to perform from memory before opening and reading the emergency procedures. In general, immediate actions are limited to the time critical actions that verify automatic protection features of the plant, but are not so complex or extensive that reliance on procedures is preferred 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 four steps is important and the rest may be interchanged (see ERG Background Document for E-0, Section 4.2 Step Sequence Requirements).

EOP Basis:

Same as ERG basis.

Supplemental Information:

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

DW-91-017: Reduced the number of ERG immediate actions from ERG Steps 1 through 14 to ERG Steps 1 through 4. ERG Steps 1 through 4 correspond to EOP Steps 1 through 5.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Note on immediate action steps.

JUST. The flowchart format presents the immediate action step designator as a zone title instead of a note in order to streamline the procedure, reducing the amount of information that must be read aloud during procedure implementation. Therefore, this note is unnecessary.

EOP Step No: N/A

ERG Step No: Note 1-2

EOP Step:

N/A

Purpose:

To remind the operator that the foldout page for E-0 should be open.

ERG Basis:

The foldout page provides a list of important items that should be continuously monitored. If any of the parameters exceeds its limit, the appropriate operations should be initiated.

EOP Basis:

N/A

Supplemental Information:

ERG Knowledge Item: The operator should know what items comprise each foldout page.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Note to open the foldout page for this procedure.

JUST. The Continuous Action Summary (CAS) replaces the ERG foldout page. The CAS is located in the upper left corner on each flowchart sheet and is in continuous view of the operator. Thus it does not have to be opened. [SD-6]

EOP Step No: Steps 1 and 2

ERG Step No: Step 1

EOP Step:

(Step 1) TRIP REACTOR
[IMMEDIATE ACTION STEPS]
[REACTOR TRIP VERIFICATION]

(Step 2) IS REACTOR TRIP CONFIRMED
[IMMEDIATE ACTION STEPS]
[TURBINE TRIP VERIFICATION]

Purpose:

To ensure that the reactor has tripped.

ERG Basis:

Reactor trip must be verified to ensure that the only heat being added to the RCS is from decay heat and reactor coolant pump heat. The Safeguards Systems that protect the plant during accidents are designed assuming that only decay heat and pump heat are being added to the RCS. If the reactor cannot be tripped, a transition is made to EOP-FRSM-1, RESPONSE TO NUCLEAR POWER GENERATION, to deal with ATWS conditions.

EOP Basis:

Same as ERG basis, with the following additional information:

Trip reactor is defined as the following action sequence:

- Operate the reactor trip handle(s).
- IF reactor NOT tripped, THEN open the reactor trip breakers using the Control Console bezels.
- IF reactor NOT tripped, THEN open 2E and 2G 460V bus supply breakers 2E6D AND 2G6D.

Reactor trip confirmed is defined as the following:

- Power range NI indication less than 5%
  AND
- Intermediate range NI indication dropping
  AND
- Intermediate range NI SUR indication negative, *at the time EOP Step 2 is read by the NSS.*

EOP Step No: Steps 1 and 2 (CONTINUED)

EOP Basis: (CONTINUED)

If an ATWS occurs, then this definition allows a limited time for CRDM emf collapse from when the 460V bus feeder breakers are opened until this step is reached. If, *at that time*, the NIS indications do not meet this definition (i.e., they indicate a RED challenge to the Subcriticality critical safety function), then the operator will trip the turbine, insert rods, and transition to EOP-FRSM-1, RESPONSE TO NUCLEAR POWER GENERATION, for ATWS actions. Refer to DW-85-012, DW-88-004 and DW-88-033 for additional information.

Supplemental Information:

Memo from Kevin White to Scott Greenlee dated January 31, 1996.

The NIS is used for reactor trip confirmation instead of IRPI or Gamma-Metrics based on the following:

- The NIS instruments will be used at the initiation of any accident sequence, before post-accident inaccuracy becomes gross.
- The NIS instruments are used for monitoring the Shutdown Margin critical safety function.
- The Gamma-Metrics indicators are too distant from the Control Console area for rapid diagnostic use, especially under degraded lighting conditions, and do not provide immediate trend (SUR) indication.

"Initiate rod insertion" This step is intended to allow the operator to either manually insert rods at 48 steps per minute or enable automatic rod insertion at up to 72 steps per minute (if sufficient T_{avg}-T_{ref} temperature error exists). If automatic rod insertion is selected and rod speed drops below 48 steps per minute then the operator should, at the earliest opportunity, select manual rod control and insert the rods. The primary concern of the ATWS analysis performed for the WOG is RCS pressurization and neither rod insertion nor boration was credited in the analysis. Refer to DW-92-049 for additional information.

EOP Step No: Steps 1 and 2 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Restructured step to trip the reactor in lieu of verify/trip.

JUST. See Generic Deviation - *Streamlining*. [SD-79]

DEV.2 Deleted the four bulleted reactor trip indications.

JUST. The conditions used to confirm reactor trip are listed in the EOP Basis and Supplemental Information sections for this step. These conditions are considered basic operator knowledge.

DEV.3 Moved EOP-FRSM-1 immediate actions (trip turbine, initiate rod insertion) into EOP-TRIP-1 to perform these actions prior to transitioning to EOP-FRSM-1.

JUST. During an ATWS, performing these actions in EOP-TRIP-1 shortens the operator response time and helps mitigate the consequences of this fast-acting event.

EOP Step No: Step 3

ERG Step No: Step 2

EOP Step:

TRIP TURBINE
[IMMEDIATE ACTION STEPS]
[TURBINE TRIP VERIFICATION]

Purpose:

To ensure that the turbine is tripped.

ERG Basis:

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:

DEV.1 Restructured step to trip the turbine in lieu of verify/trip.

JUST. See Generic Deviation - *Streamlining*. [SD-79]

EOP Step No: Step 4

ERG Step No: Step 3

EOP Step:

IS ANY 4KV VITAL BUS ENERGIZED
[IMMEDIATE ACTION STEPS]
[4 KV VITAL BUS VERIFICATION]

Purpose:

To ensure electrical power to at least one 4 KV vital bus.

ERG Basis:

AC power must be verified from either offsite sources or the DGs to ensure adequate power sources to operate the safeguards equipment. At least one train of safeguards equipment is required to deal with emergency conditions. If at least one train is not available, the operator should try to quickly restore one train, e.g., start a DG and load it on the vital bus. If at least one train cannot be restored quickly, the operator should transfer to EOP-LOPA-1, LOSS OF ALL AC POWER.

EOP-LOPA-1 is developed and structured to address the condition where all AC emergency power is lost. It is entered on the symptom of all 4 KV vital buses being de-energized. Its objective is to cope with the loss of AC emergency power until at least one 4 KV vital bus can be energized. EOP-LOPA-1 should not be entered if at least one 4 KV vital bus is energized since the other optimal recovery procedures (ORPs) and function restoration procedures (FRPs) contain guidance that accommodates multiple failures. They use available equipment to mitigate events whether plant systems are at full, minimum, or degraded safeguards capacity. The availability of minimum safeguards capacity is NOT a requirement for use of the other ORPs and FRPs. For example, the core cooling FRPs provide guidance for the use of available equipment in degraded systems to mitigate inadequate core cooling (ICC) (e.g., ICC analyses show that only one SI pump is needed to prevent ICC even though one SI pump may not be sufficient to mitigate design basis transients within their design basis acceptance criteria).

EOP Basis:

Same as ERG basis.

EOP Step No: Step 4 (CONTINUED)

Supplemental Information:

The transition from ERG E-0 to ERG ECA-0.0 is written for the ERG reference plant which has safeguards systems of a two-train design; however, the transition should also apply to plants with a three-train safeguards systems design since the structure and objectives of ERG ECA-0.0 should also apply. Plants with a three-train safeguards systems design should evaluate the impact of this difference on their EOPs. This evaluation should include an assessment of what equipment is available on their different AC emergency buses and how events will be mitigated if only one AC emergency bus and associated safeguards equipment are available.

For a plant with a three-train safeguards systems design, the operator should try to have all three emergency AC buses available so that safeguards systems can be operated at full capacity if needed. If all trains are not available, the operator should try to have two of the three trains available so that events can be mitigated within their minimum safeguards design basis. However, if only one train is available, sufficient AC power should exist to operate equipment needed to respond to the event (e.g., maintain core cooling). With at least one train of AC emergency power available, the operator should be in the optimal recovery procedures and function restoration procedures to respond to the event using available equipment while additional emergency buses are restored. Guideline ECA-0.0 is only for the situation where AC power is lost to all emergency AC buses and no AC powered safeguards equipment is available.

See DW-92-033 for additional information

Setpoints and Numerical Values:

None

EOP Step No: Step 4 (CONTINUED)

ERG Deviations:

DEV.1 Used "any 4KV vital bus energized" instead of "at least one emergency bus energized."

JUST. The reference plant has two AC emergency buses, each of which can supply one complete ECCS equipment train. The Salem plant design has three 4 KV vital buses in place of the reference plant's two emergency buses. All three 4 KV vital buses can supply two complete ECCS equipment trains. However, if only two of the three 4 KV vital buses are available, they are capable of supplying only a single complete ECCS equipment train due to the distribution of safeguard electrical loads among the three vital buses. "At least one AC emergency bus" for the reference plant is equivalent to "at least one 4 KV vital bus" for Salem. Refer to the ERG Basis and Supplemental Information sections for this EOP step for more details. Any energized vital bus is sufficient to prevent entry into EOP-LOPA-1, even if a single complete safeguards train is not available.

