PSEG NUCLEAR L.L.C.

SALEM/OPERATIONS

1-EOP-SGTR-3 – REV 23

SGTR WITH LOCA – SUBCOOLED RECOVERY

REVISION SUMMARY Biennial Review performed Yes___ No____ NA__X___

The following change is included in this revision:

- Inserted 1R41D in step 10, Table B to provide symptom recognition of a LOCA outside containment. 1R16 was removed from this table in the previous revision in accordance with the requirements of DCP 80030824. The adequacy of 1R41D for functions previously performed by 1R16 is explained in the design basis analysis and 50.59 screening contained in DCP 80030824.

This is an editorial change in accordance with NC.DM-AP.ZZ-0001(Q) Attachment 3.

No revision bars were used in making this change.

IMPLEMENTATION REQUIREMENTS: Effective Date: 12/30/03

None

APPROVED: [signature]
Operations Manager - Salem

12/30/03
Date

EMERGENCY OPERATING PROCEDURE
1-EOP-SGTR-3
SGTR WITH LOCA - SUBCOOLED RECOVERY

1.0 Entry Conditions

See Flowchart

2.0 Operator Actions

2.1 Immediate Actions

None

2.2 Subsequent Actions

See Flowchart

3.0 Attachment List

3.1 Continuous Action Summary

3.2 Tables

None

3.3 Figures

None

3.4 Graphs

None

3.5 Checkoff Sheets

None

3.6 Attachments

1 - Major Action Categories

CONTINUOUS ACTION SUMMARY

CONDITION	ACTION
RCS SUBCOOLING 0 °F OR PZR LEVEL CAN NOT BE MAINTAINED GREATER THAN 11% (19% ADVERSE)	START ECCS PUMPS AS NECESSARY TO RESTORE SUBCOOLING AND PZR LEVEL
RCS PRESSURE LESS THAN 1500 PSIG AND BIT FLOW ESTABLISHED	CLOSE CHG PUMP MINIFLOW
"AFWST LEVEL LO-LO" ALARM (10.3%)	SHIFT AFW PUMP SUCTION
ANY INTACT SG LEVEL RISING IN AN UNCONTROLLED MANNER OR ANY INTACT SG ABNORMAL RADIATION	GO TO EOP-SGTR-1
ANY UNISOLATED SG COMPLETELY DEPRESSURIZED OR DEPRESSURIZING IN AN UNCONTROLLED MANNER AND SG IS NOT NEEDED FOR RCS COOLDOWN	GO TO EOP-LOSC-1
"RWST LEVEL LO" ALARM (15.2 FT)	GO TO EOP-LOCA-3
ANY STEAM RELEASE FROM RUPTURED SG	PLACE R-46 IN SERVICE

MAJOR ACTION CATEGORIES

- **PREPARE FOR AND INITIATE RCS COOLDOWN TO COLD SHUTDOWN**
- **DEPRESSURIZE RCS TO REFILL PZR**
- **REDUCE RCS INJECTION FLOW**
- **DEPRESSURIZE RCS TO MINIMIZE RCS SUBCOOLING**
- **PERFORM OTHER LONG TERM RECOVERY ACTIONS**

SALEM GENERATING STATION

1-EOP-SGTR-3
SGTR WITH LOCA - SUBCOOLED RECOVERY

BASIS DOCUMENT

EOP Step No: ENTRY CONDITIONS

ERG Step No: ENTRY CONDITIONS

EOP Step:

EOP-SGTR-1 Steps 4.9, 7.3, 13.1, 14, 15.4, 15.5, 16.1, 16.3, 23.1, 26, 30.3
EOP-SGTR-2 Steps 3, 11.3, 27.3, 46.2
EOP-SGTR-5 Steps 7, 7.2, 10.3

Purpose:

To provide the plant conditions for entry into this procedure.

ERG Basis:

N/A

EOP Basis:

- EOP-SGTR-1 Step 4.9, if a ruptured SG cannot be isolated from any intact SG.
- EOP-SGTR-1 Step 7.3, if a PZR PORV cannot be isolated with block valve.
- EOP-SGTR-1 Step 14, if a ruptured SG pressure less than setpoint.
- EOP-SGTR-1 Steps 13.1, 15.4, and 15.5 if no intact SG available for cooldown.
- EOP-SGTR-1 Step 16.1, if minimum delta-P between ruptured and intact SG cannot be maintained.
- EOP-SGTR-1 Step 16.3, if RCS subcooling less than required.
- EOP-SGTR-1 Step 23.1, if RCS pressure does not increase after closing PZR PORV and block valve.
- EOP-SGTR-1 Step 26, if SI cannot be terminated.
- EOP-SGTR-1 Step 30.3, if SI is required.
- EOP-SGTR-2 Step 3, if RCS subcooling or PZR level are inadequate.
- EOP-SGTR-2 Steps 11.3, 27.3, and 46.2 if non-ruptured SG not available for cooldown.
- EOP-SGTR-5 Steps 7 and 7.2, if SI cannot be terminated.
- EOP-SGTR-5 Step 10.3, if SI is required.

This procedure is used to perform a subcooled recovery following a SGTR with LOCA.

Supplemental Information:

None

EOP Step No: ENTRY CONDITIONS (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: CAS

ERG Step No: 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 utilize 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
0°F	R.01	The sum of temperature and pressure measurement system errors including allowances for normal channel accuracies, translated into temperature using saturation tables - based on Subcooling Margin Monitor.
11%	D.04	Value showing pressurizer level just in range including allowances for normal channel accuracy and reference leg process errors.
19%	D.05	Value showing pressurizer level just in range, including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.
1500 psig	B.10	RCS pressure for closing charging pump miniflow valves when charging pumps are injecting through the BIT.
10.3%	U.01	AFST low-low level switchover setpoint.
15.2 ft	U.02	RWST level switchover setpoint.

EOP Step No: CAS (CONTINUED)

ERG Deviations:

DEV.1 Added an item requiring 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 criteria for transitioning back to EOP-SGTR-1 in the event another SG tube rupture occurs.

JUST. This information was added per ERG Step 10.b.RNO and the intent is explained in that step's basis.

DEV.3 Added criteria for placing ruptured SG radiation monitor R-46 in service.

JUST. These monitors (one per SG steamline) monitor the process steam for radioactivity, with the exhausted steam being directed to the condenser. EOP-SGTR-1 isolates these monitors as part of minimizing the spread of radioactive contamination throughout the secondary system. If subsequent SGTR-series EOPs should need to steam a ruptured SG, then that SG's R-46 should be placed in service to ensure that the steam release to the environment is properly monitored for purposes of calculating offsite doses. The need to monitor offsite releases outweighs the need to minimize secondary contamination in this case.

EOP Step No: N/A

ERG Step No: Caution 1-1

EOP Step:

N/A

Purpose:

To remind the operator of normal switchover setpoint.

ERG Basis:

When RWST level decreases to 15.2 ft., there should be sufficient water available in the recirculation sump to switch the suction supply to the SI pumps. The remainder of RWST water is reserved for spray pump usage.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

15.2 ft	U.02	RWST level switchover setpoint.

ERG Deviations:

DEV.1 Deleted ERG Caution regarding the monitoring of RWST level for alignment to cold leg recirculation.

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

EOP Step No: N/A

ERG Step No: Note 1-1

EOP Step:

N/A

Purpose:

To remind the operator that the foldout page for EOP-SGTR-3 should be open.

ERG Basis:

The foldout page provides a list of important items that should be continuously monitored. If any of the parameters exceed their limits, 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 to the operator. Thus it does not have to be opened. [SD-6]

EOP Step No: Step 1

ERG Step No: Caution 1-2

EOP Step:

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

Purpose:

To remind the operator of 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 step following this 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 would occur after the SI signal is reset, the operator may be required to restart additional safeguards equipment that was running prior to the initiation of the blackout loading sequence. This action is necessary because different equipment is started for blackout loading than for safeguards loading. Table A 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 their operation is required.

Supplemental Information:

None

Setpoints and Numerical Values:

None

EOP Step No: Step 1 (CONTINUED)

ERG Deviations:

DEV.1 Deleted ERG Caution on blackout loading after SI reset.

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 2

ERG Step No: Steps 1, 2, and 3

EOP Step:

RESET SI
[SAFEGUARDS RESET ACTIONS]

Purpose:

To reset the SI signal to remove the associated interlocks.

To clear the containment isolation signals to remove the associated interlocks.

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

ERG Basis:

(ERG Step 1) In order to realign or stop safeguards equipment as directed in subsequent steps, the SI signal must be reset.

(ERG Step 2) With containment Phase A or Phase B Isolation signals present, containment penetration isolation valves are maintained closed which limits the availability of instrument air, normal CVCS operation, and CCW supply. In order to open these valves as directed in subsequent steps, these signals must be cleared.

Although Phase A and Phase B Isolation signals are identified in this step, they are not necessarily expected to have occurred. However, they are highlighted here to address the possibility that they may have occurred due to multiple failures. No valve will reposition upon actuation of the resets, but subsequent control actions will open the valves. These valves should remain closed, unless necessary process streams are being established, until the cause of the isolation signals is determined or corrected.

(ERG Step 3) 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 valves provides a flow path, a compressor may also have to be started (with attendant electrical considerations) to sustain pressure.

EOP Step No: Step 2 (CONTINUED)

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.

Supplemental Information:

ERG Knowledge Item: Approximate time/cycles air-operated equipment can be operated without air compressor.

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, 11 and 12 centrifugal charging pumps, Auxiliary Lube Pumps, and DG auxiliary 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: Steps 3 and 4

ERG Step No: Step 4

EOP Step:

(Step 3) ARE ALL 4 KV GROUP BUSES ENERGIZED
[4 KV GROUP BUS RESTORATION]

(Step 4) IS 1E GROUP BUS ENERGIZED AND BKR 1E6D CLOSED
[PZR HEATER POWER AVAILABILITY]

Purpose:

To ensure electrical power supply is available to all essential equipment used in this guideline.

ERG Basis:

If offsite power is lost to any AC electrical bus, manual action may be required to establish an electrical power supply to non-safeguards equipment used during recovery, such as instrument air compressor, PZR PORVs and SG MS10s with associated isolation valves, PZR heaters, etc. If offsite power cannot be restored, essential equipment used in subsequent steps, such as instrument air compressor and PZR PORVs and SG MS10s, must be loaded on the 4KV vital buses.

EOP Basis:

Same as ERG basis, with the following additional information:

If offsite power cannot be restored to the group buses, the only load that needs to be powered from a vital bus is the PZR heaters. PZR heaters can be supplied from Group Buses 1E or 1G or from Vital Buses 1A or 1C. It is preferred to power them from a group bus to minimize unnecessary DG loading on the vital buses. The 1E6D and 1G6D breakers supply not only the PZR heaters, but also the rod drive MG sets. The rod drive MG set input breakers do NOT have undervoltage trips. To cover the case where the 1E6D and 1G6D breakers might have been opened due to an ATWS (to cause control rods to drop into the core), their input breakers are checked open prior to closing the 1E6D and 1G6D breakers to prevent an inadvertent and undesirable restart of the rod drive MG sets. Refer to Drawings 203062 and 2030633 for the electrical power supply arrangement.

EOP Step No: Steps 3 and 4 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: This step is a continuous action step. Since power to the AC buses could be lost at any time, this step applies throughout the guideline as needed.

ERG Knowledge Item: The operator should continue with subsequent steps, if possible, while establishing power to essential equipment in order to expedite recovery.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 The ERG directs verification of all AC Buses energized by off-site power. The EOP verifies that the 4 KV Group buses are energized.

JUST. The EOP checks power to all 4KV group buses, which supplies power to all other buses. The S1.OP-AB.LOOP-0001(Q) procedure will restore power to 4 KV vital buses if needed. If the group buses are unavailable, the only necessary load that can be powered from the vital buses are the PZR heaters. [SD-59]

EOP Step No: Step 5

ERG Step No: Step 5

EOP Step:

IS ANY CS PUMP RUNNING
[CS PUMP STOP CRITERIA]

Purpose:

To stop CS pumps if running and no longer needed.

ERG Basis:

Spray pumps are automatically actuated on High-High containment pressure. In EOP-TRIP-1, EOP Step 11, the operator verifies that the Containment Spray System is operating if it is required. If at any time the containment pressure increases above the High-High containment pressure setpoint, the PURPLE priority path of the Containment Environment Status Tree sends the operator to EOP-FRCE-1, RESPONSE TO EXCESSIVE CONTAINMENT PRESSURE. EOP Step 3 of EOP-FRCE-1 checks the need for CS and verifies that the spray system is operational if it is required. During a LOCA the need for continued operation of the spray system is monitored by this step. After containment pressure is reduced the pumps can be stopped to prevent RWST depletion.

EOP Basis:

Same as ERG basis.

Supplemental Information:

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

ERG Plant-Specific Information: Plant specific requirements for CS operation should be checked and, if applicable, added to this step (e.g., iodine removal and/or sump pH requirements).

ERG Knowledge Item: As part of the action to terminate containment spray, the operator should close the motor operated valve on the containment spray pump discharge line when stopping the containment spray pump. This action will ensure containment isolation.

Setpoints and Numerical Values:

Value	Setpoint	Description
13 psig	T.04	Pressure for resetting spray signal minus allowances for normal channel accuracy.

EOP Step No: Step 5 (CONTINUED)

ERG Deviations:

DEV.1 Did not specify placing the CS 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 6

ERG Step No: Caution 6-1

EOP Step:

IF ANY RUPTURED SG IS FAULTED,
THEN MAINTAIN FEED FLOW ISOLATED UNLESS NEEDED FOR RCS COOLDOWN
[RUPTURED SG FEED FLOW STATUS]

Purpose:

To prevent excessive RCS cooldown due to feeding a faulted SG.

ERG Basis:

The following step instructs the operator to feed a ruptured SG which is not faulted (secondary side boundary is intact) to ensure the SG tubes remain covered. However, if the ruptured SG is also faulted, primary-to-secondary leakage will continue even if the tubes remain covered. Feeding such a SG may aggravate an uncontrolled cooldown of the RCS and may increase the possibility of SG overfill. Feeding a ruptured SG, as directed in the following step, should be avoided if that SG is also faulted, unless it is needed to cool the RCS.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Caution regarding the isolation of feed flow to a faulted SG to a continuous action step.

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

EOP Step No: Step 7

ERG Step No: Step 6

EOP Step:

IS RUPTURED SG NR LEVEL GREATER THAN 9% (15% ADVERSE)
[RUPTURED SG FEED FLOW STATUS]

Purpose:

To reduce feed flow to the ruptured SGs to minimize the potential for SG overfill.

To establish and maintain a water level in the ruptured SGs above the top of the U-tubes in order to promote thermal stratification to prevent ruptured SG depressurization.

ERG Basis:

Following a SGTR, primary-to-secondary leakage into the affected SG will exceed steam flow and lead to an accumulation of water in the SG. Feed flow will increase the rate of accumulation and reduce the time at which SG overfill would occur. Hence, feed flow to the ruptured SG should be minimized.

