Draft Submittal
(Pink Paper)

SIMULATOR SCENARIOS

Facility: Sequoyah Scenario No.: 1 Op Test No.: NRC

Examiners: _____ Operators: _____

Initial Conditions: 100% Power BOL

Turbine Driven Auxiliary Feed water Pump OOS for Maintenance

Turnover: Reduce Power To 93% for turbine valve testing.

Target CTs: Initiate Feed and Bleed Per FR-H.1 Including manual start of SI Pump 1A-A

Establish Feedwater flow from Condensate or AFW prior to exiting FR-H.1.

Event No.	Malf. No.	Event Type*	Event Description
1	N/A	R-ATC N-SRO/BOP	Reduce Power from 100%
2	NI07A	TS-SRO I-SRO/ATC	NIS Power Range instrument Channel I fails high and requires taking rods to manual due to inadvertent insertion. Tech Spec Evaluation.
3	CV01B	TS-SRO C-ATC	Charging Pump 1B Trip Requires placing Standby pump in service and restoring letdown. Tech Spec Evaluation.
4	RX26A	TS-SRO I-SRO/BOP	Steam Generator #1 Pressure Channel fails low requiring manual control of loop 1 S/G Level Control valve. Tech Spec Evaluation.
5	CN09	C-SRO/BOP	Condenser Vacuum leak.
6	FW11A ZDISIC46 20B	M-All	MFP A Trip From Spurious Low Vacuum results in plant runback. MFP Turb B Speed Controller (SIC-46-20B) - Speed Demand Output Fails to 0% 3 Minutes after MFP A Trip requiring Reactor Trip if Rx Trip not already initiated during runback.
7	FW21B	C-SRO/BOP	AFW Pump 1B-B Airbound may eventually be restored by venting Pump casing.
8	ED06A	C-SRO/BOP	1A Shutdown board Differential Fault 5 min after Rx Trip results in loss of 2nd Charging Pump, loss of last AFW pump 1A-A, and manual shutdown of D/G 1A-A due to a loss of cooling water. Initiates loss of all Feedwater flow to S/Gs and ultimately RCS Feed and Bleed due to loss of secondary Heat Sink with both Charging Pumps unavailable.
9	SI13A	C-SRO/ATC	Safety Injection pump 1B-B Auto Start failure requiring manual start to provide injection flow for RCS Feed and Bleed.

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

Scenario 1 Summary

The Crew will assume shift at 100% power with direction to reduce poser to ~93% for Main Turbine Valve testing. The Turbine Driven Auxiliary Feedwater pump (TDAFW) out of service for maintenance and will not be returned to service during the scenario.

Following the power reduction, NIS power range channel I will fail high resulting in rod insertion and manual control to stop the insertion. The SRO will enter AOP-I.01 and direct actions to defeat the failed channel and return rod control to automatic. The SRO will also evaluate and enter applicable Technical Specifications.

After the NIS Channel failure had been addressed, Charging Pump 1B will trip requiring placing the standby pump in service and restoring letdown. The SRO will evaluate and enter applicable Technical Specifications and Technical Requirements.

After letdown is restored, Steam Generator #1 Pressure Transmitter will fail low resulting in the associated steam flow channel failing low due to density compensation input requiring manual control of Loop 1 feedwater control valve. SRO will direct performance of AOP-S.01 (Optional) and AOP-I.06 to select unaffected steam flow channel for control and returning feedwater control valve to Auto. Technical specifications may also be addressed for the failed pressure channel.

A small condenser vacuum leak will occur that requires performance of AOP-S.02 but is not large enough to require Reactor and Turbine Trip.

After condenser vacuum leak is adequately addressed, Main Feedwater Pump A will trip due to spurious low vacuum trip resulting in plant runback. Crew may elect to conservatively trip during runback since TDAAFW is not available and 1B-B MD AFW Pump is airbound (See below).

Three minutes after MFP A trip, MFP B speed controller will fail to zero resulting in loss of all Main feedwater flow. Reactor trip will be required due to loss of Steam Generator level if not already initiated during runback and crew will enter Emergency procedure E-0 and transition to ES-0.1.

When AFW pump 1B-B starts due to Main Feedwater pump A trip, it will be airbound. Crew may eventually initiate venting of the pump casing and the pump may be restored following venting.

Several minutes (~5) after the Rx Trip, a differential fault will occur on 6.9 Kv Shutdown 1A-A resulting in loss of the last Charging pump and the last Motor driven Auxiliary Feedwater pump 1A-A resulting in transition to FR-H.1 for loss of secondary heatsink. Scenario Failure/Event timing will ensure all S/G levels are less than 10% at this time.

After entering FR-H.1 the crew will initiate manual SI and RCS feed and bleed since there are no charging pumps available. Upon initiating SI for Feed and Bleed, the crew will be required to manually start the 1B Safety Injection pump that failed to auto start as the source of RCS Feed.

The Crew will continue in FR-H.1 to restore feedwater flow by either venting the airbound AFW pump or establishing condensate flow to at least one S/G.

The scenario may be terminated after feedwater flow is established to at least one Steam Generator.

Op Test No.:	NRC	Scenario #	1	Event #	1	Page	1	of 61
Event Description:	Reduce Power For Turbine Valve Testing							

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **No action required for Event 1**		
Indications available: **None Applicable**		
	SRO	Direct a load reduction in accordance with 0-GO-5 Normal Power Operations, Section 5.3, and 0-SO-62-7 Boron Concentration Control, Section 6.4.
Evaluator Note: Following Steps are from 0-SO-62-7 *Boron Concentration Control, Section 6.4*		
CAUTION: Returning the Boric Acid Blender to service after unplugging, cleaning, or maintenance on Boric Acid System could introduce debris, sludge, air or solidified boron into CCP suction resulting in pump damage. Extreme care must be exercised to properly flush the Boric Acid piping following an outage.		
NOTE: If a large amount of boration is required (plant shutdown), pzr heaters should be energized to cause spray operation for equalizing boron concentration in RCS and pressurizer.		
	RO	**ENSURE** makeup system aligned for **AUTO** operation in accordance with Section 5.1.

Op Test No.:	NRC	Scenario #	1	Event #	1	Page	2	of 61
Event Description:	Reduce Power For Turbine Valve Testing							

Time	Position	Applicant's Actions or Behavior
		NOTE Steps 2 and 3 are **N/A** for minor power changes OR if immediate boration is required to maintain shutdown margin, to maintain rods above the insertion limit, during an emergency shutdown (AOP-C.03), during recovery of a dropped/misaligned rod (AOP-C.01), or at Chemistry recommendation in mode 3, 4, 5 or 6.
	RO	**RECORD** the quantity of boric acid required to achieve desired boron concentration using Appendix D. _____ gals
	Crew	**PERFORM** Appendix I Independent Verification of Calculation for Amount of Boric Acid or Primary Water. (N/A if App. D was performed by SRO to verify data from Rx Engineering)
	RO	**DETERMINE** available boric acid volume in in-service BAT. _____ gals
	RO	**PLACE [HS-62-140A]**, Boric Acid to Blender Flow Control Switch to the **STOP** position.

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Event Description: Reduce Power For Turbine Valve Testing

Time	Position	Applicant's Actions or Behavior
	RO	**PLACE [HS-62-140B]**, CVCS Makeup Selector Switch to the **BORATE** position.
	RO	**ADJUST [FC-62-139]**, Boric Acid Flow Controller to the desired flow rate.
	RO	**SET [FQ-62-139]**, Batch Integrator to the desired quantity.
	RO	**PLACE [HS-62-140A]**, Boric Acid to Blender Flow Control Switch to the **START** position.
	RO	**ENSURE** Boric Acid Pump aligned to blender in FAST speed by right red light **LIT** on **[HS-62-230A] OR [HS-62-232A]**.

NOTE

Flow oscillations and/or erratic controller response may require manual operation of Boric Acid Flow Controller **[FC-62-139]** until stable conditions exist.

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Event Description: Reduce Power For Turbine Valve Testing

Time	Position	Applicant's Actions or Behavior
	RO	**VERIFY** Boric Acid Flow established.
NOTE It may take approximately 15 minutes before any changes to reactivity are indicated on nuclear instrumentation or RCS temperature indication.		
	RO	**IF** reactor is critical, **THEN MONITOR** nuclear instrumentation and reactor coolant temperature to ensure proper response from boration.
NOTE BAT operability limits are prescribed by TRM 3.1.2.6 (Modes 1-3) or 3.1.2.5 (Modes 4-6).		
	RO	**MONITOR** Boric Acid Storage Tank level.
	RO	**IF** Volume Control Tank level increases to 63 percent, **THEN ENSURE [LCV-62-118]**, Volume Control Tank Divert Valve **OPENS** to divert excess water to the Holdup Tank.

Op Test No.:	NRC	Scenario #	1	Event #	1	Page	5	of 61
Event Description:	Reduce Power For Turbine Valve Testing							

Time	Position	Applicant's Actions or Behavior
NOTE Sample may be obtained at normal RCS sample intervals provided the unit is at power and the unit response following the boration is as expected.		
	RO	**WHEN** boration is complete, **THEN** • **PLACE [HS-62-140A]**, Boric Acid to Blender Flow Control Switch to the **STOP** position. • **CHECK** no primary water flow on either **[FI-62-142A] OR [FQ-62-142]**. • **ENSURE [FC-62-142]**, Primary Water to Blender Flow • Controller is in **AUTO** position and the potentiometer (dial indicator) is set at 35%. • **ADJUST [FC-62-139]**, Boric Acid Flow Controller to the desired blend solution in accordance with TI-44 Boron Tables. • **ENSURE [FCV-62-128]** is **CLOSED**. • **PLACE [HS-62-140B]**, CVCS Makeup Selector Switch to the **AUTO** position. • **PLACE [HS-62-140A]**, Boric Acid to Blender Flow Control Switch to the **START** position. • **IF** RCS boron sample required, **THEN NOTIFY** Chem Lab to obtain RCS boron sample.
NOTE Boration is done in batches until the total boron and/or power change is completed.		
	RO	**REPEAT** this section as required to complete total boron change.

Op Test No.: NRC	Scenario # 1	Event # 1	Page 6 of 61
Event Description:	Reduce Power For Turbine Valve Testing		

Time	Position	Applicant's Actions or Behavior
	RO	**WHEN** total boration is complete, **THEN:** • **REALIGN** the blender controls for **AUTO** makeup to the CVCS in accordance with Section 5.1. • **NOTIFY** Chem Lab to obtain RCS boron sample.
	US	**IF** in modes 1, 2, or 3, **THEN ENSURE** requirements of TRM 3.1.2.6 are met.

Evaluator Note: Following Steps are from 0-GO-5, *Normal Power Operation,* Section 5.3 Beginning at Notes prior to step 7.

NOTES

1) Guidance on restoration of EHC Controls after a BOP runback is contained in Appendix B, *Turbine Runback Restoration.*

2) For core operating recommendations for situations such as end of core life coast down or unusual power maneuvers, contact Reactor Engineering for guidance.
3) It is recommended that AFD be controlled within the target band.

4) The following general approach should be used during power reduction:
(a) borate RCS to reduce RCS TAVG within limits of TREF, (b) reduce turbine load to match TREF with TAVG (c) periodically take rod control to MANUAL from AUTO and insert the bank to move AFD near the target value, (d) return rod control to AUTO when not using the bank to control AFD, and (e) repeat the above as necessary to accomplish the load change.

5) Actions effecting reactivity are directed in the following step. 0-SO-62-7 requirements shall be adhered to for reactivity changes (i.e. reactivity balance, amounts of boric acid or water). All appropriate verifications and peer checks shall be utilized during performance.

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Event Description: Reduce Power For Turbine Valve Testing

Time	Position	Applicant's Actions or Behavior
	BOP	**INITIATE** a load reduction.
	BOP	**MONITOR** turbine load decreasing.
CAUTION **Do NOT exceed a load change rate of plus or minus 5%/minute or a step change of 10%**		
NOTE TAVG is programmed from 578.2°F at 100% power to 547°F at zero power at a rate of 0.312°F per % power.		
	Crew	**MONITOR** the following during the load reduction: TAVG following TREF program. All RPIs, group step counters for rod insertion limits and inoperable rods or rod misalignment, Loop ΔT, and NIS for correct power distribution and quadrant power tilts. Core AFD within ~5% control band around the power level dependent target value.
NOTE Valve position limit and governor control meter are displayed on EHC Display panel 1,2-XX-047-2000 (M-2).		

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Event Description: Reduce Power For Turbine Valve Testing

Time	Position	Applicant's Actions or Behavior
	BOP	Valve position limit approximately 10% above the current governor control indication as turbine load is changed.
Lead Examiner may direct initiation of the next event at his discretion		

Op Test No.: NRC	Scenario # 1	Event # 2	Page 9 of 61
Event Description: NIS Power range Channel I (N41) Fails High			

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **When directed, initiate Event 2**		
Indications available: **Control Rods Inserting** **M-4 Indicator Full Scale** **1-AR-M4-B. D3 IPRS NIS POWER RANGE OVERPOWER ROD WITHDRAWAL STOP** **1-AR-M4-B. E3 NC-46B NIS POWER RANGE CHANNEL DEVIATION** **1-AR-M6-A. B1 NC-41U/NC-41-K NIS POWER RANGE HIGH NEUTRON FLUX RATE** **1-AR-M6-A. D1 NC-41R NIS POWER RANGE HIGH SETPOINT HIGH FLUX LEVEL**		
	RO	Recognizes, announces unexpected Control Rods insertion and takes Immediate action to place rod control in manual.
	Crew	Refer to alarm response procedures.
	US	Determine NIS Instrument Failure has occurred and direct entry to AOP-I.01, Nuclear Instrument Malfunction, section 2.3
	RO	**PLACE** rod control in MAN.

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Event Description:	NIS Power range Channel I (N41) Fails High							

Time	Position	Applicant's Actions or Behavior
	SRO	**EVALUATE** the following Tech Specs for applicability: • **3.3.1.1 (3.3.1), Reactor Trip System Instrumentation (Action 2 Applies)** • 3.3.3.5, Remote Shutdown Instrumentation **(N/A)** • 3.3.3.7, Accident Monitoring Instrumentation **(N/A)** • **SR 4.2.4.2, QPTR with one PR Channel Inoperable (Surveillance requirement is Applies)**
	RO	**PLACE** following switches located on Detector Current Comparator drawer [M-13, N50] in position corresponding to failed Power Range Channel (N41): • Upper Section • Lower Section • Appropriate Rod Stop Bypass switch • Appropriate Power Mismatch Bypass switch
	RO	**DEFEAT** failed Power Range channel USING Comparator Channel Defeat switch: • Comparator and Rate Drawer [M-13, N37]

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Event Description: NIS Power range Channel I (N41) Fails High

Time	Position	Applicant's Actions or Behavior
	Crew	**RESTORE** Tavg within 1.5°F of Tref USING one of the following: • manual rod control OR • RCS boration/dilution OR • turbine load reduction
	RO	**ENSURE** OPERABLE Power Range channel selected to the following: • Nuclear Power Recorder [M-4, NR-45] • Nuclear Power Recorder - (ΔI) [M-4, NR-45] • RCS Temp ΔT recorder - (green pen) [M-5, XS-68-2B]
	RO	**RETURN** rod control to AUTO if desired.
	RO	**CHECK** reactor power greater than 75%.
	Crew	**NOTIFY** Reactor Engineering to PERFORM 0-SI-NUC-000-011.0, Moveable Detector Determination of Quadrant Power Tilt Ratio.

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Event Description: NIS Power range Channel I (N41) Fails High

Time	Position	Applicant's Actions or Behavior
	SRO	**NOTIFY** IM to remove failed power range channel from service USING appropriate Appendix: POWER RANGE CHANNEL / PROT CH / APPENDIX N-41 / I / A N-42 / II / B N-43 / III / C N-44 / IV / D ***(N41 Requires Appendix A)***
	SRO	**GO TO** appropriate plant procedure.

When technical specifications have been identified or at discretion of the Lead Examiner, proceed to the next event

Op Test No.:	NRC	Scenario #	1	Event #	3	Page	13	of 61
Event Description:	Charging Pump 1B Trip							

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **When directed, initiate event 3**		
Indications available: **Motor trip out Alarm, Panel M-1** **Motor trip out Buzzer** **White Disagreement light on 1B CCP Handswitch** **1-AR-M6-C, D-3, FS-62-93A/B CHARGING LINE FLOW ABNORMAL**		
	Crew	Refer to alarm response procedures
	RO	Perform Alarm Response procedure for **Charging line flow Abnormal** to place standby Charging Pump in service and restore letdown.
	RO	**CHECK** charging line flow on **[1-FI-62-93A]**.
Evaluator Note: Steps 2 through 4 of ARP are Not applicable Step 5c follows below.		

Op Test No.:	NRC	Scenario #	1	Event #	3	Page	14	of 61
Event Description:	Charging Pump 1B Trip							

Time	Position	Applicant's Actions or Behavior
Note If sufficient time exists to obtain a local inspection of the Standby pump, then have an AUO conduct inspection prior to starting pump.		
	RO	**IF** CCP tripped or failed, **THEN PERFORM** the following: **1. IF** Thermal Barrier flow is present, **THEN** **A. VERIFY** 1-LCV-62-132 and -133 **OPEN** and VCT level > 8% **OR** 1-LCV-62-135 AND/OR 1-LCV-62-136 **OPEN**. **B. ANNOUNCE** pump start over PA **AND** **START** the standby CCP and check for proper operation.
Caution Starting the standby CCP with RCP seal temperature greater than 230°F could lead to seal damage.		
	RO	**2. IF** thermal barrier flow is NOT present or is lost after pump trip, **THEN** **A. ENSURE** suction path and VCT Level are normal. **B. VERIFY** all RCP Seals less than 230°F. **C. ANNOUNCE** pump start over PA **AND** **START** the standby CCP and check for proper operation. *(Step Should Be N/A)*
	RO	**3. REESTABLISH** charging and letdown in accordance with 1-SO-62-1, *Chemical & Volume Control System.*

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Event Description:	Charging Pump 1B Trip							

Time	Position	Applicant's Actions or Behavior
Evaluator Note: Following steps are from 1-SO-62-1		
Note This Instruction is to be used if letdown has been taken out of service or has isolated, charging still remains in service and CVCS demin status is unchanged.		
Note Following Instruction closely may prevent opening letdown relief valve.		
	RO	**ENSURE** following orifice isolation valves are **CLOSED**: • 1-FCV-62-72 • 1-FCV-62-73 • 1-FCV-62-74
	RO	**PLACE [1-HIC-62-78]** in **MANUAL, AND OPEN [1-TCV-70-192]** to ~50%.
	RO	**ENSURE** following letdown isolation valves are **OPEN:** • 1-FCV-62-69 • 1-FCV-62-70 • 1-FCV-62-77
Caution Flashing in letdown line may occur if 1-PCV-62-81 is opened excessively.		

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Event Description: Charging Pump 1B Trip

Time	Position	Applicant's Actions or Behavior
	RO	**PLACE [1-HIC-62-81A]** in **MANUAL, AND ADJUST [1-PCV-62-81]** to 50-60% OPEN (40-50% output).
Caution **Step [6] needs to be performed immediately after step [5] is completed to prevent flashing in letdown line.**		
	RO	**OPEN** one of the letdown orifice isolation valves (**N/A** one(s) not used): • 1-FCV-62-72 • 1-FCV-62-73 • 1-FCV-62-74
Note Normal letdown pressure is 325 psig at operating temperature.		
	RO	**ADJUST [1-HIC-62-81A]** to obtain desired letdown pressure as indicated on **[1-PI-62-81]**.
	RO	**PLACE [1-HIC-62-81A]** in **AUTO**.

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Event Description:	Charging Pump 1B Trip							

Time	Position	Applicant's Actions or Behavior
Note Normal letdown temperature is ~100°F.		
	RO	**ADJUST [1-HIC-62-78A]** to obtain desired letdown temperature, as indicated on **[1-TI-62-78]**.
	RO	**PLACE [1-HIC-62-78A]** in **AUTO.**
Note Letdown temperature may swing due to repeated actuation of TIS-62-79B/A on high temperature causing TCV-70-192 to fully open.		
	RO	**IF** necessary to stabilize letdown temperature due to oscillations in CCS flow, **THEN PERFORM** following to gain control of CCS flow through letdown heat exchanger: Open the following breaker: • Vital Instrument Power Bd 1-III 1-BKRA-250-NG/15-F **WHEN** letdown heat exchanger outlet temperature is stabilized at approximately 100°F, **THEN** **CLOSE** following breaker: • Vital Instrument Power Bd 1-III 1-BKRA-250-NG/15-F *(Step Should Be N/A)*

Op Test No.:	NRC	Scenario #	1	Event #	3	Page	18	of 61
Event Description:	Charging Pump 1B Trip							

Time	Position	Applicant's Actions or Behavior
Note 1-TCV-62-79 (letdown temperature divert valve) should be in bypass position if the temperature reaches 140°F.		
	RO	**IF** Mix Bed HI Temperature Bypass valve **[1-HS-62-79A]** auto bypasses DI on high temperature, **THEN** **ENSURE** letdown temperature returns to **NORMAL AND** **PLACE** demin in service using **[1-HS-62-79A]**. *(Step Should Be N/A)*
	RO	**IF** PZR level is on program and auto operation is desired, **THEN** **[a] IF [1-HIC-62-93A]** deviation meter is off scale high or off scale low **THEN** **PLACE [1-LIC-62-339]** in **MANUAL AND** **ADJUST** output until **[1-HIC-62-93A]** deviation meter is approximately mid-scale. **[b] PLACE [1-LIC-62-339]** in **AUTO**. **[c] PLACE [1-HIC-62-93A]** in **AUTO**.

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Event Description: Charging Pump 1B Trip

Time	Position	Applicant's Actions or Behavior
	RO/BOP	**PERFORM** Independent Verification for following valve(s) that were **OPENED:** (**N/A** one(s) not used).

VALVE NO.	DESCRIPTION	IV INITIALS
1-FCV-62-69	Letdown Isolation	_____
1-FCV-62-70	Letdown Isolation	_____
1-FCV-62-77	Letdown Flow Isolation	_____
1-FCV-62-72	Letdown Orifice Isol.	_____
1-FCV-62-73	Letdown Orifice Isol.	_____
1-FCV-62-74	Letdown Orifice Isol.	_____

Evaluator Note: The following Tech Spec evaluation is not specifically directed by the ARP or SO performed.

	SRO	Evaluate Tech Specs and Technical Requirements Manual for Charging Pump trip. • **Tech Spec LCO 3.5.2 - ECCS Subsystems (72 Hour Action Applies)** • **TRM 3.1.2.4 – Charging Pumps – Operating (72 Hour Action applies)**

When technical specifications and Tech Requirements have been identified, standby charging pump has been placed in service, and letdown restored, or at Lead Examiner's discretion, proceed to the next event.

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Event Description: Steam Generator #1 Steam Pressure channel fails low (PT-1-2A)

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **When directed, initiate Event 3**		
Indications available: • **Loop 2 Feedwater Flow Decreasing** • **1-AR-M5-A-A7, STEAM GEN FEEDWATER FLOW HIGH** • **1-AR-M6-B, A2, LOW STEAM LINE PRESSURE LOOP 1** • **1-AR-M6-B, A3, HIGH NEGATIVE RATE STEAM LINE PRESSURE LOOP 1**		
	Crew	Refer to alarm response procedures
	SRO	Direct entry to AOP-S.01, Loss Of Normal Feedwater, Sect 2.1 Steps 1-4 **If SRO goes directly to AOP-I.06, then go to next page.**
	BOP	**RESTORE** steam generator level(s) to program:
	BOP	a. **PLACE** affected level controller(s) in MANUAL: • FIC-3-35A, S/G-1
	BOP	b. **CONTROL** feedwater flow on affected S/G(s) **USING** main feedwater regulating valve controller(s) to restore level to program.

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Event Description: Steam Generator #1 Steam Pressure channel fails low (PT-1-2A)

Time	Position	Applicant's Actions or Behavior
	BOP	2. **CHECK** Steam Flow and Feed Flow Channels NORMAL. [M-4]
	BOP	**RNO:** TRANSFER associated Steam Flow selector switch to alternate channel: **LOOP** **TRANSFER SWITCH** **FLOW INDICATOR** S/G 1 XS-1-3D (FI-1-3A) FI-1-3B
Caution: Feed Flow transients may impact core thermal power.		
	BOP	3. **MAINTAIN** steam generator level(s) on program.
	BOP	4. **CHECK** S/G pressure instruments NORMAL.
	SRO	**GO TO** AOP-I.06, Steam Generator Instrument Malfunction.
Evaluator Note: SRO may directly enter AOP-I.06 at next step.		