DEV.2 Did not check all 4 KV vital buses energized or attempt to restore power to a de-energized 4 KV vital bus in this step. These actions are performed in EOP Step 14.

JUST. Directions to restore power to a de-energized vital bus are not provided in the immediate actions of EOP-TRIP-1 due to the complexity of the Safeguards Equipment Cabinets and the potential time and manpower resources required to complete this action. Moving the verification of all vital buses energized to Step 14 allows for more timely verification of proper safeguards equipment operation before attempting to restore power to a single de-energized vital bus.

EOP Step No: Step 5

ERG Step No: Step 4

EOP Step:

IS SI ACTUATED
[IMMEDIATE ACTION STEPS]
[SI ACTUATION VERIFICATION]

Purpose:

To determine if SI is in service or is required.

ERG Basis:

The operator should check if SI is actuated or if only a reactor trip has occurred. He should also evaluate if an SI is required but has not occurred (e.g., low PZR pressure SI actuation is blocked and RCS pressure is continuously decreasing at a high rate). If SI is actuated, the operator should verify that both trains of SI have received an actuation signal. If not, the SI signal should be manually actuated. The intent of this step is to check SI signal actuation and not the individual response of specific components that receive the SI signal.

EOP Basis:

Same as ERG basis, with the following additional information:

SI is required if any SI First Out OHA is lit AND associated bistable coincidence is satisfied on 2RP4 SI setpoints added to step to assist operator in verifying SI not required.

EOP Step No: Step 5 (CONTINUED)

Supplemental Information:

DW-94-032: Directs actuating both trains of SI, if SI actuation is indicated, to eliminate potential inconsistent or confusing SI indications that might mislead the operator. If only one train of SI actuates, then the operator would have contradictory indications of SI actuation, depending on which ECCS train is checked.

ERG Knowledge Item: Conditions requiring SI actuation.

The following conditions automatically actuate SI:

- Low PZR pressure (1765 psig).
- High steam line differential pressure (100 psid).
- High steam flow with either low-low T_{avg} (543°F) or low steam line pressure (600 psig).
- High containment pressure (4.0 psig).

Commitment C0550: Revise Salem EOPs as required to include issues identified in LER 272/94-007-01). To wit, three points of interest:

1. If either train of SI is actuated, then ensure *both* trains of SI are actuated.
2. Control RCS temperature at no-load after reactor trip (avoid heatup above no-load).
3. Control SG pressures via MS10s after a trip to prevent lifting safeties on RCS heatup above no-load temperature.

Setpoints and Numerical Values:

Value	Setpoint	Description
1765 psig	A.04	Low pressurizer pressure SI setpoint.
4 psig	T.06	Containment pressure SI setpoint.
100 psig	O.13	High steamline differential pressure SI setpoint.
543°F	E.03	RCS average temperature below which SI may be blocked P-12. High steamflow SI setpoint coincident with low-low Tavg.
600 psig	O.14	Low steamline pressure SI setpoint.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 6

ERG Step No: N/A

EOP Step:

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

Purpose:

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

ERG Basis:

N/A

EOP Basis:

After completion of the immediate actions and verification of automatic actions, the operator should announce that a 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 announcing the unit reactor trip.

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

EOP Step No: Steps 7, 8, and 9

ERG Step No: Steps 7, 8, 10 and 11

EOP Step:

(Step 7) IS SEC LOADING COMPLETE FOR ENERGIZED VITAL BUSES
[SEC LOADING VERIFICATION]

(Step 8) START SAFEGUARDS LOADS AS REQUIRED BY TABLE A
[SEC LOADING VERIFICATION]

(Step 9) ARE 21 AND 22 AFW PUMPS RUNNING
[AFW FLOW VERIFICATION]

Purpose:

To ensure AFW pumps are running.
To ensure ECCS pumps are running.
To ensure SW pumps are running.
To ensure CFCUs are running in low speed to limit containment pressure, temperature, and humidity.

ERG Basis:

(ERG Step 7) The 21 and 22 AFW Pumps start automatically on an SI signal to provide feed to the SGs for decay heat removal. If SG levels drop below the appropriate setpoint, the 23 AFW Pump will also automatically start to supplement the 21 and 22 AFW Pumps.

(ERG Step 8) ECCS provides makeup inventory to the RCS for cooling of the core during accident conditions. Since SI is actuated, all ECCS pumps have a start signal and the operator should verify that they are running.

(ERG Step 10) SW pumps provide cooling to certain safeguards components.

(ERG Step 11) CFCUs provide cooling of the containment atmosphere to limit containment pressure, temperature, and humidity during accident conditions.

EOP Step No: Steps 7, 8, and 9 (CONTINUED)

EOP Basis:

Same as ERG basis, with the following additional information:

Following the receipt of an SI signal, two AFW pumps are required to ensure adequate feedwater for heat removal. The SEC load sequencer will start the 21 AFW Pump on 2A vital bus and the 22 AFW Pump on 2B vital bus. If one of these buses is not available or if one of the MD AFW pumps fails to start, then the TD AFW pump is started in this step to ensure adequate RCS heat removal.

This step checks if all available equipment has started as expected after an SI signal has been generated. Table A lists the equipment loaded on each vital bus following any SI actuation. The SEC Loading Complete Light is turned on by a circuit made of individual component breaker auxiliary contacts connected in series. Thus, if illuminated, this light provides positive indication that all required components have started.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Combined multiple ERG steps into three EOP steps.

JUST. The change takes advantage of the main control board design and layout. Verification of proper sequencing and operation of safeguards equipment is done by checking the "SEC Loading Complete" light is on for each energized vital bus. These lights are activated by circuits that receive feedback from the associated safeguards equipment breaker contacts. Therefore, these lights provide an expedient and positive indication that all required safeguards equipment has started. In addition, the individual equipment lights shown in Table A of the EOP are available on Panel 2RP4 as a quick backup status check. In addition to the ERG equipment listed in ERG Steps 7, 8, 10, and 11, the SECs also start an emergency air compressor and Auxiliary Building exhaust fans.

DEV.2 Directed start of the 23 AFW Pump if either 21 or 22 AFW Pump is stopped instead of checking 23 AFW Pump running "if necessary" per the ERG.

JUST. 21 and 22 AFW Pumps each feed two SGs, while 23 AFW Pump feeds all four SGs. This step refines the meaning of the ERG intent to "Verify TD AFW pump running if necessary". If either 21 or 22 AFW Pump is stopped, then 23 AFW Pump will be needed to feed the two SGs associated with the idle 21 or 22 AFW Pump.

EOP Step No: Step 10

ERG Step No: Steps 5, 6, 12, and 18

EOP Step:

ARE VALVE GROUPS IN TABLE B IN SAFEGUARDS POSITIONS
[SAFEGUARD VALVE ALIGNMENT]

Purpose:

To ensure feedwater isolation has occurred.
To ensure non-essential containment penetrations are isolated.
To ensure non-essential containment ventilation penetrations are isolated.
To ensure the SI valves are properly aligned for inventory makeup.

ERG Basis:

(ERG Step 5) The Main Feedwater System is isolated on a FW Isolation signal to prevent uncontrolled filling of any SG and the associated excessive RCS cooldown which could aggravate the transient, especially if it were a steamline break. In the reference plant the SG blowdown and SG sample valves close on an SI signal but are included in the verification of FW isolation in order that they may be checked at this time. Other plant specific valves that receive a FW Isolation signal should also be listed.

(ERG Step 6) The non-essential containment penetrations are isolated to prevent potential release of radioactive materials from containment.

(ERG Step 12) The non-essential ventilation penetrations are isolated to prevent potential release of radioactive materials from containment.

(ERG Step 18) Although ECCS flow is verified in a previous step, it is important to verify all trains are properly aligned such that if one train is lost, the other train would still be available.

EOP Basis:

Same as ERG basis, with the following additional information:

Panel 2RP4 was designed to allow the operator to quickly verify the proper valve lineup following a reactor trip with SI through the use of the valve groupings listed in Table B. If Table B cannot be verified, then Table C provides a complete list of the valves that receive a signal to actuate (either open or close as required) on an SI signal. The SG blowdown and sample isolation valves close on a Phase A Isolation signal and are included on 2RP4 and Table C.

EOP Step No: Step 10 (CONTINUED)

EOP Basis: (CONTINUED)

115 VAC 2A vital instrument bus failure could hinder the performance of this step by causing a loss of power to Panel 2RP4. This would require an operator to individually check the valve alignments in Table C. Rather than require the reader to read these aloud, which would stop EOP progress, the valve lists were moved to 8.5" x 11" Checkoff Sheets which can be handed to an operator for concurrent performance while the reader and the remaining board operator can proceed with the EOP.

Closure of the containment control air isolation valves (both CA330s) is verified at this time to prevent potential radioactive releases from containment. Verification of valve closure is necessary because they have no redundant 2RP4 indication.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Combined multiple ERG steps into one EOP step, including a list of required valve and damper positions.