It is also important to maintain the water level in the ruptured SG above the top of the U-tubes. When the primary system is cooled in subsequent steps, the SG tubes in the ruptured SG will approach the temperature of the reactor coolant, particularly if reactor coolant pumps continue to run. If the steam space in the ruptured SG expands to contact these colder tubes, condensation will occur which would decrease the ruptured SG pressure. This would reduce the reactor coolant subcooling margin and/or increase primary-to-secondary leakage, possibly delaying SI termination or causing SI reinitiation. Consequently, the water level must be maintained above the top of the tubes to insulate the steam space. In addition to insulating the steam space, this ensures a secondary side heat sink in the event that no intact SG is available and also provides protection against misdiagnosis of the ruptured SG due to an imbalance of feed flow.

EOP Basis:

Same as ERG basis

EOP Step No: Step 7 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: The operator should stop feed flow as early as possible to minimize the potential for SG overfill.

ERG Knowledge Item: In most cases, the ruptured SG level will continue to increase even after feed flow has been completely terminated. However, for some multiple failure events, such as an unisolable SGTR (i.e., ruptured SG cannot be isolated from any intact SG), level may decrease during RCS cooldown due to steaming. Consequently, level in the ruptured SG should be monitored periodically to ensure that it remains above the tubes unless the ruptured SG is also faulted. In addition to ensuring heat sink if no intact SG is available, this also minimizes radiological releases.

ERG Knowledge Item: The operator should continuously monitor ruptured SG level. If feed flow to the ruptured SG is stopped due to level being in the NR and later the level drops below the NR, feed flow to the ruptured SG should be reinitiated to reestablish level in the NR.

ERG Plant Specific Information: For plants with qualified WR SG levels, the use of WR level above the top of the tubes may permit early reduction of feed flow to the ruptured SG.

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

Setpoints and Numerical Values:

Value	Setpoint	Description
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%.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 8

ERG Step No: Caution 7-1

EOP Step:

IF RCS PRESSURE DROPS TO LESS THAN 300 PSIG (420 PSIG ADVERSE) 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, the pumps 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 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 Step 8 and the RHR pumps are stopped in Step 9 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:

ERG Knowledge Item: During the controlled depressurization, operation of the RHR pumps is not desirable unless they are being operated as part of the closed-loop RHR System. It is also possible that one RHR pump may be operated later to allow the operator to stop a charging pump, stop an SI pump, or realign a charging pump to normal charging. The RHR pumps may also have to be restarted upon transfer to cold leg recirculation in LOCA-3.

EOP Step No: Step 8 (CONTINUED)

Setpoints and Numerical Values:

Value	Number	Description
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.

ERG Deviations:

DEV.1 Deleted ERG Caution regarding starting RHR pumps if RCS pressure drops below shutoff pressure.

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 9

ERG Step No: Step 7

EOP Step:

IS RHR FLOW AT LEAST 300 GPM ON 11 OR 12 SJ49 (COLD LEG INJECTION METER)
[RHR PUMP STOP CRITERIA]

Purpose:

To stop RHR pumps to avoid pump damage.

ERG Basis:

Operation of the RHR pumps in the SI mode at RCS pressures greater than their shutoff head is not recommended for long periods of time. On Low-head Systems where the pump recirculates on a small volume circuit there is concern for pump and motor overheating. The RHR pumps are stopped early in the recovery when the criteria outlined in this step are met to prevent pump damage due to overheating.

EOP Basis:

Same as ERG basis, with the following information:

If RCS pressure is greater than the RHR pump shutoff head in Step 8 and the RHR pumps are stopped in Step 9 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:

None

Setpoints and Numerical Values:

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

EOP Step No: Step 9 (CONTINUED)

ERG Deviations:

DEV.1 Revised ERG step to use RHR flow instead of RCS pressure magnitude/trend to determine if the RHR pumps should be stopped.

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. The ERG E-1 Step 13 Plant Specific Information states that this is acceptable on a plant specific basis. [SD-17]

EOP Step No: Steps 10 and 11

ERG Step No: Step 8

EOP Step:

(Step 10) ARE ANY AUX BLDG RADIATION DETECTORS IN TABLE B IN WARNING OR ALARM
[PLANT STATUS EVALUATION]

(Step 11) OPEN 1SS33 AND 1SS104 (11 AND 13 HOT LEG SAMPLE VALVES)
[PLANT STATUS EVALUATION]

Purpose:

To initiate an evaluation of the plant status with respect to radiation leakage and availability of equipment needed for long-term plant recovery.

ERG Basis:

Since an evaluation of plant status may require some time to complete and may affect subsequent actions, it is initiated early in the recovery and should be performed concurrently with subsequent recovery actions.

A check should be made for radioactive leaks into the Auxiliary Building (e.g., letdown line leakage, containment valve leakage, etc.) to identify and isolate, if possible, any leakage outside containment.

Samples are obtained to assess RCS reactivity, fuel damage, hydrogen concentration, etc. In the case of LOCA plus SG tube failures, backleakage could occur. The recirculation sump should be sampled to verify that excessive dilution of the RCS boron concentration has not occurred. If it has, then the operator would have to provide additional boron to the coolant before transferring to cold leg recirculation.

An evaluation of plant equipment available following a LOCA is necessary in determining long-term recovery actions. Hence, this evaluation is initiated at this time and any additional equipment that would assist in the plant recovery, such as CCW and RHR heat exchangers, is started.

EOP Basis:

Same as ERG basis, with the following additional information:

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 13 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 11 and 12 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.

EOP Step No: Steps 10 and 11 (CONTINUED)

EOP Basis: (CONTINUED)

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.

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 1EC-3544. 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: If any identified ECCS leakage is isolated, flow must be maintained to the RCS so that core cooling is maintained.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Substeps 8.c and 8.d regarding evaluating and starting plant equipment.

JUST. Operating personnel are continually evaluating the status of plant equipment under normal and emergency conditions. Equipment that is needed to complete the recovery actions is specifically addressed in the EOP.

EOP Step No: Step 12

ERG Step No: Step 9

EOP Step:

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

Purpose:

To identify any faulted SG(s) (failure in secondary pressure boundary) and to ensure proper isolation.

ERG Basis:

An uncontrolled SG pressure decrease or a completely depressurized (i.e., near containment or atmospheric pressure) SG indicates a failure of the secondary pressure boundary. If it cannot be verified that all faulted SG steamlines and feedlines are isolated, the operator is instructed to leave EOP-SGTR-3 and transfer to EOP-LOSC-1, LOSS OF SECONDARY COOLANT, to perform the isolation actions. Therefore, this step alerts the operator to a possible misdiagnosis or subsequent failure. Since decreasing SG pressure can be caused by manual actions during a controlled cooldown of the RCS, the operator must distinguish between a "controlled" and "uncontrolled" depressurization of the suspect SGs. The operator should return to EOP-SGTR-3, SGTR WITH LOCA - SUBCOOLED RECOVERY, to continue recovery when isolation of the secondary fault has been completed (as directed by EOP-LOSC-1 and EOP-SGTR-1).

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.

ERG Knowledge Item: If no intact SG is available, then the faulted SGs do not have to be isolated if the RCS cooldown is less than 100°F/hr.

ERG Knowledge Item: Automatic steam dump operation or addition of feed flow may cause SG pressure to decrease unexpectedly.

Setpoints and Numerical Values:

None

EOP Step No: Step 12 (CONTINUED)

ERG Deviations:

DEV.1 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 13

ERG Step No: N/A

EOP Step:

STOP 13 CHARGING PUMP

Purpose:

To stop any charging pumps that are running unnecessarily.

ERG Basis:

N/A

EOP Basis:

This step directs the operator to stop the 13 Charging Pump. This pump is stopped to prepare for performing ECCS flow reduction actions. ECCS flow reduction calculations were performed assuming that only the ECCS pumps were in service; therefore, the 13 Charging Pump is removed from service.

Supplemental Information:

N/A

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added an action step to stop 13 Charging Pump.

JUST. The additional action steps were added to ensure that the 13 Charging Pump is stopped prior to performing the ECCS flow reduction actions. ECCS flow reduction will be performed in subsequent steps. The ECCS flow reduction calculations were performed assuming that only the ECCS pumps were in service; therefore the 13 Charging Pump is removed from service.

EOP Step No: Step 14

ERG Step No: N/A

EOP Step:

IS AFW FLOW AVAILABLE
[CONDENSATE SYSTEM ALIGNMENT CHECK]

Purpose:

To establish the Condensate System as the SG feed source if AFW is not available.

ERG Basis:

N/A

EOP Basis:

For the reference plant, the condensate storage tank (CST) is the normal suction source for AFW. Therefore, AFW flow adds mass from the CST to the Feed and Condensate Systems, and the pursuant hotwell high level dumps this excess mass back to the CST in a closed loop. Salem plant design differs from the reference plant in this regard. The AFST is NOT in this closed loop. AFST mass is added to the Feed and Condensate Systems, but the pursuant high hotwell level dumps this excess mass to the raw water storage basin for eventual reprocessing and return to the Demineralizer Water System rather than back to the AFST. Therefore, Salem allows use of condensate pump flow from the condenser as an alternate feedwater source to establish a closed loop to conserve secondary water.

If AFW is not available (e.g., AFST level is almost empty), then the Feedwater and Condensate System is aligned to one intact SG so that the condensate pumps can be used to feed the SG. The intact SG that is being used must be depressurized to less than 575 psig. Decreasing pressure to within the discharge head of the condensate pumps will permit feeding the SG.

Supplemental Information:

None

EOP Step No: Step 14 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
575 psig	O.09	Condensate pump discharge header pressure for minimum flow operation on recirculation, minus allowances for normal channel accuracy.
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%.

ERG Deviations:

DEV.1 Added step to allow using the Condensate System to feed the SGs instead of the AFW System if SG pressure is sufficiently low and AFW is not available.

JUST. Refer to EOP basis.

EOP Step No: Step 15

ERG Step No: Step 10

EOP Step:

MAINTAIN TOTAL FEED FLOW GREATER THAN 22E04 LB/HR
UNTIL AT LEAST ONE SG NR LEVEL IS GREATER THAN 9% (15% ADVERSE)
[SG LEVEL CONTROL]

Purpose:

To control feed flow to the intact SGs to prevent excessive RCS cooldown and SG overfill.

To maintain an adequate secondary side heat sink.

To identify a previously undetected SG tube failure which could potentially result in SG overfill.

ERG Basis:

In most cases, feed flow will exceed steam flow from the intact SGs resulting in an accumulation of water in the SGs. This excess feed flow will also result in a cooldown of the RCS at a rate dependent upon the feed flow rate and heat generation rate in the primary system. Consequently, feed flow must be adjusted to control SG level and reactor coolant temperature. This step also provides for monitoring level in the intact SGs to detect multiple or subsequent tube failures. In that case, the operator is returned to EOP-SGTR-1, STEAM GENERATOR TUBE RUPTURE, Step 1, to isolate the affected SG and repeat the recovery actions.

If reactor trip occurs from a high power level, the water level may shrink below the narrow range so that temporarily no reliable indication of SG water level is available. During this time, feed flow should be maintained greater than $22x10^4$ lb/hr to ensure an adequate secondary side heat sink. This 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 reestablished in all intact SGs to maintain symmetric cooling of the RCS.

Once intact SG level has been re-established in the narrow range, the operator is directed to establish a control band between the AFW actuation setpoint and 50%. This control range ensures that an adequate inventory will be maintained close to the typical SG level control band and prevent the actuation of the AFW signal. Actuation of the AFW signal could result in potential releases from the ruptured SG through the opened steam supply valves to the turbine-driven AFW pump if the ruptured SG contains the steam supply tap. (DW-94-024)

EOP Step No: Step 15 (CONTINUED)

EOP Basis:

Same as ERG basis, with the following additional information:

The ERG action that checks for multiple SGTRs in this step has been deleted since the EOP CAS encompasses this action on a continuous 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.

ERG Knowledge Item: "Intact" refers to any SG which has not been diagnosed as having a failed tube or secondary break.

ERG Knowledge Item: This step begins a loop in the procedures which cools and depressurizes the RCS to cold shutdown conditions.

ERG Knowledge Item: At this point in a SGTR event, the auxiliary feedwater should be delivering to the intact SG(s). If auxiliary feedwater is not available, the operator should try to establish main feedwater. If main feedwater is not available, then at least one intact SG should be depressurized to establish condensate system flow.

ERG Knowledge Item: Once level is restored into the narrow range, the secondary heat sink requirement has been satisfied and the operator throttles AFW flow to control SG level and reactor coolant temperature. SG level should be allowed to gradually increase until the level is within the stated control band. (DW-94-024)

ERG Plant-Specific Information: SG wide range level instrumentation may provide additional margin to uncovering the U-tubes for control of feed flow. However, the reliability of this instrumentation should be evaluated on a plant-specific basis including consideration of calibration effects, redundant channel indications, and sensitivity to changes in SG inventory relative to the narrow range. Refer to the document Generic Instrumentation in the Generic Issues section of the Executive Volume for further discussion on the wide range SG level instrumentation.

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

EOP Step No: Step 15 (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.
9%	M.10	SG level greater than the AFW actuation setpoint.
15%	M.11	SG level just in range, including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%, or the AFW actuation setpoint, whichever is greater.

ERG Deviations:

DEV.1 Deleted ERG Step 10.b.RNO (transition to EOP-SGTR-1 on multiple SGTRs).

JUST. This action is covered by a CAS item. Therefore, it has been deleted from this step to eliminate redundancy and streamline the EOP. Refer to DEV.3 under the CAS basis for this EOP.

EOP Step No: Steps 16 and 17

ERG Step No: Note 11-1, Step 11

EOP Step:

(Step 16) MONITOR SHUTDOWN MARGIN ONCE PER HOUR
[MONITOR SHUTDOWN MARGIN]

(Step 17) IS INTACT SG AVAILABLE FOR COOLDOWN
[RCS COOLDOWN TO COLD SHUTDOWN]

Purpose:

To determine if shutdown margin is adequate for RCS cooldown.

To begin or continue a controlled RCS cooldown to cold shutdown temperature as quickly as feasible in order to minimize total leakage of reactor coolant.

ERG Basis:

(ERG Note 11-1) This note advises the operator to monitor RCS boron concentration to verify adequate shutdown margin during the cooldown to cold shutdown. Note that since SI was in service, RCS boron concentration is expected to be sufficient.

(ERG Step 11) The RCS must be cooled and depressurized to cold shutdown conditions as quickly as possible to minimize both leakage of reactor coolant and radiological releases from the ruptured SG. This step establishes a 100°F/hr cooldown rate, which balances the need for rapid RCS cooldown with the concern of pressurized thermal shock of the reactor vessel. The preferred cooling method is steam release from the intact SGs to the condenser since this conserves feedwater supply and minimizes radiological releases. If steam dump to the condenser is unavailable, atmospheric steam releases via the intact SG MS10s provides an alternative means of cooling the RCS. In the unlikely event that no intact SG is available, one must select either a faulted SG or ruptured SG to cool the RCS until the RHR System can support further cooldown to cold shutdown.

EOP Basis:

Same as ERG basis.