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Event Description: Steam Generator #1 Steam Pressure channel fails low (PT-1-2A)

Time	Position	Applicant's Actions or Behavior
	SRO	Direct entry to AOP-I.06, Steam Generator Instrument Malfunction, section 2.1
NOTES: Channels I and II compensate their respective steam flow signals which input to the STEAM/FEEDWATER FLOW MISMATCH alarms and S/G Water Level Control. Channels III and IV input to the STEAM GENERATOR LOOPS PRESS LOW alarm.		
	BOP	VERIFY unaffected steam flow channel SELECTED: • S/G-1, XS-1-3D PERFORM the following: • PLACE affected level controller(s) in MANUAL: o FIC-3-35A, S/G 1
	BOP	MATCH steam flow and feedwater flow on affected S/G USING main feedwater regulating valve controller(s).

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Event Description: Steam Generator #1 Steam Pressure channel fails low (PT-1-2A)

Time	Position	Applicant's Actions or Behavior
	BOP	TRANSFER associated Steam Flow selector switch to alternate channel: **LOOP** **TRANSFER SWITCH** **FLOW INDICATOR** S/G 1 XS-1-3D (FI-1-3A) FI-1-3B
	BOP	MAINTAIN steam generator level(s) on program.
	BOP	PLACE main feedwater regulating valve(s) in AUTO.
	SRO	EVALUATE the following Tech Specs for applicability: • 3.3.1.1 (3.3.1), Reactor Trip System Instrumentation • **3.3.2.1 (3.3.2), Engineered Safety Feature Actuation System Instrumentation. (Action 17 Applies)** • 3.3.3.5, Remote Shutdown Instrumentation • **3.3.3.7, Accident Monitoring Instrumentation. (Action 1 Applies)**

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Event Description: Steam Generator #1 Steam Pressure channel fails low (PT-1-2A)

Time	Position	Applicant's Actions or Behavior
		NOTE 1: Megawatt thermal indication on ICS (U1118 and U2118) may be impacted by this failure. **NOTE 2:** If performing AOP in conjunction with AOP-I.11 for an Eagle LCP failure, then actions to hard trip bistables should be delayed until Eagle system reset is attempted. Actions to hard trip bistables must be completed within 6 hours UNLESS affected loop is restored to operable status by resetting Eagle rack.
	SRO	NOTIFY IM to remove failed S/G pressure instrument from service USING appropriate Appendix: **LOOP INSTRUMENT NUMBER PROT CH APPENDIX** 1 P-1-2A (P-514) I A
	SRO	GO TO appropriate plant procedure.

When Technical Specifications have been addressed, Lead Examiner may cue the next event

Op Test No.: NRC	Scenario # 1	Event # 5	Page 25 of 61
Event Description: Condenser Vacuum Leak			

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **When directed, initiate Event 5**		
Indications available: • **0-M-12A, C-2, 1-RA-90-119B COND VAC PMP LO RNG AIR EXH MON INSTR MALFUNC** • **1-AR-M2-C, C6, CONDENSER VACUUM LOW** • **Condenser Vacuum degrading (Monitored on recorder or ICS), Air in leakage increasing**		
	Crew	Refer to alarm response procedure
Evaluator Note: Crew may recognize vacuum leak early and enter abnormal procedure AOP-S.02, *Loss Of Condenser Vacuum,* prior to alarm. If AOP Entered Directly go to Next page at NOTE.		
	BOP	**VERIFY** alarm via **[1-P/TR-2-2]** recorder.
	BOP	**VERIFY** required number of CCW pumps are in service.
	BOP	**CHECK** condenser vacuum exhaust on ICS using either: a. 1F2700A if 1-FCV-2-255 is closed b. 1F2263A if 1-FCV-2-255 is open.

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Event Description: Condenser Vacuum Leak

Time	Position	Applicant's Actions or Behavior
	BOP	**IF** condenser vacuum exhaust flow > 45 CFM, **THEN ENSURE** 1-FCV-2-255 **OPEN**.
	SRO	**IF** alarm is valid, **THEN GO TO** AOP-S.02, *Loss of Condenser Vacuum.*
NOTE: Use of the highest reading operable condenser pressure instrument is conservative and recommended by engineering.		
	BOP	**MONITOR** condenser pressure for turbine trip criteria. • **CHECK** turbine load greater than or equal to 30%. (MT Low Condenser Vacuum Trip @ 3.9 psia increasing)
	BOP	**CHECK** condenser pressure less than or equal to 2.7 psia. **(1-AR-M2-C, C-6, CONDENSER VACUUM LOW** @ 2.7 psia increasing.)
	BOP	**ENSURE** condenser vacuum pumps RUNNING. (Operator starts 1B Condenser Vacuum Pump)

Op Test No.: NRC Scenario # 1 Event # 5 Page 27 of 61

Event Description: Condenser Vacuum Leak

Time	Position	Applicant's Actions or Behavior
	BOP	**ENSURE** condenser vacuum breaker CLOSED.
	BOP	**CHECK** required CCW Pumps RUNNING [M-15].
NOTE: ICS points F2700A and F2263A will alarm if Condenser Vacuum Exhaust Flow is ≥ 45 cfm.		
	BOP	**DETERMINE** volume of condenser inleakage **USING** the following plant computer points: • F2700A • F2263A • F2260A

Op Test No.: NRC	Scenario # 1	Event # 5	Page 28 of 61
Event Description: Condenser Vacuum Leak			

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** inleakage value is < 45 cfm as indicated by both F2700A and F2263A. **RNO:** **PERFORM** the following: • **ENSURE** FCV-2-255, Condenser Vacuum Exhaust Bypass, is OPEN. • **IF** greater than 5% RTP, **THEN NOTIFY** Chem Lab to reevaluate Vent Flow Rate Monitor setpoint in accordance with 0-SI-CEM-030-415.0.
	Crew	**DISPATCH** an operator to PERFORM the following: **a.** **CHECK** loop seal on vacuum breaker [Turbine Bldg, 706' elev]. **b.** **CHECK** the following components: • Main Turbine rupture discs intact • Condenser shell intact • Main Feedwater Pump rupture discs intact • Main Turbine exhaust hoods **c.** **VERIFY** Main Steam Dump Drain Tank level control operating properly.
	RO	**ENSURE** control rods controlling in AUTO.

Op Test No.: NRC	Scenario # 1	Event # 5	Page 29 of 61
Event Description: Condenser Vacuum Leak			

Time	Position	Applicant's Actions or Behavior
	BOP	**CHECK** condenser pressure STABLE or DROPPING. **IF NOT:** **REDUCE** turbine load to maintain condenser vacuum **USING** one of the following: • AOP-C.03, Rapid Shutdown or Load Reduction. (preferred) **OR** • Valve Position Limiter.
Power Change not required, On Lead Examiner's cue, proceed to the next event		

Op Test No.:	NRC	Scenario #	1	Event #	6, 7, 8	Page	30	of 61

Event Description: Main Feedwater Pump A trip, MD AFW pump 1B-B Airbound, Main Feedwater Pump B Speed controller fails to 0%.

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **When directed, initiate Event 6 (Events 7, and 8 previously activated or automatically initiated)**		
Indications of Main Feed Water Pump A Trip: • **Main feedwater Pump tripped Alarms** • **Decreasing Feedwater flow to all Steam generators.** • **Turbine and Reactor Runback** **Indications of MDAFW Pump 1B-B airbound:** • **Pump running with proper valve alignment and no indicated AFW flow to loops 3 and 4.** • **Low discharge pressure and pump amps.** **Indications of Feedwater Pump B Speed control Fails to 0%.** • **Main Feedwater Flow rapidly decreasing** • **Main feedwater pump B speed rapidly decreasing**		
	Crew	Announce MFP trip and Monitor Turbine/Reactor runback, S/G levels and Running Main Feed water pump response.
Evaluator Note: Crew may only complete a small portion of AOP-S.01, if any, prior to second MFP Speed Control failure (3 min after MFP A trip) resulting in reactor trip. **Also, crew may elect to trip the reactor as a conservative action during runback since TDAFW pump is not available and if they note the condenser vacuum spike during runback due to main steam entering from steam dump.** **If Rx Tripped crew will not enter AOP-S.01.**		
	SRO	Direct Entry into AOP-S.01, section 2.3.

Op Test No.: NRC Scenario # 1 Event # 6, 7, 8 Page 31 of 61

Event Description: Main Feedwater Pump A trip, MD AFW pump 1B-B Airbound, Main Feedwater Pump B Speed controller fails to 0%.

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** turbine runback to less than 72 % load (~880 Mwe).
	RO	**VERIFY** control rods inserting automatically to match T-avg and T-ref.
	BOP	**ENSURE** running main feedwater pump FULLY LOADED: Speed controller output at maximum. [M-3, SIC-46-20A or SIC-46-20B]

Evaluator Note: Crew should identify Airbound AFW Pump prior to or during performance of the following step. When identified, crew may stop the pump or dispatch personnel to check the pump locally prior to stopping it.

Following field report on pump status, crew should also initiate venting of the pump casing.

Op Test No.:	NRC	Scenario #	1	Event #	6, 7, 8	Page	32	of 61

Event Description: Main Feedwater Pump A trip, MD AFW pump 1B-B Airbound, Main Feedwater Pump B Speed controller fails to 0%.

Time	Position	Applicant's Actions or Behavior
	BOP	**ENSURE** AFW pumps started: a. MDAFW Pumps RUNNING. [M-4] b. TDAFW Pump RUNNING. [M-3] c. TDAFW Pump LCVs OPEN. [M-3] d. MDAFW Pump recirculation valves CLOSED: [M-4] • FCV-3-400 • FCV-3-401
Evaluator Note: Second Main Feedwater Pump speed control failure will likely occur prior to or around this step.		
	RO	Recognize main feedwater flow decreasing and attempt manual speed control
	SRO	Direct /Ensure Reactor trip based on decreasing S/G levels.
Reactor trip terminates this series of events.		

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	33	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **Remaining Events Automatically initiated.**		

Indications available:
 	
1A shutdown board differential Fault (5 minutes after Rx Trip)
• **Loss of Train A Equipment including:**
  o **Last Aux Feedwater Pump 1A.**
  o **Last Charging Pump 1A.**
• **Emergency D/G Start (Cooling water not available)**
• **Multiple alarms**
 	
1B safety Injection Pump auto start failure (When SI actuated in FR-H.1)
• **Green Light on Handswitch**
• **No Pump flow or amps**		

	SRO	Directs transition to E-0, Reactor Trip or Safety Injection
	RO	VERIFY reactor TRIPPED: • Reactor trip breakers OPEN • Reactor trip bypass breakers DISCONNECTED or OPEN • Neutron flux DROPPING • Rod bottom lights LIT • Rod position indicators less than or equal to 12 steps.

Op Test No.: NRC	Scenario # 1	Event # 9 & 10	Page 34 of 61
Event Description:	Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.		

Time	Position	Applicant's Actions or Behavior
	BOP	VERIFY turbine TRIPPED: • Turbine stop valves CLOSED.
	BOP	VERIFY at least one train of shutdown boards ENERGIZED.
EVALUATOR Note: SI not required at this point crew will transition to ES-0.1 in the next step and continue until FR-H.1 is required following SD Board Differential fault. The exact Transition is crew dependent therefore steps may be included that are not performed in ES-0.1.		
	RO	**DETERMINE** if SI actuated: • ECCS pumps RUNNING. • Any SI alarm LIT [M-4D] ***(RNO)*** **DETERMINE** if SI Required: a. IF any of the following conditions exist: • S/G Pressure less than 600 psig **OR** • RCS pressure less than 1870 psig, **OR** • Containment pressure greater than 1.5 psig **THEN** **ACTUATE SI** ***(NOTE: SI NOT REQUIRED)*** b. **IF** SI not required THEN PERFORM the following: • **MONITOR** Status Trees **GO TO** ES-0.1, Reactor Trip Response

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	35	of	61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
EVALUATOR Note: During performance of ES-0.1, at some point Shutdown board 1A will be lost. Crew should note that the 1A D/G has no cooling water and emergency stop it. If not addressed by crew early, if will be addressed in AOP-P.05 as discussed below. **Crew may designate one of the ROs (most likely the BOP) to perform AOP-P.05 for Loss of Shutdown Board when it occurs. Details of AOP-P.05 are at the end of this event guide just prior to event guide for ES-0.5.**		
	SRO	Enter and direct ES-0.1, Reactor Trip Response
	RO	**MONITOR** SI NOT actuated: • SI ACTUATED permissive DARK [M-4A, D4]
	BOP	**VERIFY** generator breakers OPEN.
	RO	**MONITOR RCS** temperatures: **IF** any **RCP** running, THEN **CHECK** T-avg stable at or trending to between 547°F and **552°F.** (RNO Next Page If Required)

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	36	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP	(RNO If Required) **IF** temperature less than 547°F and dropping, **THEN** **PERFORM** the following: a. **ENSURE** steam dumps and atmospheric reliefs CLOSED. b. **ENSURE** S/G blowdown isolation valves CLOSED. c. **IF** cooldown continues, **THEN** **PERFORM** the following: 1) **CONTROL** total feed flow **USING** EA-3-8, Manual Control of AFW Flow. 2) **MAINTAIN** total feed flow greater than 440 gpm UNTIL narrow range level greater than 10% in at least one S/G. 3) **DEPRESS** RESET on MSR control panel. 4) **IF** any MSR temp control valve fails to close, **THEN** **ISOLATE** HP steam to MSRs. d. **IF** cooldown still continues, **THEN** **CLOSE** MSIVs and bypass valves.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	37	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** feedwater status: a. T-avg less than 550°F. b. MFW regulating valves CLOSED. c. MFW regulating bypass valve controller outputs ZERO. d. MFW isolation valves CLOSED. e. MFW pumps TRIPPED. f. MFW flow ZERO. g. Total feed flow to S/Gs greater than 440 gpm.
	RO	**CHECK** if emergency boration is required: a. **VERIFY** all control rods fully inserted: • Rod bottom lights LIT • Rod position indicators less than or equal to 12 steps. b. **MONITOR** RCS temperature: • T-avg greater than 540°F if any RCP running OR • T-cold greater than 540°F if all RCPs stopped.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	38	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP	**ANNOUNCE** reactor trip **USING** PA system.
	RO	**MONITOR** pressurizer level control: a. **CHECK** pressurizer level greater than 17%. b. **VERIFY** charging IN SERVICE. c. **VERIFY** letdown IN SERVICE. d. **CHECK** pressurizer level trending to 25% (normal range 20% to 30%).
	RO	**MONITOR** pressurizer pressure control: a. Pressurizer pressure greater than 1870 psig. b. Pressurizer pressure stable at or trending to 2235 psig (normal range 2210 psig to 2260 psig).
	BOP	**MAINTAIN** S/G narrow range levels: a. Greater than 10%.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	39	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** AC busses ENERGIZED from start busses.
CAUTION		**Arming steam dumps in pressure mode with demand signal present could result in rapid RCS cooldown.**
	BOP	**DETERMINE** if steam dump to condenser available: a. **CHECK** condenser AVAILABLE: • C-9 CONDENSER INTERLOCK permissive LIT [M-4A, E6] • At least one Intact S/G MSIV OPEN. b. **PLACE** steam dumps in STEAM PRESS mode: 1) **PLACE** steam dumps in OFF. 2) **ENSURE** steam dumps in steam pressure mode. 3) **ENSURE** zero output (demand). 4) **PLACE** steam dumps in ON. 5) **ADJUST** steam dump controller setpoint to 84% (1005 psig) in AUTO.

Op Test No.: NRC	Scenario # 1	Event # 9 & 10	Page 40 of 61
Event Description:	Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.		

Time	Position	Applicant's Actions or Behavior
Evaluator Note: It is assumed that transition to FR-H.1 will occur prior to or at this step. Transition should be based on Red Status tree path when the last AFW pump is lost due to the loss of the shutdown board.		
	SRO	Enter and direct actions of FR-H.1, Loss of Secondary Heat Sink.
CAUTION	**Feeding an Intact or Ruptured S/G is preferred to feeding a Faulted S/G. Thermal stresses from feeding a Faulted S/G could rupture tubes, resulting in a Faulted-AND-Ruptured S/G.**	
	BOP	**DETERMINE** procedure applicability: a. **CHECK** the following: • Total feed flow less than 440 gpm due to operator action directed by another procedure. **AND** • Total feed flow capability of greater than 440 gpm AVAILABLE.

Op Test No.: NRC Scenario # 1 Event # 9 & 10 Page 41 of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** RWST level greater than 27%.
	BOP	**CHECK** if secondary heat sink required: a. RCS pressure greater than any non-Faulted S/G pressure. b. RCS temperature greater than 350°F.
	RO	**MONITOR** at least one CCP available. (RNO Required since Last CCP was lost with the SD Board Differential Fault.)
	RO	(RNO) **STOP** all RCPs.
	SRO	(RNO) **GO TO** Caution prior to Step 16.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	42	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
CAUTION		**Any delay in completing Steps 16 through 19 could result in fuel damage.**
	RO	**ACTUATE** SI.
Evaluator Note: Crew should identify and start SI Pump 1B that failed to auto start from SI signal prior to or during this step.		
CRITICAL Task 1 – Part 1	RO	**VERIFY** RCS feed path: a. **CHECK** ECCS pump status: • At least one CCP RUNNING **OR** • At least one SI pump RUNNING.
	RO	(RNO require is SI Pump not previously started) **START** pumps. **IF** NO CCP or SI pump can be started, **THEN** **PERFORM** the following: ..... (Rest of step N/A SI pump should be started)

Op Test No.: NRC	Scenario # 1	Event # 9 & 10	Page 43 of 61
Event Description:	Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.		

Time	Position	Applicant's Actions or Behavior
	RO	**VERIFY** ECCS valve alignment for running pumps: 1) CCP suction aligned to RWST: • LCV-62-135 or LCV-62-136 OPEN • LCV-62-132 or LCV-62-133 CLOSED 2) CCPIT valves OPEN: • FCV-63-25 or FCV-63-26 • FCV-63-39 or FCV-63-40 3) SI Pump suction valves OPEN: • FCV-63-5 • FCV-63-47 (Train A) • FCV-63-48 (Train B) 4) SI Pump injection valves OPEN: • FCV-63-22 • FCV-63-152 (Train A) • FCV-63-153 (Train B)

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	44	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
CRITICAL Task 1 – Part 2	RO	**ESTABLISH** RCS bleed path: a. **CHECK** power to pressurizer PORV block valves AVAILABLE. b. **CHECK** pressurizer PORV block valves OPEN. c. **OPEN** both pressurizer PORVs. (Power will be available to only one block valve but it should be open)
	RO	**CHECK** RCS bleed path ADEQUATE: • Both Pressurizer PORVs OPEN • Both Pressurizer PORV block valves OPEN.
Evaluator Note: SRO should direct ROs to perform substeps of the following step.		
	SRO	**PERFORM** the following WHILE continuing with this procedure: a. E-0, Reactor Trip or Safety Injection, Steps 1 through 4. b. ES-0.5, Equipment Verifications. (ES-0.5 Included at the end of the Event Guides)

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Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	RO	**MAINTAIN** RCS heat removal: • ECCS flow • Pressurizer PORVs OPEN.
	RO	**RESET** SI signal.
	RO	**RESET** Phase A and Phase B.
	RO	**MONITOR** control air to containment: [Panel 6K and 6L] • 1-FCV-32-80 (2-FCV-32-81) Train A essential air OPEN • 1-FCV-32-102 (2-FCV-32-103) Train B essential air OPEN • 1-FCV-32-110 (2-FCV-32-111) Non-essential air OPEN

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	46	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** if containment spray required: a. **CHECK** the following: • Phase B ACTUATED **OR** • Containment pressure greater than 2.8 psig. (If NO, proceed to step to check RHR status) (If YES, Continue) b. **ENSURE** containment spray INITIATED: 1) Containment spray pumps RUNNING. 2) Containment spray header isolation valves FCV-72-39 and FCV-72-2 OPEN. 3) Containment spray recirculation valves to RWST FCV-72-34 and FCV-72-13 CLOSED. 4) Containment spray header flow greater than 4750 gpm per train.
	BOP	c. **WHEN** 10 minutes have elapsed **THEN** **VERIFY** containment air return fans RUNNING.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	47	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
CAUTION		**Operation of RHR pumps for greater than 100 minutes with miniflow valves open and NO CCS flow to RHR heat exchangers could result in pump damage.**
	RO BOP	**CHECK** RHR status: a. **CHECK** RHR pumps RUNNING b. **CHECK** CCS ALIGNED to RHR heat exchangers.
	RO	**MONITOR** if containment spray should be stopped: a. **CHECK** any containment spray pump RUNNING. b. **CHECK** containment pressure less than 2.0 psig. (If NO, Proceed to Monitor Containment Vacuum Control) (If YES, Continue) c. **CHECK** containment spray suction aligned to RWST. d. **RESET** containment spray. e. **STOP** containment spray pumps and **PLACE** in A-AUTO. f. **CLOSE** containment spray discharge valves: • FCV-72-39, Train A • FCV-72-2, Train B.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	48	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** if containment vacuum control should be returned to normal: a. **CHECK** containment pressure less than 1.0 psig. b. **VERIFY** containment vacuum relief isolation valves OPEN: [panel 6K] • FCV-30-46 OPEN • FCV-30-47 OPEN • FCV-30-48 OPEN.
CRITICAL Task 2 - Option 1	BOP	**ATTEMPT** to establish AFW flow to at least one S/G in the following order of priority-- Intact, Ruptured, Faulted: a. **CHECK** S/G blowdown isolation valves CLOSED. b. **CHECK** control room indications for cause of AFW failure: • CST level • AFW pump power supply • AFW valve alignment (Step Continued next page)

Evaluator Note: If not previously performed crew may initiate venting of AFW pump at this point.

Op Test No.: NRC Scenario # 1 Event # 9 & 10 Page 49 of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP	c. **ESTABLISH** MD AFW pump flow: 1) **ENSURE** MD AFW pumps RUNNING. 2) **ENSURE** AFW level control valves OPEN. 3) **ENSURE** MD AFW recirculation valves FCV-3-400 and FCV-3-401 CLOSED. d. **ESTABLISH** TD AFW pump flow: (TDAFW Flow not available due to tagout)
	BOP	e. **MONITOR** AFW flow available to at least one S/G. (If Yes, Proceed to step to control Control Feed Flow) (If NO. Continue)

Evaluator Note: If AFW flow established by venting AFW pump, crew will go to the last step in this event guide to Control Feed Flow to S/G. Steps beginning on the next page will not be required.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	50	of	61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
NOTE		Containment pressure greater than 1.5 psig will prevent opening FW isolation valves until SI signal is blocked using EA-99-1, Blocking Auto SI Signals.
CRITICAL TasK 2 - Option 2	BOP	**ATTEMPT** to establish feed flow from condensate system: a. **NOTIFY** MIG to perform EA-99-1, Blocking Auto SI signals. b. **CHECK** condensate system IN SERVICE: • Hotwell pumps • Condensate booster pumps c. **BLOCK** SI signals: • Low pressurizer pressure SI • Low steamline pressure SI. (Step Continued next page)
	BOP RO BOP	d. **CHECK** the following indications: • PRESSURIZER SI TRAINS A & B BLOCKED permissive LIT [M-4A, B4] • STEAMLINE PRESS ISOL/SI BLOCK RATE ISOL ENABLE permissive LIT [M-4A, A4]. e. **CHECK** Containment pressure less than 1.5 psig. (If NO, Skip next step until auto SI signals Blocked)

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	51	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP/RO	f. **CHECK** FW isolation valves OPEN. (RNO if Required) **PERFORM** the following: 1) **ENSURE** MFW reg valve controllers in MANUAL and output ZERO. 2) **ENSURE** MFW bypass reg valve controllers in MANUAL and output ZERO. 3) **RESET** SI signal. 4) **CYCLE** reactor trip breakers. 5) **RESET** FW Isolation. 6) **OPEN** FW isolation valves for intact S/Gs.
	BOP	g. **ALIGN** condensate flow path to S/Gs **USING** EA-2-2, Establishing Secondary Heat Sink Using Main Feedwater or Condensate System.
	BOP	h. **CHECK** Condensate flowpath established: • At least one Feedwater Isolation Valve OPEN • Condensate flowpath to S/G aligned.

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Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP	i. **DEPRESSURIZE** one S/G **USING** S/G atmospheric relief valve UNTIL condensate flow established: 1) **ENSURE** all MSIV and MSIV bypass valves CLOSED. 2) **DUMP** steam from one Intact S/G at maximum rate **USING** S/G atmospheric relief valve. j. **CONTINUE** depressurization UNTIL condensate flow established.
	BOP	k. **WHEN** condensate flow established, **THEN** **PERFORM** the following: 1) **STOP** S/G depressurization. 2) **CONTROL** pressure in selected S/G as necessary to maintain condensate flow.