JUST. The main control board layout design makes it convenient and expedient to check the feedwater isolation, Phase A, containment ventilation isolation, and ECCS valve and damper positions by checking status panels that give aggregate indications.

DEV.2 Added an action step to explicitly isolate control air to containment (CA330 valves).

JUST. The CA330 control air to containment valves are automatically closed by Phase A but are not indicated on 2RP4 with all the other Phase A valves. To ensure that these valves are closed, the operator is directed to close them.

EOP Step No: Step 11

ERG Step No: Step 14

EOP Step:

HAS CONTAINMENT PRESSURE REMAINED LESS THAN 15 PSIG
[CONTAINMENT SPRAY ACTUATION VERIFICATION]

Purpose:

To ensure automatic actuation of containment spray and Containment Isolation Phase B if containment pressure exceeded the High-High setpoint.

ERG Basis:

If containment pressure exceeds the High-High setpoint, containment spray is automatically initiated to mitigate the containment pressure transient. Containment Isolation Phase B valves are closed to isolate additional potential release paths from containment. Since component cooling to the RCP seals and motors is isolated on a Phase B signal, the RCPs are tripped to preclude overheating of the seals and motors.

The basis for the "has remained less than 15 psig" condition on containment pressure is that containment pressure may have exceeded the setpoint and then decreased due to spray actuation. In this case the operator should still verify system operation as per the NO flowchart branch.

EOP Basis:

Same as ERG basis, with the following additional information:

Both main steam isolation and containment spray actuation occur at the same setpoint (High-High containment pressure).

Supplemental Information:

DW-91-026: Designated a continuous action step in order to ensure that the appropriate actions are taken if containment pressure exceeds the spray actuation setpoint after this step is reached.

DW-94-032: Directs actuating both trains of Containment Spray or Phase B Isolation if actuation is indicated, to eliminate potential inconsistent or confusing Containment Spray or Phase B Isolation indications that might mislead the operator. If only one train of Containment Spray or Phase B Isolation actuates, then the operator would have contradictory indications of actuation, depending on which ESF train is checked.

EOP Step No: Step 11 (CONTINUED)

Setpoints and Numerical Values:

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

ERG Deviations:

DEV.1 Added Main Steam Isolation on high-high containment pressure to this step.

JUST. ERG Step 13 checks for Main Steam Isolation and ERG Step 14 checks for Containment Spray actuation. Due to plant design difference, Main Steam Isolation and Containment Spray occur at the same Containment pressure setpoint (high-high). Consequently, the check for Main Steam Isolation on high-high containment pressure has been grouped with the check for Containment Spray actuation in this step due to their close relationship (sharing the same actuation setpoint).

EOP Step No: Step 12

ERG Step No: Step 13

EOP Step:

DOES 2RP4 INDICATE HIGH STEAM FLOW COINCIDENT WITH LOW STEAM PRESSURE
[MAIN STEAM ISOLATION REQUIREMENTS]

Purpose:

To ensure main steamlines are isolated when required.

ERG Basis:

Main steamlines are isolated, when certain setpoints are reached, to either minimize the consequences of and/or terminate the mass and energy releases associated with a high energy secondary line break.

EOP Basis:

Same as ERG basis, with the following additional information:

In addition to actuating on High-High containment pressure (addressed in the previous step), main steam isolation is required by the Reactor Protection System if either a high steam flow coincident with low steam pressure or a high steam flow coincident with a low-low T_{avg} condition exists. Either condition indicates that a high energy line break has occurred and that main steam isolation is required.

Supplemental Information:

None

Setpoints and Numerical Values:

None

EOP Step No: Step 12 (CONTINUED)

ERG Deviations:

DEV.1 Omitted Main Steam Isolation on Containment high pressure from this step.

JUST. ERG Step 13 checks for Main Steam Isolation and ERG Step 14 checks for Containment Spray actuation. Due to plant design difference, Main Steam Isolation and Containment Spray occur at the same Containment pressure setpoint (high-high). Consequently, the check for Main Steam Isolation on high-high containment pressure has been grouped with the check for Containment Spray actuation in the previous step due to their close relationship (sharing the same actuation setpoint).

EOP Step No: Step 13

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 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. Added step to ensure implementation of Event Classification Guide (ECG) actions to evaluate and classify the emergency condition. [SD-8]

EOP Step No: Step 14

ERG Step No: Step 3

EOP Step:

ARE ALL 4KV VITAL BUSES ENERGIZED
[VITAL BUS STATUS]

Purpose:

To ensure electrical power to all 4 KV vital buses.

ERG Basis:

It is desirable to have power to all 4 KV vital buses. If power is available to only one train, the operator should initiate attempts to restore power to the other train while continuing with the next step in the procedure to deal with the emergency condition.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

EOP Step No: Step 14 (CONTINUED)

ERG Deviations:

DEV.1 Delayed actions to try to restore power to all 4 KV vital buses until this step.

JUST. EOP Step 4 (ERG Step 3) checked if at least one 4KV vital bus was energized to preclude a transition to EOP-LOPA-1. ERG Step 3.b, which verifies that all 4 KV vital buses are energized, was delayed until this point to allow timely performance of the immediate action steps and safeguards equipment operation status checks. This delay is necessary due to the complexity of the safeguards equipment cabinets (SECs) and the potential time and manpower resources required to restore power to de-energized AC buses. At this point in the EOP, all major safeguards equipment has been verified to be operating as required and time is now available to initiate corrective actions to restore power to any de-energized vital bus.

DEV.2 Added reference to applicable operating procedures to restore power to the individual vital buses.

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

EOP Step No: Step 15

ERG Step No: N/A

EOP Step:

IS CONTROL ROOM VENTILATION IN "ACCIDENT PRESSURIZED" MODE

Purpose:

To ensure the Control Room Ventilation System is properly aligned following SI actuation.

ERG Basis:

N/A

EOP Basis:

Following safety injection actuation, Control Room ventilation realigns to an emergency recirculation mode to ensure habitability requirements are met for personnel in the Control Room. This mode of ventilation prevents introducing potentially contaminated outside air into the Control Room, which could require a Control Room evacuation.

Control Room ventilation is a Safeguards System and its proper operation is required by the FSAR. Addition of this step is allowed by the note in ERG E-0 between Steps 12 and 13 that states that "*[Appropriate steps for verification of other essential equipment as required by the specific plant design should be placed after ERG Step 12.]*".

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 16

ERG Step No: N/A

EOP Step:

RUN

- TWO SWGR ROOM SUPPLY FANS
- ONE SWGR ROOM EXHAUST FAN

Purpose:

To ensure cooling for equipment in the switchgear room.

ERG Basis:

N/A

EOP Basis:

Ventilation to the 4 KV switchgear rooms is required for long term equipment cooling. Running the switchgear room supply fans will ensure that the switchgear environment will remain adequate for long term switchgear operation throughout the event recovery period. Following SI signal generation, operation is verified on 2RP2 since there is no redundant 2RP4 indication. Two switchgear room supply fans and one switchgear room exhaust fan are required to support long term equipment cooling. The system is designed to start redundant equipment should a mechanical or electrical failure occur. Reference 2EC3625 safety evaluation.

Addition of this step is allowed by the note in ERG E-0 between ERG Steps 12 and 13 that states that "*[Appropriate steps for verification of other essential equipment as required by the specific plant design should be placed after ERG Step 12.]*".

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 17

ERG Step No: Step 9

EOP Step:

ARE TWO OR MORE CCW PUMPS RUNNING
[CCW PUMP OPERATION EVALUATION]

Purpose:

To ensure CCW pumps are running.

ERG Basis:

CCW pumps provide cooling to certain safeguards components.

Resequencing of this step is allowed by the ERG Step Sequence Table.

EOP Basis:

Same as ERG basis, with the following additional information:

CCW pumps provide cooling to certain safeguards components, such as ECCS pump seals. Two CCW pumps are required to provide adequate cooling water to all systems and components requiring CCW. If only one CCW pump is operating, then CCW must be diverted from non-essential loads (spent fuel heat exchanger, BA evaporator, etc.) in order to provide adequate cooling for safeguards components. *Closing 2CC37 and 2CC48 to isolate these non-essential loads was credited in the fluid hydraulic analysis performed for the cold leg recirculation alignment in EOP-LOCA-3.*

The CCW pumps are powered from the 4KV vital buses. Depending on the SEC mode of operation, the CCW pumps are sequenced on their associated vital buses to provide cooling to various safeguards components. The CCW pumps do not start for all modes of SEC; for example, they do not run during SEC Mode Op III (to prevent DG overload). CCW pump operation is therefore verified after ensuring that all 4KV vital buses are energized, or actions to restore power to any de-energized vital bus are in progress.

Supplemental Information:

PSEG Letter NE-96-0642 dated 4/26/96, "Isolation of BA Evaporator in the EOPs".

Commitment 0623: This commitment is listed here for information only; it doesn't strictly apply to this EOP. This commitment requires that EOP-LOCA-1 be revised to ensure CCW is isolated to the SFP heat exchanger and BAE if it wasn't previously done in EOP-APPX-1.

EOP Step No: Step 17 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations: (CONTINUED)

DEV.1 Added guidance to establish minimum CCW cooling for safeguards loads.