EOP Step No: Steps 16 and 17 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: Flow in the loops with an inactive SG may stagnate during this cooldown if no RCP is running. The hot leg temperature in those loops may remain significantly greater than the active loops. In addition, safety injection flow into the cold leg may cause the cold leg fluid temperature to decrease rapidly in the stagnant loop. Steps to depressurize the RCS and terminate SI should be performed as quickly as possible after the cooldown has been initiated to minimize possible pressurized thermal shock of the reactor vessel.

ERG Knowledge Item: If no intact SG is available, a choice must be made between feeding a faulted SG or steaming a ruptured SG for RCS cooldown to RHR conditions. One must weigh the concerns of reactor vessel thermal stresses, increased discharge to containment, and thermal stresses on the SG tubes against increased radiological releases from the ruptured SG and the potential for SG overfill on an event specific basis. Refer to ERG Section 3.2, Key Utility, Decision Points.

ERG Knowledge Item: With a 100°F/hr cooldown rate, steam flow may exceed feed flow capacity so that the SG levels may decrease. Although the plant should be cooled as quickly as possible, the cooldown rate should be controlled to maintain the SG tubes covered in the ruptured SG if a ruptured, non-faulted SG is being used for cooldown.

ERG Knowledge Item: Periodic samples should be taken to monitor shutdown margin, however, the operator should not wait for the sample results. (DW-92-060)

Setpoints and Numerical Values:

Value	Setpoint	Description
100 °F/hr	H.02	Maximum cooldown rate of the RCS.

ERG Deviations:

DEV.1 Deleted ERG Note on monitoring shutdown margin during RCS cooldown.

JUST. Since the EOP Writer's Guide does not allow hidden actions in cautions and notes, the ERG Note was converted into a continuous action step. The continuous action step includes plant specific details to aid the operators in performing these actions in a consistent manner. [SD-20]

EOP Step No: Steps 16 and 17 (CONTINUED)

ERG Deviations: (CONTINUED)

DEV.2 Added plant specific details for calculating radioactive release rates prior to dumping steam from the ruptured SG.

JUST. See Knowledge Item #2. Performing these calculations will ensure radioactive release rates and dose rates are known prior to release of the radioactive steam. These calculations may also affect the decision on releasing the radioactive steam from the ruptured SG.

DEV.3 ERG RNO Step 11.c provides direction for manually or locally dumping steam from an intact SG MS10. The EOP did not provide any guidance for locally dumping steam in this manner.

JUST. Operators are trained to operate MS10s locally if manual operation (from the control room) is required but unavailable. Therefore, the contingency to locally dump steam has been deleted since it is covered by the operator training program.

DEV.4 Added plant-specific details for condenser steam dump operation.

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

EOP Step No: N/A

ERG Step No: Notes 11-2 and 11-3

EOP Step:

N/A

Purpose:

To prevent main steamline isolation valve (MSIV) closure on low compensated steamline pressure during controlled RCS cooldown.

ERG Basis:

An automatic protection feature is provided to close the main steamline isolation valves when steam pressure approaches the low steamline pressure SI setpoint. In the following step the operator is instructed to dump steam from the intact SGs which is expected to reduce their pressure below this setpoint. If automatic isolation occurred, steam flow to the condenser would be terminated requiring the operator to continue the cooldown by dumping steam to the atmosphere. In addition to delaying recovery, this would increase the radiological releases and reduce feedwater supply. This note directs the operator to block the low steamline pressure SI signal when PZR pressure decreases below the P-11 permissive.

EOP Basis:

N/A

Supplemental Information:

ERG Knowledge Item: The pressure at which steamline isolation occurs is rate dependent and may occur at a higher pressure than the setpoint so that the signal should be blocked as soon as PZR pressure decreases to less than (A.05) psig.

ERG Knowledge Item: For small tube failures, PZR pressure may remain above the P-11 permissive. Although pressure will decrease as the RCS is cooled, it may still remain greater than the P-11 permissive. In that case the operator can reduce RCS pressure using the PZR spray or PORV so that the SI signal can be blocked.

Setpoints and Numerical Values:

N/A

EOP Step No: N/A (CONTINUED)

ERG Deviations:

DEV.1 Deleted these ERG notes regarding low steamline pressure SI block.

JUST. The ERG reference plant allows this signal to be blocked. At this plant, both SI and MSIV Isolation signals occur on high steam flow coincident with either low Tavg or low SG pressure. This SI signal is blockable below 543°F, but the MSIV Isolation signal is NOT blockable. Therefore, these notes are NOT applicable to this plant. See Logic Diagram 221057. In addition, per verification comment #049, below 543°F, only three condenser steam dump valves are available (cooldown group), and their combined steam flow capacity is less than the high steam flow setpoint for these SI and MSIV Isolation signals.

EOP Step No: Step 18

ERG Step No: Step 12

EOP Step:

IS RWST LEVEL LESS THAN 29 FT
[RECOVERY OPTIONS EVALUATION]

Purpose:

To direct the operator to EOP-SGTR-4, SGTR WITH LOCA - SATURATED RECOVERY if additional actions are necessary to limit leakage from the RCS.

ERG Basis:

Two similar but different contingency procedures are available to limit leakage from the RCS following a loss of reactor coolant event with a SG tube failure. EOP-SGTR-3 SGTR WITH LOCA - SUBCOOLED RECOVERY, provides guidance for sequentially stopping ECCS pumps when the reduced SI capacity will be sufficient to maintain RCS subcooling. It is advantageous to maintain subcooling in the RCS in order to provide an indication of coolant inventory trends and ensure significant margin to core uncovery. RCS subcooling also facilitates PZR pressure control and allows RCP operation without concern of coolant depletion or pump damage. However, leakage from the RCS is directly related to subcooling in the primary system. Hence, by maintaining reactor coolant subcooling, one increases leakage.

An alternative contingency procedure EOP-SGTR-4, SGTR WITH LOCA - SATURATED RECOVERY, was developed to further limit leakage from the RCS if conditions warrant. In that procedure, ECCS pumps are sequentially stopped when the reduced ECCS capacity will be sufficient to match leakage from the RCS at saturation. Although this procedure allows one to further reduce the loss of reactor coolant, there are trade-offs. Most importantly, without RCS subcooling, no indication of reactor coolant inventory trends exist until the core begins to uncover (unless RVLIS is available). In that case, one must rely on temperature trends on the CETs to detect superheat conditions at the onset of core uncovery. Since RCP operation would homogenize the RCS and preclude detection of excessive coolant depletion via the CETs, the RCPs must be stopped (refer to the document RCP TRIP/RESTART in the Generic Issues section of the ERG Executive Volume for further discussion on RCP operation with saturated RCS conditions if RVLIS is available). Consequently, one must weigh the benefit of reduced coolant leakage against the above concerns of a saturated recovery.

EOP Step No: Step 18 (CONTINUED)

ERG BASIS: (CONTINUED)

If the leakage from the RCS is to the containment sump, then the coolant is recoverable so that long term cooling is ensured and the radiological releases will be small. Consequently, the subcooled recovery method is sufficient. On the other hand, if significant leakage is outside containment then reactor coolant makeup supply will decrease and radiological releases may become excessive. In that case, the saturated recovery method in EOP-SGTR-4 is more appropriate. This step first compares RWST level and containment sump level to determine the extent of net coolant depletion, i.e., unrecoverable leakage from the RCS. If the available coolant supply is less than 50% of the total RWST capacity, the operator is directed to EOP-SGTR-4 in order to conserve the remaining water. The level in the ruptured SG is also checked to determine the potential for SG overfill. An overfill condition could lead to additional secondary side failures and excessive radiological releases via liquid relief to the environment. Hence the operator is instructed to consider continuing recovery using EOP-SGTR-4 to limit the potential for and consequences of SG overfill. This decision must be based on consideration of secondary side coolant activity, capability of steamlines to support liquid, and the availability of a RVLIS, and overall understanding of the event in progress.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: This step is a continuous action step. The operator can transition to EOP-SGTR-4 if the criteria in ERG Step 12 are satisfied any time during the cooldown to cold shutdown.

ERG Knowledge Item: If the RCS is saturated, there is no benefit in transitioning to EOP-SGTR-4.

If cold leg recirculation is not available, then the inventory in the containment sump is unrecoverable. In that case, the operator should transition to EOP-SGTR-4 when RWST level has decreased to 50% of the total.

DW-93-042: The setpoint for the ERGs only addresses normal channel accuracy since the containment level indication for the ERG reference plant is provided by level switches which are not subject to adverse containment conditions. Plants that have containment level instrumentation that is subject to adverse containment conditions should also include in the decision block a plant specific setpoint that addresses allowances for post accident transmitter errors.

ERG Knowledge Item: If the operator determines that subcooled recovery is appropriate based on RWST level/containment sump level and ruptured SG level, the operator stays in EOP-SGTR-3 which provides guidance for subcooled recovery but also includes guidance for a saturated recovery if subcooling cannot be maintained. In this case if RWST level/containment sump level or ruptured SG level subsequently reach the transition setpoints, the operator will transition to EOP-SGTR-4 since the step to determine if a subcooled (or saturated) recovery is appropriate is a continuous action step.

EOP Step No: Step 18 (CONTINUED)

Supplemental Information: (CONTINUED)

ERG Knowledge Item: If the operator determines that a saturated recovery is appropriate based on RWST level/containment sump level or ruptured SG level, the operator is transitioned to EOP-SGTR-4 to perform a saturated recovery in order to minimize RCS inventory losses through the ruptured SG. By transitioning to EOP-SGTR-4 for this case, the operator also receives direction to add makeup water to the RWST (EOP-SGTR-4, Step 1). This guidance is not provided in EOP-SGTR-3 even though both EOP-SGTR-3 and EOP-SGTR-4 provide the same basic guidance with respect to performing a saturated recovery.

Setpoints and Numerical Values:

Value	Setpoint	Description
29 feet	U.08	Lowest RWST level for which transition to EOP-SGTR-4 is not necessary if primary system leakage is not accumulating in the containment sump.
TABLE. ECA31-1	U.09	RWST level versus containment sump level used to determine if adequate recirculation capability exists for remaining in EOP-SGTR-3.
92%	M.07	Value corresponding to SG level at the upper tap including allowances for normal channel accuracy.
90%	M.08	Value corresponding to SG level at the upper tap including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors.

ERG Deviations:

DEV.1 Added action steps for resetting the semi-automatic swapover "S-Signal" prior to making a transition to EOP-SGTR-4.

JUST. Entry into the unacceptable region of Figure 1 indicates a probable LOCA outside containment with the potential for inadequate containment sump inventory to support cold leg recirculation. Therefore, the SI signal input to the auto-swapover circuit is reset to prevent inadvertently swapping over to a containment sump with inadequate inventory.

EOP Step No: Step 19

ERG Step No: Step 13

EOP Step:

IS RCS SUBCOOLING GREATER THAN 0°F
[SI FLOW EVALUATION]

Purpose:

To determine if the RCS is subcooled.

ERG Basis:

The EOP-SGTR-3, SGTR WITH LOCA - SUBCOOLED RECOVERY, recovery scheme is designed to limit leakage of reactor coolant while ensuring adequate coolant inventory by maintaining RCS subcooling and a reliable PZR level. Leakage from the RCS is directly related to subcooling. If the RCS is sufficiently cooled, RCS pressure and reactor coolant makeup flow should be reduced to decrease subcooling and, hence, leakage. If the reactor coolant is saturated such actions are not necessary. In that case, it may be necessary to increase reactor coolant makeup flow to ensure adequate coolant inventory. This step checks RCS subcooling and directs the operator to the appropriate steps in the procedure so that the correct actions are taken.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
0°F	R.01	The sum of temperature and pressure measurement system errors including allowances for normal channel accuracies, translated into temperature using saturation tables - based on Subcooling Margin Monitor.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 20

ERG Step No: Step 14

EOP Step:

ARE BOTH SI PUMPS STOPPED
[SI FLOW EVALUATION]

Purpose:

To determine if any SI pump is running, if any centrifugal charging pump is injecting through the BIT, or if any RHR pump is running in the SI mode.

ERG Basis:

With SI in service, (either high pressure or low pressure pumps), RCS pressure will tend toward an equilibrium value where ECCS flow matches leakage from the RCS. For RCS pressures less than this value, ECCS flow will exceed leakage so that reactor coolant inventory will increase, as illustrated in ERG Figure 16. Depressurizing the RCS using only PZR pressure control will decrease coolant leakage and increase SI flow. Eventually, the PZR would fill with water, rendering PZR pressure control ineffective. Actions to reduce ECCS flow are also needed to reduce RCS pressure. Hence, with SI in service, PZR pressure control is used to control reactor coolant inventory. ECCS flow is reduced by stopping ECCS pumps one at a time when sufficient RCS subcooling has been established. The combination of these actions control reactor coolant inventory and decrease RCS pressure to limit leakage from the RCS.

After ECCS flow has been terminated and normal CVCS operation established, PZR pressure control can be used effectively to depressurize the RCS. Flow through the normal charging lines can be adjusted to manage PZR level. So two different recovery schemes exist depending on the status of the SI Systems. With ECCS in service, PZR pressure control is used to control reactor coolant inventory while ECCS flow is decreased in a stepwise fashion to decrease RCS pressure. After ECCS flow has been terminated, PZR pressure control is used to decrease RCS pressure while flow through the normal charging lines is throttled to control PZR level. This step checks the status of the ECCS pumps to direct the operator to the appropriate steps for each recovery scheme.