Op Test No.:	NRC	Scenario #	1	Event #	9 & 10	Page	53	of 61

Event Description: Loss of Heat Sink Feed/Bleed – 1A shutdown Board differential Fault, SI Pump 1B auto start failure.

Time	Position	Applicant's Actions or Behavior
	BOP	**CONTROL** feed flow to S/G: a. **CHECK** Core Exit TCs STABLE or DROPPING. b. **CHECK** wide range level on selected S/G greater than 10% [30% ADV] c. **CONTROL** S/G feed flow as necessary to restore narrow range level in selected S/G between 10% [25% ADV] and 50%.

Scenario may be terminated when crew has established feedwater flow from either AFW or Condensate.

Op Test No.: NRC Scenario # 1 Event # AOP-P.05 Page 54 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior

AOP-P.05 Actions		
Evaluator Note: Operator may discontinue early to assist with loss of heat sink		
	BOP	Enter and perform AOP-P.05 Section 2.1 Reader-Doer.
NOTE:	Indicating lights for the turbine throttle, governor, intercept & reheat-stop valves are de-energized.	
	BOP	**MONITOR** 1B-B 6900V Shutdown Board ENERGIZED.
CAUTION 1:	**Restoring seal cooling to an overheated RCP seal could result in RCP seal damage or steam voiding in CCS.**	
CAUTION 2:	**Operation of RCPs for greater than 2 minutes without CCS cooling to oil coolers will result in bearing temperatures greater than 200°F.**	
	BOP	**CHECK** RCP seal cooling available: • seal injection flow OR • thermal barrier cooling flow

Op Test No.: NRC Scenario # 1 Event # AOP-P.05 Page 55 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
CAUTION:		**CCP and SI Pumps may experience bearing failure 10 minutes after loss of ERCW cooling.**
	BOP	**ENSURE** two Train A ERCW Pumps IN SERVICE: • K-A ERCW Pump • R-A ERCW Pump
	BOP	**ENSURE** Diesel Generators RUNNING and ERCW ALIGNED to all D/Gs. (RNO if not previously performed) **EMERGENCY STOP** any D/G with NO ERCW cooling available.
	BOP	**ENSURE** 1B-B CCS Pump supplying Train A CCS.
	BOP	**MONITOR** REACTOR COOLANT PUMPS MOTOR THRUST BEARING TEMP HIGH alarm DARK [1-M-5B, E-3].

Op Test No.: NRC Scenario # 1 Event # AOP-P.05 Page 56 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**CHECK** ERCW supply header pressure NORMAL: • 1(2)-PI-67-493, between 80 psig and 120 psig
	BOP	**CHECK** charging IN SERVICE: a. **CHECK** 1B-B CCP RUNNING.
	BOP	**IF** Reactor is critical, **THEN** **EVALUATE CLOSING** TDAFW LCVs to prevent RCS cooldown
	BOP	**CHECK** letdown IN SERVICE.
	BOP	**PERFORM** Appendix AA, Potential Tech Spec Impacts.. (May be performed later)

NOTE 1: 1-M-7 Instrument Rack A is normally powered from 480V Shutdown Bd 1A1-A. Power loss results in loss of various rad monitors, boric acid flow indication, and other MCR indications and controls.

NOTE 2: Restoration of power to Instrument Rack A may cause LCV-6-106B to open, resulting in condensate system flow changes.

Op Test No.: NRC Scenario # 1 Event # AOP-P.05 Page 57 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		RESTORE power to 1-M-7 Instrument Rack A by placing Instrument Rack A Transfer Switch to ALTERNATE position. [1-M-7, middle switch]
Evaluator Note: remainder of procedure will most likely not be complete due to Loss of Heat sink and is therefore not included..		

Op Test No.: NRC Scenario # 1 Event # ES-0.5 Page 58 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		ES-0.5 Actions
	BOP	**CHECK** ERCW system operation: • **VERIFY** at least four ERCW pumps RUNNING. • **VERIFY** D/G ERCW supply valves OPEN.
	BOP	**VERIFY** CCS pumps RUNNING: • Pump 1A-A (2A-A) • Pump 1B-B (2B-B) • Pump C-S.
	BOP	**VERIFY** EGTS fans RUNNING.
	BOP	**VERIFY** generator breakers OPEN.
	BOP	**VERIFY** AFW pumps RUNNING: • MD AFW pumps • TD AFW pump.

Op Test No.: NRC Scenario # 1 Event # ES-0.5 Page 59 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		NOTE AFW level control valves should **NOT** be repositioned if manual action has been taken to control S/G levels, to establish flow due to failure, or to isolate a faulted S/G.
	BOP	**CHECK** AFW valve alignment: a. **VERIFY** MD AFW LCVs in AUTO. b. **VERIFY** TD AFW LCVs OPEN. c. **VERIFY** MD AFW pump recirculation valves FCV-3-400 and FCV-3-401 CLOSED.
	BOP	**VERIFY** MFW Isolation: • MFW pumps TRIPPED • MFW regulating valves CLOSED • MFW regulating bypass valve controller outputs ZERO • MFW isolation valves CLOSED • MFW flow ZERO.
	BOP	**MONITOR** ECCS operation: **VERIFY** ECCS pumps RUNNING: • CCPs • RHR pumps • SI pumps

Op Test No.: NRC Scenario # 1 Event # ES-0.5 Page 60 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** CCP flow through CCPIT. • **CHECK** RCS pressure less than 1500 psig. • **VERIFY** SI pump flow. • **CHECK** RCS pressure less than 300 psig. • **VERIFY** RHR pump flow.

	BOP	**VERIFY** ESF systems ALIGNED:
		
		• Phase A ACTUATED:
		  o CONTAINMENT ISOLATION PHASE A TRAIN A alarm LIT [M-6C, B5].
		  o CONTAINMENT ISOLATION PHASE A TRAIN B alarm LIT [M-6C, B6].
		
		• Containment Ventilation Isolation ACTUATED:
		  o CONTAINMENT VENTILATION ISOLATION TRAIN A alarm LIT [M-6C, C5].
		  o CONTAINMENT VENTILATION ISOLATION TRAIN B alarm LIT [M-6C, C6].
		
		• Status monitor panels:
		  o 6C DARK
		  o 6D DARK
		  o 6E LIT OUTSIDE outlined area
		  o 6H DARK
		  o 6J LIT.
		
		• Train A status panel 6K:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN
		
		• Train B status panel 6L:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN

Op Test No.: NRC Scenario # 1 Event # ES-0.5 Page 61 of 61

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** containment spray NOT required: • Phase B NOT ACTUATED **AND** • Containment pressure less than 2.81 psig • Ensure Containment Spray is actuated
	BOP	**VERIFY** pocket sump pumps STOPPED: [M-15, upper left corner] • HS-77-410, Rx Bldg Aux Floor and Equipment Drain Sump pump A • HS-77-411, Rx Bldg Aux Floor and Equipment Drain Sump pump B.
	BOP	**DISPATCH** personnel to perform EA-0-1, Equipment Checks Following ESF Actuation.

Facility: Sequoyah Scenario No.: 2 Op Test No.: NRC

Examiners: _____ Operators: _____

Initial Conditions: 100% Power BOL

Turbine Driven Auxiliary Feedwater Pump OOS for maintenance.

Turnover: Maintain Current Plant conditions.

Target CTs: Isolate Steam flow and Feedwater flow to ruptured S/G prior to initiation of RCS Cooldown to target temperature.

Cooldown RCS to less than or equal to target temperature prior to RCS depressurization.

Depressurize RCS to meet E-3 depressurization criteria prior to S/G overfill (100% S/G dome level from simulator computer variable).

Event No.	Malf. No.	Event Type*	Event Description
1	ED16A	TS-SRO C-SRO/BOP	125 DC Vital Battery Charger I failure. Tech Spec evaluation. Crew initiates placing Spare Charger in Service to Vital Battery.
2	RW01E	TS-SRO C-SRO/BOP	ERCW pump N-B trips. Requires placing standby pump in service and AOP M.01performance. Tech Spec Evaluation.
3	RX11B	TS-SRO I-All	Impulse pressure transmitter PT-1-73 fails low resulting in rod insertion and manual rod control. SRO will direct AOP-I.08 to remove from service and transfer steam dump system to pressure control. Tech Spec Evaluation.
4	TH05A	TS-SRO C-All	Steam generator #1 tube leak of approximately 15 gpm requiring rapid plant shutdown. Tech Spec Evaluation.
5	N/A	R-ATC N-SRO/BOP	Perform rapid plant shutdown using AOP-C.03. Manual Rod control will be required.
6	ZDIHS621 38A	C-SRO/ATC	Emergency boration valve (FCV-62-138) will not open from control room handswitch. Normal boration required for shutdown.
7	TH05A	M-All	Steam generator tube leak increases to tube rupture (~400 gpm) requiring Rx Trip and Safety injection.
8	FW09A	C-BOP	Motor Driven Auxiliary Feeedwater pump 1A-A fails to Auto start requiring manual start.
9	RC06A	C-SRO/ATC	Pressurizer Spray valve fails full open during RCS depressurization in E-3. Stopping RCPs (at least #1 & #2) to terminate depressurization required.

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

Scenario 2 Summary

Shortly after assuming shift, 125 Volt DC Vital Battery Charger I will fail. Crew will diagnose the failure and initiate Vital battery I transfer to the spare charger. SRO will evaluate and enter applicable Technical Specifications.

After addressing the charger failure, Essential Raw Cooling Water pump N-B will trip. Crew will start the standby pump and perform the AOP which will require realigning the Standby pump for Emergency start also. SRO will evaluate Technical Specifications, LOC is applicable until selector switch for auto start is aligned to the operable pump then it may be exitedl.

After the ERCW pump AOP is complete Turbine Impulse Transmitter PT-1-73 will fail low. This will result in inadvertent rod insertion which will require placing rod control in manual for the remainder of the scenario. This failure will also require transferring steam dump control system to steam pressure mode. S/G level program and Tavg reference program (Tref) will be also be affected. SRO should again evaluate Technical Specifications; however, LCO entry will not be required since the low failure does not affect the associated interlock in such a way as to prevent the associated reactor protection system functions from operating.

After this AOP has been addressed, a steam generator tube leak of approximately 15 gpm will occur in Steam Generator #1. Since this leak is within the capacity of the normal charging system, the associated AOP will require initiation of a rapid shutdown. RCS leakage Tech Spec. is applicable. When starting the rapid shutdown, the emergency boration valve will not open from the control room handswitch requiring performance of the altenate path to initiate boration using normal boration. Rod control during the shutdown will be manual.

After the rapid shutdown has resulted in a sufficient power reduction, the steam generator Tube leak will propagate to a significant rupture of approximately 400 gpm. This leak size will require initiation of a Reactor Trip and Safety Injection. Motor Driven Auxiliary Feedwater Pump 1A-A will fail to auto start from the SI signal and will require manual start.

The crew will progress through E-0 and transition to E-3 where they will cooldown to target RCS temperature and depressurize the RCS. During depressurization a Pressurizer spray valve will fail open requiring stopping of at least RCPs 1 and 2 to stop the depressurization.

The scenario may be terminated when crew has completed RCS depressurization in E-3.

Op Test No.:	NRC	Scenario #	2	Event #	1	Page	1	of 47
Event Description:	125 Volt DC Vital Battery Charger I							

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate Event 1**		
Indications Available: **1-AR-M1-C, A4, 125 DC VITAL CHGR I FAILURE OR VITAL BAT I DISCHARGE** **Upscale Deflection of of EI-57-92 on M-2.**		
	BOP	Refer to alarm response procedure 1-AR-M1-C window A4
	BOP	**SELECT** channel I on **[1-XS-57-96]** 125V Vital Battery voltage, **AND CHECK** battery bd voltage.
	CREW	**IF** failure of 125V DC Vital Battery Bd, **THEN** **GO TO** AOP-P.02, *Loss of 125V DC Vital Battery Board.* (Step is N/A Board Voltage Normal)
NOTE Downscale (zero or below) deflection of EI-57-92 indicates current flow from normal power supply (charger). Upscale (greater than zero) deflection of EI-57-92 indicates current flow from the battery.		
	BOP	**CHECK [1-EI-57-92]** Vital Battery Bd I amps. (Ampmeter shows upscale deflection indicating battery discharge)

Op Test No.: NRC Scenario # 2 Event # 1 Page 2 of 47

Event Description: 125 Volt DC Vital Battery Charger I

Time	Position	Applicant's Actions or Behavior
	BOP	**DISPATCH** personnel to **INSPECT AND CHECK** for local alarms on the 125V DC Vital Charger I and 125V DC Vital Battery bd I.
	BOP	Next 5 Steps of Annunciator Response Procedure are NA for this failure.
	CREW	**IF** charger failure, **THEN EVALUATE** need to place spare charger in service in accordance with 0-SO-250-1, *125 Volt dc Vital Battery Board* (Crew should initiate placing spare charger in service to Vital Batt Bd I)
	CREW	**EVALUATE** EPIP-1 Emergency Plan Classification Matrix. (Crew should notify Shift Manager to evaluate REP)
	SRO	**EVALUATE** TS LCOs 3.8.2.3. **(2 Hr Action b. Applies)**

When Technical Specifications have been identified or at discretion of the Lead Examiner, proceed to the next event.

Op Test No.:	NRC	Scenario #	2	Event #	2	Page	3	of 47
Event Description:	ERCW Pump N-B Trips							

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate event 2**		
Indications available: • **Motor Trip out Buzzer and White Light on Pump Handswitch.** • **Low ERCW Header Pressure Alarm**		
	BOP	Respond Backpanel Alarm, Place Failed Pump switch in Pull to Lock, and Perform Annunciator Response Procedure.
	SRO	Enter and Direct performance of AOP-M.01, Section 2.1 *ERCW Pump Failure*.
	BOP	**IDENTIFY** and **LOCK OUT** failed ERCW pump.
	BOP	**START** additional ERCW pumps as required to maintain supply header pressure between 78 psig and 124 psig. ***(Pressure should be in the band (~82 psig) however, Crew may start standby pump to provide additional margin since 4 pumps were initially running)***

Op Test No.: NRC Scenario # 2 Event # 2 Page 4 of 47

Event Description: ERCW Pump N-B Trips

Time	Position	Applicant's Actions or Behavior
	BOP	**CHECK** two Train A ERCW Pumps AVAILABLE. a. Supply header pressures [between 78 psig and 124 psig]: • 1-PI-67-493A • 2-PI-67-493A b. Supply header flows [expected value]: • 1-FI-67-61 ***(~2700 gpm acceptable)*** • 2-FI-67-61 ***(~13,500 gpm acceptable)***
	BOP	**CHECK** 1B and 2B ERCW supply header pressures and flows NORMAL: a. Supply header pressures [between 78 psig and 124 psig]: • 1-PI-67-488A • 2-PI-67-488A b. Supply header flows [expected value]: • 1-FI-67-62 ***(~1500 gpm acceptable)*** • 2-FI-67-62 ***(~11,500 gpm acceptable***
	Crew	**DISPATCH** personnel to INSPECT failed pump(s) and determine cause for failure.

Op Test No.: NRC Scenario # 2 Event # 2 Page 5 of 47

Event Description: ERCW Pump N-B Trips

Time	Position	Applicant's Actions or Behavior
	SRO	**NOTIFY** STA to evaluate Tech Spec LCO 3.7.4, ERCW System. ***(SRO should evaluate Tech Specs - LCO Applies until selector switch is repositioned to operable pump. This may result in LCO entry and exit)***
	RO	**CHECK** ERCW pump loading amps NORMAL.
	RO	**TRANSFER** emergency power selector switch away from failed pump.
	Crew	**EVALUATE** need to close and place clearance on manual discharge valve for failed pump.
	SRO	**GO TO** appropriate plant procedure.

When Technical Specifications have been identified or at discretion of the Lead Examiner, proceed to the next event.

Op Test No.:	NRC	Scenario #	2	Event #	3	Page	6	of 47
Event Description:	Impulse Pressure Transmitter PT-1-73 fails low							

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate event 3**		
Indications available: • **Control Rod insertion** • **1-AR-M5-A, C6, TAVG/TREF DEVIATION** • **1-AR-M5-A, B7, STEAM GEN LVL HIGH-LOW DEVIATION**		
	Crew	Refer to alarm response procedures
	SRO	Direct entry to AOP-I.08, Turbine Impulse Pressure Instrument Malfunction **OR**
	SRO	**MAY** enter to AOP-C.01, Sect 2.1, Continuous rod bank movement: 1. CHECK rod control: a. ENSURE rod control in MAN. (YES) b. CHECK rod motion STOPPED. (YES) 2. CHECK for steam line or feedwater line break: (NO) 3. CHECK for instrumentation malfunction: a. CHECK nuclear instrumentation OPERABLE. (YES) b. CHECK RCS RTDs OPERABLE. (YES) **c. CHECK turbine impulse pressure channels OPERABLE. (NO)** **Transitions to AOP-I.08 from 3.c**

Op Test No.:	NRC	Scenario #	2	Event #	3	Page	7	of 47

Event Description: Impulse Pressure Transmitter PT-1-73 fails low

Time	Position	Applicant's Actions or Behavior
NOTE: Loss of Instrument Power to Steam Generator level setpoint program input will drive the setpoint below 33% Steam Generator level.		
	RO/BOP	CHECK PI-1-73 indicates normal. (RNO Steps) • PLACE rods in MAN. • EVALUATE placing Main Reg Valves in MAN to maintain SG level on program. ***Operators may elect to leave FW Reg valves in auto, S/G will control at a lower level.*** • PLACE Steam Dumps in Steam Pressure Mode USING 0-SO-1-2, Steam Dump System. [1] **PLACE [HS-1-103A]** Steam Dump A FSV and **[HS-1-103B]** Steam Dump B FSV handswitches to **OFF.** [2] **PLACE [HS-1-103D]** Steam Dump Mode selector to **STEAM PRESS**. [3] **VERIFY [XI-1-103A/B]** Steam Dumps Armed white light is **LIT.** [4] **IF [PIC-1-33]** Steam Dump Controller in MANUAL, **THEN ENSURE** demand is Zero on controller. [5] **IF [PIC-1-33]** Steam Dump controller in **AUTO, THEN ADJUST** setpoint to obtain zero output (demand). [6] **PLACE [HS-1-103A]** Steam Dump A FSV and **[HS-1-103B]** Steam Dump B FSV handswitches to **ON.** [7] **ADJUST [PIC-1-33]** Steam Dump controller to maintain desired steam pressure.

Op Test No.: NRC Scenario # 2 Event # 3 Page 8 of 47

Event Description: Impulse Pressure Transmitter PT-1-73 fails low

Time	Position	Applicant's Actions or Behavior
	RO/BOP	• DETERMINE Program T-avg for current reactor power USING TI-28 Figure A.9 or ICS (NSSS / BOP, Program Reactor Average Temperature). • WHEN plant stable, THEN RESTORE T-avg to within 3 degrees of program: • POSITION control rods. OR • ADJUST turbine load. OR • ADJUST RCS boron concentration
	BOP	CHECK PI-1-72 indicates normal.
NOTE: If performing AOP in conjunction with AOP-I.11 for an Eagle LCP failure, then actions to hard trip bistables should be delayed until Eagle system reset is attempted. Actions to hard trip bistables must be completed within 6 hours UNLESS affected loop is restored to operable status by resetting Eagle rack.		
	CREW	IF PI-1-72 or PI-1-73 has failed, THEN NOTIFY IM to remove failed channel from service USING Appendix A, P-1-72 (P-506) OR Appendix B, P-1-73 (P-505)

Op Test No.:	NRC	Scenario #	2	Event #	3	Page	9	of 47
Event Description:	Impulse Pressure Transmitter PT-1-73 fails low							

Time	Position	Applicant's Actions or Behavior
	SRO	EVALUATE the following Tech Specs for applicability: • 3.3.1.1 (3.3.1), Reactor Trip System Instrumentation - ***(ACTION 8.b applies, affected channels are operable)***
When Technical Specifications have been determined, the Lead Examiner may cue the next event		

Op Test No.: NRC Scenario # 2 Event # 4 Page 10 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior
		Console Operator: **When directed, initiate Event 4**
		Indications available: 0-AR-M12-A, C1, CNDS VAC PMP LO RNG AIR EXH MON HIGH RAD 0-AR-M12-A, B5, STM GEN BLDN LIQ SAMP MON HI RAD (~10-12 min delay)
	Crew	Refer to alarm response procedure, Condenser Vacuum Exhaust Hi Rad.
	BOP	**CHECK** 1-RM-90-119 rate meter and 1-RR-90-119 on 0-M-12 for indication of increased radiation.
		NOTE Alarm validity may be determined based on absence of instrument malfunction alarm, indicated response of the rad monitor, and , if possible, other indications such as blowdown monitor (recognizing the difference in response time due to blowdown transport time).
	BOP	**IF** alarm is valid, **THEN NOTIFY** RCL to perform 1-CEM-068-137.5 Primary to Secondary Leakage via Steam Generators.

Op Test No.: NRC Scenario # 2 Event # 4 Page 11 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior
	BOP	**IF** alarm is valid, **THEN GO TO** AOP-R.01, Steam Generator Tube Leak.
	SRO	Direct entry to AOP-R.01, Steam Generator Tube Leak
	SRO	EVALUATE the following Tech Specs for applicability:
Evaluator Note: SRO may refer to Operations Chemistry Information Sheet in turnover package.		
	SRO	• **3.4.6.2, Operational Leakage. Enters action b.** • 3.7.1.2, Auxiliary Feedwater System • 3.7.1.3, Condensate Storage Tank • 3.7.1.4, Secondary Coolant Activity ***(May Address TS Later, as required)*** • 3.2.5, DNB Tech Spec: Pzr heater operation to control/restore to within limits.
	SRO	EVALUATE EPIP-1, Emergency Plan Classification Matrix or notifies the SM. **NOUE: RCS Identified leakage**

Op Test No.: NRC Scenario # 2 Event # 4 Page 12 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior
	SRO	High Secondary Radiation AND Pressurizer level dropping OR Charging flow rising with stable Pressurizer level • Go to section 2.1
NOTE: This section should be used if tube leakage has an observable effect upon charging flow and/or Pressurizer level OR if directed by Section 2.2 due to leak rate exceeding 75 gallons per day (not due to temporary spike).		
	RO	CONTROL charging flow USING FCV-62-89 and FCV-62-93 as necessary to maintain pzr level on program.
	RO	MONITOR Pressurizer level STABLE or RISING.

Op Test No.: NRC Scenario # 2 Event # 4 Page 13 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior

	RO/SRO	(RNO - May be performed later when leak increases)
		
		PERFORM the following:
		
		• START additional CCP as necessary.
		• IF pressurizer level continues to drop, THEN ENSURE letdown isolated:
		  • FCV-62-72 CLOSED
		  • FCV-62-73 CLOSED
		  • FCV-62-74 CLOSED
		
		IF loss of Pressurizer level is imminent,
		THEN PERFORM the following:
		
		• TRIP the reactor.
		• INITIATE Safety Injection.
		• GO TO E-0, Reactor Trip or Safety Injection.

	RO	MAINTAIN VCT level greater than 13% using automatic or manual makeup.
	Crew	INITIATE rapid shutdown by performing the following: • ANNOUNCE S/G tube leak on PA system. • PERFORM rapid shutdown USING AOP-C.03 **WHILE continuing in this section.** • ENSURE power reduced to less than 50% within one hour. • ENSURE unit in Mode 3 within the following 2 hours. ***(SRO May handoff AOP-R.01 top BOP to perform reader Doer while directing rapid shutdown)***

Op Test No.: NRC Scenario # 2 Event # 4 Page 14 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior
Evaluator Note: The following steps from AOP-R.01 should continue in parallel with plant rapid shutdown using AOP-C.03 directed by SRO. Refer to the next event guide for rapid shutdown.		
	BOP	**NOTIFY** RADCON to monitor Turbine Building and site environment: • Steam lines • S/G blowdown
	BOP	**NOTIFY** Chem Lab to perform the following: **a.** **EVALUATE** Primary to Secondary Leakage **USING** 1(2)-SI-CEM-068-137.5: • Method 1, Rapid Identification of Leaking Steam Generators (S/Gs) [Identifies S/G via blowdown sampling • Method 3, Condenser Vacuum Exhaust (CVE) Sampling for Determination of Primary-to-Secondary (P/S) Leakage. [provides leak rate by comparison of RCS activity and CVE. Steady State conditions increase accuracy] b. **DETERMINE** noble gas release rate, and particulate & iodine dose rates for condenser vacuum exhaust **USING** 0-SI-CEM-030-415.0 and 0-SI-CEM-030-407.2. c. **ALIGN** steam generator sample drain lines to FDCT **USING** 0-TI-CEM-000-016.4.
	BOP	**BYPASS** condensate DI.