JUST. CCW loads must be reduced if less than two CCW pumps are running because one CCW pump is not sufficient to supply all CCW loads for extended periods during emergency conditions. This guidance aids operators in performing these actions in a consistent manner and accounts for plant-specific limitations on the CCW System.

DEV.2 Added reference to EOP-APPX-1 to restore CCW cooling.

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

EOP Step No: Step 18

ERG Step No: N/A

EOP Step:

IF "RWST LEVEL LO" ALARM ACTUATES (15.2 FT),
THEN GO TO EOP-LOCA-3, STEP 1

Purpose:

To guarantee coolant flow to the core by switching to cold leg recirculation if the RWST level is below the switchover setpoint.

ERG Basis:

N/A

EOP Basis:

For a large LOCA with all buses energized and all safeguards pumps operating, the RWST can drain to the low level switchover setpoint within approximately 15 minutes. If equipment failures do not cause delays and if offsite power remains available, the time response of the accident would be similar to that at many other Westinghouse plants. That is, typically the operator would enter EOP-TRIP-1, perform/verify a number of automatic actions, diagnose the accident as a LOCA, transition to EOP-LOCA-1, transfer to cold leg recirculation per EOP-LOCA-3 at the RWST switchover level, and then return to the procedure and step in effect.

If a loss of offsite power also occurs with the LOCA (or with any SI actuation), the CCW pumps trip and SW cooling to the CCW heat exchangers is isolated. Automatic CCW pump restart does NOT occur for this situation (SEC Mode 3) primarily due to DG loading concerns. To ensure CCW is available later in the accident to cool the ECCS pump seals (and to supply the RHR heat exchangers during recirculation), the operator is directed to EOP-APPX-1 to reduce CCW loads, start one CCW pump, and restore one or both CCW heat exchangers to service. Both CCW heat exchangers are restored if three SW pumps are running (one on each bus). Only one CCW heat exchanger is restored if less than three SW pumps are running. The time required to perform EOP-APPX-1 is typically around five minutes. However, for certain equipment failures (e.g., 12 or 22 CCW pump), the transition to EOP-APPX-1 could take approximately seven or eight minutes.

Because of the potential delays associated with performing actions of EOP-APPX-1 and other equipment failures, it is possible that the RWST switchover level could be reached while still in EOP-TRIP-1. Therefore, this step has been added to alert the operator to monitor for this condition while in this EOP.

If the plant is aligned for cold leg recirculation, then EOP Step 19 is skipped since it aligns valves for injection mode only.

EOP Step No: Step 18 (CONTINUED)

Supplemental Information:

Refer to Westinghouse SECL-95-173/PSE&G P.O. P3-0816556, "Salem EOP Switchover To Recirculation Evaluation".

Setpoints and Numerical Values:

Value	Setpoint	Description
15.2 ft	U.02	RWST low level switchover setpoint.

ERG Deviations:

DEV.1 Added step to monitor RWST level.

JUST. Because of the potential delays associated with performing actions of EOP-APPX-1 and other equipment failures, it is possible that the RWST switchover level could be reached while still in EOP-TRIP-1. This step alerts the operator to monitor for RWST switchover in case transfer to cold leg recirculation should be required while performing EOP-TRIP-1. Refer to the EOP Basis for this step for more information.

EOP Step No: Step 19

ERG Step No: Step 15

EOP Step:

IS RHR ALIGNED FOR COLD LEG RECIRCULATION
[ECCS FLOW EVALUATION]

Purpose:

To ensure flow to the RCS from the ECCS.

ERG Basis:

ECCS flow is necessary to make up for the RCS inventory changes due to either RCS shrinkage or inventory losses from the RCS.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

EOP Step No: Step 19 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
1540 psig	B.05	Shutoff head pressure of the high-head SI pumps plus allowances for normal channel accuracy.
1660 psig	B.06	Shutoff head pressure of the high-head SI pumps plus allowances for normal channel accuracy and post accident transmitter errors, not to exceed 2000 psig.
300 psig	B.07	Shutoff head pressure of the RHR pumps plus allowances for normal channel accuracy.
420 psig	B.08	Shutoff head pressure of the RHR pumps plus allowance for normal channel accuracy and post accident transmitter errors.
300 gpm	S.03	The minimum low-head SI pump which indicates injection into the RCS.
100 gpm	S.07	Minimum charging flow (per the SI systems charging flow meter) which indicates injection into the RCS.
100 gpm	S.08	Minimum SI flow (per the SI pump flow meter) which indicates injection into the RCS.

ERG Deviations:

DEV.1 Added step to determine if RHR is aligned for cold leg recirculation.

JUST. It is possible that the RWST switchover level could be reached while still in EOP-TRIP-1 (refer to the EOP Basis section for EOP Step 18), thus requiring alignment of ECCS for cold leg recirculation. If aligned for cold leg recirculation, then EOP Step 19 is not applicable since the valve alignments in that step are appropriate for injection mode only.

DEV.2 Deleted ERG RNO actions to start pumps as necessary.

JUST. EOP Steps 7 and 8 started all available ECCS pumps. Therefore, only valve alignments are included in the step to avoid redundancy and streamline the EOP.

EOP Step No: Step 20

ERG Step No: Steps 16 and 17

EOP Step:

IS TOTAL AFW FLOW GREATER THAN 22E04 LB/HR
[HEAT SINK STATUS]

Purpose:

To ensure AFW flow to the SGs.
To ensure the AFW valves are properly aligned to feed the SGs.

ERG Basis:

AFW flow is necessary for secondary heat sink. If SG level is in the narrow range in at least one SG, a heat sink is available. Therefore, AFW flow is needed only to maintain level. If adequate AFW flow for decay heat removal cannot be established, the transition to EOP-FRHS-1, RESPONSE TO LOSS OF SECONDARY HEAT SINK, is necessary to establish an alternate source of feed flow or an alternate heat sink.

Although minimum AFW flow is verified in a previous step, it is important to verify all trains are properly aligned such that if one train is lost, the other train would still be available.

EOP Basis:

Same as ERG basis, with the following additional information:

The AFW pump discharge isolation valves (AF21) automatically travel to 95% open when the associated AFW pump is running unless pump discharge pressure falls below some minimum pressure, at which point they will close down as necessary to protect the pump against runout conditions. This runout protection feature may be defeated from the main control board (PRESSURE OVERRIDE DEFEAT pushbutton) by redirecting the valve positioning air to allow full manual control of the AF21 valves.

Supplemental Information:

Commitment C0542: Excessive Cooldown on Reactor Trips, provide direction on throttling Auxiliary Feedwater flow to minimize cooldowns from excessive feedwater flow.

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 20 (CONTINUED)

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).
9%	M.02	Value showing SG level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
15%	M.03	Value showing SG 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.
95%	X.09	Valve demand for the AF21 control valve that will prevent runout of the AFW pump.

ERG Deviations:

DEV.1 Checked AFW valve alignment only if both AFW total flow and SG NR level requirements are not met.

JUST. The fail-safe design of the AFW System ensures that the valve alignment will be proper. Therefore, the valve alignment is only checked if both AFW flow and SG NR level requirements are not met since these conditions indicate equipment failures must have occurred.

EOP Step No: Step 21

ERG Step No: Step 19

EOP Step:

IS ANY RCP RUNNING
[RCS TEMPERATURE CONTROL]

Purpose:

To ensure that RCS heat is being properly removed through the secondary side.

ERG Basis:

RCS average temperature stable at or trending to the no-load value with any RCP running indicates that the Secondary Steam Dump System is operating as designed. If no RCP is running, then the RCS average temperature will be higher than the no-load value as natural circulation conditions are established. However, if the Steam Dump System is working properly, the cold leg temperatures will stabilize at the no-load value. If the RCS cooldown is excessive, then steam dump should be stopped. Excessive feed to the SGs can also result in cooling down the RCS and it may be necessary to reduce feed flow to the minimum for decay heat removal until SG level is in the narrow range. If the cooldown continues, the main steamlines are isolated to stop any steam leakage downstream of the MSIVs, such as a stuck open condenser steam dump valve.

If RCS temperature is greater than no-load and increasing, then steam dump from the secondary must be increased for decay heat removal.

EOP Basis:

Same as ERG basis

Supplemental Information:

DW-94-017: This step is designated a continuous action step in order allow the operator to ensure proper RCS heat removal through the secondary side by dumping steam when required.

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 21 (CONTINUED)

Commitment C0550: Revise Salem EOPs as required to include issues identified in LER 272/94-007-01). To wit, three points of interest:

1. If either train of SI is actuated, then ensure *both* trains of SI are actuated.
2. Control RCS temperature at no-load after reactor trip (avoid heatup above no-load).
3. Control SG pressures via MS10s after a trip to prevent lifting safeties on RCS heatup above no-load temperature.

Setpoints and Numerical Values:

Value	Setpoint	Description
547°F	E.02	No-load RCS average temperature.
9%	M.02	Value showing SG level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
15%	M.03	Value showing SG 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.
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:

DEV.1 Added plant specific details for controlling RCS temperature and total feed flow.

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

DEV.2 Directed the operator to initiate main steamline isolation instead of closing the MSIVs and bypasses.