EOP Step No: Step 20 (CONTINUED)

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

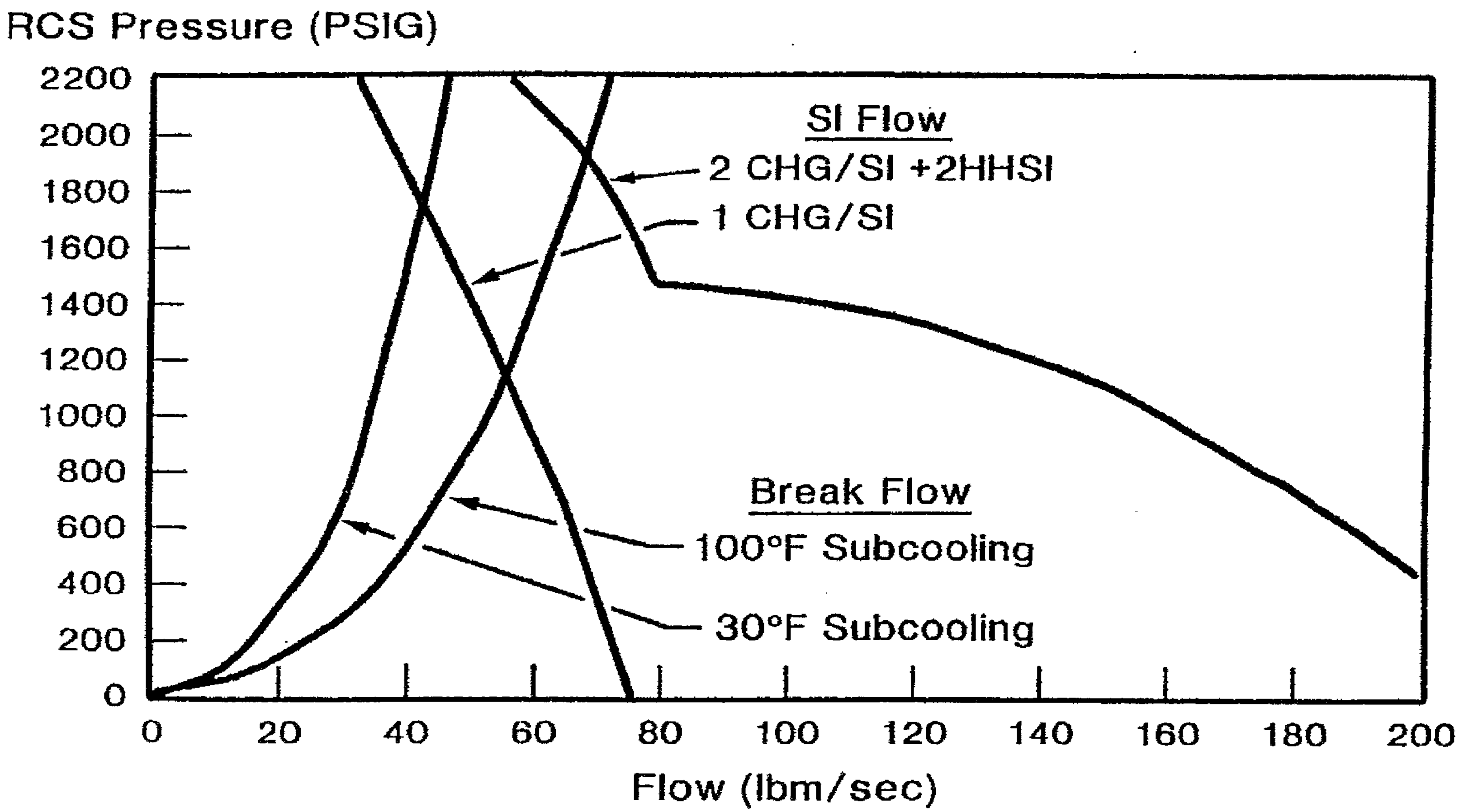
None

ERG Deviations:

DEV.1 Added plant specific details to check if RHR pumps are running in SI mode.

JUST. "RUNNING IN SI MODE" is not common operator terminology. Therefore, this determination has been presented in equivalent but more familiar terminology.

Figure 16. EQUILIBRIUM RCS PRESSURE



EOP Step No: Step 21

ERG Step No: Step 15

EOP Step:

PLACE ALL PZR HEATERS IN "MANUAL" AND "OFF"

Purpose:

To prevent actuation of PZR heaters when PZR level is restored.

ERG Basis:

With ECCS in service, PZR pressure control is used to control reactor coolant inventory, as previously discussed. PZR heaters will tend to maintain leakage from the RCS greater than ECCS flow, and thereby decrease reactor coolant inventory. This could lead to additional cycling of PZR spray valves or PORVs in order to maintain PZR level. To avoid this, the heaters are placed in the off position. However, if PZR level approaches a water solid condition, PZR heaters can be energized, as necessary, to maintain a steam bubble.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 22

ERG Step No: Caution 16-1

EOP Step:

CAUTION VOIDING MAY OCCUR IN RCS DURING DEPRESSURIZATION AND CAUSE RAPIDLY RISING PZR LEVEL
[RCS DEPRESSURIZATION TO REFILL PZR]

Purpose:

To inform the operator that PZR level may increase rapidly because of voiding in the RCS during the RCS depressurization.

ERG Basis:

As the RCS is depressurized steam may form in the hotter regions of the RCS. PZR level will increase rapidly as water displaced from these voided regions replaces steam in the PZR. If voiding occurs, the PZR may fill with water within a few minutes. This caution informs the operator of this condition so that RCS depressurization can be stopped quickly to avoid a water solid PZR.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 23

ERG Step No: Step 16

EOP Step:

WHEN PZR LEVEL IS GREATER THAN 25% (33% ADVERSE),
THEN STOP RCS DEPRESSURIZATION
[RCS DEPRESSURIZATION TO REFILL PZR]

Purpose:

To restore PZR level.

ERG Basis:

Following a loss of reactor coolant event, PZR level will most likely be offscale low. In order to restore level, which provides a direct indication of reactor coolant inventory trends when used in combination with RCS subcooling, one must decrease RCS pressure using PZR pressure control. Normal PZR spray is the preferred means for decreasing RCS pressure since this conserves reactor coolant inventory and provides the best pressure control. If normal spray is not available PZR PORVs and auxiliary spray provide alternative means. Since auxiliary spray will not be heated by letdown at this time, it should be used only if normal spray and PORVs are unavailable to prevent excessive thermal stresses on the spray nozzle. In order to successfully initiate auxiliary spray flow, the flow through the BIT lines must first be isolated, since sufficient differential pressure will not be available across the auxiliary spray line with the SI lines open to deliver adequate auxiliary spray flow. If the charging flow control valve is not fully open, auxiliary spray flow may not be effective. In addition, auxiliary spray flow may not be effective due to the elevation differences of the spray nozzles unless charging flow to the loops is isolated and the normal PZR spray valves are closed. Therefore, the plant specific steps necessary for establishing auxiliary spray flow should be incorporated into this step. The intent of this action is to establish an auxiliary spray flow path (e.g., open charging flow control valve, ensure the charging line isolation valves are open, isolate the charging header from the loops and close the normal spray valves).

When level returns on span RCS depressurization is stopped to prevent filling the PZR with water.

The combination of subcooling and PZR level ensures that RCS conditions are under adequate operator control. Subcooling should have been established before entry to this step. If subcooling is lost during the depressurization, it will be reestablished after the depressurization is stopped as the RCS continues to cool down.

EOP Basis:

Same as ERG basis, with the following additional information:

EOP Step No: Step 23 (CONTINUED)

EOP Basis: (CONTINUED)

This Technical Specification limit prevents thermal shock to the PZR spray nozzle, the failure of which would degrade PZR pressure control capability using spray. This limit is likely to be exceeded whenever auxiliary spray is used with letdown isolated. Although it is desirable to remain within this Technical Specification limit at all times, the overall objective of the EOPs is to protect the health and safety of the public and there are times when this is the overriding priority.

This 320°F limit is observed whenever the ERGs prohibit use of auxiliary spray if letdown is isolated. This limit is not applicable (may be exceeded) whenever the ERGs direct use of auxiliary spray even if letdown is isolated because the need to depressurize the RCS (to protect the public) overrides this limit and its associated concerns. This note explicitly identifies instances in the EOPs where this limit may be exceeded to assure the operator of this fact.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
25%	D.06	Value showing pressurizer level just covering the heaters, including allowances for normal channel accuracy and reference leg process errors.
33%	D.07	Value showing pressurizer level just covering the heaters including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.
320°F	X.04	Maximum pressurizer to auxiliary spray delta-T for placing aux spray in service.

ERG Deviations:

DEV.1 Added a note regarding the 320° F PZR to auxiliary spray delta-T limit.

JUST. This Tech. Spec. limit is applicable whenever the ERGs prohibit use of auxiliary spray without letdown flow. In some instances the ERGs direct use of auxiliary spray regardless of letdown flow because the need to depressurize the RCS overrides the Tech. Spec. considerations. This note provides assurance to the operator that the EOP has priority over the Tech. Spec. limit in these instances. [SD-43]

EOP Step No: Step 24

ERG Step No: Caution 17-1

EOP Step:

IF ALL SEAL COOLING WAS LOST TO ANY RCP,
THEN PERFORM AN ENGINEERING EVALUATION BEFORE STARTING AFFECTED RCP
[RCP STATUS]

Purpose:

To alert the operator that RCP seal damage may have occurred if RCP cooling had previously been lost. In that case, starting the affected RCP may further damage the seal and RCP.

ERG Basis:

The potential for degradation in RCP seal performance and seal life increases with increasing temperature above 300°F. Hence, if RCP seal cooling is lost for a significant period of time, seal and/or bearing damage may occur. The potential non-uniform sealing surfaces and seal crud blockage that may exist prior to RCP start can aggravate bearing and seal damage if the RCP is started. Following restoration of seal cooling, the RCP should not be started prior to a complete RCP status evaluation in order to minimize potential RCP damage on restart. Refer to Subsection 2.1 of the ERG background document for ECA-0.0, LOSS OF ALL AC POWER, for additional information.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If RCP sealing is lost for only a few minutes, the inventory of cold water in the seal area should prevent excessive seal heat up. For longer periods of time, seal and bearing temperatures may increase greater than 300°F. If excessive temperatures develop, the affected RCP should not be restarted prior to a complete RCP evaluation.

ERG Knowledge Item: RCPs should not be started prior to a status evaluation unless an extreme (RED) or severe (PURPLE) CSF challenge is diagnosed. Under such a CSF challenge, the "rules of usage" apply and an RCP should be started if so instructed by the associated FRG. Under a CSF challenge, potential RCP damage is an acceptable consequence if RCP start is required to address a CSF challenge (e.g., to mitigate an inadequate core cooling condition). This is consistent with the intent of the FRGs, which attempt to first establish support conditions to start on RCP, but then start an RCP whether or not the support conditions are established.

EOP Step No: Step 24 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Caution regarding losing RCP seal cooling.

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: N/A

ERG Step No: Caution 17-2

EOP Step:

N/A

Purpose:

To alert the operator that the RTD bypass temperatures will not be accurate during natural circulation.

ERG Basis:

The RCS bypass manifolds are used to obtain fast and accurate temperature measurements when RCPs are operating. With natural circulation flow, the manifolds receive inadequate flow to produce accurate readings so that RTD temperatures should be considered invalid and the associated interlocks should be bypassed if necessary.

EOP Basis:

N/A

Supplemental Information:

None

Setpoints and Numerical Values:

N/A

ERG Deviations:

DEV.1 Deleted caution on impact of low flow to the RTD bypass manifolds on RTD measurements during natural circulation.

JUST. The plant design does not include RTD bypass manifolds. The RCS loop RTDs are located in thermowells in the main loop piping. Therefore, this caution is not applicable. [SD-24]

EOP Step No: Step 25

ERG Step No: Note 17-1

EOP Step:

NOTE 13 RCP PROVIDES NORMAL PZR SPRAY CAPABILITY
[RCP STATUS]

Purpose:

To inform the operator that an RCP should be run in a loop which provides PZR spray if possible.

ERG Basis:

Subsequent steps require operator actions to control RCS pressure. The preferred means of control is normal PZR spray since this conserves reactor coolant inventory. Since spray line connections are provided in only two loops, an RCP should be run in one of those loops, if possible. Refer to the document RCP TRIP/RESTART in the Generic Issues Section of the ERG Executive Volume for additional information on RCP restart.

EOP Basis:

Same as ERG basis, with the following additional information:

Loop 3 provides the best spray capability since it has both a normal PZR spray line and the PZR surge line. If RCP 13 is unavailable, then RCP 11 in conjunction with any other RCP will also be capable of providing normal spray. Procedure S1.OP-SO.RC-0001(Q) contains guidance for starting an RCP, including the RCP starting priorities.

Supplemental Information:

ERG Knowledge Item: If an RCP in a loop with a ruptured SG is started, steam flow from that SG via a secondary side break will increase. Although this may increase radiological releases due to steam relief, it will also reduce the accumulation of water in the SG and decrease the possibility of overfill. Consequently, for such multiple failure events in which SG overfill appears imminent, starting an RCP in the affected loop may be beneficial.

EOP Step No: Step 25 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
13	W.03.1	Loop designation for RCP which provides best pressurizer spray capability - Unit 1.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 26

ERG Step No: Step 17

EOP Step:

ARE ALL RCPs STOPPED
[RCP STATUS]

Purpose:

To establish forced coolant flow, if possible.

ERG Basis:

RCP operation is preferred to provide normal PZR spray, to ensure homogenous fluid temperatures and boron concentrations, and to minimize the subcooling requirements for stopping SI pumps. This step provides guidance on establishing conditions for starting an RCP to prevent RCP damage and minimize any perturbations in RCS conditions.

Normal RCP startup requirements, such as RCP cooling and seal leakoff flows, should also be enforced to prevent pump damage. These include RCS subcooling to prevent cavitation at the pump suction during startup and PZR level to minimize changes in RCS pressure and provide reactor coolant inventory trends. Refer to RCP TRIP/RESTART document in the Generic Issues Section of the ERG Executive Volume for additional information on RCP restart.

If all seal cooling has been lost long enough that the maximum RCP seal parameters identified in the RCP Vendor Manual have been exceeded, seal injection and CCW thermal barrier cooling should not be established to the affected RCP(s). Both of these methods of seal cooling could have unintended consequences that result in additional pump damage or the failure of plant safety systems. Seal cooling should instead be restored by cooling the RCS, which will reduce the temperature of the water flowing through the pump seals.

EOP Basis:

Same as ERG basis.

EOP Step No: Step 26 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: Typical symptoms of natural circulation flow may not be evident at this time since ECCS pumps are injecting. Steam dump from the intact SG should be controlled to maintain 100°F/hr cooldown rate.

ERG Knowledge Item: Depressurization of the RCS may generate a steam bubble in the upper head region of the reactor vessel if no RCP is running. This bubble could rapidly condense during pump startup, drawing liquid from the PZR and reducing reactor coolant subcooling. If PZR inventory is not sufficient, level may decrease offspan. In addition, local flashing of reactor coolant could occur if RCS subcooling is not adequate. These conditions would require SI reinitiation and may confuse the operator is such behavior was unexpected.

ERG Knowledge Item: Plant specific procedures for starting an RCP may require a steam bubble to be present in the PZR. RCP restart should be permitted if an RCS leak path is certain since the leak ensures that there will not be a significant surge when the RCP is started.

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

Setpoints and Numerical Values:

Value	Setpoint	Description
0°F	R.01	The sum of temperature and pressure measurement system errors including allowances for normal channel accuracies, translated into temperature using saturation tables - based on Subcooling Margin Monitor.
25%	D.06	Value showing pressurizer level just covering the heaters, including allowances for normal channel accuracy and reference leg process errors.
33%	D.07	Value showing pressurizer level just covering the heaters including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

ERG Deviations:

No deviation from the ERG.

EOP Step No: 26.3

ERG Step No: Caution 17-3

EOP Step:

INADVERTENT CRITICALITY MAY OCCUR FOLLOWING ANY NATURAL CIRCULATION COOLDOWN IF THE FIRST RCP STARTED IS IN THE RUPTURED LOOP WITH THE RUPTURED STEAM GENERATOR.

Purpose:

To preclude initiation of forced RCS flow via startup of the RCP in the stagnant loop when post-SGTR cooldown is underway.