Op Test No.: NRC Scenario # 2 Event # 4 Page 15 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior
NOTE Closure of FCV-15-44 or FCV-15-43 will isolate blowdown flow to RM-90-120/121. Steam Generator Blowdown must be re-aligned to Con DI using 1(2)-SO-15-1 to re-establish flow to rad monitors.		
	BOP	**TERMINATE** Steam Generator Blowdown to Cooling Tower Blowdown: a. **ENSURE** FCV-15-44 S/G blowdown to Cooling Tower Blowdown CLOSED. b. **ENSURE** S/G blowdown ALIGNED to Con DI **USING** 1(2)-SO-15-1.
NOTE Condenser Vacuum Exhaust and S/G blowdown Radiation Monitors should be monitored at approximately 15 minute intervals for indications of rising leak rate. Appendix A performance is not required.		
	BOP	**MONITOR** indications of leaking steam generator: a. **IDENTIFY** leaking S/G(s) **USING** any of the following: • Unexpected rise in any S/G narrow range level. • S/G sample results. • RADCON survey of main steamlines and S/G blowdown lines. • High radiation on any main steamline radiation monitor. b. **MONITOR** Condenser Vacuum Exhaust and S/G Blowdown Radiation Monitors for rise in leak rate.

Op Test No.: NRC Scenario # 2 Event # 4 Page 16 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior
		CAUTION **Closing TD AFW pump steam supply from S/G #1 will impact AFW operability. Refer to LCO 3.7.1.2.**
	BOP	**WHEN** leaking S/G IDENTIFIED, **THEN PERFORM** the following: a. **ADJUST** leaking S/G atmospheric relief controller to 87% in AUTO. (1040 psig) b. **ENSURE** blowdown valves on leaking S/G CLOSED. c. **CLOSE** TD AFW pump steam supply from leaking S/G • FCV-1-15 (S/G #1) Or • FCV-1-16 (S/G #4). d. **ENSURE** TD AFW pump steam supply from intact S/G OPEN
	BOP	**MINIMIZE** Spread of contamination. a. **PERFORM** EA-0-3, Minimizing Secondary Plant Contamination. b. **EVALUATE** Appendix C, Contingency Plan for Control and Processing of Large Volumes of Contaminated Water

Op Test No.: NRC Scenario # 2 Event # 4 Page 17 of 47

Event Description: S/G #1 Tube Leak

Time	Position	Applicant's Actions or Behavior
NOTE Steps prior to Step 21 may be performed in parallel with ES-0.1.		
		CHECK reactor SHUTDOWN. **DO NOT CONTINUE** this section UNTIL reactor shut down.
Section will be terminated when Reactor Trip and SI have been actuated.		

Op Test No.: NRC Scenario # 2 Event # 5 & 6 Page 18 of 47

Event Description: Rapid Shutdown, Emergency Boration Valve Failure

Time	Position	Applicant's Actions or Behavior
Console Operator: **No action required for event 5 or 6.**		
Indications Available: • **Rapid Shutdown: N/A** • **Emergency Boration Valve continues to indicate closed with 0 flow when taken to the open position.**		
	SRO	Enter and Direct performance of AOP-C.03, Rapid Shutdown or Load Reduction.
	SRO	**ENSURE** crew has been briefed on reactivity management expectations **USING** Appendix E.
	Crew	**NOTIFY** following personnel of rapid shutdown or load reduction: • Load Coordinator • Chemistry • RADCON • Plant Management
	BOP/RO	**MONITOR** reactor/turbine trip NOT required **USING** Appendix A, Reactor and Turbine Trip Criteria.

Op Test No.: NRC Scenario # 2 Event # 5 & 6 Page 19 of 47

Event Description: Rapid Shutdown, Emergency Boration Valve Failure

Time	Position	Applicant's Actions or Behavior
	BOP/RO	**CHECK** VALVE POSITION LIMIT light DARK on EHC panel. [M-2]
NOTE: BAT is preferred boration source. Boration volume and flowrates in the following step are recommendations and may be adjusted as necessary.		
	RO/SRO	**IF** borating from BAT, **THEN PERFORM** the following: a. **DETERMINE** recommended boration volume: • ~800 gal to reduce power from 100% to 20% **OR** • 10 gal for each 1% power reduction

Op Test No.: NRC Scenario # 2 Event # 5 & 6 Page 20 of 47

Event Description: Rapid Shutdown, Emergency Boration Valve Failure

Time	Position	Applicant's Actions or Behavior
	SRO	b. **DETERMINE** recommended boration flowrate and volume from table below: TURBINE LOAD REDUCTION RATE (%/min) / BORATION FLOWRATE 1% / ~15 gpm 2% / ~30 gpm 3% / ~45 gpm 4% / ~70 gpm ***(SRO discretion may be used to determine reduction rate)***
	RO	c. **PLACE** boric acid transfer pump aligned to blender in FAST speed.
	RO	**ADJUST** FCV-62-138 to establish desired flow rate. (Valve will not open, RNO required –Appendix D next page) **INITIATE** normal boration **USING** Appendix D.

Op Test No.: NRC Scenario # 2 Event # 5 & 6 Page 21 of 47

Event Description: Rapid Shutdown, Emergency Boration Valve Failure

Time	Position	Applicant's Actions or Behavior
	RO	**APPENDIX D – NORMAL BORATION** **PLACE [HS-62-140A]** Makeup Control to STOP position. **PLACE [HS-62-140B]** Makeup mode selector switch in BORATE position. **NOTE** Boric Acid controller setting is twice the desired flow rate. Maximum Boric Acid flow is ~45 gpm. **ADJUST [FC-62-139]** BA flow controller setpoint for desired flow rate. **ADJUST [FQ-62-139]** BA integrator (batch counter) to desired boric acid volume. **PLACE [HS-62-140A]** Makeup Control Switch mode selector switch to START. **IF** desired boric acid flow rate NOT obtained, **THEN ADJUST** one or both of the following as necessary: • **[FC-62-139]** BA flow controller • recirculation valve for BAT aligned to blender. **ENSURE** desired boric acid flow indicated on FI-62-139. **WHEN** required boric acid volume has been added, **THEN PERFORM** the following: a. **PLACE [HS-62-140A]**, Makeup Control to STOP position b. **ENSURE [FC-62-142]**, Primary Water to Blender Flow Controller in AUTO with dial indicator set at 35%. c. **ADJUST [FC-62-139]**, Boric Acid Flow Controller to desired blend solution **USING** TI-44 Boron Tables. d. **PLACE [HS-62-140B]**, Makeup Mode Selector e. Switch in AUTO position. f. **PLACE [HS-62-140A]**, Makeup Control to START.

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Event Description: Rapid Shutdown, Emergency Boration Valve Failure

Time	Position	Applicant's Actions or Behavior
	RO	**CONTROL** boration flow as required to inject desired boric acid volume.
	SRO/RO	**INITIATE** load reduction as follows: a. **ADJUST** load rate to desired value: • between 1% and 4% per minute if borating via FCV-62-138 **OR** • ***between 1% and 3% per minute if borating via normal boration (App. D)*** b. **ADJUST** setter for desired power level:

DESIRED RX POWER LEVEL	RECOMMENDED SETTER VALUE
90%	70
80%	60
70%	50
60%	40
50%	35
40%	30
30%	25
20% or less	15

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Event Description: Rapid Shutdown, Emergency Boration Valve Failure

Time	Position	Applicant's Actions or Behavior
	BOP	**INITIATE** turbine load reduction by depressing GO pushbutton.
	BOP	**CONTROL** turbine load reduction as necessary to reduce power to desired level.
	RO/BOP	**MONITOR** T-avg/T-ref mismatch: a. **CHECK** T-ref indication AVAILABLE. (Tref Indication is not available due to PT-1-73 failure) – RNO Required – Next Step)
	RO/BOP	**PERFORM** the following: 1) **MONITOR** Program T-avg for current reactor power **USING** TI-28 Figure A.9 or ICS (NSSS / BOP, Program Reactor Average Temperature). 2) **USE** program T-avg in place of T-ref. 3) **MAINTAIN** T-avg within 3°F of program T-avg **USING** manual rod control. 4) **ADJUST** turbine load rate as necessary. 5) **IF** mismatch between T-avg and program value CANNOT be maintained less than 5°F, **THEN** **TRIP** the reactor and **GO TO** E-0, Reactor Trip or Safety Injection.

Op Test No.: NRC Scenario # 2 Event # 5 & 6 Page 24 of 47

Event Description: Rapid Shutdown, Emergency Boration Valve Failure

Time	Position	Applicant's Actions or Behavior
	BOP	**STOP** secondary plant equipment **USING** Appendix B, Secondary Plant Equipment.
	RO	**MONITOR** control rods above low-low insertion limit **USING** ICS or COLR.

Evaluator Note: Additional AOP-C.03 Steps not included as required power change should be complete at or around this step.

When desired, the Lead Examiner may cue the next event.

Op Test No.: NRC Scenario # 2 Event # 7, 8, & 9 Page 25 of 47

Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
		Console Operator: **Increase SGTR to 8.6 severity (400 gpm) with 300 second ramp.** **Fail Pressurizer loop 2 spray valve full open after it has been fully opened for RCS depressurization in E-3.**
		Indications Available: **Steam Generator tube Rupture:** • **Pressurizer pressure decreasing** • **Pressurizer level decreasing and charging flow increasing** • **Loop 1 Main Steam Line Rad Monitor Increasing** **AFW Pump 1A auto Start Failure:** • **Pump Not running with SI Signal present** **Pressurizer Spray valve failed open:** • **Red Control panel light lit with 0 controller demand** • **Pressurizer Pressure Stable or slightly decreasing**
	SRO	Direct Manual Reactor trip and Safety Injection based on loss of pressurizer level imminent from AOP-R.01 Step 1 RNO. As time allows, may also perform the following as directed by same RNO: • start additionsl CCP • isolate letdown
	RO	Manually Trip Reactor and initiate SI.

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	SRO	Enter and Direct performance of E-0, Reactor Trip Or Safety Injection.
NOTE 1: Steps 1 through 4 are immediate action steps. **NOTE 2:** This procedure has a foldout page.		
Evaluator Note: AFW Pump 1A auto start failure should be identified and pump started during performance of prudent operator actions immediately following performance of Immediate Operator Actions.		
	RO	**VERIFY** reactor TRIPPED: • Reactor trip breakers OPEN • Reactor trip bypass breakers DISCONNECTED or OPEN • Rod bottom lights LIT • Rod position indicators less than or equal to 12 steps. • Neutron flux DROPPING
	BOP	**VERIFY** turbine TRIPPED: • Turbine stop valves CLOSED.

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** at least one train of shutdown boards ENERGIZED.
	RO	**DETERMINE** if SI actuated: • ECCS pumps RUNNING. • Any SI alarm LIT [M-4D].
Evaluator Note:		If not previously Identified, AFW Pump 1A auto start failure should be identified during performance ES-0.5. When Identified, the pump should be immediately started.
	BOP	**PERFORM** ES-0.5, Equipment Verifications WHILE continuing in this procedure. (ES-0.5 At end of Scenario)
	BOP	**DETERMINE** if secondary heat sink available: a. **CHECK** total AFW flow greater than 440 gpm. b. **CHECK** narrow range level greater than 10% [25% ADV] in at least one S/G. c. **CONTROL** feed flow to maintain narrow range level between 10% [25% ADV] and 50% in intact or ruptured S/Gs.

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP/RO	**CHECK** if main steam lines should be isolated: a. **CHECK** if any of the following conditions have occurred: • Any S/G pressure less than 600 psig. **OR** • Any S/G pressure dropping UNCONTROLLED. **OR** • Phase B actuation.
	RO	**CHECK** RCP trip criteria: a. **CHECK** the following: • RCS pressure less than 1250 psig **AND** • At least one CCP **OR** SI pump RUNNING.
	RO	**MONITOR** RCS temperatures: • **IF** any RCP running, **THEN** **CHECK** T-avg stable at or trending to between 547°F and 552°F. (If No Perform RNO)

Op Test No.: NRC Scenario # 2 Event # 7, 8, & 9 Page 29 of 47

Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	RO/BOP	(RNO) **IF** temperature less than 547°F and dropping, **THEN** **PERFORM** the following: a. **ENSURE** steam dumps and atmospheric reliefs CLOSED. b. **IF** cooldown continues, **THEN** **CONTROL** total feed flow **USING** EA-3-8, Manual Control of AFW Flow. ***(AFW Flow to Ruptured S/G #1 may be isolated during performance of EA-3-8. Level should be >10%)***
	RO	**CHECK** pressurizer PORVs, safeties, and spray valves: a. Pressurizer PORVs CLOSED. b. Pressurizer safety valves CLOSED. c. Normal spray valves CLOSED. d. Power to at least one block valve AVAILABLE. e. At least one block valve OPEN.

Op Test No.: NRC Scenario # 2 Event # 7, 8, & 9 Page 30 of 47

Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	**DETERMINE** if S/G secondary pressure boundaries are INTACT: • **CHECK** all S/G pressures CONTROLLED or RISING. • **CHECK** all S/G pressures greater than 140 psig.
	BOP	**DETERMINE** if S/G tubes are INTACT: a. **CHECK** the following: • all S/G narrow range levels CONTROLLED or DROPPING • secondary radiation NORMAL **USING** Appendix A, Secondary Rad Monitors. (App. A is also contained in ES-0.5). ***(Crew will Transition to E-3 at this Step)***
	SRO	Enter and direct performance of E-3 Steam Generator Tube rupture.
	RO	**MONITOR** at least one RCP RUNNING.

Op Test No.: NRC Scenario # 2 Event # 7, 8, & 9 Page 31 of 47

Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** RCP trip criteria: a. **CHECK** the following: • RCS pressure less than 1250 psig **AND** • At least one CCP **OR** SI pump RUNNING.
	BOP	**MONITOR** indications of Ruptured S/G(s): a. **IDENTIFY** Ruptured S/G(s) as indicated by any of the following: • Unexpected rise in any S/G narrow range level. **OR** • High radiation from any S/G sample. **OR** • RADCON survey of main steam lines and S/G blowdown lines. **OR** • High radiation on any main steamline radiation monitor.

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
CAUTION	**Isolating both steam supplies to the TD AFW pump when it is the only source of feed flow will result in loss of secondary heat sink.**	
Critical Task 1 – Part 1	BOP	**ISOLATE** flow from Ruptured S/G(s): a. **ADJUST** Ruptured S/G(s) atmospheric relief controller setpoint to 87% in AUTO. (1040 psig) b. **CHECK** Ruptured S/G(s) atmospheric relief hand switch in P-AUTO and valve(s) CLOSED. c. **CLOSE** TD AFW pump steam supply from Ruptured S/G FCV-1-15 (S/G #1) or FCV-1-16 (S/G #4). ***(If not previously performed, TD AFW steam supply should be realigned to S/G #4 at this point)*** d. **VERIFY** Ruptured S/G(s) blowdown isolation valves CLOSED. e. **CLOSE** Ruptured S/G(s) MSIV and MSIV bypass valve. ***(Crew will close Loop #1 MSIV)***
CAUTION	**Feeding a S/G that is Faulted and Ruptured increases the potential for an uncontrolled RCS cooldown and S/G overfill. This option should NOT be considered UNLESS needed for RCS cooldown.**	

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
Critical Task 1 – Part 2	BOP	**MONITOR** Ruptured S/G(s) level: a. **CHECK** narrow range level greater than 10% [25% ADV]. b. **WHEN** ruptured S/G level is greater than 10% [25% ADV], **THEN** **PERFORM** the following: 1) **STOP** feed flow to ruptured S/G. 2) **ENSURE** Turbine Driven AFW LCV for ruptured S/G in CLOSE PULL TO LOCK. ***(Crew will isolate or verify isolated AFW to Loop 1 S/G)***
	BOP	**VERIFY** Ruptured S/G ISOLATED from Intact S/G(s): a. **CHECK** either of the following conditions SATISFIED: • Ruptured S/G MSIVs and MSIV bypass valves CLOSED **OR** • MSIV(s) and MSIV bypass valve(s) CLOSED on Intact S/G(s) to be used for RCS cooldown. b. **CHECK** S/G #1 or S/G #4 ruptured. c. **CHECK** TDAFW pump steam supply from ruptured S/G ISOLATED: • FCV-1-15 (S/G #1) or FCV-1-16 (S/G #4) CLOSED

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	**CHECK** Ruptured S/G pressure greater than 550 psig (Unit 1) or 425 psig (Unit 2).
	SRO	Determine Target Temperature using table on next page.

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior

NOTE

- Blocking low steamline pressure SI as soon as pressurizer pressure is less than 1960 psig will prevent an inadvertent MSIV closure and keep the condenser available for steam dump.
- After the low steamline pressure SI signal is blocked, main steamline isolation will occur if the high steam pressure rate setpoint is exceeded.
- The 1250 psig RCP trip criterion is NOT applicable after RCS cooldown is initiated in the following step.

INITIATE RCS cooldown:

a. **DETERMINE** target core exit T/C temperature based on Ruptured S/G pressure:

Lowest Ruptured S/G pressure (psig)	Target Core Exit T/C Temp (°F)
1100 or greater	497
1050 - 1099	492
1000 - 1049	486
950 - 999	480
900 - 949	473
850 - 899	467
800 - 849	460
750 - 799	453
700 - 749	445
650 - 699	437
600 - 649	428
550 - 599	419
500 - 549	410
450 - 499	399
425 - 449	393

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	b. **WHEN** RCS pressure less than 1960 psig, **THEN** **PERFORM** the following: 1) **BLOCK** low steamline pressure SI. 2) **CHECK** STEAMLINE PRESS ISOL/SI BLOCK RATE ISOL ENABLE permissive LIT. [M-4A, A4]

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	c. **DUMP** steam to condenser from intact S/G(s) at maximum achievable rate: 1) **CHECK** condenser available: • C-9 condenser interlock permissive LIT. [M-4A, E6] • Intact S/G MSIVs OPEN. 2) **PLACE** steam dumps in OFF. 3) **ENSURE** steam dumps in steam pressure mode with demand less than 25%. 4) **PLACE** steam dumps in ON. 5) **ADJUST** steam dump demand to FULLY OPEN three cooldown valves. 6) **WHEN** T-avg is less than 540°F, **THEN** **BYPASS** steam dump interlock. 7) **RAISE** AFW flow to intact S/Gs as necessary to support cooldown.

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	d. **WHEN** core exit T/Cs less than target temperature determined in Substep 8.a, **THEN** **PERFORM** the following: 1) **CLOSE** steam dumps or S/G atmospheric reliefs to stop cooldown. 2) **REDUCE** AFW flow as necessary to stop cooldown. **MAINTAIN** total feed flow greater than 440 gpm UNTIL level greater than 10% [25% ADV] in at least one intact S/G. 3) **MAINTAIN** core exit T/Cs less than target temperature **USING** steam dumps or atmospheric reliefs.
	BOP	**MAINTAIN** intact S/G narrow range levels: a. Greater than 10% [25% ADV] b. Between 20% [25% ADV] and 50%.
CAUTION	**Any time a pressurizer PORV opens, there is a possibility that it may stick open.**	

Op Test No.: NRC Scenario # 2 Event # 7, 8, & 9 Page 39 of 47

Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** pressurizer PORVs and block valves: a. Power to block valves AVAILABLE b. Pressurizer PORVs CLOSED c. At least one block valve OPEN.
	RO	**RESET** SI signal.
	BOP	**MONITOR** AC busses energized from start busses.
	RO	**ENSURE** Phase A and Phase B RESET.
	RO	**CHECK** control air established to containment: [Panel 6K and 6L] • 1-FCV-32-80 (2-FCV-32-81) Train A essential air OPEN • 1-FCV-32-102 (2-FCV-32-103) Train B essential air OPEN • 1-FCV-32-110 (2-FCV-32-111) non-essential air OPEN.

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	RO	**DETERMINE** if RHR pumps should be stopped: a. **CHECK** RHR pump suction aligned from RWST. b. **CHECK** RCS pressure greater than 300 psig. c. **STOP** RHR pumps and **PLACE** in A-AUTO. d. **MONITOR** RCS pressure greater than 300 psig.
Critical Task 2	BOP	**CHECK** if RCS cooldown should be stopped: a. **CHECK** core exit T/Cs less than target temperature determined in Substep 8.a. **DO NOT CONTINUE** this procedure UNTIL core exit T/Cs less than target temperature. b. **CLOSE** steam dumps or atmospheric reliefs to stop cooldown. c. **REDUCE** AFW flow as necessary to stop cooldown. **MAINTAIN** total feed flow greater than 440 gpm UNTIL level greater than 10% [25% ADV] in at least one intact S/G. (Step Continued Next Page)

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	d. **MAINTAIN** core exit T/Cs less than target temperature **USING** steam dumps or atmospheric reliefs.
	BOP	**CHECK** Ruptured S/G(s) pressure STABLE or RISING.
	RO	**CHECK** RCS subcooling based on core exit T/Cs greater than 60°F.
Console Operator Note: When loop 2 spray valve is completely open in next step, insert malfunction to fail Loop 2 spray valve full open **(Key 6)**.		
	RO	**DEPRESSURIZE** RCS to minimize break flow and to refill pressurizer: a. **CHECK** normal pressurizer spray AVAILABLE. b. **INITIATE** maximum available pressurizer spray. c. **CHECK** depressurization rate ADEQUATE. (Step Continued Next Page)

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
Critical Task 3	RO	d. **CONTINUE** depressurization UNTIL any of the following conditions SATISFIED: • Both of the following: 1) RCS pressure less than Ruptured S/G(s) pressure **AND** 2) Pressurizer level greater than 10% [20% ADV]. **OR** • Pressurizer level greater than 65%. **OR** • RCS subcooling based on core exit T/Cs less than 40°F. e. **CLOSE** spray valve(s): 1) Normal spray valves. (RNO since spray valve will not close - Next Page)

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Event Description: #1 S/G Tube Rupture, AFW Pump 1A Auto start fail, Przr spray Valve fails open.

Time	Position	Applicant's Actions or Behavior
	RO	(RNO) 1) **STOP RCPs #1 and 2.** **IF RCS pressure continues to drop,** **THEN** **STOP additional RCP as necessary.**

Scenario may be terminated when crew has completed RCS cooldown and depressurization at lead examiner discretion.

Op Test No.: NRC Scenario # 2 Event # ES-0.5 Page 44 of 47

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		ES-0.5 Actions
	BOP	**CHECK** ERCW system operation: • **VERIFY** at least four ERCW pumps RUNNING. • **VERIFY** D/G ERCW supply valves OPEN.
	BOP	**VERIFY** CCS pumps RUNNING: • Pump 1A-A (2A-A) • Pump 1B-B (2B-B) • Pump C-S.
	BOP	**VERIFY** EGTS fans RUNNING.
	BOP	**VERIFY** generator breakers OPEN.
	BOP	**VERIFY** AFW pumps RUNNING: • MD AFW pumps • TD AFW pump. ***(If Not previously identified and started, 1A-A MDAFW pump start failure should be identified during performance of this step and pump immediately started)***

Op Test No.: NRC Scenario # 2 Event # ES-0.5 Page 45 of 47

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		NOTE AFW level control valves should NOT be repositioned if manual action has been taken to control S/G levels, to establish flow due to failure, or to isolate a faulted S/G.
	BOP	**CHECK** AFW valve alignment: a. **VERIFY** MD AFW LCVs in AUTO. b. **VERIFY** TD AFW LCVs OPEN. c. **VERIFY** MD AFW pump recirculation valves FCV-3-400 and FCV-3-401 CLOSED.
	BOP	**VERIFY** MFW Isolation: • MFW pumps TRIPPED • MFW regulating valves CLOSED • MFW regulating bypass valve controller outputs ZERO • MFW isolation valves CLOSED • MFW flow ZERO.
	BOP	**MONITOR** ECCS operation: **VERIFY** ECCS pumps RUNNING: • CCPs • RHR pumps • SI pumps

Op Test No.: NRC Scenario # 2 Event # ES-0.5 Page 46 of 47

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** CCP flow through CCPIT. • **CHECK** RCS pressure less than 1500 psig. • **VERIFY** SI pump flow. • **CHECK** RCS pressure less than 300 psig. • **VERIFY** RHR pump flow.

	BOP	**VERIFY** ESF systems ALIGNED:
		
		• Phase A ACTUATED:
		  o CONTAINMENT ISOLATION PHASE A TRAIN A alarm LIT [M-6C, B5].
		  o CONTAINMENT ISOLATION PHASE A TRAIN B alarm LIT [M-6C, B6].
		