JUST. Initiation of main steamline isolation results in a more rapid closure of the main steamline isolation and bypass valves than manual closure of these valves. Use of main steamline isolation is preferred in this case to mitigate excessive RCS cooldown. [SD-9]

EOP Step No: Step 22

ERG Step No: N/A

EOP Step:

ARE BOTH REACTOR TRIP BKRS OPEN
[REACTOR TRIP BKR STATUS]

Purpose:

To place the P-4 interlocks on both safeguards trains in the desired state.

ERG Basis:

N/A

EOP Basis:

Permissive interlock P-4 is generated by auxiliary breaker contacts when a reactor trip breaker and its associated bypass breaker are open (e.g., breakers RTA and BYA both open generates P-4 on Train A). There are two P-4 signals (one for each safeguards train). The P-4 interlock is used for the following control functions:

- Transfers steam dump control to Reactor Trip Mode
- Arms the condenser Steam Dump System
- Generates a MFW isolation signal coincident with low T_{avg}
- Trips the main turbine
- Permits SI reset, which blocks all subsequent automatic SI signals.

Of the control functions above, the most important one is the ability to reset SI, which will be required later in the EOP set. If either trip breaker is not open, then an operator is sent to locally open both trip breakers to ensure their status. If a breaker cannot be opened locally or there is a breaker contact failure, then I&C is directed to install jumpers to instate the P-4 signal to allow SI reset when required.

ERG Deviations:

DEV.1 Added step to verify both reactor trip breakers are open.

JUST. Ensures that the P-4 interlocks on both safeguards trains are in the correct state so that SI can be reset in an expeditious manner.

EOP Step No: Steps 23 and 24

ERG Step No: Step 20

EOP Step:

(Step 23) ARE BOTH PZR PORVs CLOSED
[PZR PORV STATUS]

(Step 24) IS ANY RCP RUNNING
[PZR SPRAY STATUS]

Purpose:

To check that the PZR PORVs or spray valves are not causing an RCS depressurization.

To specifically note the position of the PORV block valves.

ERG Basis:

PZR PORVs are provided to relieve RCS pressure excursions and are assumed available on the reference plant to prevent reactor trip for design basis load rejection events. An open PZR PORV or spray valve may cause an RCS depressurization. The operator checks that these valves are closed if PZR pressure is below the appropriate setpoints. At least one block valve should be open to ensure availability of at least one PORV for pressure excursions in the RCS (due to degraded situations such as inadequate core cooling or an event misdiagnosis such as a SGTR) and preclude the operation of PZR safety valves. Since this step would be reached in the early phase of accident recovery, the operators should not spend much time getting a block valve open. Therefore, if power is not available to the block valve, the operator should continue in the procedure. Procedural guidance does exist for restoring power to a block valve later in the accident recovery.

If the PZR pressure is below 2335 psig and any PZR PORV or its block valve cannot be closed, the operator is instructed to transfer to EOP-LOCA-1, LOSS OF REACTOR COOLANT, to address this equivalent small break LOCA condition. If the PZR pressure is below 2335 psig and any normal PZR spray valve cannot be closed, the operator is instructed to stop RCPs as necessary to terminate the spray flow. It may be necessary to stop two (or more) RCPs in order to minimize the RCS depressurization, depending on which spray valve is failed open, the availability of pressurizer heaters, the existing pressurizer level, and the individual plant design. Spray effectiveness with different combinations of RCPs running will vary with plant design as discussed in the EOP Basis section below.

EOP Step No: Steps 23 and 24 (CONTINUED)

EOP Basis:

Expected spray flow with different combinations of RCPs running will vary depending on which spray valve is open, the existing pressurizer level, and individual plant design. Analyses have demonstrated that differential pressure for providing spray flow is available for 2-loop, 3-loop and 4-loop plants when the RCP in the loop with the pressurizer surge line is running. Spray differential pressure may be available if the surge line RCP is idle and the other spray line RCP is running; it is more likely with the non-spray RCP(s) also running. With only non-spray RCP(s) running, spray differential pressure will likely be negative (indicating no spray flow will occur) or insignificant unless PZR level is high. Refer to the supplemental information from DW-2002u below for additional guidance on stopping RCPs to minimize spray flow for different plant designs and conditions.

Supplemental Information:

ERG Knowledge Item: PZR PORV leakoff line temperature response.

DW-94-028: At least one PZR PORV block valve should be open to ensure availability of at least one PORV for high pressure excursions in the RCS (Engineering evaluation S-2-RC-MEE-1108 for inadvertent SI, or due to degraded situations such as inadequate core cooling or an event misdiagnosis such as a SGTR) and preclude the operation of the PZR safety valves.

DW-2002u: A failed open pressurizer spray valve could have closed when instrument air isolated, and may reopen when instrument air is restored to containment. This may reinitiate a RCS pressure decrease.

DW-2002u: High PZR water level with any combination of RCPs operating will increase spray effectiveness.

DW-2002u: The Generic Issue "RCP Trip/Restart" in the ERG Executive Volume will be revised to contain the following:

An analysis was performed to determine available pressurizer spray differential pressure for various combinations of RCPs operating using input data representative of standard Westinghouse 2-loop, 3-loop and 4-loop plants. For this analysis, the spray driving head (or Δp) with various combinations of RCPs operating was compared with the pressurizer elevation head loss (or Δp) to determine whether or not spray would be produced. The results of this analysis are similar to information developed previously for these plant types, where the spray predictions compared favorably with the plant test results.

EOP Step No: Steps 23 and 24 (CONTINUED)

Supplemental Information: (CONTINUED)

Spray performance is affected by the differences in coolant velocity head (V2/2g) and static pressure associated with the pressurizer surge line connection. The differential pressure available for pressurizer spray is determined by the difference between spray driving Δp (psi) and pressurizer elevation Δp (psi). The spray driving Δp is the differential pressure between the scoop inlet in the cold leg and the surge line inlet in the hot leg. The spray driving Δp is dictated by RCS loop and vessel hydraulic losses and velocity changes. Its value depends on the number of RCPs operating and in which loops they are operating relative to the open spray line. Pressure losses due to reverse flow at either spray scoop are assumed to be minimal. The pressurizer elevation Δp is determined from the difference in elevation head between the spray line (that is, from cold leg scoop to top of the spray line) and the pressurizer/surge line (that is, the Δp due to the steam space, pressurizer liquid volume, and surge line). The pressurizer elevation Δp must be overcome to attain spray flow. Its value depends primarily on the pressurizer liquid level and the density difference between the various fluid states.

The analysis assumed operation at zero percent power with Tavg at no-load temperature and one spray valve failed open. The differential pressure available for spray was determined with both normal (25%) and high (90%) pressurizer levels. Note that these results are general; individual plant characteristics (e.g., piping configuration, core height, pressurizer size) may alter the results. The results of this analysis are summarized in the following table "Differential Pressure (psi) Available for Pressurizer Spray".

Differential Pressure (psi) Available for Pressurizer Spray

A positive differential pressure (Δp) indicates that spray would be produced. A negative Δp (in bold) indicates that the elevation loss is higher than the spray Δp, and spray water could not be raised to the top of the spray line above the pressurizer to initiate spray. A Δp close to zero indicates that spray flow may or may not be produced (due to analysis uncertainties).

[See Table on next page]

EOP Step No: Steps 23 and 24 (CONTINUED)

Supplemental Information: (CONTINUED)

Note: The table below has been edited to display only results applicable to Salem. Loop "A" has the surge line and a spray line, and loop "B" has a spray line. Equivalent Salem component designations are included in parentheses. Values for differential pressure are in psid.

RCS loops	RCP hp	Spray valve A open (PS3)			Spray valve B open (PS1)			Spray valve B open (PS1)			Spray valve A open (PS3)		
		RCP(s) ON	25% PZR	90% PZR	RCP(s) ON	25% PZR	90% PZR	RCP(s) ON	25% PZR	90% PZR	RCP(s) ON	25% PZR	90% PZR
4	6000	A (23)	+16.0	+22.3	B (21)	**-1.2**	+5.0	A (23)	+6.5	+12.7	B (21) C* (22) D* (24)	**-10.8**	**-4.6**
		A,C (23,22) A,D (23,24)	+21.0	+27.2	B,C (21,22) B,D (21,24)	+4.4	+10.6	A,C (23,22) A,D (23,24)	+11.8	+18.0	B,C (21,22) B,D (21,24) C, D * (22,24)	**-4.8**	+1.4
		A,C,D (23, 22,24)	+29.9	+36.1	B,C,D (21, 22,24)	+14.5	+20.7	A,C,D (23, 22,24)	+21.4	+27.6	B,C,D (21, 22,24)	+6.0	+12.2

* - also applies if spray valve B is open instead of spray valve A

As the above results indicate, spray will be produced in all cases when the RCP is operating in the loop with the surge line connection. Spray may be produced if the surge line RCP is idle and the other spray line RCP is running; it is more likely with the non-spray RCP(s) also running. Spray flow with any combination of RCPs operating will be more effective with a high pressurizer water level. These results should be generally applicable to 2-loop, 3-loop and 4-loop plants, although differences in system hydraulics, spray scoop effectiveness, or pressurizer elevation could change a few of the cases listed above. The results also indicate that there will be sufficient operating flexibility to obtain spray flow for the normal shutdown and cooldown operations with one or two pumps stopped. The previous studies for 2-loop, 3-loop and 4-loop plants provided similar results, with 4-loop plants tending to have less operating flexibility than the others. In some 3-loop and 4-loop plants, the spray line in the loop without the surge line may not generate adequate spray unless the pressurizer water level is high.