ERG Basis:

Initiation of forced RCS flow by starting an RCP in a loop with an intact steam generator will ensure mixing of the diluted water in the stagnant loop with the borated water in the other RCS loops such that localized dilution in the core region is precluded. Refer to ERG Maintenance Item DW-89-041 for a detailed discussion of the possibility of a localized boron dilution transient

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 27

ERG Step No: Note 18-1

EOP Step:

WHEN ECCS PUMPS ARE STOPPED,
THEN ALLOW RCS PRESSURE TO STABILIZE OR RISE
BEFORE STOPPING ANOTHER ECCS PUMP
[CHARGING PUMP REDUCTION]

Purpose:

To prevent RCS injection flow from being reduced too rapidly.

ERG Basis:

RCS pressure may decrease rapidly after an ECCS pump is stopped to a new value where the reduced ECCS flow again matches leakage from the RCS. The criteria for stopping the next ECCS pump has been calculated assuming steady-state conditions.

Hence, to ensure that these criteria are appropriate, RCS pressure and subcooling should be allowed to stabilize or increase between stopping successive ECCS pumps.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: RCS pressure may continue to decrease slowly as the reactor coolant temperature is reduced. However, if subcooling is increasing, ECCS flow can be reduced when the SI reduction criteria are satisfied.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Note regarding the RCS pressure stabilizing or increasing after an SI pump is stopped.

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

EOP Step No: Step 28

ERG Step No: Note 18-2

EOP Step:

NOTE ECCS PUMPS SHOULD BE STOPPED ON ALTERNATE VITAL BUSES
[CHARGING PUMP REDUCTION]

Purpose:

To balance the load between the ECCS trains.

ERG Basis:

Balancing the load increases the probability that there will be some RCS injection flow immediately following loss of one train.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Specified using alternate vital buses instead of alternate ECCS trains.

JUST. Due to plant design differences, two ECCS trains are distributed among three electrical trains (4KV Vital Buses A, B, and C). The intent of this step is best met by starting equipment on alternate vital buses. [SD-61]

EOP Step No: Step 29

ERG Step No: Step 18

EOP Step:

ARE 11 AND 12 CHARGING PUMPS RUNNING
[CHARGING PUMP REDUCTION]

Purpose:

To determine if conditions have been established which indicate SI flow can be reduced by stopping one centrifugal charging pump.

To reduce SI flow by stopping one centrifugal charging pump.

ERG Basis:

With SI in service, RCS pressure will tend toward an equilibrium value where ECCS flow matches leakage from the RCS. For subcooled conditions, the amount of leakage from the RCS is directly related to the capacity of the operating ECCS pumps, as shown in ERG Figure 17. Hence, in order to minimize the loss of coolant from the primary system, ECCS flow must be reduced. On the other hand, some ECCS flow is necessary to maintain coolant inventory and pressurize the RCS sufficiently to promote primary-to-secondary heat transfer. A conflict arises between keeping the ECCS pumps running to maintain adequate coolant inventory and reducing ECCS flow to minimize leakage from the RCS. A program REDUCE has been developed for calculating various pressure/temperature relationships for stopping ECCS pumps which ensures that the reduced ECCS flow will be sufficient to maintain adequate coolant inventory. Application of this program on a plant specific basis for calculating such criteria and determining the best method of reducing ECCS flow is described in the document SI REDUCTION SEQUENCE EVALUATION in the Generic Issues section of the ERG Executive Volume.

The results of the above efforts are expressed in terms of subcooling requirements for stopping or realigning the different ECCS pumps to reduce ECCS flow. The required subcooling depends on the number of operating ECCS pumps, the status of the RCPs, and the method by which ECCS flow is reduced. For the reference high-pressure SI plant, the best sequence for reducing ECCS flow is by stopping one of two operating centrifugal charging pumps. This step checks that RCS subcooling and PZR level are sufficient to perform this action. When this step is completed with all criteria satisfied, a maximum of one centrifugal charging pump should be running. Note that for other plants, the first step in reducing ECCS flow may be different, e.g., isolate BIT. In that case, this step and the subcooling requirements will be different.

If the RCS subcooling criterion is not satisfied, but the RCS hot leg temperatures are less than the saturation temperature corresponding to the RHR pump head at minimum pump recirculation flow, the centrifugal charging pump can be stopped if a RHR pump is running or can be started. Starting an RHR pump for this case ensures that RCS subcooling will be maintained after the centrifugal charging pump is stopped.

EOP Step No: Step 29 (CONTINUED)

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: This step is part of a large loop implemented during the cooldown to cold shutdown. Although RCS subcooling may be insufficient when this step is first encountered, it will continue to increase as the cooldown proceeds.

ERG Knowledge Item: PZR level may decrease rapidly when ECCS flow is reduced. In order to maintain level on span, it may be necessary to concurrently decrease RCS pressure as directed in ERG Step 16.

ERG Knowledge Item: When the SI reduction subcooling criterion is not met, the RHR pump contingency applies to the RHR pump injecting in the SI mode, not operating in the closed-loop RHR System cooling mode.

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

Setpoints and Numerical Values:

Value	Setpoint	Description
Tables	R.07	Subcooling criteria calculations for stopping SI pumps in ES-1.2, ECA-3.1 and ECA-3.2. Refer to document SI REDUCTION SEQUENCE EVALUATION in Generic Issues section of Executive Volume.
360°F	F.03	Saturation temperature of the RHR pump head at minimum pump recirculation flow including allowances for normal channel accuracy.
25%	D.06	Value showing pressurizer level just covering the heaters, including allowances for normal channel accuracy and reference leg process errors.
33%	D.07	Value showing pressurizer level just covering the heaters including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

EOP Step No: Step 29 (CONTINUED)

ERG Deviations:

DEV.1 Specified "at least two" hot leg temperatures whereas the ERG does not specify any particular number.

JUST. Specifying at least two hot leg temperatures protects against taking action based on a single failed instrument. [SD-62]

EOP Step No: Step 30

ERG Step No: Step 19

EOP Step:

IS ANY SI PUMP RUNNING
[SI PUMP REDUCTION]

Purpose:

To determine if conditions have been established which indicate ECCS flow can be reduced by stopping one SI pump.

To stop the SI pumps.

ERG Basis:

For the reference high-pressure SI plant, the best sequence for reducing ECCS flow begins by stopping one of two operating centrifugal charging pumps. If leakage from the RCS is small enough, ECCS flow can be further reduced by stopping the SI pumps one at a time. This step checks the PZR level and RCS subcooling requirements, calculated as described in the document SI REDUCTION SEQUENCE EVALUATION in the Generic Issues section of the ERG Executive Volume, for stopping these pumps to ensure that the reduced capacity will be sufficient. Note that this step is part of a large loop which is implemented during the cooldown to cold shutdown. Each time this step is executed with the various criteria satisfied, one SI pump will be stopped. Additional SI pumps will be stopped if conditions permit with successive passes through the cooldown loop until all SI pumps have been stopped.

If the RCS subcooling criterion is not satisfied, but the RCS hot leg temperatures are less than the saturation temperature corresponding to the RHR pump head at minimum pump recirculation flow, the SI pump can be stopped if an RHR pump is running or can be started. Starting an RHR pump for this case ensures that RCS subcooling will be maintained after the SI pump is stopped.

EOP Basis:

Same as ERG basis.

EOP Step No: Step 30 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: PZR level may decrease rapidly when ECCS flow is reduced. In order to maintain level on span, it may be necessary to concurrently decrease RCS pressure as directed in ERG Step 16.

ERG Knowledge Item: When the SI reduction subcooling criterion is not met, the low head SI (RHR) pump contingency applies to the RHR pump injecting in the SI mode, not operating in the closed-loop RHR System cooling mode.

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

Setpoints and Numerical Values:

Value	Number	Description
Tables	R.07	Subcooling criteria calculations for stopping SI pumps in ES-1.2, ECA-3.1 and ECA-3.2. Refer to document SI REDUCTION SEQUENCE EVALUATION in Generic Issues section of Executive Volume.
360°F	F.03	Saturation temperature of the RHR pump head at minimum pump recirculation flow including allowances for normal channel accuracy.
25%	D.06	Value showing pressurizer level just covering the heaters, including allowances for normal channel accuracy and reference leg process errors.
33%	D.07	Value showing pressurizer level just covering the heaters including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

EOP Step No: Step 30 (CONTINUED)

ERG Deviations:

DEV.1 Specified "at least two" hot leg temperatures whereas the ERG does not specify any particular number.

JUST. Specifying at least two hot leg temperatures protects against taking action based on a single failed instrument. [SD-62]

EOP Step No: Step 31

ERG Step No: Step 20

EOP Step:

ARE BOTH SI PUMPS STOPPED
[NORMAL CHARGING CRITERIA]

Purpose:

To determine if conditions have been established which indicate RCS injection flow can be reduced by aligning the last centrifugal charging pump to normal charging.

ERG Basis:

As the final step in reducing ECCS flow, the operating centrifugal charging pump is realigned from the BIT to the normal charging lines. Since the resistance through the normal charging lines is generally greater than that through the BIT, this action results in a decrease in injection capacity. The criteria for performing this step which ensures that flow capacity through the normal charging lines will be sufficient to maintain adequate coolant inventory are presented in this step. Once ECCS flow has been terminated and normal charging flow has been established, makeup flow can be controlled more precisely. This allows one to decrease RCS pressure to maintain a minimum RCS subcooling while also controlling PZR level, as discussed in ERG Step 16. ERG Steps 23 through 26 reflect the different recovery scheme after ECCS flow has been terminated.

If the RCS subcooling criterion for establishing normal charging is not met, but the RCS hot leg temperatures are less than the saturation temperature corresponding to the RHR pump head at minimum pump recirculation flow, normal charging can be established if an RHR pump is running or can be started and if other requirements (e.g., pressure, level) are met.

EOP Basis:

Same as ERG basis.

Supplemental Information:

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

EOP Step No: Step 31 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
Tables	R.07	Subcooling criteria calculations for stopping SI pumps in ES-1.2, ECA-3.1 and ECA-3.2. Refer to document SI REDUCTION SEQUENCE EVALUATION in Generic Issues section of Executive Volume.
360°F	F.03	Saturation temperature of the RHR pump head at minimum pump recirculation flow including allowances for normal channel accuracy.
25%	D.06	Value showing pressurizer level just covering the heaters, including allowances for normal channel accuracy and reference leg process errors.
33%	D.07	Value showing pressurizer level just covering the heaters including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

ERG Deviations:

DEV.1 Specified "at least two" hot leg temperatures whereas the ERG does not specify any particular number.

JUST. Specifying at least two hot leg temperatures protects against taking action based on a single failed instrument. [SD-62]

EOP Step No: Step 32

ERG Step No: Steps 21, 22, and 23

EOP Step:

IS CHARGING PUMP SUCTION ALIGNED TO THE RWST
[NORMAL CHARGING ALIGNMENT]

Purpose:

To properly establish a charging path and charging flow.
To stop injection flow to the RCS through the BIT.
To maintain PZR level on span by either running an RHR pump or by adjusting normal charging flow.

ERG Basis:

(ERG Step 21) Normal charging and the BIT injection lines are parallel flow paths from the discharge of the centrifugal charging pumps. Isolating the BIT directs the flow only through the charging lines which provides more precise flow control. The inlet valves should be closed first to minimize any pressure surge in the BIT. Prior to isolating the BIT, the operator checks that the charging pump miniflow valves are open in order to ensure that the charging pump minimum flow is available.

Prior to opening the charging pump miniflow isolation valves, the operator checks to determine if the charging pumps are aligned to the RWST in the injection mode or to the discharge of the RHR pumps in the recirculation mode. If the charging pumps are aligned to the RWST, the miniflow isolation valves should be opened. If the charging pumps are aligned to the discharge of the RHR pumps in the recirculation mode, the miniflow valves should not be opened since this will, for certain conditions, establish a flow path from the containment sump through the RHR pumps via the CVCS relief valves to the CVCS holdup tanks. For the recirculation mode, the operator opens the charging flow control valve to establish a minimum charging flow prior to isolating the BIT.

(ERG Step 22) Proper alignment of the charging path allows flow to be controlled in the normal manner. This provides more precise reactor coolant inventory control which minimizes primary-to-secondary leakage while maintaining a boration path. For the reference plant, normal miniflow for the charging pump does not isolate on an SI signal and miniflow will be available since miniflow was verified in the previous step before the BIT was isolated. Charging flow is established by closing the charging flow control valve, opening the charging discharge valves and then establishing the desired charging flow by adjusting the charging flow control valve.

(ERG Step 23) PZR level will tend to decrease when ECCS flow is terminated as leakage from the RCS continues. The operator is instructed to control charging flow as necessary to compensate for this leakage and coolant shrinkage so that PZR level is maintained on span.

EOP Step No: Step 32 (CONTINUED)

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: To prevent cycling between the VCT and RWST, charging pump suction should remain aligned to the RWST. Letdown flow should be established only if necessary to control PZR level.

ERG Knowledge Item: If the PZR is solid, charging flow will also control RCS pressure. In that case, flow should be controlled as necessary to maintain RCS subcooling greater than instrument uncertainties.

ERG Knowledge Item: Pressurizer level may decrease rapidly when SI flow is reduced. In order to maintain level on span, it may be necessary to concurrently decrease RCS pressure as directed in ERG Step 16. It would also be advantageous to establish a pressurizer level greater than (D.06)% [(D.07)% for adverse containment] prior to reducing ECCS flow to ensure level remains on span.

ERG Plant Specific Information: The substeps in this step are an example of how to establish charging and may be modified as long as minimum seal injection flow is maintained and charging is introduced cautiously through the charging line.

DW-91-004: Due to the potential difficulty in obtaining 60 gpm of flow through the normal charging lines with the BIT valves open, the sequence of actions were modified to isolate the BIT prior to establishing 60 gpm of flow.

DW-91-019 Centrifugal charging pump miniflow isolation valves should not be opened in recirculation mode since this will, for certain conditions, establish a flow path to the CVCS holdup tanks.

Setpoints and Numerical Values:

Value	Setpoint	Description
60 gpm	S.01	Charging flow rate comparable to normal charging pump miniflow when in recirculation mode.
25%	D.06	Value showing pressurizer level just covering the heaters, including allowances for normal channel accuracy and reference leg process errors.
33%	D.07	Value showing pressurizer level just covering the heaters, including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

EOP Step No: Step 32 (CONTINUED)

ERG Deviations:

DEV.1 Added an action to adjust RCP seal injection as necessary after charging flow is established.

JUST. Meets the intent of the ERG Plant-Specific Information section, which requires that the minimum seal injection flow be maintained. [SD-28]

EOP Step No: Step 33

ERG Step No: Caution 24-1

EOP Step:

IF ALL SEAL COOLING WAS LOST TO ANY RCP,
THEN PERFORM AN ENGINEERING EVALUATION BEFORE STARTING AFFECTED RCP
[RCP STATUS CHECK]

Purpose:

To alert the operator that RCP seal damage may have occurred if RCP cooling had previously been lost. In that case, starting the affected RCP may further damage the seal and RCP.