		• Containment Ventilation Isolation ACTUATED:
		  o CONTAINMENT VENTILATION ISOLATION TRAIN A alarm LIT [M-6C, C5].
		  o CONTAINMENT VENTILATION ISOLATION TRAIN B alarm LIT [M-6C, C6].
		
		• Status monitor panels:
		  o 6C DARK
		  o 6D DARK
		  o 6E LIT OUTSIDE outlined area
		  o 6H DARK
		  o 6J LIT.
		
		• Train A status panel 6K:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN
		
		• Train B status panel 6L:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN

Op Test No.: NRC Scenario # 2 Event # ES-0.5 Page 47 of 47

Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** containment spray NOT required: • Phase B NOT ACTUATED **AND** • Containment pressure less than 2.81 psig • Ensure Containment Spray is actuated
	BOP	**VERIFY** pocket sump pumps STOPPED: [M-15, upper left corner] • HS-77-410, Rx Bldg Aux Floor and Equipment Drain Sump pump A • HS-77-411, Rx Bldg Aux Floor and Equipment Drain Sump pump B.
	BOP	**DISPATCH** personnel to perform EA-0-1, Equipment Checks Following ESF Actuation.

Facility: Sequoyah Scenario No.: 3 Op Test No.: NRC

Examiners: _____ Operators: _____

_____ _____

_____ _____

Initial Conditions: ~2% Reactor Power, A Main Feedwater Pump I/S

Turnover: Continue Plant Startup. Currently at 0-GO-4 Section 5.2 Step 3.

Target CTs: Establish at least one train of containment spray prior to completing FR-Z.1

Manually align one train of RHR for Containment Sump Recirculation and Establish ECCS flow.

Event No.	Malf. No.	Event Type*	Event Description
1	N/A	R-ATC N-SRO/BOP	Continue Power Increase from ~2%.
2	CN01B	C-SRO/BOP	Trip one of two running hotwell pumps. Standby pump should be started.
3	RX07A	TS-SRO I-SRO/ATC	Controlling Pressurizer Pressure Channel Fails High. Przr spray valves Open and require manual action to close. Tech spec Evaluation.
4	RX02A2	TS-SRO I-SRO/ATC	RTD COLD LEG 1 SENSOR 2 fails high. Requires manual action to defeat the channel. Tech Spec evaluation.
5	TH01B	C-All	Small RCS Leak ~21 gpm in Loop 2 Hot leg.
6	TH01B	M-All	RCS Leak increase to Break requires Rx trip and Safety Injection.
N/A	TH01B	N/A	Following Transition to E-1 RCS Break Increases to large break LOCA to expedite Containment Sump Swapover.
7	RP13C	C-SRO/BOP	Automatic Feedwater Isolation fails on both trains requiring manual isolation.
8	RP16K644A RP16K644B ZDIHS722A CH08B	C-SRO/ATC	Both containment spray discharge valves fail to Auto open on Hi-Hi Containment pressure signal requiring manual action to open. Train B Spray valve will not manually open 1B Containment Air Return fan Overcurrent trip on Start.
9	ZDIHS6372 A	C-SRO/ATC	RHR suction valve FCV-63-72 from containment Sump will not open. This requires stopping the RHR Pump on the affected train and aligning sump recirculation and ECCS injection on one train of RHR.

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

Scenario 3 Summary

The crew will assume shift at approximately 2% reactor power with first Main feedwater pump in service and continue a power increase. During the power increase one of the two running hotwell pumps will trip requiring the crew to perform the associated AOP and place the third non-operating hotwell pump in service. The power increase should continue.

Following an adequate power increase to demonstrate proficiency, the controlling pressurizer pressure channel will fail high resulting in pressurizer spray valves fully opening and requiring manual action to close them and stop the RCS depressurization. The SRO will direct performance of AOP to select another controlling channel and return spray control to automatic. SRO will evaluate and enter applicable Reactor Protection and ESFAS instrumentation Technical specifications.

When pressurizer pressure instrument actions are complete, a cold leg RTD on loop 1 will fail high, this will cause the Tavg channel for loop 1 to be high and Delta T channel to be low. Tavg and Delta control inputs will be defeated by AOP performance and protection channel inputs will require Technical Specification entries. SRO will evaluate and enter applicable Technical specifications.

A small unisolable RCS leak will occur of approximately 21gpm. Crew will attempt actions to isolate leak using AOP. Following determination that the leak is not isolated the Leak will be increased to a Large Break requiring Reactor Trip and Safety Injection. Following Transition to E-1, RCS break will be further increased to a large Break LOCA to expedite reaching RHR containment sump swapover.

Following the Rx Trip and Safety Injection, Automatic Feedwater Isolation will fail requiring manual isolation. Upon reaching the Hi Hi containment pressure setpoint, containment spray pumps will start but their discharge valves will not open requiring manual action to initiate containment spray. Train A spray valve will open manually but B Train will not. 1B containment Air return fan will trip on Overcurrent when starting 10 minutes after Phase B. B train spray valve and 1B Air return fan failure ensure containment pressure remains high enough to require crew to perform FR-Z.1.

The Crew will continue through the E procedures including FR-Z.1 contingency procedure for Hi containment pressure and eventually reach the setpoints for RHR suction to containments sump realignment. One of the containment sump supply valves fail open automatically or manually and require the crew to stop the affected RHR pump and realign only one train of RHR suction to containment sump. If a setpoint for containment spray realignment to containment sump is reached, only one train of containment spray can be aligned to the containment sump.

The scenario may be terminated after ECCS is aligned for RHR sump recirculation using one train of RHR

Op Test No.:	NRC	Scenario #	3	Event #	1	Page	1	of 55
Event Description:	Power increase and 2nd MFPT Roll							

Time	Position	Applicant's Actions or Behavior
Console Operator: **No action required for event 1**		
Indications Available: **None Applicable**		
	SRO	Direct load increase in accordance with 0-GO-4 Section 5.2, Step 3. *Reactor Power Ascension To Between 13% And 15% RTP.*
NOTES 1. Actions effecting reactivity are directed in the following step. 0-SO-62-7 requirements shall be adhered to for reactivity changes (i.e. reactivity balance, amounts of boric acid or water). All appropriate verifications and peer checks shall be utilized during performance. 2. Recommended dilution rate is 50 to 75 gallon batches every 12 to 15 minutes for a steady power increase. Rod movement should be limited to 1/2 step increments approximately every 1 1/2 minutes. Dilution and rod movement rates may be adjusted depending on SG level control stability. 3. Control Rod withdrawal and / or dilution requirements may be significantly impacted by the change in core reactivity due to changing Xenon concentration.		
	CREW	**INITIATE** a methodical and deliberate reactor power increase by manual adjustment of the control banks or by diluting the RCS.
	CREW	**WHEN** reactor power is above 5%, **THEN LOG** Mode 1 entry in the Unit Narrative Log.

Op Test No.: NRC Scenario # 3 Event # 1 Page 2 of 55

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	CRO	**MAINTAIN** the SG levels on program by periodically adjusting the feedwater bypass reg controller level setpoints using Appendix B and C.
Evaluator Note: The following Steps are from 0-SO-62-7 *Boron Concentration Control*, Section 6.2, *Dilute*		
CAUTION 1: When making an RCS dilution of ≥3000 gallons, it should be done in batches with an RCS boron concentration verification at the halfway point (e.g., 1500 gallons). Allow at least 15 minutes between batches. **CAUTION 2**; Returning the Boric Acid Blender to service after unplugging, cleaning, or maintenance on the Boric Acid System could introduce debris, sludge, air or chunks of solidified boron into the CCP suction resulting in pump damage. Extreme care must be exercised to properly flush the Boric Acid Blender system following an outage.		
NOTE 1: If an excessive amount of dilution is required (plant startup), the pressurizer heaters should be energized to cause pressurizer spray operation for equalizing boron concentration in RCS and pressurizer. **NOTE 2:** Dilute mode will be used anytime a long-term positive reactivity addition is desired. The operator should use the normal dilute mode whenever conditions permit.		
	RO	**ENSURE** unit is NOT in a Tech Spec or TRM action that prohibits positive reactivity additions.

Op Test No.: NRC Scenario # 3 Event # 1 Page 3 of 55

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
NOTE: HUT level increase of 1% is equal to 1380 gallons (TI-28 fig. C.21)		
	RO	**ENSURE** sufficient capacity available in the HUT selected to receive expected amounts of CVCS letdown: (**N/A** if not used) HUT: A, B LEVEL: _____ % INITIALS: _____
	RO	**ENSURE** makeup system is aligned for **AUTO** operation in accordance with Section 5.1.
	RO	**RECORD** the quantity of dilution water required to achieve desired boron concentration using Appendix D. (**N/A** for minor power changes)
NOTE Due to eyeball interpolation the verified calculation may slightly differ from the initial calculation. The following signoff indicates that any differences in the two results have been discussed and are close enough to be considered validated.		
	SRO	**PERFORM** Appendix I Independent Verification of Calculation for Amount of Boric Acid or Primary Water. (N/A if App. D was performed by SRO to verify data from Rx Engineering) ***(Step not required provided in shift turnover package)***
	RO	**PLACE [HS-62-140A]**, Boric Acid Supply to Blender Flow Control Switch to the **STOP** position.

Op Test No.: NRC Scenario # 3 Event # 1 Page 4 of 55

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	RO	**PLACE [HS-62-140B]**, CVCS Makeup Selector Switch to the **DILUTE** position.
	RO	**ENSURE [HS-62-140D]**, Boric Acid Valve to the Blender is **CLOSED** (Green light is **LIT**).
	RO	**SET [FQ-62-142]**, Batch Integrator for the desired quantity.
NOTE: Primary Water Flow Controller **[FC-62-142]** receives its reference signal (70 gpm) from setpoint potentiometer (dial indicator) located on panel M-6. A setpoint of 35% corresponds to a 70 gpm primary water flow rate.		
	RO	**ADJUST [FC-62-142]**, Primary Makeup Water Flow Controller for the desired flow rate.
	RO	**PLACE [HS-62-140A]**, Boric Acid Supply to Blender Flow Control Switch to the **START** position.
NOTE: Flow oscillations and/or erratic controller response may require manual operation of Primary Water Flow Controller **[FC-62-142]** until stable conditions exist.		

Op Test No.:	NRC	Scenario #	3	Event #	1	Page	5	of 55
Event Description:	Power increase and 2nd MFPT Roll							

Time	Position	Applicant's Actions or Behavior
	RO	**VERIFY** the following; **[a]** Inlet to top of VCT [FCV-62-128] is **OPEN**. **[b]** Primary Water flow by [FI-62-142A] **OR** [FQ-62-142].
NOTE: Alternate dilution in small amounts is acceptable on a regular basis, provided no significant changes in seal water temperature or seal leakoff are indicated. Batches of 5 to 10 gallons may be added through FCV-62-144 on a frequency not to exceed once per 30 minutes. ICS points for No. 1 seal leakoffs and seal water temperatures on the RCPs should be monitored during and after dilution.		
	RO	**IF** primary water addition to the bottom of the VCT [FCV-62-144] is desired, **THEN** **[a]** **CLOSE** [FCV-62-128] with [HS-62-128]. **[b]** **OPEN** [FCV-62-144] with [HS-62-144]. **[c]** **VERIFY** Primary Water flow by [FI-62-142A] **OR** [FQ-62-142].
NOTE: It may take approximately 15 minutes before any changes to reactivity are indicated on nuclear instrumentation or RCS temperature indication.		
	RO	**MONITOR** nuclear instrumentation and reactor coolant temperature to ensure the proper response from dilution.

Op Test No.:	NRC	Scenario #	3	Event #	1	Page	6	of 55
Event Description:	Power increase and 2nd MFPT Roll							

Time	Position	Applicant's Actions or Behavior
	RO	**IF [LI-62-129]**, Volume Control Tank Level, increases to 63 percent, **THEN ENSURE [LCV-62-118]**, Volume Control Tank Divert Valve **OPENS** to divert excess water to the Holdup Tanks.
	RO	**WHEN** dilution is complete, **THEN** **[a] PLACE** [HS-62-140A], Boric Acid to Blender Flow Control Switch to the **STOP** position. **[b] IF** [FCV-62-144] was previously **OPENED**, **THEN** **CLOSE** [FCV-62-144] with [HS-62-144]. **[c] VERIFY** no primary water flow on either [FI-62-142A] **OR** [FQ-62-142]. **[d] ENSURE** [FCV-62-128] is **CLOSED**.

Lead Examiner may direct initiation of the next event at his discretion. Steps on the next two pages are associated with performance of repetitive dilutions or may not be performed until all dilutions are complete.

Op Test No.: NRC Scenario # 3 Event # 1 Page 7 of 55

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	RO	**[17] IF** power increase in progress and additional dilutions will be required, **THEN** use this table to re-perform steps **[4]** through **[18]**.

STEP	1st	2nd	3rd
[4] RECORD the quantity of dilution water required to achieve desired boron concentration using Appendix D.	Quantity	Quantity	Quantity
[5] PERFORM Appendix I, IV of Calculation for amount of BA or PW.	SRO	SRO	SRO
[6] PLACE [HS-62-140A], Boric Acid Supply to Blender Flow Control Switch to the **STOP** position.	1st / CV	1st / CV	1st / CV
[7] PLACE [HS-62-140B], CVCS Makeup Selector Switch to the **DILUTE** position.	☐	☐	☐
[8] ENSURE [HS-62-140D] Boric Acid Valve to Blender is **CLOSED** (Green light LIT).	☐	☐	☐
[9] SET [FQ-62-142], Batch Integrator for the desired quantity.	1st / CV	1st / CV	1st / CV
[10] ADJUST [FC-62-142], Primary Makeup Water Flow Controller for the desired flow rate.	1st / CV	1st / CV	1st / CV
[11] PLACE [HS-62-140A], BA Supply to Blender Flow Control Switch to **START**.	1st / CV	1st / CV	1st / CV
[12] VERIFY the following:			
[a] Inlet to top of VCT [FCV-62-128] is OPEN.	☐	☐	☐
[b] Primary Water flow by [FI-62-142A] or [FQ-62-142].	☐	☐	☐
[13] IF PW addition to top of VCT [FCV-62-128] is not warranted, but PW addition to the bottom of the VCT [FCV-62-144] is desired, THEN			
[a] CLOSE [FCV-62-128]with [HS-62-128]	☐	☐	☐
[b] OPEN [FCV-62-144] with [HS-62-144].	☐	☐	☐
[c] VERIFY Primary Water flow by [FI-62-142A] or [FQ-62-142].	☐	☐	☐
[14] MONITOR nuclear instrumentation and reactor coolant temperature to ensure the proper response from dilution.	☐	☐	☐
[15] IF [LI-62-129], VCT level, increases to 63 percent, THEN ENSURE [LCV-62-118], VCT Divert Valve, **OPENS** to divert excess water to the HUTs.	☐	☐	☐
[16] WHEN dilution is complete, THEN			
[a] PLACE [HS-62-140A], Boric Acid to Blender Flow Control Switch to **STOP**	1st / CV	1st / CV	1st / CV
[b] IF [FCV-62-144] was previously **OPENED**, THEN CLOSE [FCV-62-144] with [HS-62-144].	☐	☐	☐
[c] VERIFY no primary water flow on either [FI-62-142A] or [FQ-62-142].	☐	☐	☐
[d] ENSURE [FCV-62-128] is CLOSED.	☐	☐	☐

[18] IF Step **[17]** will be repeated, **THEN**
PERFORM the following:
[a] PLACE [HS-62-140B], CVCS Makeup Selector Switch to the **AUTO** position.

[b] PLACE [HS-62-140A], BA to Blender Flow Control Switch to **START** position.
[c] ENSURE dilution is logged in Unit Narrative Log.

Op Test No.: NRC Scenario # 3 Event # 1 Page 8 of 55

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	RO	**REALIGN** the blender controls for **AUTO** makeup to the CVCS in accordance with Section 5.1.
	RO	**ENSURE** dilution(s) is logged in Unit Narrative Log.
NOTE Sample may be obtained at normal RCS sample intervals provided the unit is at power and the unit response following the dilution is as expected.		
		IF RCS boron sample is required, **THEN NOTIFY** Chem Lab to obtain RCS boron sample.

Op Test No.:	NRC	Scenario #	3	Event #	2	Page	9	of 55
Event Description:	Trip one of two running hotwell pumps (B Pump)							

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate event 2**		
Indications available: **Motor Tripout alarm Panel M-1** **White disagreement light on Hotwell Pump B handswitch.**		
	BOP	Place failed pump switch in Pull to Lock Position. Refer to Annunciator Response Procedure.
	SRO	Enter and direct actions of AOP-S.04, section 2.4.
	BOP	**ENSURE** two hotwell pumps RUNNING. (Should Start Non-Operating Pump)
	BOP	**MONITOR** Steam generator levels returning to program. [M-4]
	CREW	**ENSURE** the following conditions: • Reactor power STABLE • Turbine load STABLE
	BOP	**DISPATCH** operator to investigate cause of Hotwell Pump trip.

Op Test No.: NRC Scenario # 3 Event # 2 Page 10 of 55

Event Description: Trip one of two running hotwell pumps (B Pump)

Time	Position	Applicant's Actions or Behavior
CAUTION: Reducing turbine load too rapidly could result in further drop in condensate pressure due to reduction in heater drain flow. Recommended load rate is 1% per minute if turbine load reduction is needed.		
NOTE: Severe MFW pump cavitation is likely if inlet pressure is less than 250 psig.		
	BOP	**MONITOR** Feedwater pump inlet pressure greater than 320 psig. [M-3, PI-2-129]
	RO	**CHECK** reactor power greater than 75%.
NOTE: With only two Hotwell pumps in service at 100% power, cavitation may occur and over time could lead to pump damage. Power reduction to 75% provides margin for additional failures.		
		IF Hotwell Pump cannot be restored within 24 hours, **THEN EVALUATE** reactor power reduction to less than 75% at 1% per minute **USING** 0-GO-5, Normal Power Operation.
		NOTIFY Maintenance to investigate and repair pump malfunction as necessary.
		GO TO appropriate plant procedure.
Proceed to next event at lead examiners discretion.		

Op Test No.:	NRC	Scenario #	3	Event #	3	Page	11	of 55

Event Description: Controlling Pressurizer Pressure channel Fails High

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate event 3**		
Indications available: **Pressurizer Hi Pressure, Alarm Panel (M-6a, C-5)** **Pressurizer Pressure above Setpoint ,Alarm Panel (M-5A, B-3)** **Both Pressurizer spray valves full open.**		
	RO	Manually close both spray valves. (Immediate Action)
	SRO	Enter and direct actions of AOP-I.04, Section 2.3.
NOTE Step 1 is an IMMEDIATE ACTION.		
	RO	**CHECK** normal spray valves CLOSED. (RNO)
	RO	**IF** RCS pressure is less than 2260 psig, **THEN** **CLOSE** affected spray valve(s) **USING** the following: PIC-68-340A, Master Pressure Controller. **OR** PZR Spray controllers PIC-68-340D (Loop 1) and/or PIC-68-340B (Loop 2).

Op Test No.: NRC Scenario # 3 Event # 3 Page 12 of 55

Event Description: Controlling Pressurizer Pressure channel Fails High

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** pressurizer pressure stable or trending to desired pressure.
	RO	**CHECK** PI-68-340A NORMAL. (RNO)
	RO	**PERFORM** the following: a. **ENSURE** PRESS CONTROL SELECTOR switch XS-68-340D in PT-68-334 & 323. b. **ENSURE** LOOP TAVG □T REC/SEL selector switch XS-68-2B in LOOP 2, 3, or 4. c. **ENSURE** PRESS REC CHANNEL SELECTOR XS-68-340B in PT-68-334, PT-68-323, or PT-68-322. d. **GO TO** Caution prior to Step 8.
CAUTION: RCS pressure changes and changes in RCS boron concentration (due to differences between pzr and RCS boron) may cause small change in core reactivity.		
	RO	**MONITOR** reactor power: a. **CHECK** reactor in Mode 1 or 2. b. **MONITOR** core thermal power for unexpected changes.
	SRO	**EVALUATE** the following Tech Specs for applicability: • 3.2.5 DNB Parameters - (N/A unless RCS press decreased below 2205 psig) • **3.3.1.1 (3.3.1), Reactor Trip System Instrumentation - (Action 6 applies)** • **3.3.2.1 (3.3.2), ESF Actuation System Instrumentation - (Action 17 applies)** • 3.3.3.5 Remote Shutdown Instrumentation - (N/A) • 3.4.4 Pressurizer Heaters (may be applicable while heaters are unavailable due to instrument failure) – (N/A)

Op Test No.: NRC Scenario # 3 Event # 3 Page 13 of 55

Event Description: Controlling Pressurizer Pressure channel Fails High

Time	Position	Applicant's Actions or Behavior
	RO	**CHECK** PZR PRESS and PZR SPRAY controllers in AUTO. (RNO)
	RO	**WHEN** malfunction has been identified **AND** isolated or corrected, **THEN PERFORM** the following: a. **ENSURE** Master Pzr Pressure Controller PIC–68–340A Output Percent Meter is less than 40%. b. **ENSURE** PZR PRESS Controller, PZR SPRAY controller, and PZR HTRS in AUTO.
NOTE: If performing AOP in conjunction with AOP-I.11 for an Eagle LCP failure, then actions to hard trip bistables should be delayed until Eagle system reset is attempted. Actions to hard trip bistables must be completed within 6 hours UNLESS affected loop is restored to operable status by resetting Eagle rack.		
	SRO	**REMOVE** failed pressurizer pressure channel from service:
	RO	**CHECK** any pressurizer pressure channel INOPERABLE.
	RO	**CHECK** OTΔT setpoint on affected channel NORMAL. (RNO) **GO TO** Substep 11.d.

Op Test No.: NRC Scenario # 3 Event # 3 Page 14 of 55

Event Description: Controlling Pressurizer Pressure channel Fails High

Time	Position	Applicant's Actions or Behavior
	SRO	**IF** any of the following conditions exists: • transmitter signal failed (entire instrument loop affected including OTΔT pressure input) **OR** • OTΔT pressure input potentially affected or status CANNOT be determined, **THEN PERFORM** applicable appendix:
	SRO	PZR PRESSURE INSTRUMENT / CHANNEL / APPENDIX P-68-340 (P-455) / I / A P-68-334 (P-456) / II / B P-68-323 (P-457) / III / C P-68-322 (P-458) / IV / D
	SRO	**GO TO** appropriate plant procedure.

If Tech Specs have been evaluated, Proceed to next event at lead examiners discretion.

Op Test No.: NRC Scenario # 3 Event # 4 Page 15 of 55

Event Description: RTD failure Cold Leg Loop 1 Sensor #2 Fail High.

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate Event 4**		
Indications available: **Alarm "Narrow Range RTD failure Loop 1" (Panel XA-55 5A, D-6)** **Alarm "TS-68-2D Reac Cool Loops Overtemp ΔT Trip Alert" (Panel XA-55 6A, A-2)** **Loop 1 Tavg indicating HI and Loop 1 ΔT Indicating Low (Panel M-5)**		
	RO	Refer to Annunciator Response Procedure
	SRO	Enter and direct Actions of AOP-I.02
	RO	**PLACE** rod control in **MANUAL**. (N/A Rods already in Manual at 2% Power)
CAUTION: Control rods should NOT be manually withdrawn during a plant transient.		
	SRO	**RESTORE** Tavg within 1.5°F of Tref **USING** one of the following: • manual rod control OR • RCS boration/dilution OR • turbine load reduction (Step is N/A since Tref not available with Turbine offline)

Op Test No.: NRC Scenario # 3 Event # 4 Page 16 of 55

Event Description: RTD failure Cold Leg Loop 1 Sensor #2 Fail High.

Time	Position	Applicant's Actions or Behavior
	RO	**CHECK** loop 1 temperature channel OPERABLE. (RNO)
	RO	**PERFORM** the following: a. **PULL-TO-DEFEAT** TAVG CHANNEL DEFEAT switch to LOOP 1 b. **PULL-TO-DEFEAT** ΔT CHANNEL DEFEAT switch to LOOP 1 c. **PLACE** LOOP TAVG ΔT REC/SEL switch in LOOP 2, 3, or 4 d. **GO TO** Step 7.
	SRO	**EVALUATE** the following Tech Specs for applicability: • 3.3.1.1 (3.3.1), Reactor Trip System Instrumentation – **(OTΔT Action 6 already in effect, S/G Level ΔT Action 10 also applies.)** • 3.3.2.1 (3.3.2), Engineered Safety Feature Actuation System Instrumentation – **(Action 37 for S/G Level AFW start applies).**
NOTE: If performing AOP in conjunction with AOP-I.11 for an Eagle LCP failure, then actions to hard trip bistables should be delayed until Eagle system reset is attempted. Actions to hard trip bistables must be completed within 6 hours UNLESS affected loop is restored to operable status by resetting Eagle rack.		