EOP Step No: Steps 23 and 24 (CONTINUED)

Setpoints and Numerical Values:

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

ERG Deviations:

DEV.1 Revised ERG Step 20.d to open *both* PZR PORVs instead of *at least one.*

JUST. While one is adequate, it is preferable to open both for single failure considerations.

DEV.2 Added a continuous action to close the PORVs (if presently open due to high pressure), when pressure decreases below the actuation setpoint.

JUST. This reminds the operator to monitor this situation to ensure that the appropriate response actions are taken when required. [SD-10]

DEV.3 Added an action to open a PZR PORV if pressure is greater than the actuation setpoint.

JUST. This backs up automatic response with manual confirmatory action and is consistent with the intent of DW-94-028.

DEV.4 Added an action to determine RCP status.

JUST. RCS depressurization due to normal spray is only applicable if an RCP is running. Therefore, RCP status is checked first. This expedites movement through the EOP by skipping this step if all RCPs are stopped.

DEV.5 To determine if spray valves should be closed, the EOP uses criteria of *pressure dropping uncontrollably* in lieu of using the 2260 psig setpoint as required by the ERG.

JUST. The master PZR spray controller is rate-compensated and may open the spray valves at a pressure below the setpoint value called for by the ERG. Therefore, use of a specific setpoint has been avoided for this reason.

DEV.6 Revised step to trip additional RCPs for a stuck open spray valve.

JUST. This is consistent with WOG guidance contained in DW-2002u. [CR 70022203]

EOP Step No: Step 25

ERG Step No: Note 21-1, Step 21

EOP Step:

IS RCS PRESSURE LESS THAN 1350 PSIG
[RCP TRIP CRITERIA]

Purpose:

To ensure that seal cooling flow is continued even if RCPs are stopped.

To trip RCPs if required conditions are satisfied.

ERG Basis:

(ERG Note 21-1) The effectiveness of the RCP Number 1 seal is not affected by pump rotation. To ensure continued performance of the seal, cool filtered water should be continuously supplied. The operator should not isolate the seal injection lines unless directed to in the procedures.

(ERG Step 21) Refer to document RCP TRIP/RESTART in the Generic Issues section of the Executive Volume.

EOP Basis:

Same as ERG basis, with the following additional information:

The RCP trip parameter is RCS pressure. The RCPs are stopped if RCS pressure decreases to less than 1350 psig AND ECCS flow of at least 100 gpm can be confirmed. The ECCS flow can be provided by either the 21 or 22 Charging Pump OR the SI pumps. The setpoint value of 1350 psig was chosen to allow for continued operation of the RCPs for non-LOCA and SGTR events in which RCP operation would facilitate plant recovery.

Supplemental Information:

ERG Knowledge Item: Seal injection flow response following a safety injection.

ERG Knowledge Item: Importance of RCP trip when required conditions are satisfied.

ERG Knowledge Item: This step is a continuous action step and is on the CAS for EOP-TRIP-1.

EOP Step No: Step 25 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
100 gpm	S.07	Minimum charging flow (per the SI systems charging flow meter) which indicates injection into the RCS.
100 gpm	S.08	Minimum SI flow (per the SI pump flow meter) which indicates injection into the RCS.
1350 psig	W.05	RCP trip parameter and setpoint including allowances for normal channel accuracy and post-accident transmitter errors.

ERG Deviations:

DEV.1 Deleted ERG note regarding seal injection flow.

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, ERG Note 21-1 was converted into an action. [SD-20]

DEV.2 Changed ERG substep from "SI pumps - AT LEAST ONE RUNNING" to actions to check for minimum ECCS flow established.

JUST. Per the ERG Executive Volume discussion of Generic Issue RCP TRIP/RESTART, the intent of this RCP trip criterion is "Successful operation of the Safety Injection System". Use of the criterion "ECCS flow established" is more indicative of flow delivery to the RCS than verification of pump operating status.

EOP Step No: Step 26

ERG Step No: Step 22

EOP Step:

IS ANY SG PRESSURE DROPPING IN AN UNCONTROLLED MANNER
[FAULTED SG EVALUATION]

Purpose:

To identify any faulted SGs (failure in secondary pressure boundary).

ERG Basis:

An uncontrolled SG pressure decrease or a completely depressurized (i.e., near containment or atmospheric pressure) SG indicates failure of the secondary pressure boundary. Isolation is to be performed using EOP-LOSC-1, LOSS OF SECONDARY COOLANT.

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:

DEV.1 Added direction to initiate main steam isolation prior to transition to EOP-LOSC-1.

JUST. Initiation of main steam isolation is the most rapid method of reducing steam flow from the SGs, thus mitigating blowdown from a faulted SG. This action is performed quickly to lessen the severity of the accident.

DEV.2 Restructured ERG step to eliminate negatives.

JUST. Since the EOP Writer's Guide requires that action steps avoid negative wording when possible, this step was written in a positive context. [SD-11]

EOP Step No: Step 27

ERG Step No: Step 23

EOP Step:

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

Purpose:

To identify any ruptured SGs (failure in primary to secondary pressure boundary).

ERG Basis:

Abnormal condenser air ejector radiation, SG blowdown or steamline radiation indicates primary to secondary leakage. Optimal recovery in dealing with a SGTR is provided in EOP-SGTR-1, STEAM GENERATOR TUBE RUPTURE.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: "Normal" means the value of a process parameter experienced during routine plant operations.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Add level check as an additional SGTR indication.

JUST. This is consistent with ERG Step 28.b.RNO indication of a SGTR. It was added here with these other SGTR indications for functional grouping and to allow an earlier transition to EOP-SGTR-1 if appropriate.

EOP Step No: Step 28

ERG Step No: Step 24

EOP Step:

ARE TWO OR MORE CHANNELS IN TABLE F IN WARNING OR ALARM OR RISING
|LOCA EVALUATION|

Purpose:

To identify any failure in the RCS pressure boundary into the containment.

ERG Basis:

Abnormal containment radiation, pressure, or recirculation sump level is indicative of a high energy line break in containment. Since the SGs have been determined to be non-faulted in an earlier step, the break must be in the Reactor Coolant System. For smaller size breaks, containment pressure and recirculation sump level may not increase for a period of time; however, containment radiation would be apparent. EOP-LOCA-1, LOSS OF REACTOR COOLANT, is used for breaks in the RCS.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: "Normal" means the value of a process parameter experienced during routine plant operations.

Setpoints and Numerical Values:

Value	Setpoint	Description
4 psig	T.06	Containment pressure SI setpoint.
46%	T.16	Containment sump level determined to transition to LOCA-1 (this is used in TRIP-1 to diagnose a LOCA).

ERG Deviations:

DEV.1 Added plant specific details defining normal containment conditions.

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

EOP Step No: Step 29

ERG Step No: Steps 25

EOP Step:

IS RCS SUBCOOLING GREATER THAN 0°F
[SI TERMINATION CRITERIA]

Purpose:

To determine if conditions have been established which indicate that full ECCS flow is no longer required.

ERG Basis:

(ERG Step 25) Following SI actuation, RCS conditions may be restored to within acceptable limits for ECCS flow reduction to be allowed, particularly if the SI is spurious. Refer to document SI TERMINATION / REINITIATION in the Generic Issues section of the ERG Executive Volume.

EOP Basis:

Same as ERG basis, with the following additional information:

At this point in the procedure, the operator has been unsuccessful in diagnosing that a SGTR, LOCA, or a secondary side break was the cause for the reactor trip and SI. A likely scenario is that a spurious SI signal caused the trip. This step checks the SI termination criteria and, if all criteria are met, then EOP-TRIP-3 is implemented to terminate SI. In the event PZR level is the only criterion not satisfied when this step is performed, an attempt is made to restore the necessary level by operating PZR spray. Stabilizing pressure aids in restoring PZR level. Otherwise, ECCS flow will raise RCS pressure and reduce ECCS flow due to centrifugal pump operating characteristics. It may be necessary to establish control air (reset Phase A, open 21 and 22 CA330 valves) to the spray valves to accomplish this action.

EOP Step No: Step 29 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: Use of PZR spray valves to assist in restoring PZR level.

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.

ERG Knowledge Item: This step is a continuous action step. It contains a transition to EOP-TRIP-3, SAFETY INJECTION TERMINATION, when the SI reduction criteria are satisfied. (DW-91-014)

Setpoints and Numerical Values:

Value	Setpoint	Description
11%	D.04	Value showing pressurizer level just in range including allowances for normal channel accuracy and reference leg process errors.
9%	M.02	Value showing SG level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
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.
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:

DEV.1 Added action to check if control air must be restored to operate PZR spray valves after safeguards have been reset.

JUST. This step is in a loop from EOP Step 39 back to EOP Step 21. During the initial pass through this loop, control air to containment (and therefore normal spray) may not be available. EOP Step 35 will restore control air to containment, so on subsequent loops, normal spray will be available.

EOP Step No: Step 30

ERG Step No: Step 26

EOP Step:

INITIATE EOP-CFST-1

Purpose:

To initiate monitoring of the status trees.