ERG Basis:

The potential for degradation in RCP seal performance and seal life increases with increasing temperature above 300°F. Hence, if seal cooling is lost for a significant period of time, seal and/or bearing damage may occur. The potential non-uniform sealing surfaces and seal crud blockage that may exist prior to RCP start can aggravate bearing and seal damage if the RCP is started. Following restoration of seal cooling, the RCP should not be started prior to a complete RCP status evaluation in order to minimize potential RCP damage on restart. Refer to Subsection 2.1 of the ERG background document for ECA-0.0, LOSS OF ALL AC POWER, for additional information.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If RCP seal cooling is lost for only a few minutes, the inventory of cold water in the seal area should prevent excessive seal heat up. For longer periods of time, seal and bearing temperatures may increase greater than 300°F. If excessive temperatures develop, the affected RCP should not be restarted prior to a complete RCP evaluation.

ERG Knowledge Item: RCPs should not be started prior to a status evaluation unless an extreme (RED) or severe (PURPLE) CSF challenge is diagnosed. Under such a CSF challenge, the "rules of usage" apply and an RCP should be started if so instructed by the associated FRP. Under a CSF challenge, potential RCP damage is an acceptable consequence if RCP start is required to address a CSF challenge (e.g., to mitigate an inadequate core cooling condition). This is consistent with the intent of the FRPs, which attempt to first establish support conditions to start on RCP, but then start an RCP whether or not the support conditions are established.

EOP Step No: Step 33 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Caution regarding losing RCP seal cooling.

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: N/A

ERG Step No: Caution 24-2

EOP Step:

N/A

Purpose:

To alert the operator that the RTD bypass temperatures will not be accurate during natural circulation.

ERG Basis:

The RCS bypass manifolds are used to obtain fast and accurate temperature measurements when RCPs are operating. With natural circulation flow, the manifolds receive inadequate flow to produce accurate readings so that RTD temperatures should be considered invalid and the associated interlocks should be bypassed if necessary.

EOP Basis:

N/A

Supplemental Information:

None

Setpoints and Numerical Values:

N/A

ERG Deviations:

DEV.1 Deleted caution on impact of low flow to the RTD bypass manifolds on RTD measurements during natural circulation.

JUST. The plant design does not include RTD bypass manifolds. The RCS loop RTDs are located in thermowells in the main loop piping. Therefore, this caution is not applicable. [SD-24]

EOP Step No: Step 34

ERG Step No: Note 24-1

EOP Step:

NOTE 13 RCP PROVIDES NORMAL PZR SPRAY CAPABILITY
[RCP STATUS CHECK]

Purpose:

To inform the operator that an RCP should be run in a loop which provides PZR spray if possible.

ERG Basis:

Subsequent steps require operator actions to control RCS pressure. The preferred means of control is normal PZR spray since this conserves reactor coolant inventory. Since spray line connections are provided in only two loops, an RCP should be run in one of those loops, if possible. Refer to the document RCP TRIP/RESTART in the Generic Issues section of the ERG Executive Volume for additional information on RCP restart.

EOP Basis:

Same as ERG basis, with the following additional information:

Loop 3 provides the best spray capability since it has both a normal PZR spray line and the PZR surge line. If RCP 13 is unavailable, then RCP 11 in conjunction with any other RCP will also be capable of providing normal spray. Procedure S1.OP-SO.RC-0001(Q) contains guidance for starting an RCP, including the RCP starting priorities.

Supplemental Information:

ERG Knowledge Item: If an RCP in a loop with a ruptured SG is started, steam flow from that SG via a secondary side break will increase. Although this may increase radiological releases due to steam relief, it will also reduce accumulation of water in the SG and decrease the possibility of overfill. Consequently, for such multiple failure events in which SG overfill appears imminent, starting an RCP in the affected loop may be beneficial.

Setpoints and Numerical Values:

Value	Setpoint	Description
13	W.03.1	Loop designation for RCP which provides best pressurizer spray capability - Unit 1.

EOP Step No: Step 34 (CONTINUED)

ERG Deviations:

No deviation from the ERG.

EOP Step No: 35.1

ERG Step No: Caution 24-3

EOP Step:

INADVERTENT CRITICALITY MAY OCCUR FOLLOWING ANY NATURAL CIRCULATION COOLDOWN IF THE FIRST RCP STARTED IS IN THE RUPTURED LOOP WITH THE RUPTURED STEAM GENERATOR.

Purpose:

To preclude initiation of forced RCS flow via startup of the RCP in the stagnant loop when post-SGTR cooldown is underway.

ERG Basis:

Initiation of forced RCS flow by starting an RCP in a loop with an intact steam generator will ensure mixing of the diluted water in the stagnant loop with the borated water in the other RCS loops such that localized dilution in the core region is precluded. Refer to ERG Maintenance Item DW-89-041 for a detailed discussion of the possibility of a localized boron dilution transient

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Steps 35 and 36

ERG Step No: Step 24

EOP Step:

(Step 35) IS ANY RCP RUNNING
[RCP STATUS CHECK]

(Step 36) MONITOR FOR NATURAL CIRCULATION FLOW IN RCS LOOPS WITH INTACT SGs
[NATURAL CIRCULATION FLOW VERIFICATION]

Purpose:

To establish forced coolant flow, if possible, or to verify natural circulation flow if RCPs cannot be started.

ERG Basis:

RCP operation is preferred to provide normal PZR spray and to ensure homogeneous fluid temperatures and boron concentrations. This step provides guidance on establishing conditions for starting an RCP to prevent RCP damage and minimize any perturbations in RCS conditions. Normal RCP startup requirements, such as RCP cooling and seal leakoff flows, should be enforced to prevent pump damage. These include RCS subcooling to prevent cavitation at the pump suction during startup and PZR level to minimize changes in RCS pressure and provide reactor coolant inventory trends. Refer to the document RCP TRIP/RESTART in the Generic Issues section of the ERG Executive Volume for additional information on RCP restart.

If all RCPs are stopped and none can be started, the operator should monitor system conditions to verify natural circulation flow. The conditions indicative of natural circulation are provided as ATTACHMENT A and include RCS subcooling, stable or decreasing CETs, and cold leg temperatures in the active loops approximately equal to saturation at the associated SG pressure. If these conditions are not verified, the operator should increase steam flow from the intact SGs to establish and maintain natural circulation.

To limit the pressure decrease upon RCP restart, saturated conditions should first be established in the PZR. If the PZR is not saturated, starting an RCP will cause the PZR level and pressure to decrease faster than if the PZR were saturated. The PZR pressure and level will still decrease when an RCP is started under saturated conditions, but the rate of decrease is slower since vapor is created as the pressure drops.

EOP Step No: Steps 35 and 36 (CONTINUED)

ERG Basis: (CONTINUED)

If all seal cooling has been lost long enough that the maximum RCP seal parameters identified in the RCP Vendor Manual have been exceeded, seal injection and CCW thermal barrier cooling should not be established to the affected RCP(s). Both of these methods of seal cooling could have unintended consequences that result in additional pump damage or the failure of plant safety systems. Seal cooling should instead be restored by cooling the RCS, which will reduce the temperature of the water flowing through the pump seals.

EOP Basis:

Same as ERG basis, with the following additional information:

EOP Step 35 uses S1.OP-SO.RC-0001(Q) "REACTOR COOLANT PUMP OPERATION" to ensure conditions for starting an RCP are satisfied.

Supplemental Information:

ERG Knowledge Item: Depressurization of the RCS may generate a steam bubble in the upper head region of the reactor vessel if no RCP is running. This bubble could rapidly condense during pump startup, drawing liquid from the PZR and reducing reactor coolant subcooling. If PZR inventory is not sufficient, level may decrease offspan. In addition, local flashing of reactor coolant could occur if RCS subcooling is not adequate. These conditions would require SI reinitiation and may confuse the operator if such behavior was unexpected.

ERG Knowledge Item: Means to verify natural circulation flow.

ERG Knowledge Item: Plant specific procedures for starting an RCP may require a steam bubble to be present in the PZR. RCP restart should be permitted if an RCS leak path is certain since the leak ensures that there will not be a significant surge when the RCP is started.

ERG Knowledge Item: Pressurizer level and subcooling requirements to accommodate a void in the upper head are designed to address operational concerns due to the collapse of an upper head void. If these conditions cannot be established but all other startup conditions have, the operator should consider starting the RCP particularly if this will preclude the use of a pressurizer PORV during subsequent recovery. However, in that case, one should be aware that pressurizer level and RCS subcooling may decrease when the RCP is started if an upper head bubble exists. ECCS pumps should be started following RCP restart if necessary to maintain pressurizer level on span or adequate RCS subcooling.

EOP Step No: Steps 35 and 36 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
100%	J.01	RVLIS upper range value indicating upper head region full.
69%	D.10	Pressurizer level to accommodate upper head void collapse. Refer to document RCP TRIP/RESTART in Generic Issues section of the ERG Executive Volume.
77%	D.11	Pressurizer level to accommodate upper head void collapse, including allowances for post-accident transmitter errors and reference leg process errors. Refer to document RCP TRIP/RESTART in Generic Issues section of the Executive Volume.
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°F	R.05	RCS subcooling necessary to accommodate upper head void collapse. Refer to document RCP TRIP/RESTART in Generic Issues section of Executive Volume.

ERG Deviations:

DEV.1 Deleted Attachment A.

JUST. Moved ERG attachment information directly into step to make this needed information immediately accessible to the operator. [SD-64]

EOP Step No: Step 37

ERG Step No: Caution 25-1, Step 25

EOP Step:

CAUTION VOIDING MAY OCCUR IN RCS DURING DEPRESSURIZATION, RESULTING IN RAPIDLY RISING PZR LEVEL
[RCS DEPRESSURIZATION TO MINIMIZE SUBCOOLING]

Purpose:

To inform the operator that PZR level may increase rapidly because of voiding in the RCS during the RCS depressurization.

To minimize break flow by reducing RCS pressure.

ERG Basis:

(ERG Caution 25-1) As the RCS is depressurized, steam may form in the hotter regions of the RCS. PZR level will increase rapidly as water displaced from these voided regions replaces steam in the PZR. If voiding occurs, the PZR may fill with water within a few minutes. This note informs the operator of this condition so that RCS depressurization can be stopped quickly to avoid a water solid PZR.

(ERG Step 25) After ECCS flow has been terminated, RCS pressure should be reduced to maintain minimum subcooling in the RCS since this minimizes reactor coolant leakage. Normal PZR spray is the preferred means for decreasing RCS pressure since this conserves reactor coolant inventory and provides the best pressure control. If normal spray is not available PZR PORVs and auxiliary spray provide alternative means. If auxiliary spray is not heated by letdown it should be used only if normal spray and PORVs are unavailable to prevent excessive thermal stresses on the spray nozzle.

Charging flow can be throttled in conjunction with this depressurization to maintain PZR level on span. However, if reactor coolant voiding occurs, level may increase rapidly. The operator is instructed to monitor PZR level so that RCS depressurization can be terminated quickly if this occurs to avoid a water solid condition. PZR heaters can also be energized as necessary to maintain a steam bubble in the PZR.

EOP Step No: Step 37 (CONTINUED)

EOP Basis:

Same as ERG basis, with the following additional information:

This Technical Specification limit prevents thermal shock to the PZR spray nozzle, the failure of which would degrade PZR pressure control capability using spray. This limit is likely to be exceeded whenever auxiliary spray is used with letdown isolated. Although it is desirable to remain within this Technical Specification limit at all times, the overall objective of the EOPs is to protect the health and safety of the public and there are times when this is the overriding priority.

This 320°F limit is observed whenever the ERGs prohibit use of auxiliary spray if letdown is isolated. This limit is not applicable (may be exceeded) whenever the ERGs direct use of auxiliary spray even if letdown is isolated because the need to depressurize the RCS (to protect the public) overrides this limit and its associated concerns. This note explicitly identifies instances in the EOPs where this limit may be exceeded to assure the operator of this fact.

Supplemental Information:

ERG Knowledge Item: If subcooling decreases below the setpoint for reinitiating SI during the depressurization, the operator should take the appropriate actions such as closing the PORV or the block valve for a stuck open PORV, and wait to see if the actions are successful (i.e., allow adequate time for valves to stroke closed), before reinitiating SI. If the actions stop the depressurization and subcooling is restored, SI reinitiation is not necessary.

Setpoints and Numerical Values:

Value	Setpoint	Description
320°F	X.04	Maximum pressurizer to auxiliary spray delta-T for placing aux spray in service.
77%	D.08	Value showing pressurizer level at the upper tap, including allowances for normal channel accuracy, minus 20% for operating margin.
74%	D.09	Value showing pressurizer level at the upper tap, including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, minus 20% for operating margin, but not less than 50%.
10 °F	R.08	The sum of temperature and pressure measurement system errors including allowances for normal channel accuracies, translated into temperature using saturation tables, plus 10°F.

EOP Step No: Step 37 (CONTINUED)

ERG Deviations:

DEV.1 Added a note regarding the 320° F PZR to auxiliary spray delta-T limit.

JUST. This Tech. Spec. limit is applicable whenever the ERGs prohibit use of auxiliary spray without letdown flow. In some instances the ERGs direct use of auxiliary spray regardless of letdown flow because the need to depressurize the RCS overrides the Tech. Spec. considerations. This note provides assurance to the operator that the EOP has priority over the Tech. Spec. limit in these instances. [SD-43]

DEV.2 Added plant specific details to use auxiliary spray.

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

EOP Step No: Step 38

ERG Step No: Step 26

EOP Step:

DIRECT CHEMISTRY TO SAMPLE THE RUPTURED SG(s) AND RCS FOR BORON
[SHUTDOWN MARGIN VERIFICATION]

Purpose:

Verify that adequate shutdown margin is maintained in the RCS.

ERG Basis:

Subsequent steps will bring the RCS to cold shutdown conditions. The RCS boron concentration should be verified to be adequate for reactivity control at cold shutdown. Since ECCS flow has been terminated, boron must be supplied through the normal charging lines to ensure adequate shutdown margin. The ruptured SG water should also be sampled since backflow into the RCS may occur. Sufficient boron concentration must be provided to compensate for boron dilution from this backflow.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Leakage from the ruptured SG into the RCS may dilute the RCS boron concentration.

ERG Knowledge Item: Effects of stuck control rods on shutdown margin.

ERG Knowledge Item: Shutdown margin should not be a major concern since the charging pump suction will be aligned to the RWST. If additional boron is necessary, realignment of the charging pump suction to the emergency boration supply may be required.

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added plant specific details to verify shutdown margin.

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

EOP Step No: Step 39

ERG Step No: Step 27

EOP Step:

IS RCS SUBCOOLING GREATER THAN 0°F
[ADEQUATE SI FLOW VERIFICATION]

Purpose:

To instruct the operator to initiate or increase ECCS flow when necessary to maintain adequate coolant inventory.

ERG Basis:

Reliable indications of RCS subcooling and PZR level are necessary to monitor coolant inventory trends and ensure sufficient core cooling. If either of these indications cannot be maintained, reactor coolant makeup flow must be supplemented with additional ECCS flow to restore such indications. The operator is also directed to appropriate steps for continuing the RCS cooldown to increase subcooling and for decreasing RCS pressure with SI in service to restore PZR level.

EOP Basis:

Same as ERG basis.