Op Test No.: NRC Scenario # 3 Event # 4 Page 17 of 55

Event Description: RTD failure Cold Leg Loop 1 Sensor #2 Fail High.

Time	Position	Applicant's Actions or Behavior
	RO	**NOTIFY** IM to remove failed TAVG ΔT instrument loop from service **USING** appropriate Appendix:

RCS LOOP	INSTRUMENT LOOP NUMBER	PROT CH	APPENDIX
1	T-68-2 (T-411/412)	I	A
2	T-68-25 (T-421/422)	II	B
3	T-68-44 (T-431/432)	III	C
4	T-68-67 (T-441/442)	IV	D

IF automatic rod control is available, **THEN RESTORE** rod control to **AUTO**. **USING** 0-SO-85-1.

(Step Is N/A)

GO TO appropriate plant procedure.

When Tech Spec Evaluation is complete proceed to the next event at lead examiner's discretion.

Op Test No.: NRC Scenario # 3 Event # 5 Page 18 of 55

Event Description: Small RCS Leak inside containment (Hot Leg Loop 2)

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate Event 5**		
Indications available: **Containment Pressure Small Increase on M-6 Recorder PDIR-30-133** **Containment Radiation monitors 106, and 112 increase** **Charging flow increase & VCT Level Decrease** **Alarm (1st one after ~12 min): Reactor Building AUX FL & EQ Drain Sump Hi**		
	SRO	When RCS Leak Identified enter and direct actions of AOP-R.05.
	SRO	**EVALUATE** the following Tech Spec/TRM LCOs for applicability: • 3.2.5, DNB parameters • 3.4.3.1, Safety and Relief Valves- Operating • 3.4.3.2, Relief Valves-Operating • 3.4.6.2, RCS Leakage • TRM 3.4.11, Reactor Coolant System Head Vents • 3.4.12, Low Temperature Over Pressure Protection Systems • 3.6.1.4, Containment Pressure • 3.6.1.5, Containment Air Temperature (Tech Specs may be evaluated later at Lead Examiners discretion)
	SRO	**EVALUATE** EPIP-1, Emergency Plan Classification Matrix. (Direct SM to Evaluate REP)

Op Test No.: NRC Scenario # 3 Event # 5 Page 19 of 55

Event Description: Small RCS Leak inside containment (Hot Leg Loop 2)

Time	Position	Applicant's Actions or Behavior
	SRO	**IF** leak results in radiological hazard or safety hazard, **THEN EVACUATE** unnecessary personnel from affected areas.
	SRO	**DIAGNOSE** the failure: (Enter Section 2.1)
	RO	**CONTROL** charging flow as necessary to maintain pressurizer level on program.
	RO	**MONITOR** pressurizer level: • greater than 10% • STABLE or RISING. (May Return to perform RNO To Trip RX and Initiate SI later when Leak increases)
NOTE: VCT level to volume conversion is approximately 20 gal / %. A change in indicated level of 0.5% in one minute equals the 10 gal / min EPIP-1 criteria.		
	RO	**MAINTAIN** VCT level greater than 13% **USING** automatic or manual makeup.

Op Test No.: NRC Scenario # 3 Event # 5 Page 20 of 55

Event Description: Small RCS Leak inside containment (Hot Leg Loop 2)

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** containment pressure STABLE or DROPPING. (RNO to Trip and SI may also apply later when leak increases)
	RO	**MONITOR** RCS pressure STABLE or RISING.
	BOP	**CHECK** secondary side radiation NORMAL: • S/G blowdown rad monitor • Condenser vacuum exhaust rad monitor • Main steam line rad monitors.
	CREW	**CHECK** leak inside containment: • containment pressure RISING ABNORMALLY **OR** • containment temperature or humidity abnormal **OR** • containment airborne activity abnormal (RM-90-106 or 112).
	BOP	**CHECK** containment airborne activity RISING. (RM-90-106 or 112)

Op Test No.: NRC Scenario # 3 Event # 5 Page 21 of 55

Event Description: Small RCS Leak inside containment (Hot Leg Loop 2)

Time	Position	Applicant's Actions or Behavior
NOTE: Containment purging and venting should NOT be resumed until Chemistry has evaluated off-site dose in a later step.		
	BOP	**ENSURE** containment purging and venting STOPPED: a. **CHECK** containment purging or venting in progress.
	CREW	**DETERMINE** leakage source: a. **CHECK** leakage source UNKNOWN.
	RO	b. **ISOLATE** letdown and charging: 1) **CLOSE** letdown orifice valves: • FCV-62-72 • FCV-62-73 • FCV-62-74 2) **CLOSE** letdown isolation valves: • FCV-62-69 • FCV-62-70 • FCV-62-77 3) **CLOSE** FCV-62-90 and -91, Charging header isolation valves. 4) **ENSURE** FCV-62-83, RHR Letdown Isolation CLOSED.

Op Test No.: NRC Scenario # 3 Event # 5 Page 22 of 55

Event Description: Small RCS Leak inside containment (Hot Leg Loop 2)

Time	Position	Applicant's Actions or Behavior
	RO	c. **CHECK** pressurizer PORVs NORMAL: • Tailpipe temperature • Acoustic monitors
	RO	d. **CHECK** pressurizer safety valves NORMAL: • Tailpipe temperature • Acoustic monitors
	RO	e. **CHECK** PRT conditions NORMAL: • Level • Pressure • Temperature
	RO	f. **NOTIFY** Chemistry to ensure all primary side sample valves CLOSED. [Hot Sample Room]
	BOP	g. **CHECK** CCS parameters NORMAL: • CCS radiation monitors NORMAL • CCS surge tank level STABLE.

Op Test No.: NRC Scenario # 3 Event # 5 Page 23 of 55

Event Description: Small RCS Leak inside containment (Hot Leg Loop 2)

Time	Position	Applicant's Actions or Behavior
	BOP	h. **CHECK** excess letdown heat exchanger NORMAL (if applicable): • Temperature • Pressure
	RO	i. **CHECK** TI-68-398, Reactor Vessel Head Vent Temperature NORMAL. [M-4]
	RO	j. **CHECK** TI-68-21, reactor vessel flange leakoff temperature NORMAL. [M-5]
	BOP	**MONITOR** auxiliary building radiation and HELB recorders NORMAL.
	CREW	12. **CHECK** leak IDENTIFIED and ISOLATED.

After Crew has evaluated whether leak is isolated, (Step 12 of AOP-R.05) the leak can be increased to require Reactor Trip and Safety Injection at Lead Examiners discretion.

Op Test No.: NRC Scenario # 3 Event # 6, 7, 8, & 9 Page 24 of 55

Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior

Console Operator:

When directed, initiate Event

Indications available:

Large Break LOCA

- **RCS Pressure and Pressurizer level decreasing**
- **Containment Pressure Increasing**

Auto Feedwater Isolation Failure (Manual isolation is available)

- **Main Feedwater Pumps do not auto trip on SI**
- **Main Feedwater Isolation valves do not auto close on SI**

Containment Spray discharge valves fail to Auto Open (Valves will manually open)

- **Spray pumps running due to Hi Hi containment pressure (2.81 Psi) with no spray flow indicated.**
- **Spray pump recirculation valves open**

A Train RHR sump suction valve FCV-63-72 fails closed (Will not manually open)

- **Valve remains closed (green light lit) when auto sump swapover criteria is met and will not manually open.**

	SRO	Direct Manual Reactor Trip and Safety Injection based on one of several monitor steps in AOP-R.05 for either Pressurizer level, Containment Pressure, Or RCS Pressure.
	RO	Manually Trip the Reactor and Initiate SI.

Op Test No.: NRC Scenario # 3 Event # 6, 7, 8, & 9 Page 25 of 55

Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	SRO	Enter and Direct performance of E-0, Reactor Trip Or Safety Injection.

Evaluator Note: **Immediately following performance of Immediate actions for Rx trip and SI, the Feedwater isolation failure may be identified and manually isolated. Also, a Hi Hi containment pressure condition may occur shortly after the trip and the containment Spray valve failures may be identified and corrected at this time. These actions may be performed as prudent actions prior to reaching the applicable procedure steps. ES-0.5, initiated at Step 5 of E-0, procedurally address each of these failures and will be performed by the BOP operator.**

NOTE 1: Steps 1 through 4 are immediate action steps.

NOTE 2: This procedure has a foldout page.

	RO	**VERIFY** reactor TRIPPED: • Reactor trip breakers OPEN • Reactor trip bypass breakers DISCONNECTED or OPEN • Rod bottom lights LIT • Rod position indicators less than or equal to 12 steps. • Neutron flux DROPPING

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** turbine TRIPPED: • Turbine stop valves CLOSED.
	BOP	**VERIFY** at least one train of shutdown boards ENERGIZED.
	RO	**DETERMINE** if SI actuated: • ECCS pumps RUNNING. • Any SI alarm LIT [M-4D].
	BOP	**PERFORM** ES-0.5, Equipment Verifications WHILE continuing in this procedure. (ES-0.5 At end of Scenario)

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	**DETERMINE** if secondary heat sink available: a. **CHECK** total AFW flow greater than 440 gpm. b. **CHECK** narrow range level greater than 10% [25% ADV] in at least one S/G. c. **CONTROL** feed flow to maintain narrow range level between 10% [25% ADV] and 50% in intact or ruptured S/Gs.
	RO	**CHECK** if main steam lines should be isolated: a. **CHECK** if any of the following conditions have occurred: • Any S/G pressure less than 600 psig. **OR** • Any S/G pressure dropping UNCONTROLLED. **OR** • Phase B actuation.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	b. **ENSURE** MSIVs and MSIV bypass valves CLOSED.
	SRO	c. **ENSURE** applicable Foldout Page actions COMPLETED.
Evaluator Note:		**RCPs will probably be stopped prior to the next step due to Phase B actuation. (E-0 Foldout page action)**
	RO	**CHECK** RCP trip criteria: a. **CHECK** the following: • RCS pressure less than 1250 psig **AND** • At least one CCP **OR** SI pump RUNNING. b. **STOP** RCPs.
	RO/BOP	**MONITOR** RCS temperatures: • **IF** RCPs stopped, **THEN** **CHECK** T-cold stable at or trending to between 547°F and 552°F. (If No Perform RNO)

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO/BOP	(RNO) **IF** temperature less than 547°F and dropping, **THEN** **PERFORM** the following: a. **ENSURE** steam dumps and atmospheric reliefs CLOSED. b. **IF** cooldown continues, **THEN** **CONTROL** total feed flow **USING** EA-3-8, Manual Control of AFW Flow.
	RO	**CHECK** pressurizer PORVs, safeties, and spray valves: a. Pressurizer PORVs CLOSED. b. Pressurizer safety valves CLOSED. c. Normal spray valves CLOSED. d. Power to at least one block valve AVAILABLE. e. At least one block valve OPEN.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO/BOP	**DETERMINE** if S/G secondary pressure boundaries are INTACT: • **CHECK** all S/G pressures CONTROLLED or RISING. • **CHECK** all S/G pressures greater than 140 psig.
	RO/BOP	**DETERMINE** if S/G tubes are INTACT: a. **CHECK** the following: • all S/G narrow range levels CONTROLLED or DROPPING • secondary radiation NORMAL **USING** Appendix A, Secondary Rad Monitors. (App. A is also contained in ES-0.5). b. **CHECK** Appendix A COMPLETED. (RNO) b. **DO NOT CONTINUE** this procedure UNTIL App. A has been completed or attempted.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	**DETERMINE** if RCS is INTACT: a. **CHECK** the following: • Containment pressure NORMAL • Containment sump level NORMAL • LOWER COMPT TEMP HIGH alarm DARK. [M-5C, B1] (RNO) **PERFORM** the following: 1) **MONITOR** status trees. 2) **GO TO** E-1, Loss of Reactor or Secondary Coolant.
	SRO	Ensure Status Trees are monitored (STA will perform if available at this time) and Transition to E-1.
Evaluator Note: Orange Paths may already be present at this point to perform FR-P.1 and/or FR-Z.1. When verified, SRO will leave E-1 after performing only a few steps.		
	SRO	Enter and direct actions of E-1

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	NOTE	This procedure has a foldout page.
	RO	**CHECK** RCP trip criteria: a. **CHECK** the following: • At least one CCP **OR** SI pump RUNNING **AND** • RCS pressure less than 1250 psig. b. **STOP** RCPs. (Step Previously performed)
		MONITOR if hydrogen igniters and recombiners should be turned on: a. **CHECK** containment conditions NOT normal: • containment pressure high OR • containment sump level high. b. **DISPATCH** personnel to open ice condenser AHU breakers **USING** EA-201-1, 480 V Board Room Breaker Alignments.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
		c. **CHECK** hydrogen concentration measurement AVAILABLE: • Hydrogen analyzers have been in ANALYZE for at least 5 minutes. (RNO) **PERFORM** the following: 1) **DISPATCH** operator to place hydrogen analyzers in service **USING** Appendix D (also contained in ES-0.5). 2) **WHEN** hydrogen analyzers have been in ANALYZE for at least 5 minutes, **THEN** **PERFORM** substeps 2.d through 2.f
	SRO	Enter and Direct actions of FR-P.1, Pressurized thermal Shock if orange path present. ***(If FR-P.1 not required at this point continue on next page with FR-Z.1)***
	RO	**MONITOR** RWST level greater than 27%.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** CST level greater than 5%.
	RO	**CHECK** RCS pressure greater than 300 psig. (RNO) **IF** any of the following conditions exist: • RHR injection flow greater than 1000 gpm **OR** • both RHR pumps STOPPED **AND** sump recirc capability has been lost **THEN** **RETURN TO** procedure and step in effect.
	SRO	Transition to and Direct action of FR-Z.1

Evaluator Note: At some point during the performance of FR-Z.1, RHR Auto Containment Sump swapover criteria may be met. At this point, crew will leave FR-Z.1 and enter ES-1.3. ES-1.3 will direct Resume FRP implementation to return to and complete FR-Z.1. All of FR-Z.1 is contained next in this event guide. ES-1.3 begins immediately following FR-Z.1.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
		NOTE If this procedure has been entered for an orange path and performance of ECA-1.1 (Loss of RHR Sump Recirculation) is required, FR-Z.1 may be performed concurrently with ECA-1.1.
	RO	MONITOR RWST level greater than 27%.
	RO	VERIFY Phase B valves CLOSED. • Panel 6K PHASE B GREEN • Panel 6L PHASE B GREEN
	RO	ENSURE RCPs STOPPED. (RCPs will be off due E-0 foldout page actions)
	RO	DETERMINE if this procedure should be exited: a. CHECK for faulted S/G: • Any S/G pressure DROPPING in an uncontrolled manner OR • Any S/G pressure less than 140 psig.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
Critical Task	RO	**VERIFY** containment spray operation: a. **CHECK** RHR sump recirculation capability AVAILABLE. b. **VERIFY** containment spray pumps RUNNING. c. **CHECK** RWST level greater than 27%. d. **VERIFY** containment spray suctio ALIGNED to RWST: • FCV-72-22 OPEN • FCV-72-21 OPEN. e. **VERIFY** containment spray discharge valves OPEN: • FCV-72-39 • FCV-72-2. *(Evaluator Note: FCV-72-2 will not manually open)* f. **VERIFY** containment spray recirc valves CLOSED: • FCV-72-34 • FCV-72-13. g. **VERIFY** containment spray flow greater than 4750 gpm on each train.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** containment air return fans: • **WHEN** at least 10 minutes have elapsed from Phase B, **THEN** **ENSURE** containment air return fans RUNNING. *(Evaluator Note: B Train Air return Fan Trips on overcurrent when it starts)*
	RO	**VERIFY** containment ventilation dampers CLOSED: • Panel 6K CNTMT VENT GREEN • Panel 6L CNTMT VENT GREEN.
	RO	**VERIFY** Phase A valves CLOSED: • Panel 6K PHASE A GREEN • Panel 6L PHASE A GREEN.
	BOP	**VERIFY** MSIVs and MSIV bypass valves CLOSED.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	BOP	**DETERMINE** if any S/G Intact: a. **CHECK** at least one S/G pressure: • CONTROLLED or RISING **AND** • Greater than 140 psig.
CAUTION	**Isolating all S/Gs will result in a loss of secondary heat sink.**	
	BOP	**DETERMINE** if any S/G Faulted: a. **CHECK** S/G pressures: • Any S/G pressure DROPPING in an uncontrolled manner **OR** • Any S/G pressure less than 140 psig.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** if hydrogen igniters and recombiners should be turned on: a. **DISPATCH** personnel to open ice condenser AHU breakers **USING** EA-201-1, 480 V Board Room Breaker Alignments. b. **CHECK** hydrogen concentration measurement AVAILABLE: • Hydrogen analyzers have been in ANALYZE for at least 5 minutes.
	BOP	(RNO May be previously performed) b. **PERFORM** the following: 1) **DISPATCH** operator to place hydrogen analyzers in service **USING** Appendix D. (also contained in ES-0.5) 2) **WHEN** hydrogen analyzers have been in ANALYZE for at least 5 minutes, **THEN** **PERFORM** substeps 12.c through 12.e.
	RO	**MONITOR** if RHR spray should be placed in service:
	RO	**MONITOR** if containment spray should be stopped: a. **CHECK** any containment spray pump RUNNING.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
		b. **CHECK** containment pressure less than 2.0 psig. c. **CHECK** containment spray suction aligned to RWST. d. **RESET** Containment Spray. e. **STOP** containment spray pumps and **PLACE** in A-AUTO. f. **CLOSE** containment spray discharge valves: • FCV-72-39, Train A • FCV-72-2, Train B.
	SRO	**RETURN TO** procedure and step in effect.
Evaluator Note: As previously discussed, ES-1.3 may be entered prior to completion of FR-Z.1.		
	SRO	Enter and direct actions of ES-1.3 when Sump Swapover criteria is met (RWST Level less than 27%).
CAUTION	**Transfer to sump recirculation may cause high radiation in Aux Building.**	
	SRO	**SUSPEND** FRP implementation.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** RHR automatic switchover: a. **CHECK** containment sump level greater than 11%. b. **CHECK** containment sump valves FCV-63-72 and FCV-63-73 OPEN. (RNO FCV-63-72 Failed to open) **IF** any sump valve is CLOSED, **THEN** **ATTEMPT** to open affected sump valve from MCR. (Valve will not open) c. **CHECK** RHR suction valves FCV-74-3 and FCV-74-21 CLOSING. (RNO FCV-74-3 will not be closing since FCV-63-72 will not open, however valve should not be closed based on RNO) **IF** sump valve on affected train is opening, **THEN** **ATTEMPT** to close RHR suction valve from MCR.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	**DETERMINE** if containment spray should be stopped: a. **CHECK** any containment spray pump RUNNING. b. **CHECK** containment pressure greater than or equal to 2.0 psig. (RNO if less than 2.0 psig) **STOP** containment spray pumps as follows: 1) **RESET** containment spray signal. 2) **STOP** containment spray pumps and **PLACE** in A-AUTO. 3) **CLOSE** cntmt spray discharge valves FCV-72-39 and FCV-72-2. **GO TO** Step 4. (If RNO Not required, i.e. greater than 2.0 psi) c. **CHECK** BOTH cntmt spray pumps RUNNING. d. **STOP** one cntmt spray pump and **PLACE** in PULL-TO-LOCK. e. **MONITOR** one cntmt spray pump RUNNING and delivering flow.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** RWST supply to ECCS pumps: • RWST LVL LO-LO alarm DARK [M-6E, E4]. • RWST level greater than 8%. (RNO if Required at some point) **WHEN** RWST level is less than or equal to 8%, **THEN** **PULL TO LOCK** any pumps taking suction from RWST: a. Containment spray pumps. b. SI pumps. c. CCPs.
	RO	**MONITOR** RHR pumps RUNNING.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior

	NOTE	Step 6 should be handed off to a Unit Operator.
	BOP	6. **PERFORM** the following: a. **DISPATCH** personnel to restore power to FCV-63-1 **USING** EA-201-1, 480 V Board Room Breaker Alignments. b. **OPEN** RHR heat exchanger outlet valves FCV-70-156 and FCV-70-153. c. **VERIFY** CCS flow FI-70-159A and FI-70-165A greater than 5050 gpm. d. **MONITOR** CCS temperature and surge tank level.
	RO	**VERIFY** RHR automatic switchover: a. **VERIFY** containment sump valves FCV-63-72 and FCV-63-73 OPEN. (RNO) **IF** any containment sump valve(s) CANNOT be opened, **THEN** **PULL TO LOCK** RHR pump on affected train(s). (A Train RHR Pump should be stopped) (RNO continued next page)

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	**IF** Train A containment sump valve FCV-63-72 CANNOT be opened, **THEN** **PERFORM** the following: 1) **CLOSE** FCV-74-3 Train A RHR suction valve to satisfy interlock. 2) **WHEN** FCV-74-3 is CLOSED, **THEN** **ATTEMPT** to OPEN FCV-63-72. (Continue AER for step 6) b. **ENSURE** RWST to RHR suction valves FCV-74-3 and FCV-74-21 CLOSED.
CAUTION	**SI pump operation with miniflow isolated and RCS pressure above shutoff head will result in SI pump damage.**	
NOTE	The following continuous action applies even after this procedure is exited.	
	RO	**MONITOR** RCS pressure less than 1500 psig.
	RO	**CLOSE** SI pump miniflow to RWST valves: • FCV-63-3 • FCV-63-4 • FCV-63-175

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	**CLOSE** RHR crosstie valves: • FCV-74-33 • FCV-74-35.
	RO	**OPEN** CCP and SI pump suction valves from RHR: • FCV-63-7 • FCV-63-6.
	RO	**ALIGN** RHR discharge to CCP and SI pump suction: a. **OPEN** RHR discharge to CCP suction FCV-63-8. (RNO since FCV-63-8 will not open due to interlock with FCV-63-72 Sump valve that will not open) **ENSURE** operation of Train B RHR: • Train B RHR pump RUNNING • FCV-63-11 OPEN. b. **OPEN** RHR discharge to SI pump suction FCV-63-11.
Critical Task	SRO/RO	**VERIFY** Steps 9 through 12 COMPLETED.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
Evaluator Note: ECCS Alignment to containment sump is complete at this point. Lead Examiner may evaluate terminating scenario if **critical tasks** have been addressed and sufficient actions from contingency procedure FR-Z.1 have also been completed.		
	RO	**CHECK** ECCS pump status: a. **MONITOR** BOTH RHR pumps RUNNING. (RNO since only B RHR Pump is running) **PERFORM** the following: 1) **ENSURE** the following: • one CCP RUNNING (same train as running RHR pump preferred) • other CCP in PULL TO LOCK. (RNO 2) is N/A) 3) **IF** RCS press is less than 1500 psig, **THEN** **ENSURE** the following: • one SI pump RUNNING (same train as running RHR pump preferred) • other SI pump in PULL TO LOCK
CAUTION		**Momentary loss of shutdown power while aligned for sump recirculation could result in CCP damage since the blackout sequencer will start the CCPs but will NOT start the RHR pumps.**

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** shutdown boards continuously energized.
	RO	**RESET** SI signal.
	BOP	**ALIGN** ERCW System **USING** EA-67-1, ERCW Operation.
	RO	**ISOLATE** CCP suction from RWST: a. **CLOSE** RWST suction valves LCV-62-135 and LCV-62-136 WHILE monitoring CCPIT flow. b. **PLACE** RWST suction valve handswitches in A-AUTO (pushed in): • HS-62-135 • HS-62-136 c. **ENSURE** at least one VCT outlet valve CLOSED: • LCV-62-132 **OR** • LCV-62-133.

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
		ISOLATE RHR suction from RWST: a. **CHECK** power RESTORED to FCV-63-1. b. **CLOSE** FCV-63-1 WHILE monitoring RHR flow.
	RO	**ISOLATE** SI pump suction from RWST: • **CLOSE** FCV-63-5 WHILE monitoring SI pump flow.
	RO	**ALIGN** containment spray suction to containment sump: a. **CHECK** any of the following conditions met: • RWST level less than or equal to 8% **OR** • containment sump level greater than or equal to 56%. b. **ENSURE** containment spray pumps in PULL-TO-LOCK. c. **CHECK** FCV-63-72 Train A containment sump valve OPEN. (RNO FCV-63-72 failed closed) **GO TO** Substep 21.i. (Step Continued next page)

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	i. **CHECK** FCV-63-73 Train B containment sump valve OPEN. J. **CLOSE** FCV-72-21, Train B cntmt spray suction from RWST k. **OPEN** FCV-72-20 Train B cntmt spray suction from containment sump. l. **CHECK** containment pressure greater than 2.0 psig. (RNO if pressure less than 2.0 psi) **PERFORM** the following: 1) **RESET** Train B Containment Spray signal. 2) **WHEN** containment sump level is greater than 18% [22% ADV], **THEN** **PLACE** Train B containment spray pump in A-AUTO. 3) **ENSURE** FCV-72-2 Train B cntmt spray isol valve CLOSED. (Continue step if pressure greater than 2.0 psi) m. **CHECK** containment sump level greater than 18% [22% ADV]. (Continue step next page)

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Event Description: Large Break LOCA, Auto FW Isol failure, Cntmt Spray Vlvs Auto open fail, A Train RHR sump suction vlv fails closed.