ERG Basis:

At this point in EOP-TRIP-1, no transition to an Optimal Recovery Guideline has been made and SI termination criteria have not been met. The operator will remain in EOP-TRIP-1 until either a transition to a recovery guideline is made or SI can be terminated. Monitoring the Critical Safety Function Status Trees will ensure that the plant remains in a safe condition while the operator remains in EOP-TRIP-1. The basis for the placement of this instruction in this step follows.

The operator is trained to monitor the Critical Safety Function Status Trees when a transition out of EOP-TRIP-1 is made (see EOP User's Guide). Since a transition out of EOP-TRIP-1 is expected, the Critical Safety Function Status Trees are monitored soon after the reactor trip or safety injection. However, if the operator does not make a transition out of EOP-TRIP-1 due to lack of appropriate symptoms, this step gives explicit instruction to monitor the Status Trees while remaining in EOP-TRIP-1. Placement of this instruction after the verification of automatic actions and the diagnostic sequence is due to various reasons. Verification of automatic actions ensures that plant equipment is operating properly. These steps are performed prior to monitoring the Status Trees since the proper operation of the safeguards equipment is the first means of preventing or correcting any challenges to the Critical Safety Functions. The diagnostic sequence can be performed fairly quickly and any transition to another Optimal Recovery Procedure would require that the Critical Safety Function Status Trees be monitored. Hence, the step to explicitly monitor the Status Trees in EOP-TRIP-1 follows these actions. In addition, any extreme challenges to the Critical Safety Functions due to equipment failure are addressed by explicit transitions out of the immediate action steps in EOP-TRIP-1.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

EOP Step No: Step 30 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 31

ERG Step No: Step 27

EOP Step:

MAINTAIN TOTAL FEED FLOW GREATER THAN 22E04 LB/HR
UNTIL AT LEAST ONE SG NR LEVEL IS GREATER THAN 9%
[SG LEVEL CONTROL]

Purpose:

To ensure adequate feed flow or SG inventory for secondary heat sink requirements.

ERG Basis:

The minimum feed flow requirement satisfies the feed flow requirement of the Heat Sink Status Tree until level in at least one SG is restored into the narrow range. Narrow range level is re-established in all SGs to maintain symmetric cooling of the RCS. The control range ensures adequate inventory with level readings on span. The transition to EOP-SGTR-1, STEAM GENERATOR TUBE RUPTURE, responds to an increasing level which would be observed following a SGTR.

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.

ERG Knowledge Item: This step is a continuous action step.

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.

DW-89-075: The lower limit for controlling SG levels should be greater than the AFW actuation setpoint to allow SG sampling as necessary while also meeting the lower limit imposed by the ERG.

EOP Step No: Step 31 (CONTINUED)

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).
9%	M.02	Value showing SG level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
15%	M.03	Value showing SG level just in the narrow range including allowances 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 Specified checking both NR and WR SG levels for uncontrolled level increases to determine if a SGTR exists.

JUST. Westinghouse evaluation SECL 95-151 allows use of both NR and WR instrumentation for this purpose. Use of WR level allows an earlier diagnosis than use of NR level alone.

EOP Step No: Step 32

ERG Step No: Step 29

EOP Step:

ARE ANY AUX BLDG RADIATION DETECTORS IN TABLE G IN WARNING OR ALARM
[AUXILIARY BUILDING RADIATION EVALUATION]

Purpose:

To ensure that there is no primary leakage into the Auxiliary Building.

ERG Basis:

During the initiation of the transient, there should be no abnormal indications in the Auxiliary Building. If abnormal radiation levels exist, the operating crew should attempt to identify the cause of the abnormal conditions. If the cause is determined to be a loss of RCS inventory outside containment, then the operator should go to EOP-LOCA-6, LOCA OUTSIDE CONTAINMENT, to try to terminate the leakage.

EOP Basis:

Same as ERG basis, with the following additional information:

There are six area radiation detectors in the Auxiliary Building (listed in Table G). Since it may take some time to determine the cause of the radiation in those areas, the operator is instructed to continue with this procedure until the cause of the radiation is identified. If the cause is a LOCA outside containment, then the operator is instructed to go to EOP-LOCA-6 to try to terminate the leakage.

Supplemental Information:

ERG Knowledge Item: Determination of a loss of RCS inventory outside containment

ERG Knowledge Item: "Normal" means the value of a process parameter experienced during routine plant operations.

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 33

ERG Step No: Step 30

EOP Step:

IS ANY PRT PARAMETER IN TABLE H RISING
[PRT STATUS CHECK]

Purpose:

To check if there is any inleakage into the PRT.

ERG Basis:

Leakage into the PRT may come from various sources (e.g., seal return, valve stem leak-off). Evaluating the cause of any abnormal PRT conditions may assist the operator in the diagnosis of the plant fault (e.g., a leaking PORV).

EOP Basis:

Same as ERG basis, with the following additional information:

PRT level, temperature or pressure indications increasing is a symptom of leakage into the PRT. Leakage through a PZR PORV or safety valve will cause these symptoms, in addition to reducing RCS pressure and inventory. The operator should check PORV status versus current RCS pressure when evaluating any abnormal PRT parameters.

Supplemental Information:

ERG Knowledge Item: Flow paths that enter the PRT

ERG Knowledge Item: "Normal" means the value of process parameter experienced during routine plant operations.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added specific details for evaluating PRT conditions.

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

EOP Step No: Step 34

ERG Step No: Caution 31-1

EOP Step:

IF BLACKOUT LOADING OCCURS ON ANY VITAL BUS AFTER SI RESET,
THEN: PERFORM ACTIONS PER TABLE I
[SAFEGUARDS RESET ACTIONS]

Purpose:

To alert the operator to a possible configuration which would not provide automatic start of safeguards equipment.

ERG Basis:

With the SI signal reset, no further automatic signal will be generated to restart safeguards equipment. Normal sequencing of safeguards loads onto the emergency bus after DG startup will not occur. However, a "blackout" sequencer actuation is possible.

EOP Basis:

Same as ERG basis, with the following additional information:

The next step directs resetting of the SI signal. Resetting the SI signal removes the auto start signal to the safeguards equipment. If a blackout loading sequence occurs after the SI signal is reset, the operator may be required to restart additional safeguards equipment that was running prior to blackout loading sequence initiation. Table I provides the required actions to reset the SEC as well as a list of equipment which is to be loaded on the appropriate vital buses if required. The loading sequencer must be reset and required loads manually started if operation is required. This action is necessary because different equipment is started for blackout loading than for safeguards loading.

Supplemental Information:

None

Setpoints and Numerical Values:

None

EOP Step No: Step 34 (CONTINUED)

ERG Deviations:

DEV.1 Deleted ERG caution on blackout loading.

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, ERG Caution 31-1 was converted into a continuous action step. [SD-20]

DEV.2 Added plant specific details for loading safeguards equipment after SI reset.

JUST. This guidance aids operators in performing these actions in a consistent manner. These details include information to assist the operator in restarting safeguards equipment following SI reset. If a blackout loading sequence occurs on any 4 KV vital bus with SI previously reset, then ECCS pumps and other safeguards equipment will not automatically start and must be manually operated if required since different equipment is started on a SEC blackout loading than on a safeguards loading. [SD-29]

EOP Step No: Step 35

ERG Step No: Steps 31, 32, and 33

EOP Step:

RESET SI
[SAFEGUARDS RESET ACTIONS]

Purpose:

To utilize the reset function which is part of the safeguards actuation logic such that equipment can be realigned.

To remove the "locked-in" signal such that equipment can be realigned.

To restore a sustained, compressed air supply to allow control of air-operated equipment inside containment (e.g., charging and letdown valves, PZR PORVs, etc.).

ERG Basis:

(ERG Step 31) In order to realign safeguards equipment, a deliberate action must be taken to reset the SI signal.

(ERG Step 32) This part of the automatic logic requires a deliberate operator action to remove the "close" signal. No valve will reposition upon actuation of the resets, but separate control actions will subsequently open the valves.

(ERG Step 33) The Instrument (control) Air System on the reference plant utilizes a large volume receiver to sustain pressure in the system. A separate receiver inside containment allows limited equipment operation; however, the line to the compressors is isolated with Phase A Isolation. While opening the containment valve provides a flow path, a compressor may have to be started also (with attendant electrical considerations) to supply pressure.

EOP Basis:

Same as ERG basis, with the following additional information:

The SECs must be reset as part of safeguards reset to allow operator control of the associated equipment. If the SEC will not reset, the operator will be directed to block the affected SEC and attempt to reset the SEC. The SEC block switch on RP1 functions only to block the safety injection signal to the SEC. In addition, this block switch will only function if an SI signal is present. If efforts to reset the SEC are still unsuccessful, the operators will be directed to de-energize the affected SEC to allow operator control of safeguards equipment.

EOP Step No: Step 35 (CONTINUED)

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added plant specific details for resetting of SI signal (SECs).

JUST. The SECs must be reset along with (but following) SI to allow manual control of safeguards equipment. The necessary steps have been added, along with possible contingency actions. [SD-13]

DEV.2 Revised ERG step (establish instrument air to containment) to accommodate the plant specific design.

JUST. The ERG action for starting an air compressor was deleted since an emergency air compressor is auto started on an SI. It is checked running in a previous step. Since the instrument air receiver is located outside containment, the control air isolation valves must be opened to supply air operated valves inside containment. [SD-15]

DEV.3 Added plant specific details to reset the 230V control centers.