EOP Step No: Step 39 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: Reinitiating ECCS flow by generating an SI signal should be avoided unless necessary to establish ECCS flow since this will also cause a containment isolation signal and rearrange loads on the emergency AC buses if offsite power is unavailable. This may also lead to excessive ECCS flow.

ERG Knowledge Item: Operation of ECCS pumps will increase leakage from the RCS and, consequently, should be avoided unless necessary to maintain RCS subcooling or PZR level. Note that if subcooling is temporarily lost during RCS depressurization to restore PZR level (EOP Step 22), it should soon be restored as the cooldown to cold shutdown continues. If the cooldown is effective in restoring subcooling, SI reinitiation is not required.

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

ERG Knowledge Item: No preference is given in the generic guidelines about which pumps to start to establish ECCS flow although an individual plant may have a preference. The operator has the option of using either a SI pump or a centrifugal charging pump. If the operator selects to use a centrifugal charging pump, then he must align the suction and discharge of the pump to the SI mode and isolate the normal charging suction and discharge flow paths. (DW-93-032)

ERG Knowledge Item: If conditions deteriorate and the operator is required to manually start ECCS pumps to restore RCS subcooling or pressurizer level, the operator should leave the ECCS pumps on until the SI reduction criteria is met in the appropriate step.

Setpoints and Numerical Values:

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

ERG Deviations:

No deviation from the ERG.

EOP Step No: Steps 40 and 41

ERG Step No: Step 28

EOP Step:

(Step 40) IS RCS SUBCOOLING GREATER THAN 0°F
[SI ACCUMULATOR ISOLATION]

(Step 41) REMOVE LOCKOUT FOR 11 THRU 14 SJ54 (ACCUMULATOR OUTLET VALVES)
[SI ACCUMULATOR ISOLATION]

Purpose:

To close SI accumulator isolation valves or vent if criteria are satisfied.

ERG Basis:

The SI accumulators should be isolated or vented during RCS depressurization prior to reaching the accumulator nitrogen pressure in the RCS to prevent unnecessary discharge. Such discharge would impede further RCS depressurization, increasing leakage from the RCS, and may cause an unnecessary cooldown in stagnant loops. Eventually non-condensable nitrogen could be injected rendering PZR pressure control ineffective or causing gas binding in the SG U-tubes.

Previous actions were designed to establish adequate RCS inventory and secondary heat sink to ensure that the accumulators are not needed. Consequently, if RCS subcooling and PZR level are sufficient at this time, the accumulators should be isolated or vented. If the RCS temperature is less than 375°F, the accumulators should be isolated even if the RCS is not subcooled to prevent nitrogen injection.

The hot leg temperature of (F.08) should be determined so that the RCS saturation pressure exceeds the accumulator pressure after the accumulator water has been discharged. This precludes nitrogen injection into the RCS. To determine the hot leg temperature, an ideal gas expansion calculation should be performed based on nominal plant specific values for initial accumulator tank pressure (P_1), initial nitrogen gas volume (V_1), and final nitrogen gas volume (V_2). The final nitrogen gas volume should be equivalent to the total accumulator tank volume. The RCS pressure at empty tank conditions (P_2) is determined from:

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

where $\gamma = 1.25$ for ideal gas expansion. The setpoint temperature of (F.08) is the saturation temperature corresponding to P_2. Instrument uncertainties are not included in the determination of the RCS hot leg temperature setpoint to preclude a bias toward either having more accumulator water injected into the RCS or having less nitrogen injected into the RCS.

EOP Step No: Steps 40 and 41 (CONTINUED)

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Approximate time required to vent accumulators. RCS depressurization can be performed concurrently with accumulator venting provided RCS pressure is maintained greater than the accumulator nitrogen pressure.

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

Setpoints and Numerical Values:

Value	Setpoint	Description
375°F	F.08	RCS hot leg temperature to prevent accumulator nitrogen injection.
0°F	R.01	The sum of temperature and pressure measurement system errors including allowances for normal channel accuracies, translated into temperature using saturation tables - based on Subcooling Margin Monitor.
11%	D.04	Value showing pressurizer level just in range including allowances for normal channel accuracy and reference leg process errors.
19%	D.05	Value showing pressurizer level just in range, including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

ERG Deviations:

DEV.1 Added plant-specific details to isolate SI accumulators, vent any unisolated accumulators, and to close accumulator vent valves when venting is completed.

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

EOP Step No: Step 42

ERG Step No: Step 29

EOP Step:

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

Purpose:

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

ERG Basis:

Manufacturers typically recommend that diesels not be run for a long period of time unless carrying load. Since they should start automatically on a SI signal but will not load if offsite power is available, the emergency diesels should be stopped at this time if the emergency AC buses are energized by offsite power.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 The EOP does 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]

DEV.2 Added consulting the TSC to restore power.

JUST. At this point in the SGTR recovery, the TSC is activated. Therefore, the TSC is available to assist the operator in assessing the best methods to restore offsite power.

EOP Step No: Step 43

ERG Step No: Step 30

EOP Step:

BYPASS CONDENSATE POLISHERS AS FOLLOWS:
1. OPEN 11 THRU 13 CN108 (POLISHER BYPASS VALVES)
2. CLOSE 1CN109 (POLISHER INLET VALVE)

[MINIMIZING SECONDARY CONTAMINATION]

Purpose:

To minimize the spread of contamination throughout the secondary system.

ERG Basis:

Prior to isolation of the ruptured SG, steam flow from that SG may have contaminated the secondary including the Condenser Hotwell and the Blowdown System. Plant specific steps to minimize the spread of this contamination should be considered, including isolating recirculation from the hot well to the CST, bypassing the condensate polishing demineralizers, and transferring auxiliary steam to the auxiliary boiler.

EOP Basis:

Same as ERG basis, with the following additional information:

Bypassing the condensate polishers will direct potentially contaminated condensate water around the condensate polishers to prevent further contamination of these components. The following operations are performed in addition to bypassing the polishers to help minimize contamination to the secondary systems: steam is dumped from the intact SG MS10s, condenser-to-raw water valve is closed, various blowdown sample discharges are isolated, the R-46 radiation monitors are isolated, and condenser steam dumps are isolated when hotwell level reaches 71 inches.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
71"	U.07	Safe upper limit for hotwell operation.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 44

ERG Step No: Step 31

EOP Step:

OPEN THE FOLLOWING VALVES:

- 1CC30 OR 1CC31 (CCHX OUT TO AUX HDR)
- 1CC117 AND 1CC118 (RCP COOLING INLET)
- 1CC136 AND 1CC187 (RCP BEARING OUTLET)

[RCP COOLING VERIFICATION]

Purpose:

To check that RCPs are properly cooled to prevent RCP seal damage and to establish or maintain conditions for RCP operation.

ERG Basis:

CCW is used for RCP motor oil cooling as well as thermal barrier cooling. Seal injection flow is only for seal cooling. If these normal cooling alignments are not present, the appropriate system procedures should be used for establishing normal cooling to the RCPs.

If all seal cooling has been lost long enough that the maximum RCP seal parameters identified in the RCP Vendor Manual have been exceeded, seal injection and CCW thermal barrier cooling should not be established to the affected RCP(s). Both of these methods of seal cooling could have unintended consequences that result in additional pump damage or the failure of plant safety systems. Seal cooling should instead be restored by cooling the RCS, which will reduce the temperature of the water flowing through the pump seals.

EOP Basis:

Same as ERG basis, with the following information:

Two CCW pumps can provide adequate cooling water to all systems and components requiring CCW. If only one CCW pump is operating, then CCW must be diverted from some non-vital equipment and the equipment stopped.

Supplemental Information:

ERG Plant Specific Information: Restoration of RCP seal cooling should be performed consistent with the limitations and requirements in the Westinghouse RCP Instruction and Operating Manual. Refer to ERG background document ECA-0.0, LOSS OF ALL AC POWER, for additional information.

EOP Step No: Step 44 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 45

ERG Step No: Step 32

EOP Step:

IS CCW FLOW ESTABLISHED TO SEAL WATER HX
[RCP SEAL RETURN RESTORATION]

Purpose:

To open the normal seal return path (which was isolated by the SI signal) if proper conditions exist.

ERG Basis:

Normal seal return to the VCT is isolated on a SI signal. In this case, seal leakoff flows to the PRT via a relief valve in the return line. Opening of the normal return path is part of establishing normal system operation, limits discharge to the PRT, and ensures proper seal return flow at low RCS pressures. However, certain conditions should be present before establishing normal seal return flow such as CCW to the seal water heat exchanger.

EOP Basis:

Same as ERG basis, with the following additional information:

Seal water return valves to the VCT, 1CV116 and 1CV284 close on a Phase A isolation. These valves must be opened to restore a RCP seal return flowpath to the VCT.

Supplemental Information:

ERG Knowledge Item: If charging pump suction remains aligned to the RWST, re-establishing seal return flow may result in a high VCT level.

ERG Knowledge Item: If the reactor coolant drain tank pressure is high compared to the VCT pressure and the number one seal leakoff is realigned to the VCT, the number 2 seal could open up and reverse flow could occur possibly resulting in seal damage. Under those conditions, the operator may want to reduce reactor coolant drain tank pressure prior to reestablishing the number one seal leakoff lineup to the VCT.

ERG Knowledge Item: If excess activity levels in the RCS are suspected, then an evaluation of the consequences of re-establishing seal return flow should be made prior to taking that action

Plant Specific Information: Conditions for establishing seal return flow should be evaluated on a plant-specific basis and should include consideration of CCW flow to seal water heat exchanger, discharge to the PRT via the seal return line relief valve, and RCP seal cooling.

EOP Step No: Step 45 (CONTINUED)

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added a continuous action step to establish RCP seal return when prerequisite conditions are established.

JUST. Since it may take considerable time to establish CCW flow to the seal water heat exchanger, subsequent steps should not wait for this action to happen.

EOP Step No: Step 46

ERG Step No: Step 33

EOP Step:

ARE BOTH IR CHANNELS LESS THAN 7E-11 AMPS
[SOURCE RANGE STATUS CHECK]

Purpose:

To verify that SR detectors are energized and to transfer nuclear recorders to the SR scale when the core neutron flux is in the SR.

ERG Basis:

When IR flux decreases below the IR permissive to block SR high flux trip (P-6), the SR detectors should be automatically energized, and subsequent flux monitoring should use the SR indicators.

EOP Basis:

Same as ERG basis, with the following additional information:

Following a reactor trip, the operator monitors nuclear instrumentation to ensure that nuclear flux levels are decreasing normally. When flux levels are approaching or decrease to 7E-11 amps, the IR channels are checked for undercompensation. This will ensure that IR channels are accurately indicating flux levels. In addition to monitoring flux level and proper response of the nuclear instrumentation, the operator also ensures that the SR detectors automatically energize when IR flux levels decreases to 7E-11 amps. After the SR detectors are energized, subsequent flux level monitoring will be performed using SR indication. As flux level continues to decrease, the operator will adjust the SR Audio Count Rate Circuit scale.

Supplemental Information:

DW-90-020: States to use trip setpoint, not the reset setpoint.

Setpoints and Numerical Values:

Value	Setpoint	Description
7×10^{-11} amps	P.01	Value for intermediate range permissive to block source range high flux trip (P-6).

EOP Step No: Step 46 (CONTINUED)

ERG Deviations:

DEV.1 Added an action step for adjusting the Audio Count Rate Circuit scale.

JUST. Adjusting the Audio Count Rate Circuit scale is a normal operating practice after energizing SR instrumentation. In addition, it provides a measure of protection against a subsequent dilution accident or inadvertent criticality by providing an audible warning to the operator in case of an unexpected increase in SR count. [SD-25]

DEV.2 Added a check for undercompensation of the IR Channels if they are reading greater than 7E-11 amps.

JUST. Undercompensation could prevent the IR channels from dropping below the setpoint which would automatically re-energize the SR channels. In this case, the operator must re-energize the SR channels manually to reinstate neutron flux monitoring and trending capability. [SD-26]

DEV.3 Used reset setpoint instead of trip setpoint as required by the ERG.

JUST. ERG convention is generally to use trip setpoints instead of reset setpoints, as explained in DW-90-020. This plant has chosen to use the reset setpoint in this case based on operator validation comments. [SD-78]

EOP Step No: Step 47

ERG Step No: Step 34

EOP Step:

STOP THE FOLLOWING SECONDARY PUMPS:
- BOTH SGFPs
- ALL HEATER DRAIN PUMPS
- BOTH BSCDT PUMPS
- ALL BUT ONE CONDENSATE PUMP

[UNNECESSARY EQUIPMENT SHUTDOWN]

Purpose:

To stop equipment not needed during cooldown to cold shutdown.

ERG Basis:

Since the plant may have been operating at full power prior to the trip, certain equipment may be in operation and not needed at this time, e.g., two condensate pumps, circulating water pumps, etc.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 48

ERG Step No: Caution 35-1

EOP Step:

IF ANY RUPTURED SG IS FAULTED,
THEN MAINTAIN FEED FLOW ISOLATED UNLESS NEEDED FOR RCS COOLDOWN
[RUPTURED SG FILL AND DRAIN]

Purpose:

To prevent excessive RCS cooldown due to feeding a faulted SG.

ERG Basis:

The following step instructs the operator to feed a ruptured SG which is not faulted (secondary side boundary is intact) to ensure the SG tubes remain covered. If the tubes should uncover, the affected SG may depressurize uncontrollably and initiate primary-to-secondary leakage. Feeding the ruptured SG also aids in cooling that SG. However, if the ruptured SG is also faulted, a condition for which the EOP-SGTR-3 recovery scheme is appropriate, primary-to-secondary leakage will continue even if the tubes remain covered. Feeding such a SG may aggravate an uncontrolled cooldown of the RCS and may increase the possibility of SG overfill. Hence, feeding a ruptured SG as directed in the following step should be avoided if that SG is also faulted unless it is needed to cool the RCS.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Deleted ERG Caution regarding the isolation of feed flow to a faulted SG.

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 49

ERG Step No: N/A

EOP Step:

NOTE THE FOLLOWING STEPS PERFORM FILL AND DRAIN CYCLES ON RUPTURED SG TO COOL AND DEPRESSURIZE RUPTURED SG STEAM SPACE
[RUPTURED SG FILL AND DRAIN]

Purpose:

To remind the operator that the subsequent step attempts to cool the ruptured SG steam space by filling and draining.

ERG Basis:

N/A

EOP Basis:

The intent of the following step may not be obvious to the operator.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Added note informing the operator of the purpose of the next step.

JUST. As discussed in the Supplemental Information for the next step, draining and then refilling the ruptured SG is the best method of cooling the SG steam space. Due to the importance of performing drain and refill operations versus maintaining a steady level, this note was added to remind the operator of the purpose and methodology of the next step.

EOP Step No: Step 50

ERG Step No: Step 35

EOP Step:

IF ANY OF THE FOLLOWING CONDITIONS OCCURS:
THEN STOP FEED FLOW TO RUPTURED SG UNLESS NEEDED FOR RCS COOLDOWN:

- RUPTURED SG PRESSURE DROPS IN AN UNCONTROLLED MANNER
- RUPTURED SG PRESSURE RISES TO 1020 PSIG
- RUPTURED SG LEVEL IS GREATER THAN 62% (55% ADVERSE)

[RUPTURED SG FILL AND DRAIN]

Purpose:

To maintain ruptured SG tubes covered.