Time	Position	Applicant's Actions or Behavior
	RO	n. **ESTABLISH** Train B Cntmt Spray: 1) **CHECK** Train B containment spray pump suction aligned to containment sump. 2) **START** Cntmt spray pump B-B. 3) **ENSURE** FCV-72-2 Train B Cntmt Spray isol valve OPEN. o. **ENSURE** recirc valves CLOSED for running Containment Spray pump(s): • FCV-72-34 Train A • FCV-72-13 Train B. p. **CHECK** containment spray flow greater than 4750 gpm on each train in service.
		MONITOR if RHR spray should be placed in service:
		RESUME FRP implementation.

Evaluator Note: Crew may return to FR-Z.1 at this point if not completed earlier. Scenario may be terminated at lead examiner discretion when **critical tasks** have been addressed and sufficient actions in FR-Z.1 and ES-1.3 have been completed.

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		ES-0.5 Actions
	BOP	**CHECK** ERCW system operation: • **VERIFY** at least four ERCW pumps RUNNING. • **VERIFY** D/G ERCW supply valves OPEN.
	BOP	**VERIFY** CCS pumps RUNNING: • Pump 1A-A (2A-A) • Pump 1B-B (2B-B) • Pump C-S.
	BOP	**VERIFY** EGTS fans RUNNING.
	BOP	**VERIFY** generator breakers OPEN.
	BOP	**VERIFY** AFW pumps RUNNING: • MD AFW pumps • TD AFW pump.

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		NOTE AFW level control valves should NOT be repositioned if manual action has been taken to control S/G levels, to establish flow due to failure, or to isolate a faulted S/G.
	BOP	**CHECK** AFW valve alignment: a. **VERIFY** MD AFW LCVs in AUTO. b. **VERIFY** TD AFW LCVs OPEN. c. **VERIFY** MD AFW pump recirculation valves FCV-3-400 and FCV-3-401 CLOSED.
	BOP	**VERIFY** MFW Isolation: • MFW pumps TRIPPED • MFW regulating valves CLOSED • MFW regulating bypass valve controller outputs ZERO • MFW isolation valves CLOSED • MFW flow ZERO. (**Evaluator Note:** If not previously completed Auto Feedwater Isolation Failure should be addressed at this point.)
	BOP	**MONITOR** ECCS operation: **VERIFY** ECCS pumps RUNNING: • CCPs • RHR pumps • SI pumps

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** CCP flow through CCPIT. • **CHECK** RCS pressure less than 1500 psig. • **VERIFY** SI pump flow. • **CHECK** RCS pressure less than 300 psig. • **VERIFY** RHR pump flow.

	BOP	**VERIFY** ESF systems ALIGNED:
		
		• Phase A ACTUATED:
		  o CONTAINMENT ISOLATION PHASE A TRAIN A alarm LIT [M-6C, B5].
		  o CONTAINMENT ISOLATION PHASE A TRAIN B alarm LIT [M-6C, B6].
		
		• Containment Ventilation Isolation ACTUATED:
		  o CONTAINMENT VENTILATION ISOLATION TRAIN A alarm LIT [M-6C, C5].
		  o CONTAINMENT VENTILATION ISOLATION TRAIN B alarm LIT [M-6C, C6].
		
		• Status monitor panels:
		  o 6C DARK
		  o 6D DARK
		  o 6E LIT OUTSIDE outlined area
		  o 6H DARK
		  o 6J LIT.
		
		• Train A status panel 6K:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN
		
		• Train B status panel 6L:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** containment spray NOT required: • Phase B NOT ACTUATED **AND** • Containment pressure less than 2.81 psig • Ensure Containment Spray is actuated (**Evaluator Note:** If not previously addressed Containment Spray discharge valve auto open failures should be addressed at this point, only A Train valve can be manually opened)
	BOP	**VERIFY** pocket sump pumps STOPPED: [M-15, upper left corner] • HS-77-410, Rx Bldg Aux Floor and Equipment Drain Sump pump A • HS-77-411, Rx Bldg Aux Floor and Equipment Drain Sump pump B.
	BOP	**DISPATCH** personnel to perform EA-0-1, Equipment Checks Following ESF Actuation.

Facility: Sequoyah Scenario No.: 4 Op Test No.: NRC

Examiners: _____ Operators: _____

_____ _____

_____ _____

Initial Conditions: ~41% Power BOL Ready to Increase Power and Roll 2nd Main Feedwater Pump.

Turbine Driven Auxiliary Feedwater Pump OOS for maintenance

Turnover: Continue plant startup. Currently at 0-GO-5 Section 5.1, Step 23.

Target CTs: Insert Negative reactivity using rods or boration prior to completion of FR-S.1 Step 4.

Close MSIVs and Stop/Isolate AFW flow to Faulted S/G prior to transition out of E-2.

Event No.	Malf. No.	Event Type*	Event Description
1	N/A	R-ATC N-SRO/BOP	~41% Continue Power increase to Roll 2nd MFP
2	RX06A	TS-SRO I-SRO/ATC	Controlling Pressurizer level transmitter fails low LT 68-339. Results in letdown isolation which requires restoration. Tech Spec Evaluation.
3	RX16D	TS-SRO I-SRO	Steam Generator # 4 narrow range level transmitter fails low. Tech Spec Evaluation.
4	RX24	I-SRO/BOP	Feed Water Header Pressure Transmitter PT-3-1 Fails Low. MFP Speed will increase requiring manual control.
5	MS06C	C-SRO	Small Steam Leak Outside Containment Upstream Of MSIV On Loop 3. (Non-Isolable)
6	MS06C	M-All	Steam leak increases to large break requiring Reactor Trip and Safety Injection.
7	RP01C	C-All	Both Reactor trip Breakers fail to trip automatically or manually resulting in ATWS.
8	RD09	C-SRO/ATC	Rods Fail to move in auto but will move manually 5 seconds after turbine trip.
9	FW04C	C-SRO/BOP	Motor Driven AFW Level Control Valve To Loop 3 S/G (Faulted) Fails Full Open. Requires Stopping AFW Pump Or Local Isolation To Stop Feedwater To Faulted S/G.

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

Scenario 4 Summary

Crew will assume shift at approximately at ~41% reactor power with direction to continue plant startup. Crew will continue power increase and roll second Main Feedwater Pump (MFP).

When the Main feedwater pump has been rolled, and adequate power change has been performed to demonstrate proficiency, the controlling pressurizer level channel will fail low. This will result in letdown isolation, channel defeat, and restoration of letdown as directed by the AOP. SRO will evaluate and enter applicable Technical Specifications.

Following restoration of letdown, a Steam Generator #4 narrow range level transmitter will fail low. No plant transient will result due to the median selector circuit. SRO will direct AOP and evaluate and enter applicable Technical Specifications.

Feedwater header pressure transmitter PT-3-1 will fail low resulting in MFP speed increasing to attempt to restore steam header to feedwater differential pressure to program. This will require manual control of MFP speed. AOP will be performed; however, MFP speed will have to remain in manual.

When plant is stable a small unisolable steam leak will occur on loop 3 Steam generator outside containment upstream of the Main Steam Isolation Valve. Crew will perform actions of the AOP to stabilize the plant and monitor key parameters for Reactor trip.

When the small steam leak has been addressed, the steam leak will be increased to a significant break requiring Reactor Trip and Safety injection. When manual reactor trip is actuated, both reactor trip breakers will fail to open automatically and manually resulting in an ATWS and entry into contingency procedure FR-S.1.

During response to the ATWS, control rods will initially insert in automatic but stop after ~5 seconds requiring manual rod insertion. When the Reactor is shutdown and Safety injection has occurred, the auxiliary feedwater supply valve to the faulted S/G will fail full open requiring that the associated AFW pump be stopped to stop feed flow to the faulted S/G. Local isolation of the failed AFW valve may also initiated.

The scenario may be terminated when crew transitions out of emergency procedure E-2.

Op Test No.:	NRC	Scenario #	4	Event #	1	Page	1	of 44
Event Description:	Power increase and 2nd MFPT Roll							

Time	Position	Applicant's Actions or Behavior
Console Operator: **No action required for event 1**		
Indications Available: **None Applicable**		
	SRO	Direct load increase from ~41% power in accordance with 0-GO-5, *Normal Power Operation*, beginning in Section 5.1, at Step 23.
NOTE With verbal approval from the Operations Superintendent, placing the second main feed pump in service may be deferred until power is approximately 55% (Unit 1) or 65% (Unit 2). Logic prevents opening the standby MFPT condenser isolation valves if the pump is **NOT** reset prior to exceeding 9 million lbs/hr flow on the running pump.		
	SRO	**WHEN** approximately 40 to 45% turbine load, **THEN** **PLACE** second MFPT in service by performing the following:
	SRO	**IF** the Operations Superintendent has approved one MFP operation during the power ascension, **THEN** A. **1.RECORD** which MFPT is in service. _____MFPT _____ B. **MONITOR** loading of the MFP in service as load is increased. (Step is N/A Second MFPT is to be placed in Service)

Op Test No.: NRC Scenario # 4 Event # 1 Page 2 of 44

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	SRO/BOP	**WHEN second MFPT is to be placed in service, THEN** **PLACE** second MFPT in service in accordance with 1,2-SO-2/3-1.
Evaluator Note: The following steps are from 1-SO-2/3-1 Section 5.16.4 beginning at step 15. The preceding steps of the SO were previously performed and snapped into the Scenario Initial Conditions.		
	BOP	OPEN Governor Valve by PERFORMING one of the following: • IF MCR operation of Governor Valve Positioner is available, THEN • PLACE the applicable Governor Valve Positioner to the RAISE position to open the steam chest valves and accelerate the MFPT: **MFPT** — **HANDSWITCH** — **POSITION** B — GV Positioner 1-HS-46-40A — OPEN
CAUTION DO NOT increase second MFPT speed faster than the master speed control can maintain program d/p.		
NOTE As the second MFPT is loaded, the first MFPT should back down in load.		

Op Test No.: NRC Scenario # 4 Event # 1 Page 3 of 44

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	BOP	SLOWLY LOAD the second MFPT to raise MFPT speed until demand on MFPT speed controller matches the demand output of the first MFPT.
	BOP	ENSURE MFP Injection Water Intermediate Leakoff Pressure for BOTH MFPs is at least 250 psig. • [1-PI-54-2], 1A MFP AND • [1-PI-54-6], 1B MFP ENSURE MFP Injection Water Differential Pressure for pump started is equal to or greater than 25 psid. • [1-PDI-54-1], 1A MFP OR • [1-PDI-54-5], 1B MFP
	BOP	WHEN the output meter for the SIC for the second MFPT matches the output meter on the Master Controller, THEN PLACE the second MFPT SIC in AUTO.
	BOP	CLOSE the second MFPT drain valves 1B Drain Valves 1-HS-46-41 CLOSED

Op Test No.:	NRC	Scenario #	4	Event #	1	Page	4	of 44
Event Description:	Power increase and 2nd MFPT Roll							

Time	Position	Applicant's Actions or Behavior
		CAUTION 1 MFP Recirc valves controllers should NOT be operated in AUTOMATIC due to the potential for isolating all three intermediate heater strings and resulting MFP damage.
		CAUTION 2 Operation of MFP RECIRC valve should be performed slowly due to affect on MFP DP program.
	BOP	ENSURE [1-FCV-3-70] or [1-FCV-3-84] MFP Recirc valve is CLOSED and in MANUAL.
		CAUTION Failure to readjust the minimum speed on the second MFWP could result in the second MFWP being unable to supply adequate feed flow in the event the first MFWP trips.
		NOTE The following step may be performed in parallel with power increase but should be completed prior to exceeding 55% power.
		WHEN MFWP speed controllers [1-SIC-46-20A] and [1-SIC-46-20B] are in AUTO, THEN PERFORM the following to adjust the minimum speed on the second MFWP: • VERIFY both MFWP speed controller bias settings at 50%. • NOTIFY MIG to slowly adjust the hand speed changer on the second MFWP so that the MFWP speeds are equal.

Op Test No.: NRC	Scenario # 4	Event # 1	Page 5 of 44
Event Description: Power increase and 2nd MFPT Roll			

Time	Position	Applicant's Actions or Behavior
	SRO	Continue directing power increase in accordance with 0-GO-5. Using Dilution, Rod W/D and Turbine load increase to maintain Tavg on program and AFD.

Evaluator Note: The following Steps are from 0-SO-62-7 *Boron Concentration Control*, Section 6.2, *Dilute*

CAUTION 1: When making an RCS dilution of ≥3000 gallons, it should be done in batches with an RCS boron concentration verification at the halfway point (e.g., 1500 gallons). Allow at least 15 minutes between batches.

CAUTION 2; Returning the Boric Acid Blender to service after unplugging, cleaning, or maintenance on the Boric Acid System could introduce debris, sludge, air or chunks of solidified boron into the CCP suction resulting in pump damage. Extreme care must be exercised to properly flush the Boric Acid Blender system following an outage.

NOTE 1: If an excessive amount of dilution is required (plant startup), the pressurizer heaters should be energized to cause pressurizer spray operation for equalizing boron concentration in RCS and pressurizer.

NOTE 2: Dilute mode will be used anytime a long-term positive reactivity addition is desired. The operator should use the normal dilute mode whenever conditions permit.

	RO	**ENSURE** unit is NOT in a Tech Spec or TRM action that prohibits positive reactivity additions.

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Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
NOTE: HUT level increase of 1% is equal to 1380 gallons (TI-28 fig. C.21)		
	RO	**ENSURE** sufficient capacity available in the HUT selected to receive expected amounts of CVCS letdown: (**N/A** if not used) HUT: A, LEVEL: _____ %, INITIALS: _____ HUT: B, LEVEL: _____ %, INITIALS: _____
	RO	**ENSURE** makeup system is aligned for **AUTO** operation in accordance with Section 5.1.
	RO	**RECORD** the quantity of dilution water required to achieve desired boron concentration using Appendix D. (**N/A** for minor power changes)
NOTE Due to eyeball interpolation the verified calculation may slightly differ from the initial calculation. The following signoff indicates that any differences in the two results have been discussed and are close enough to be considered validated.		
	SRO	**PERFORM** Appendix I Independent Verification of Calculation for Amount of Boric Acid or Primary Water. (N/A if App. D was performed by SRO to verify data from Rx Engineering) ***(Step not required provided in shift turnover package)***
	RO	**PLACE [HS-62-140A]**, Boric Acid Supply to Blender Flow Control Switch to the **STOP** position.

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Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	RO	**PLACE [HS-62-140B]**, CVCS Makeup Selector Switch to the **DILUTE** position.
	RO	**ENSURE [HS-62-140D]**, Boric Acid Valve to the Blender is **CLOSED** (Green light is **LIT**).
	RO	**SET [FQ-62-142]**, Batch Integrator for the desired quantity.
NOTE: Primary Water Flow Controller **[FC-62-142]** receives its reference signal (70 gpm) from setpoint potentiometer (dial indicator) located on panel M-6. A setpoint of 35% corresponds to a 70 gpm primary water flow rate.		
	RO	**ADJUST [FC-62-142]**, Primary Makeup Water Flow Controller for the desired flow rate.
	RO	**PLACE [HS-62-140A]**, Boric Acid Supply to Blender Flow Control Switch to the **START** position.
NOTE: Flow oscillations and/or erratic controller response may require manual operation of Primary Water Flow Controller **[FC-62-142]** until stable conditions exist.		

Op Test No.: NRC Scenario # 4 Event # 1 Page 8 of 44

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	RO	**VERIFY** the following; **[a]** Inlet to top of VCT [FCV-62-128] is **OPEN**. **[b]** Primary Water flow by [FI-62-142A] **OR** [FQ-62-142].
NOTE: Alternate dilution in small amounts is acceptable on a regular basis, provided no significant changes in seal water temperature or seal leakoff are indicated. Batches of 5 to 10 gallons may be added through FCV-62-144 on a frequency not to exceed once per 30 minutes. ICS points for No. 1 seal leakoffs and seal water temperatures on the RCPs should be monitored during and after dilution.		
	RO	**IF** primary water addition to the bottom of the VCT [FCV-62-144] is desired, **THEN** **[a]** **CLOSE** [FCV-62-128] with [HS-62-128]. **[b]** **OPEN** [FCV-62-144] with [HS-62-144]. **[c]** **VERIFY** Primary Water flow by [FI-62-142A] **OR** [FQ-62-142].
NOTE: It may take approximately 15 minutes before any changes to reactivity are indicated on nuclear instrumentation or RCS temperature indication.		
	RO	**MONITOR** nuclear instrumentation and reactor coolant temperature to ensure the proper response from dilution.

Op Test No.:	NRC	Scenario #	4	Event #	1	Page 9	of 44
Event Description:	Power increase and 2nd MFPT Roll						

Time	Position	Applicant's Actions or Behavior
	RO	**IF [LI-62-129]**, Volume Control Tank Level, increases to 63 percent, **THEN ENSURE [LCV-62-118]**, Volume Control Tank Divert Valve **OPENS** to divert excess water to the Holdup Tanks.
	RO	**WHEN** dilution is complete, **THEN** **[a] PLACE** [HS-62-140A], Boric Acid to Blender Flow Control Switch to the **STOP** position. **[b] IF** [FCV-62-144] was previously **OPENED**, **THEN** **CLOSE** [FCV-62-144] with [HS-62-144]. **[c] VERIFY** no primary water flow on either [FI-62-142A] **OR** [FQ-62-142]. **[d] ENSURE** [FCV-62-128] is **CLOSED**.

Lead Examiner may direct initiation of the next event at his discretion. Steps on the next two pages are associated with performance of repetitive dilutions or may not be performed until all dilutions are complete.

Op Test No.: NRC Scenario # 4 Event # 1 Page 10 of 44

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	RO	**[17] IF** power increase in progress and additional dilutions will be required, **THEN** use this table to re-perform steps **[4]** through **[18]**.

STEP	1st	2nd	3rd
[4] RECORD the quantity of dilution water required to achieve desired boron concentration using Appendix D.	Quantity	Quantity	Quantity
[5] PERFORM Appendix I, IV of Calculation for amount of BA or PW.	SRO	SRO	SRO
[6] PLACE [HS-62-140A], Boric Acid Supply to Blender Flow Control Switch to the **STOP** position.	1st CV	1st CV	1st CV
[7] PLACE [HS-62-140B], CVCS Makeup Selector Switch to the **DILUTE** position.	☐	☐	☐
[8] **ENSURE** [HS-62-140D] Boric Acid Valve to Blender is **CLOSED** (Green light LIT).	☐	☐	☐
[9] **SET** [FQ-62-142], Batch Integrator for the desired quantity.	1st CV	1st CV	1st CV
[10] **ADJUST** [FC-62-142], Primary Makeup Water Flow Controller for the desired flow rate.	1st CV	1st CV	1st CV
[11] PLACE [HS-62-140A], BA Supply to Blender Flow Control Switch to **START**.	1st CV	1st CV	1st CV
[12] VERIFY the following:			
[a] Inlet to top of VCT [FCV-62-128] is **OPEN**.	☐	☐	☐
[b] Primary Water flow by [FI-62-142A] or [FQ-62-142].	☐	☐	☐
[13] IF PW addition to top of VCT [FCV-62-128] is not warranted, but PW addition to the bottom of the VCT [FCV-62-144] is desired, THEN			
[a] CLOSE [FCV-62-128]with [HS-62-128]	☐	☐	☐
[b] OPEN [FCV-62-144] with [HS-62-144].	☐	☐	☐
[c] VERIFY Primary Water flow by [FI-62-142A] or [FQ-62-142].	☐	☐	☐
[14] MONITOR nuclear instrumentation and reactor coolant temperature to ensure the proper response from dilution.	☐	☐	☐
[15] IF [LI-62-129], VCT level, increases to 63 percent, THEN **ENSURE** [LCV-62-118], VCT Divert Valve, **OPENS** to divert excess water to the HUTs.	☐	☐	☐
[16] WHEN dilution is complete, THEN			
[a] PLACE [HS-62-140A], Boric Acid to Blender Flow Control Switch to **STOP**	1st CV	1st CV	1st CV
[b] IF [FCV-62-144] was previously **OPENED**, THEN **CLOSE** [FCV-62-144] with [HS-62-144].	☐	☐	☐
[c] **VERIFY** no primary water flow on either [FI-62-142A] or [FQ-62-142].	☐	☐	☐
[d] **ENSURE** [FCV-62-128] is **CLOSED**.	☐	☐	☐

[18] IF Step **[17]** will be repeated, **THEN**
PERFORM the following:
[a] PLACE [HS-62-140B], CVCS Makeup Selector Switch to the **AUTO** position.

[b] PLACE [HS-62-140A], BA to Blender Flow Control Switch to **START** position.
[c] ENSURE dilution is logged in Unit Narrative Log.

Op Test No.: NRC Scenario # 4 Event # 1 Page 11 of 44

Event Description: Power increase and 2nd MFPT Roll

Time	Position	Applicant's Actions or Behavior
	RO	**REALIGN** the blender controls for **AUTO** makeup to the CVCS in accordance with Section 5.1.
	RO	**ENSURE** dilution(s) is logged in Unit Narrative Log.
NOTE Sample may be obtained at normal RCS sample intervals provided the unit is at power and the unit response following the dilution is as expected.		
		IF RCS boron sample is required, **THEN NOTIFY** Chem Lab to obtain RCS boron sample.

Op Test No.:	NRC	Scenario #	4	Event #	2	Page	12	of 44
Event Description:	Controlling Pressurizer Level Channel Fails Low							

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **When directed, initiate event 2**		
Indications available: 1-AR-M5-A, C3, PRESSURIZER LEVEL HIGH-LOW 1-AR-M5-A, E3, PRZR LVL LOW HEATER OFF & LETDOWN SECURED 0-AR-M27B-B, A5, LETDOWN HX OUTLET FLOW/TEMP ABNORMAL		
	Crew	Refer to alarm response procedures
	US	Direct entry to AOP-I.04, Pressurizer Instrument Malfunction, section 2.2
NOTE: Appendixes "I" is a layout of PZR level control provided for operator reference.		
	RO	CHECK LI-68-339 indicates NORMAL. (NO) PERFORM the following: • ENSURE LEVEL CONTROL CHANNEL SELECTOR switch XS-68-339E in LT-68-335 & 320. • ENSURE LEVEL REC CHANNEL SELECTOR switch XS-68-339B in LT-68-320 or LT-68-335.

Op Test No.: NRC Scenario # 4 Event # 2 Page 13 of 44

Event Description: Controlling Pressurizer Level Channel Fails Low

Time	Position	Applicant's Actions or Behavior
	RO	CHECK letdown IN SERVICE. **(NO)** • RESTORE letdown USING EA-62-5, Establishing Normal Charging and Letdown.
Evaluator Note: The following steps are from EA-62-5 performed by the RO to reestablish Letdown. SRO may continue in AOP-I04 with Tech Spec Evaluation etc..		
NOTE EA-62-3, Establishing Excess Letdown, may be utilized if Normal Letdown cannot be established.		
	RO	IF charging flow NOT established, THEN PERFORM Section 4.2. (Charging flow is established)
	RO	VERIFY pressurizer level greater than 17%.
	RO	ENSURE letdown orifice isolation valves CLOSED: • FCV-62-72 • FCV-62-73 • FCV-62-74

Op Test No.: NRC Scenario # 4 Event # 2 Page 14 of 44

Event Description: Controlling Pressurizer Level Channel Fails Low

Time	Position	Applicant's Actions or Behavior
	RO	OPEN letdown isolation valves: • FCV-62-69 • FCV-62-70 • FCV-62-77
NOTE Placing cooling water on the Letdown Heat Exchanger prior to restoring letdown flow should prevent TIS-62-79B/A from actuating and fully opening TCV-70-192.		
	RO	PLACE [HIC-62-78] in MANUAL, AND OPEN [TCV-70-192] to ~ 50%.
	RO	PLACE letdown pressure controller [PCV-62-81] in MANUAL and ADJUST output between 40 and 50%, (50%-60% open).
	RO	ADJUST charging flow as necessary to prevent flashing in the letdown line.