JUST. Some 230V loads are initially locked out in SEC Modes II, III, and IV to reduce initial DG loading. These loads include charging/RHR/CS pump room coolers, RHR sump pumps, BAT heaters, 21 and 22 Charging Pump Aux Lube Pumps, and DG aux loads such as air start air compressors, jacket water heaters, fuel oil transfer pumps, etc. At 20 minutes after SEC actuation, this lockout is automatically removed, allowing these loads to be automatically energized. This lockout is reset manually as a backup to the automatic reset. [SD-16]

EOP Step No: Step 36

ERG Step No: Step 28

EOP Step:

OPEN 21 THRU 24 SS94 (SG B/D SAMPLE VALVES)
[SG RADIATION EVALUATION]

Purpose:

To identify any ruptured (failure in primary to secondary pressure boundary) SGs.

ERG Basis:

Abnormal radiation in a SG indicates primary to secondary leakage. Since the air ejector and blowdown lines may have been isolated at the initiation of the transient, it may be necessary to check each SG at this time. Optimal recovery in dealing with a SGTR is provided in EOP-SGTR-1, STEAM GENERATOR TUBE RUPTURE.

EOP Basis:

Same as ERG basis, with the following additional information:

Abnormal radiation in a SG indicates primary to secondary leakage. This step instructs chemistry to sample the SGs for boron and activity to determine if a SGTR exists. If the samples indicate abnormal amounts of boron or activity, the operator is instructed to go to EOP-SGTR-1.

The SG B/D sample isolation valves (SS94) automatically close on either a Phase A Isolation signal OR on any automatic AFW pump start signal. The 23 AFW Pump automatic start signals that close the SS94 valves are loss of 125VDC control power, low-low SG water level, 4KV group bus UV, and AMSAC actuation. The 21 and 22 AFW Pump automatic start signals that close the SS94 valves are low-low water level, SGFP trip, AMSAC, and SEC load sequencing. Refer to Logic Diagrams 231446 thru 231448 for the details on these pump start and SS94 isolation signals.

Normally, the SS94 valves can NOT be re-opened to sample SGs until the Phase A Isolation signal is reset AND the automatic AFW pump start signals are removed.

EOP Step No: Step 36 (CONTINUED)

EOP Basis: (CONTINUED)

To allow prompt SG sample capability without having to wait for SG water levels to rise above the low-low setpoint, a SG B/D SAMPLE ISOLATION BYPASS keyswitch was installed on control console CC2 by DCP 2EC-3470. This switch has positions of OFF and ON. In the OFF position, the SS94 valves respond normally to Phase A Isolation and AFW pump automatic start signals. In the ON position, the auto close signal to the SS94 valves due to an AFW pump automatic start signal is bypassed, allowing the operator to open the valves using their normal open pushbuttons. A SG B/D SAMPLE ISOLATION BYPASS status light illuminates above the keyswitch to indicate that this bypass is in effect. Note that the Phase A Isolation signal is NOT bypassed by this keyswitch. Thus, Phase A Isolation must still be reset to allow opening these valves using the normal open pushbutton.

Supplemental Information:

ERG Knowledge Item: How to obtain secondary radiation level readings, including signals that may need to be reset

ERG Knowledge Item: "Normal" means the value of a process parameter experienced during routine plant operations.

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 37

ERG Step No: Caution 34-1

EOP Step:

IF RCS PRESSURE DROPS TO LESS THAN 300 PSIG IN AN UNCONTROLLED MANNER, THEN START BOTH RHR PUMPS
[RHR PUMP STOP CRITERIA]

Purpose:

To alert the operator that if RCS pressure should decrease in an uncontrolled manner to less than the shutoff head of the RHR pumps, they must be manually restarted since the SI signal has been reset.

ERG Basis:

Except for relatively large LOCAs, the RCS pressure should remain greater than the shutoff head of the RHR pumps until later in the recovery following a controlled cooldown and depressurization. To avoid damage to the RHR pumps, instructions are provided to stop these pumps early in the recovery if RCS pressure is greater than their shutoff head. An automatic signal to restart these pumps may not be available if RCS pressure subsequently decreases uncontrollably to less than their shutoff head. In that case, manual action is required to restart these pumps.

EOP Basis:

Same as ERG basis, with the following information:

If RCS pressure is greater than the RHR pump shutoff head in this step and the RHR pumps are stopped in the next step as a result of flow being less than 300 gpm, and subsequently, RCS pressure drops less than the RHR pump shutoff head *in an uncontrolled manner*, then the RHR pumps should be restarted and left running, even if flow is less than 300 gpm at that point.

Supplemental Information:

DW-94-030: Revised this caution to start the RHR pumps if RCS pressure decreases in an uncontrolled manner to less than the RHR pump shutoff head.

EOP Step No: Step 37 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
300 psig	B.07	Shutoff head pressure of the RHR pumps plus allowances for normal channel accuracy.

ERG Deviations:

DEV.1 Deleted ERG Caution regarding RHR pump restart.

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 38

ERG Step No: Step 34

EOP Step:

IS RHR FLOW AT LEAST 300 GPM ON 21 OR 22 SJ49 COLD LEG INJECTION METER
[RHR PUMP STOP CRITERIA]

Purpose:

To stop the RHR pumps if RCS pressure is sufficiently high to prevent any injection flow.

ERG Basis:

RHR pumps can only deliver flow against fairly low RCS pressures. At higher pressures, they inject no water and are pumping water around a small closed loop. The pumps are stopped to prevent potential damage due to heatup.

EOP Basis:

Same as ERG basis.

Supplemental Information:

SC-RHR0006-01, Attachment 10.3

Background information for ERG E-1 Step 12 states that flow can be used instead of pressure if the RHR flow transmitter is qualified.

Setpoints and Numerical Values:

Value	Setpoint	Description
300 gpm	S.03	The minimum RHR pump flow into the RCS cold legs which indicates injection into the RCS.

EOP Step No: Step 38 (CONTINUED)

ERG Deviations:

DEV.1 Revised ERG step to use RHR flow instead of RCS pressure magnitude/trend to determine if transition to EOP-LOCA-1 should be made.

JUST. RHR flow is a positive indication of injection whereas RCS pressure less than the RHR pump shutoff head is only an inference of the capability of injection. ERG E-1 Step 12 Plant Specific Information states that this is acceptable on a plant-specific basis. [SD-17]

DEV.2 Did not specify placing the RHR pumps in standby after stopping them.

JUST. When a pump is stopped, its pushbutton control switch is electronically aligned by design to automatically start when required. No additional manual action is required to place the pump in "standby". [SD-18]

EOP Step No: Step 39

ERG Step No: Steps 35 and 36

EOP Step:

ARE ALL 4KV VITAL BUSES ENERGIZED BY OFFSITE POWER
[STOPPING UNLOADED DGs]

Purpose:

To stop emergency DGs if they have started and are running unloaded.

To continue trying to identify the appropriate Optimal Recovery Guideline.

ERG Basis:

(ERG Step 35) Manufactures typically recommend that DGs not be run extensively unless carrying load. DGs should auto-start on an SI signal, but will not load if offsite power is available. If DGs are supplying the emergency buses, then possibly some additional equipment should be loaded to aid the recovery process. When the DGs are stopped, they are placed in standby to be ready to start either manually or automatically.

(ERG Step 36) The operator is instructed to remain in EOP-TRIP-1 until either a transition is made to a recovery procedure or SI can be terminated. EOP Step 21 is after the verification of automatic action steps and is the beginning of the diagnostic sequence.

EOP Basis:

Same as ERG basis.

ERG Deviations:

DEV.1 Did not specify placing the DG(s) in standby after stopping.

JUST. When a DG is stopped, it is electrically aligned to automatically start when required. No additional action is necessary to place the DG in "standby". [SD-19]

APPENDIX A

EOP/ERG CORRELATION

2-EOP-TRIP-1:
REACTOR TRIP OR SAFETY INJECTION

EOP/ERG CORRELATION

EOP Step	ERG Step
ENTRY CONDITIONS	ENTRY CONDITIONS
CAS	FOLDOUT PAGE
N/A	Note 1-1 (1)
N/A	Note 1-2 (1)
1, 2	1 (1)
3	2 (2)
4	3 (3)
5	4 (4)
6	N/A
7, 8, 9	7 (5a) 8 (5a) 10 (5a) 11 (5a)
10	5 (5a) 6 (5a) 12 (5a) 18 (5)
11	14 (5a)
12	13 (5a)
13	N/A
14	3 (3)
15	N/A
16	N/A
17	9 (5a)
18	N/A
19	15 (5)
20	16 (5b) 17 (5)
21	19 (6)

EOP Step	ERG Step
22	N/A
23, 24	20 (6)
25	Note 21-1 (6) 21 (6)
26	22 (7)
27	23 (8)
28	24 (9)
29	25 (10)
30	26 (11)
31	27 (12)
32	29 (12)
33	30 (12)
34	Caution 31-1 (12a)
35	31 (12a) 32 (12b) 33 (12c)
36	28 (12)
37	Caution 34-1 (12b-c)
38	34 (12b-c)
39	35 (12) 36 (13)