To refill the ruptured SG with feed flow to aid in cooling the RCS and ruptured SG.

ERG Basis:

When level is in the NR, the steam region in the ruptured SG is insulated from colder water in the U-tubes region by a layer of warmer water. Consequently, pressure is maintained in the ruptured SG when the RCS is cooled by the intact SGs. Backflow from the ruptured SG will decrease the water level. If the U-tubes uncover, the ruptured SG pressure could rapidly decrease due to condensation of steam on the cooler surface of the U-tubes. This rapid depressurization could reinitiate break flow and may result in a loss of RCS pressure control or SI reinitiation. Thus, in order to maintain the U-tubes covered, feed flow to the ruptured SG may be required. This feed flow will also aid in the cooldown of the ruptured SG. However, flow should be initiated slowly to avoid a rapid decrease in SG pressure due to condensation of steam by cold feed flow. In some cases, SG pressure may increase as feed flow compresses the steam bubble. If this occurs, feed flow should be stopped prior to lifting the MS10 or safety valve on the ruptured SG.

EOP Basis:

Same as ERG basis.

EOP Step No: Step 50 (CONTINUED)

Supplemental Information:

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

ERG Knowledge Item: This step does not apply to ruptured SGs which are also faulted.

ERG Knowledge Item: It is intended for the operator to allow the ruptured SG to drain to a low narrow range level and then refill it with feed flow as opposed to continuously feeding the ruptured SG to control level. This is expected to be more effective in cooling the steam space since colder water pushed into the upper regions will cool the metal which will condense steam as the SG drains.

DW-89-056: Reference leg heatup errors should be included in the determination of the level setpoint for normal containment conditions.

Setpoints and Numerical Values:

Value	Setpoint	Description
9%	M.10	SG level greater than the AFW actuation setpoint.
15%	M.11	SG level just in range, including allowances for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%, or the AFW actuation setpoint, whichever is greater.
62%	M.06	Value for SG high-high level feedwater isolation setpoint minus 5% operating margin.
55%	M.12	Value for high-high SG level feedwater isolation setpoint minus 5% operating margin including allowances for post accident transmitter errors and reference leg process errors, not less than 50%.
1020 psig	O.04	Setpoint for SG steam dump to atmosphere controller which will prevent SG safety valve actuation minus 25 psi.

EOP Step No: Step 50 (CONTINUED)

ERG Deviations:

DEV.1 Restructured step.

JUST. The ERG step lists two bullet conditions for stopping feed to the ruptured SG. In addition, the RNO column contains an implied condition of refilling to a certain level and then stopping feed. All three conditions were listed in the EOP step for ease and clarity of presentation to the operator. In addition, a step was added to begin refill of the SG when level drops to less than a certain point. This restructuring accomplished the SG "fill and drain" cycles as intended by the ERG.

EOP Step No: Step 51

ERG Step No: Step 36

EOP Step:

WHEN EITHER OF THE FOLLOWING CONDITIONS IS MET ON ANY RCP,
THEN STOP THE RCP:

- NUMBER ONE SEAL DELTA-P IS LESS THAN 210 PSID
  OR
- NUMBER ONE SEAL LEAKOFF IS LESS THAN 0.3 GPM

Purpose:

To stop RCPs if minimal operating conditions cannot be maintained for the Number 1 seal.

ERG Basis:

A minimum seal differential pressure and leakoff flow for the RCP Number 1 seal are required to prevent seal damage. This step alerts the operator to stop any RCPs when such conditions are not satisfied. Refer to the Westinghouse RCP Instruction and Operating Manual for the basis for these conditions.

EOP Basis:

Same as ERG basis.

Supplemental Information:

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

Setpoints and Numerical Values:

Value	Setpoint	Description
210 psid	W.01	Minimum seal differential pressure for continued RCP operation including allowances for normal channel accuracy.
0.3 gpm	W.02	Minimum seal leakoff flow for continued RCP operation including allowances for normal channel accuracy.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Steps 52 and 53

ERG Step No: N/A

EOP Step:

(Step 52) SEND OPERATOR TO SHIFT GLAND SEAL TO ALTERNATE SOURCE

(Step 53) PERFORM ADDITIONAL PLANT SHUTDOWN ACTIVITIES AS NECESSARY

Purpose:

To direct the operator to perform additional plant shutdown activities which are appropriate at this time.

ERG Basis:

N/A

EOP Basis:

At this point in the cooldown and depressurization, the operator is directed to shift gland seal to an alternate source to assist in maintaining condenser vacuum. This will allow continued use of the condenser steam dumps. In addition, the operator is directed to perform normal plant cooldown activities per S1.OP-IO.ZZ-0006(Q) (on a not-to-interfere basis) concurrently with the RCS cooldown. S1.OP-IO.ZZ-0006(Q) does such things as log Mode 4 entry, lock out ECCS pumps as required by Tech Specs, place POPS in service, place SGs in wet layup, etc.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

DEV.1 Add steps to shift gland seal to alternate source and to perform S1.OP-IO.ZZ-0006(Q) concurrently with the cooldown.

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

EOP Step No: Step 54

ERG Step No: N/A

EOP Step:

DOES NSS WANT SW RESTORED TO TURBINE BLDG
[TURBINE BUILDING SERVICE WATER RESTORATION]

Purpose:

To provide instructions for restoring service water to the Turbine Building following an SI.

ERG Basis:

N/A

EOP Basis:

During any SEC mode operation, valve 1SW26 automatically closes to isolate SW cooling to all loads in the Turbine Building. This ensures that sufficient SW cooling capacity is available for safety-related loads. Turbine Building loads include the TAC heat exchangers, main turbine and SGFP turbine lube oil coolers, and Unit 1 station air compressors. Once the plant is stabilized, it is desirable to restore SW cooling to these loads, not only to extend equipment service life by removing residual heat but also to ensure the SGFPs and Unit 1 station air compressors will be available if needed during plant recovery.

The NSS may choose to inspect the SW System piping prior to restoring normal lineup. This decision should consider the current SW System status, plant conditions before and after the event, and the magnitude of any transients placed on the SW System. If performed, the inspection should include an operator walkdown of the SW System in the Turbine Building to check for abnormal valve lineups, leaks, and signs of water hammer damage.

To avoid water hammer during the restoration, the SW header downstream of 1SW26 is filled and pressurized slowly by locally throttling the valve open 25%. For personnel safety reasons, plant operators are trained to remove power to a motor-operated valve prior to operating it locally. After filling the header, this breaker must be reclosed to allow remote operation from the control room.

Supplemental Information:

None

EOP Step No: Step 54 (CONTINUED)

Setpoints and Numerical Values:

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

ERG Deviations:

DEV.1 Added plant specific details for inspecting and restoring the SW System to the Turbine Building.

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

EOP Step No: Step 55

ERG Step No: Step 37

EOP Step:

IS RCS TEMPERATURE LESS THAN 350°F
[RHR INITIATION CRITERIA]

Purpose:

To place RHR in service.

ERG Basis:

The RHR System is designed to operate below specific RCS pressure and temperature conditions. When such conditions are established, the RHR System should be placed in service to complete the cooldown to cold shutdown and provide long term cooling.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If the plant design permits, one RHR pump could be aligned in the normal closed-loop cooling RHR mode (taking suction from the hot legs); the other RHR pump could be aligned in (or reserved for) the recirculation mode (to provide RCS makeup flow).

ERG Knowledge Item: If RCS subcooling criteria for stopping the centrifugal charging pump (ERG Step 18), stopping the SI pump (ERG Step 19), or for establishing normal charging (ERG Step 20) are not satisfied, a RHR pump may be started to provide injection flow after the centrifugal charging pump or SI pumps are stopped or to permit the establishing of normal charging flow and BIT isolation. For this situation, the RHR pump would not be available for the closed-loop RHR System cooling mode of operation.

ERG Plant Specific Information: The RHR pumps would be aligned for SI injection and must be realigned for RHR operation. Normal procedures for placing RHR in service should be reviewed for compatibility with the ERGs.

EOP Step No: Step 55 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
350°F	F.09	Temperature requirement for placing RHR System in service including allowances for normal channel accuracy.
325 psig	B.01	Pressure requirement for placing RHR System in service including allowances for normal channel accuracy.
280 psig	B.02	Pressure requirement for placing RHR System in service including allowances for normal channel accuracy and post accident transmitter errors.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 56

ERG Step No: Step 38

EOP Step:

IS CONTAINMENT HYDROGEN CONCENTRATION LESS THAN 0.5%
[CONTAINMENT HYDROGEN CONCENTRATION]

Purpose:

To check if an excessive containment hydrogen concentration is present.

ERG Basis:

This step instructs the operator to obtain a current hydrogen concentration measurement. Depending upon the magnitude of the hydrogen concentration, the operator will either continue with EOP-SGTR-3, turn on the hydrogen recombiners or notify the plant engineering staff to determine additional recovery actions before continuing with the procedure.

When inadequate core cooling has occurred, the containment hydrogen concentration may be as much as 10 to 12 volume percent, depending on the amount of metal-water reactor (to produce hydrogen) that has occurred in the core. The hydrogen concentration is of concern since a flammable mixture can burn, if an ignition source is available, and cause a sudden rise in containment pressure which may challenge containment integrity. The operator is instructed to obtain a current containment hydrogen concentration measurement at this point in order to ascertain the potential flammability of the combustible gases in the containment. Note that in order to have the potential for flammable hydrogen concentrations, an inadequate core cooling situation must have already existed. Without an inadequate core cooling situation, sufficient hydrogen would not be expected to have been produced to cause potentially flammable mixtures.

A determination is made of the flammability of the hydrogen mixture with respect to the possible containment pressure rise. If the hydrogen mixture is between 0.5 volume percent and 6.0 volume percent in dry air, either no hydrogen burn is possible or a limited burn may occur which does not produce a significant pressure rise. In this case the operator is instructed to start the Hydrogen Recombiner system to slowly reduce containment hydrogen concentration. If the hydrogen concentration is less than 0.5 volume percent in dry air, a flammable situation is not imminent and the operator continues with EOP-SGTR-3. If the concentration is greater than 4% volume per-cent in dry air, the operator is instructed to immediately notify the TSC of the situation. In this case the operator is instructed to consult the TSC for additional recovery actions while proceeding with this procedure.

All hydrogen measurements are referenced to concentrations in dry air even though the actual containment environment may contain significant steam concentrations. The reason for this is twofold: 1) most hydrogen measurement systems remove moisture from the sample thus approximating a dry air condition and 2) the indication of the potential of hydrogen flammability is conservative when based upon using hydrogen concentration in dry air.

EOP Step No: Step 56 (CONTINUED)

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Number	Description
0.5%	T.17	Minimum containment hydrogen concentration in dry air that requires action by the operator.
4%	T.18	Containment hydrogen concentration corresponding to the limit of the hydrogen recombiners, not to exceed 6%.

ERG Deviations:

DEV.1 Did not add a plant specific means for obtaining Containment hydrogen concentration.

JUST. The hydrogen analyzers are continuously in service as required by Technical Specifications. Hydrogen analyzer indication is located in the Control Room on 1RP5 and is available at all times.

DEV.2 Added plant specific details for placing the Hydrogen Recombiners in service.

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

DEV.3 Did not specify "based on dry air conditions."

JUST. The hydrogen concentration monitor used to determine containment hydrogen concentration will indicate concentration based on dry air conditions since all steam is removed from the atmosphere sample prior to determining the hydrogen concentration. Thus there are no additional steps that the operator needs to take to obtain a "dry-air" measurement.

EOP Step No: Step 57

ERG Step No: Step 39

EOP Step:

IS RCS TEMPERATURE LESS THAN 200°F

Purpose:

To check if cold shutdown conditions have been achieved.

ERG Basis:

This procedure provides generic instructions for cooldown and depressurization of the plant to cold shutdown conditions of less than 200°F. Subsequent actions necessary for repair are plant and event specific.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Number	Description
200°F	E.04	RCS average temperature corresponding to cold shutdown conditions.

ERG Deviations:

No deviation from the ERG.

EOP Step No: Step 58

ERG Step No: Step 40

EOP Step:

MAINTAIN COLD SHUTDOWN CONDITIONS

Purpose:

To determine long term plant status and future recovery actions.

ERG Basis:

After reaching and maintaining cold shutdown conditions, the plant is effectively stable for the long term. This is the appropriate time for plant operators, engineering staff, and utility management to make decisions about long term plant operation and any repairs necessary for plant restart.

Some LOCAs will occur which do not generate the High-High signal needed to initiate containment spray. The presence of acidic water from the LOCA may lead to chloride induced stress corrosion of the recirculation loop piping. If spray was not initiated during EOP-LOCA-1, LOSS OF REACTOR COOLANT, the operator should evaluate plant conditions to determine if sodium hydroxide addition is needed. If required, the operator should take appropriate actions to add sodium hydroxide to increase the sump pH.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

APPENDIX A

EOP/ERG CORRELATION

1-EOP-SGTR-3: SGTR WITH LOCA - SUBCOOLED RECOVERY

EOP/ERG CORRELATION

EOP Step	ERG Step
ENTRY CONDITIONS	ENTRY CONDITIONS
CAS	FOLDOUT PAGE
N/A	Caution 1-1 (1a)
N/A	Note 1-1 (1a)
1	Caution 1-2 (1a)
2	1 (1a) 2 (1b) 3 (1c)
3 4	4 (1)
5	5 (1)
6	Caution 6-1 (1d)
7	6 (1d)
8	Caution 7-1(1e)
9	7 (1e)
10, 11	8 (1)
12	9 (1)
N/A	Caution 10-1 (2)
13	N/A
14	N/A
15	10 (2)
16 17	Note 11-1 (2) 11 (2)
N/A	Note 11-2 (2)
18	13 (4)
19	12 (3)
20	14 (5)
21	15 (6)
22	Caution 16-1 (7)
23	16 (7)
24	Caution 17-1 (8)
N/A 26.3	Caution 17-2 (8) Caution 17-3 (8)
25	Note 17-1 (8)
26	17 (8)
27	Note 18-1 (9)

EOP Step	ERG Step
28	Note 18-2 (9)
29	18 (9)
30	19 (10)
31	20 (11)
32	21 (12a) 22 (12b) 23 (13)
33	Caution 24-1 (14)
N/A 35.1	Caution 24-2 (14) Caution 24-3 (14)
34	Note 24-1 (14)
35 36	24 (14)
37	Caution 25-1 (15) 25 (15)
38	26 (15)
39	27 (16)
40, 41	28 (17)
42	29 (17)
43	30 (17)
44	31 (17a)
45	32 (17b)
46	33 (17)
47	34 (17)
48	Caution 35-1 (17)
49	N/A
50	35 (17)
51	36 (17)
52, 53	N/A
54	N/A
55	37 (18)
56	38 (19)
57	39 (20)
58	40 (21)