Op Test No.: NRC Scenario # 4 Event # 2 Page 15 of 44

Event Description: Controlling Pressurizer Level Channel Fails Low

Time	Position	Applicant's Actions or Behavior
	RO	OPEN letdown orifice isolation valves as needed: • FCV-62-72 • FCV-62-73 • FCV-62-74
NOTE Normal letdown pressure is 325 psig at normal operating temperature.		
	RO	ADJUST letdown pressure controller [PCV-62-81] output to obtain desired pressure.
	RO	ADJUST letdown pressure controller [PCV-62-81] setpoint to match existing pressure.
	RO	PLACE letdown pressure controller [PCV-62-81] in AUTO.
NOTE Normal letdown temperature is ~100°F.		
	RO	ADJUST [HIC-62-78A] to obtain desired letdown temperature, as indicated on [TI-62-78].

Op Test No.: NRC Scenario # 4 Event # 2 Page 16 of 44

Event Description: Controlling Pressurizer Level Channel Fails Low

Time	Position	Applicant's Actions or Behavior
	RO	PLACE [HIC-62-78A] in AUTO.
NOTE Letdown temperature may swing due to repeated actuation of TIS-62-79B/A, which causes letdown temperature control valve TCV-70-192 to fully open.		
	RO	IF necessary to stabilize letdown temperature, THEN PERFORM the following: • PLACE [HIC-62-78A] in MANUAL and ADJUST controller output in OPEN direction. • WHEN letdown heat exchanger outlet temperature is stabilized at approximately 100°F, THEN PLACE [HIC-62-78A] in AUTO.
	RO	ENSURE high temperature divert valve [HS-62-79A] in DEMIN position.
	RO	ADJUST charging and letdown as necessary to maintain RCP seal injection flow and pressurizer level.

Op Test No.: NRC Scenario # 4 Event # 2 Page 17 of 44

Event Description: Controlling Pressurizer Level Channel Fails Low

Time	Position	Applicant's Actions or Behavior
	US	EVALUATE the following Tech Specs for applicability: • **3.3.1.1 (3.3.1), Reactor Trip System Instrumentation. Enters action 6.** • 3.3.3.5 Remote Shutdown Instrumentation • **3.3.3.7 Accident Monitoring Instrumentation. Enters action 2.**
	RO	ENSURE pressurizer heaters restored to service.
CAUTION: RCS pressure changes and changes in RCS boron concentration (due to differences between pzr and RCS boron) may impact core reactivity.		
	RO	**MONITOR** reactor power: a. **CHECK** reactor in Mode 1 or 2. b. **MONITOR** core thermal power for unexpected changes.
NOTE: If performing AOP in conjunction with AOP-I.11 for an Eagle LCP failure, then actions to hard trip bistables should be delayed until Eagle system reset is attempted. Actions to hard trip bistables must be completed within 6 hours UNLESS affected loop is restored to operable status by resetting Eagle rack.		

Op Test No.: NRC Scenario # 4 Event # 2 Page 18 of 44

Event Description: Controlling Pressurizer Level Channel Fails Low

Time	Position	Applicant's Actions or Behavior
		NOTIFY IM to remove failed pressurizer level channel from service USING appropriate Appendix: • L-68-339 Appendix I
When Letdown is restored and Technical Specifications are addressed, the Lead Examiner may cue the next event		

Op Test No.:	NRC	Scenario #	4	Event #	3	Page	19	of 44
Event Description:	Steam Generator #3 NR Level Transmitter fails low							

Time	Position	Applicant's Actions or Behavior
Console Operator: **When directed, initiate event 3**		
Indications available: **S/G Level instrument LT-3-107 indicates downscale** **Alarm: XA-55-6B, D-1 "LS-3-107 SATM Gen LOOP 4 LOW FW FLOW LOW WATER LEVEL"** **Alarm: XA-55-3C, D-2 "EAM/TTD SG LOOP 4 LO LO LEVEL"**		
	CREW	Refer to Annunciator Response. Diagnose failure. (**Evaluator Note:** No Plant transient occurs due to median selection circuit).
	SRO	Enter and direct actions of AOP-I.06, Section 2.2.

	SRO	**EVALUATE** the following Tech Specs for applicability:
		• **3.3.1.1 (3.3.1), Reactor Trip System Instrumentation**
		  • **Action 9 Applies for S/G Water Level Low Low Trip)**
		• **3.3.2.1 (3.3.2), Engineered Safety Feature Actuation System Instrumentation**
		  • **Action 17 Applies for Turbine Trip and FW Isolation from S/G water Level High High.**
		  • **Action 36 applies for S/G water level low low AFW start**
		  • **Action 22 c applies for P-14 Interlock**
		• 3.3.3.5, Remote Shutdown Instrumentation – N/A
		• **3.3.3.7, Accident Monitoring Instrumentation**
		  • **Action 1 applies (30 days)**

Op Test No.:	NRC	Scenario #	4	Event #	3	Page	20	of 44
Event Description:	Steam Generator #3 NR Level Transmitter fails low							

Time	Position	Applicant's Actions or Behavior
NOTE: If performing AOP in conjunction with AOP-I.11 for an Eagle LCP failure, then actions to hard trip bistables should be delayed until Eagle system reset is attempted. Actions to hard trip bistables must be completed within 6 hours UNLESS affected loop is restored to operable status by resetting Eagle rack.		
		NOTIFY IM to remove failed S/G level instrument from service **USING** appropriate Appendix: L-3-107 – Appendix W
When Technical Specifications are addressed, the Lead Examiner may cue the next event		

Op Test No.: NRC Scenario # 4 Event # 4 Page 21 of 44

Event Description: FW Hdr Press Transmitter Fails low (PT-3-1)

Time	Position	Applicant's Actions or Behavior
		Console Operator: **When directed, initiate Event 4**
		Indications available: **MFW Pump speed increases increasing FW flow to all S/G** **Hotwell level decreases due to increased FW demand** **Alarm: XA-55-3C, C-1 "PS-3-4 NO 1 FW HTR PRESSURE HI"**
		Evaluator Note: For this event, crew may respond per the Annunciator Response Procedure or AOP-S.01 Section 2.2. Both are not required. The ARP is outlined first then the AOP.
	BOP	Take Manual Control of MFP Master Speed control and reduce Feedwater pressure and Flow.
	Crew	Refer to annunciator Response procedure.
	BOP	**[1] DISPATCH** operator to #1 feedwater heaters to verify the following valves open: a. 1-PSV-3-4 b. 1-PSV-3-14 c. 1-PSV-3-24 **[2] REDUCE** feedwater pressure to ≤1100 psig. **[3] WHEN** pressure reduces to ~ 1100 psig, **THEN VERIFY** the above mentioned PSV's closed. **[4] IF** alarm still illuminated or by SRO decision, **THEN GO TO** AOP-S.01, Loss of Normal Feedwater.

Op Test No.: NRC Scenario # 4 Event # 4 Page 22 of 44

Event Description: FW Hdr Press Transmitter Fails low (PT-3-1)

Time	Position	Applicant's Actions or Behavior
	SRO (Optional)	Implement AOP-S.01 Section 2.2.
NOTE: Step 1 is an IMMEDIATE ACTION.		
	BOP	**RESTORE** feedwater pressure: a. **PLACE** affected MFP speed controller(s) in MANUAL: • MFPT 1A(2A) & 1B(2B) Speed Control **OR** • MFPT 1A(2A) Speed Controller **OR** • MFPT 1B(2B) Speed Controller b. **ADJUST** speed on affected MFP(s) to restore feedwater pressure to normal (~1040 psig at full power).

Op Test No.: NRC Scenario # 4 Event # 4 Page 23 of 44

Event Description: FW Hdr Press Transmitter Fails low (PT-3-1)

Time	Position	Applicant's Actions or Behavior
	BOP	**DETERMINE** if MFP trip is needed: a. **CHECK** BOTH MFWPs in service. b. **IF** MFW pump trip is needed due to loss of speed control, **THEN** **PERFORM** the following: 1) **TRIP** affected MFP. 2) **GO TO** applicable section: (Step Should be N/A)
CAUTION:	**Feed flow transients may impact core thermal power.**	
	BOP	**MAINTAIN** steam generator level(s) on program.
NOTE:	Appendix C may be used to determine program feedwater D/P for current power.	
	BOP	**MAINTAIN** MFP discharge pressure on program **USING** ICS or available control board indications.

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Event Description: FW Hdr Press Transmitter Fails low (PT-3-1)

Time	Position	Applicant's Actions or Behavior
	CREW	**INITIATE** repairs on failed equipment.

When Plant is stable with MFP speed control in manual, Lead Examiner may cue the next event at his discretion.

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Event Description: Small Steam Leak Outside containment on loop 3

Time	Position	Applicant's Actions or Behavior
Booth Instructor: **When directed, initiate Event 5**		
Indications available: **NIS Power Increasing** **Condenser Hotwell level decrease**		
	Crew	Diagnose Secondary leak outside containment based on NIS power increase, containment conditions normal, Hotwell level decreasing
	SRO	Enter and direct actions of AOP-S.01, *Steam Line or Feedwater Line BreaK/Leak.*
	SRO	**MONITOR** actions necessary to protect personnel: • **IF** immediate isolation of steam/feedwater lines is needed to protect personnel, **THEN** **PERFORM** the following: a) **TRIP** the reactor. b) **WHEN** reactor is tripped, **THEN** **CLOSE** MSIVs and FEED REG VALVES. c) **GO TO** E-0, Reactor Trip or Safety Injection.

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Event Description: Small Steam Leak Outside containment on loop 3

Time	Position	Applicant's Actions or Behavior
	RO	**MONITOR** reactor power STABLE or CONTROLLED. (RNO May Be performed later when leak increases to break) **PERFORM** the following: a. **TRIP** the reactor. b. **WHEN** reactor is tripped, **THEN** **CLOSE** MSIVs. c. **GO TO** E-0, Reactor Trip or Safety Injection.
	RO	**MONITOR** reactor power less than 100%
	BOP	**MONITOR** steam generator levels STABLE on program.
	RO	**MONITOR** T-avg/T-ref deviation less than 5°F.
	SRO	**EVALUATE** EPIP-1, Emergency Plan Initiating Conditions Matrix. (Notify Shift Manager to Evaluate REP)

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Event Description: Small Steam Leak Outside containment on loop 3

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** hotwell level STABLE: • **VERIFY** LCV-2-9 maintaining hotwell level in AUTO. (RNO May be required) **INITIATE** makeup to hotwell at 100% [M-2]: a. **PLACE** LIC-2-9, Auto Makeup, in MANUAL. b. **OPEN** LCV-2-9 **USING** LIC-2-9, Auto Makeup, to fill hotwell. c. **IF** loss of hotwell level is imminent, **THEN** **PERFORM** the following: 1. **TRIP** the reactor. 2. **WHEN** reactor is tripped, **THEN** **CLOSE** MSIVs. 3. **GO TO** E-0, Reactor Trip or Safety Injection.
NOTE	Tech Spec LCO 3.6.1.4 action is applicable if containment pressure exceeds 0.3 psig.	
	RO	**MONITOR** containment pressure STABLE.

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Event Description: Small Steam Leak Outside containment on loop 3

Time	Position	Applicant's Actions or Behavior
	BOP/RO	**CHECK** the following containment parameters NORMAL: • Containment temperature • Containment humidity

Lead Examiner may initiate next event to increase leak to a large break at or before this point when crew has determined there is a secondary leak outside containment.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior

Booth Instructor:

When directed, initiate Event 6

Indications available:

Steam Leak Increases to Large Break:
- **NIS Power Increasing**
- **Hotwell Level decreasing**
-

ATWS:
- **Reactor Trip breakers still closed after attempting to open with both Rx Trip switches.**
-

Rods Fail to Move in auto:
- **Rods stop moving 5 seconds following turbine trip.**

Motor Driven AFW Pump Level control valve to Loop 3 fails open:
- **Red position indicating light remains on when attempting to manually close**
- **Continued Flow to Faulted S/G when attempting to manually isolate.**

	SRO	Direct manual Rx Trip and MSIV closure based on AOP-S.05 criteria. (Rx Power not stable or Loss of Hotwell Level Imminent)
	RO	Identify ATWS after attempting both Rx trip Switches.
	US	Direct entry to FR-S.1, Nuclear Power Generation/ATWS

CAUTION: RCPs should NOT be tripped with reactor power greater than 5%.

NOTE: Steps 1 and 2 are immediate action steps.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior

Evaluator Note: Crew may close MSIV's and attempt to isolate AFW to faulted S/.G WHEN REACTOR IS TRIPPED during performance of FR-S.1. When attempting to isolate AFW, level control valve will not close and crew may elect to stop 1B AFW Pump at that time.

CRITICAL TASK	RO	**VERIFY** reactor TRIPPED: • Reactor trip breakers OPEN • Reactor trip bypass breakers OPEN or DISCONNECTED • Neutron flux DROPPING • Rod bottom lights LIT • Rod position indicators less than or equal to 12 steps. (RNO required) **TRIP** reactor. **IF** reactor trip breakers will NOT open, **THEN** **MAINTAIN** auto or manual rod insertion at max achievable rate UNTIL rods are at bottom ***(Should identify rod failing to insert automatically 5 sec after turbine Trip initiates rod insertion and begin manually inserting rods)***
	BOP	**VERIFY** turbine TRIPPED: • ALL turbine stop valves CLOSED

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	**CHECK** AFW System operation: MD AFW pumps RUNNING TD AFW pump RUNNING as necessary. ***(Not Running Tagged OOS in initial conditions)*** MD AFW LCVs in AUTO. TD AFW LCVs OPEN. MD AFW pump recirculation valves FCV-3-400 and FCV-3-401 CLOSED.
CRITICAL TASK	BOP	**EMERGENCY BORATE** RCS by performing the following: **a. ENSURE** at least one CCP RUNNING. **b. INITIATE** Emergency Boration **USING** EA-68-4. • **PLACE** boric acid transfer pumps in fast speed. • **ADJUST** emergency borate valve **[FCV-62-138]** to obtain boric acid flow between 35 gpm and 150 gpm on **[FI-62-137A]**. • **MONITOR** emergency boration flow: **a. CHECK** emergency boration flow established on **[FI-62-137A]**. **b. IF** boric acid flow less than 35 gpm, **THEN (N/A)** **c. VERIFY** charging flow path established: • FCV-62-90 OPEN • FCV-62-91 OPEN • FCV-62-86 or FCV-62-85 OPEN. **d. CHECK** pressurizer pressure less than 2335 psig.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	Crew	**VERIFY** Containment Purge isolated: **VERIFY** containment purge and vent dampers (System 30) CLOSED. [Panel 6K and 6L]
	Crew	**MONITOR** SI NOT actuated: • S.I. ACTUATED permissive DARK [M-4A, D4]. (RNO required If SI occurs during performance of FR-S.1) **IF** SI actuated, **THEN** **PERFORM** the following WHILE continuing with this procedure: a. E-0, Reactor Trip or Safety Injection, Steps 1 through 4. b. ES-0.5, Equipment Verifications.
	Crew	Reactor TRIPPED. (RNO) **PERFORM** the following: • **DISPATCH** personnel to locally open reactor trip breakers and MG set output breakers [MG Set Room, Aux Bldg el. 759]. • **DISPATCH** personnel to locally open breakers to MG sets [480V Unit Boards A and B]. ***(Evaluator Note: Crew will likely have dispatched personnel prior to reaching this step)***

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	Turbine TRIPPED: • ALL turbine stop valves CLOSED.
	RO	**MONITOR** reactor subcritical: • Power range channels less than 5%. • Intermediate range SUR NEGATIVE.
	SRO	**GO TO** Step 19.
	SRO	**19. ENSURE** status tree monitoring initiated.
	RO	**MONITOR** boration termination criteria: • **NOTIFY** Chem Lab to sample RCS boron concentration. • **CHECK** for all of the following: o all control rods FULLY INSERTED o RCS temperature greater than 540°F o no RCS dilution has occurred.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	RO/US	**WHEN** emergency boration is no longer needed, **THEN STOP** emergency boration **USING** EA-68-4, Emergency Boration.
	SRO	**RETURN TO** procedure and step in effect.
	SRO	Directs transition to E-0, Reactor Trip or Safety Injection
	RO	VERIFY reactor TRIPPED: • Reactor trip breakers OPEN • Reactor trip bypass breakers DISCONNECTED or OPEN • Neutron flux DROPPING • Rod bottom lights LIT • Rod position indicators less than or equal to 12 steps.
	BOP	VERIFY turbine TRIPPED: • Turbine stop valves CLOSED.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	VERIFY at least one train of shutdown boards ENERGIZED.
	RO	DETERMINE if SI actuated: • ECCS pumps RUNNING. • Any SI alarm LIT [M-4D] **(May manually actuate SI if not already actuated. Auto SI will likely occur when MSIV's are closed after Rx Trip in FR-S.1 and faulted S/G continues to depressurize)**
	BOP	PERFORM ES-0.5, Equipment Verifications WHILE continuing in this procedure. **(At end of scenario)**
	RO	DETERMINE if secondary heat sink available: a. CHECK total AFW flow greater than 440 gpm. b. CHECK narrow range level greater than 10% [25 ADV] in at least one S/G. c. CONTROL feed flow to maintain narrow range level between 10% [25% ADV] and 50% in all S/Gs.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	RO	CHECK if main steam lines should be isolated: a. CHECK if any of the following conditions have occurred: • Any S/G pressure less than 600 psig AND STEAMLINE PRESS ISOL SI BLOCK RATE ISOL ENABLE permissive DARK [M-4A, A4] OR • Any S/G pressure dropping UNCONTROLLED. OR • Phase B actuation b. ENSURE MSIVs and MSIV bypass valves CLOSED. ***(May have already closed MSIVs)*** c. **ENSURE** applicable Foldout Page actions COMPLETED. *(Includes AFW isolation to faulted S/G if not previously performed)*
NOTE: Loss of seal injection flow could adversely affect RCP seals.		
	RO	CHECK RCP trip criteria: a. CHECK the following: • RCS pressure less than 1250 psig. (NO) AND • At least one CCP OR SI pump RUNNING

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	RO BOP	MONITOR RCS temperatures: • IF any RCP running, THEN CHECK T-avg stable at or trending between 547 degrees F and 552 degrees F. (RNO) **IF temperature less than 547°F and dropping,** **THEN** **PERFORM the following:** a. **ENSURE steam dumps and atmospheric reliefs CLOSED.** b. **IF cooldown continues,** **THEN** **CONTROL total feed flow** **USING EA-3-8, Manual Control of AFW Flow.**
	RO	CHECK pressurizer PORV's, safeties, and spray valves: a. Pressurizer PORV's CLOSED. b. Pressurizer safety valves CLOSED. c. Normal spray valves CLOSED. d. Power to at least one block valve AVAILABLE. e. At least one block valve OPEN.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	RO/SRO	CHECK S/G secondary pressure boundaries INTACT: • All S/G pressures CONTROLLED or RISING **(NO)** • All S/G pressures greater than 140 psig. (RNO) **PERFORM** the following: a. **MONITOR** status trees. b. **GO TO** E-2, Faulted Steam Generator Isolation.
	SRO	Ensure Status Trees monitoring and Direct entry to E-2, Faulted SG Isolation. ***(Status Tree monitoring should already be implemented due to previous transition to FR-S.1)***
CAUTION	**Unisolating a faulted S/G or secondary break should NOT be considered UNLESS needed for RCS cooldown.**	
	RO/BOP	**CHECK** MSIVs and MSIV bypass valves CLOSED. ***(MSIV's should already be closed shortly after Rx Trip in FR-S.1 or in E-0 per foldout page)***
	RO/BOP	**CHECK** ANY S/G secondary pressure boundary INTACT: • Any S/G pressure controlled or rising.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	BOP	**IDENTIFY** Faulted S/G(s): **CHECK** S/G pressures: • Any S/G pressure DROPPING in an uncontrolled manner. **OR** • Any S/G pressure less than 140 psig.
Caution: Secondary heat sink requires at least one S/G available. **Caution:** Isolating both steam supplies to the TD AFW pump when it is the only source of feed flow will result in loss of secondary heat sink.		
Evaluator Note: AFW may have previously been isolated per E-0 fold-out page. If not previously performed, 1B AFW pump will be stopped until local isolation of loop 3 AFW LCV is performed since it failed open)		
CRITICAL TASK	RO/BOP	**ISOLATE** Faulted S/G(s): • **ISOLATE** MFW. • **ISOLATE** AFW. (RNO) • **CIOSE** valves manually of locally • **CLOSE** TD AFW pump steam supply from faulted S/G o FCV-1-15 (S/G 1) or FCV-1-16 (S/G 4). • **VERIFY** S/G blowdown valves CLOSED. • **VERIFY** atmospheric relief CLOSED.

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Event Description: Steam leak increases to large break, ATWS occurs, Rods fail to move in auto (5 sec delay) and MDAFW pump Lvl Control Vlv to faulted S/G fails open.

Time	Position	Applicant's Actions or Behavior
	RO/BOP	**CHECK** CST level greater than 5%.
	BOP	**VERIFY** secondary radiation NORMAL: a. **CHECK** secondary radiation NORMAL **USING** Appendix A, Secondary Rad Monitors. (App. A also contained in ES-0.5) b. **NOTIFY** Chem Lab to take S/G activity samples.
	Crew	**CHECK** SI termination criteria: a. RCS subcooling based on core exit T/Cs greater than 40°F. b. Secondary heat sink: • Narrow range level in at least one Intact S/G greater than 10% [25% ADV] **OR** • Total feed flow to Intact S/Gs greater than 440 gpm. c. RCS pressure stable or rising. d. Pressurizer level greater than 10% [20% ADV]. e. **GO TO** ES-1.1, SI Termination.
Scenario may be terminated when crew transitions to ES-1.1, SI Termination		

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		ES-0.5 Actions
	BOP	**CHECK** ERCW system operation: • **VERIFY** at least four ERCW pumps RUNNING. • **VERIFY** D/G ERCW supply valves OPEN.
	BOP	**VERIFY** CCS pumps RUNNING: • Pump 1A-A (2A-A) • Pump 1B-B (2B-B) • Pump C-S.
	BOP	**VERIFY** EGTS fans RUNNING.
	BOP	**VERIFY** generator breakers OPEN.
	BOP	**VERIFY** AFW pumps RUNNING: • MD AFW pumps • TD AFW pump.

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
		NOTE AFW level control valves should NOT be repositioned if manual action has been taken to control S/G levels, to establish flow due to failure, or to isolate a faulted S/G.
	BOP	**CHECK** AFW valve alignment: a. **VERIFY** MD AFW LCVs in AUTO. b. **VERIFY** TD AFW LCVs OPEN. c. **VERIFY** MD AFW pump recirculation valves FCV-3-400 and FCV-3-401 CLOSED.
	BOP	**VERIFY** MFW Isolation: • MFW pumps TRIPPED • MFW regulating valves CLOSED • MFW regulating bypass valve controller outputs ZERO • MFW isolation valves CLOSED • MFW flow ZERO.
	BOP	**MONITOR** ECCS operation: **VERIFY** ECCS pumps RUNNING: • CCPs • RHR pumps • SI pumps

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**VERIFY** CCP flow through CCPIT. • **CHECK** RCS pressure less than 1500 psig. • **VERIFY** SI pump flow. • **CHECK** RCS pressure less than 300 psig. • **VERIFY** RHR pump flow.

	BOP	**VERIFY** ESF systems ALIGNED:
		
		• Phase A ACTUATED:
		  o CONTAINMENT ISOLATION PHASE A TRAIN A alarm LIT [M-6C, B5].
		  o CONTAINMENT ISOLATION PHASE A TRAIN B alarm LIT [M-6C, B6].
		
		• Containment Ventilation Isolation ACTUATED:
		  o CONTAINMENT VENTILATION ISOLATION TRAIN A alarm LIT [M-6C, C5].
		  o CONTAINMENT VENTILATION ISOLATION TRAIN B alarm LIT [M-6C, C6].
		
		• Status monitor panels:
		  o 6C DARK
		  o 6D DARK
		  o 6E LIT OUTSIDE outlined area
		  o 6H DARK
		  o 6J LIT.
		
		• Train A status panel 6K:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN
		
		• Train B status panel 6L:
		  o CNTMT VENT GREEN
		  o PHASE A GREEN

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Event Description: Equipment Verifications

Time	Position	Applicant's Actions or Behavior
	BOP	**MONITOR** containment spray NOT required: • Phase B NOT ACTUATED **AND** • Containment pressure less than 2.81 psig • Ensure Containment Spray is actuated
	BOP	**VERIFY** pocket sump pumps STOPPED: [M-15, upper left corner] • HS-77-410, Rx Bldg Aux Floor and Equipment Drain Sump pump A • HS-77-411, Rx Bldg Aux Floor and Equipment Drain Sump pump B.
	BOP	**DISPATCH** personnel to perform EA-0-1, Equipment Checks Following ESF Actuation.