

# WOLF CREEK NUCLEAR OPERATING CORPORATION

DATE: December 3, 2009

TO: Gabe Apper (USNRC)

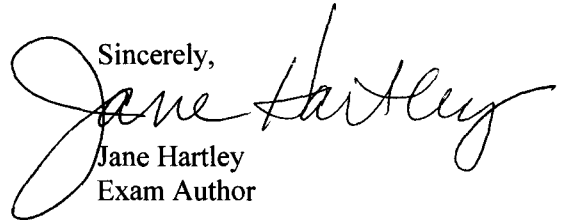
FROM: Jane Hartley (WCNOC)

SUBJECT: Wolf Creek Generating Station FINAL Operating Examination

Dear Mr. Apper,

The FINAL Operating Examination for the examination scheduled to occur December 15, 2009 was sent electronically to you on December 3, 2009. The FINAL Operating Examination was developed in accordance with NUREG 1021 Revision 9, Supplement 1 and clarifications as described on the NRC Web page and reflects your comments made per telephone conversation of November 17, 2009.

Sincerely,



Jane Hartley  
Exam Author

Changes per Gabe – 11-17-09:

Scenario #2:

- P. 23 Event 4: Put in an Examiner's Note that explains 42A and 42E
- P. 54: delete "terminate scenario..."

Scenario #3:

- P. 11 Event 2 header: Change 514 to 514A
- P. 18 Event 3: remove B4 and B5 steps
- P 19, 20, 21, 22: Label as Event 3
- P 23: Label as Event 4, 5, and 6

Facility: <u>Wolf Creek</u> Scenario No.: <u>1</u> Op-Test No.: _____			
Examiners: _____ Operators: _____ _____ _____			
Initial Conditions: <u>100% power, EOL</u>			
Turnover: EDG “B” out of service for Maintenance PM’s – expected back in six hours. TS 3.8.1 conditions A & B entered; STS NB-005, Breaker Alignment Verification has been completed – due in seven hours.			
MDAFW pump “B” tagged out/out of service due to Emergent work (SM Concern). Expected return is six hours. TS 3.7.5 condition B entered.			
Event No.	Malf. No.	Event Type*	Event Description
1 t+2	mBB22 A	I -- ATC, SRO	PZR level channel BB LI-459A failure high. OFN SB-008, Instrument Malfunctions, Attachment J
2 t+8	bkrDPA D01A	R – ATC  C – BOP, SRO	Condensate pump “A” trip  OFN AF-025, Unit Limitations, Attachment A  OFN MA-038, Rapid Plant Shutdown
3 t+25	mSG01  mSF15A mSF15B	M - All	Seismic event followed by a Reactor trip occurs. EMG E-0, Reactor Trip or Safety Injection  This event series sets up the scenario for the Major event EMG FR-H1, Response to Loss of Secondary Heat Sink.

4 t+25	mNB01 mNB02  mNE02 A	C -- ATC, SRO	(Post Reactor trip) NB01 & NB02 trip  (Post reactor trip) EDG "A" autostart feature disabled – manual available  <b>(CT – start EDG "A" in order to energize NB01 bus)</b>  Recall NB02 bus unavailable because EDG "B" out of service as part of Turnover item.
5 t+25	mAL02  mtrDPA L01A  mBG13 A	M – All	TDAFW pump trip (broken linkage)  MDAFW pump "A" trip (shaft seizure)  CCP "A" trips due to overcurrent  Loss of all Auxiliary Feedwater EMG FR-H1, Response to Loss of Secondary Heat Sink  <b>(CT - Establish RCS bleed and feed before Steam Generators dry out)</b>
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor			

Scenario summary:

Plant is at 100% power, End of life (EOL). Emergency Diesel Generator (EDG) “B” is tagged out/out of service for Maintenance – Preventative Maintenance (PM). Expected return is six hours. Technical Specifications (TS) 3.8.1 condition A & B entered. STS NB-005, Breaker Alignment Verification, complete (due in seven hours).

Motor Drive Auxiliary Feedwater Pump (MDAFWP) “B” is tagged out/out of service due to Emergent work (SM Concern). Expected return is six hours. Technical Specification 3.7.5 condition B entered.

Pressurizer (PZR) controlling level channel BB LI-459A fails high. Crew responds using OFN SB-008, Instrument Malfunctions, Attachment J.

- Attachment J: Select an alternate level channel as the controlling channel.
- Crew stabilizes the plant.

Condensate pump “A” trips. The crew responds by entering OFN AF-025, Unit Limitations. Attachment A will require a downpower evolution.

Downpower guidance per OFN AF-025: If one condensate pump is lost, reduce power as necessary to maintain Main Feed Pump (MFP) suction pressure greater than 340 psig on AEP0006 for “A” MFP and AEP0005 for “B” MFP.

- Crew responds by performing a downpower.
- Crew stabilizes the plant.

A seismic event occurs resulting in an inadvertent reactor trip. EMG E-0, Reactor Trip or Safety Injection is entered. (Major event)

Post trip, both NB01 and NB02 busses trip. Due to the Maintenance PM’s (see Turnover item), Emergency Diesel Generator “B” will not start and load onto NB02 bus. The Control Room must manually start Emergency Diesel Generator “A” and then it will load onto NB01 bus.

As the scenario progresses, the Turbine Driven Auxiliary Feedwater Pump (TDAFWP) trips due to broken linkage and the Motor Driven Auxiliary Feedwater Pump “A” will trip due to shaft seizure and BOTH cannot be restarted. Motor Driven Auxiliary Feedwater Pump “B” cannot be started (see Turnover item). No Auxiliary Feedwater (AFW) to the Steam Generators is available. Note that the running CCP (CCP “A”) trips off due to overcurrent.

The crew enters EMG FR-H1, Response to Loss of Secondary Heat Sink (Major event).

Mitigation strategy: the crew uses the Foldout page of EMG FR-H1, Bleed and Feed.

EMG FR-H1, Response to Loss of Secondary Heat Sink, Major Actions:

- Attempt restoration of RCS bleed and feed flow to the S/Gs
- Initiation of RCS bleed and feed heat removal
- Restore and verify secondary heat sink

- Termination of RCS bleed and feed heat removal

Scenario has two Critical Tasks (CT):

1. Starting the EDG “A” to re-energize NB01 bus before placing safeguards equipment in pull-to-lock or prior to any needless Orange or Red path entry conditions.
2. Establish RCS bleed and feed before Steam Generators (SG) dry out establishing a heat sink for the core.

Probabilistic Risk Analysis for this scenario includes:

**Top 10 Human Action Failures by the Importance Measure Rankings**  
(Reference PSA-07-0001)

F-V Rank	RRW Rank	Total Rank	Event Name	Description	Point Est.	F-V	RAW	RRW	Birnbau m
1	8	34	OPA-OD1-EXE	FAILURE OF RCS COOL DOWN & DEPRESSURIZE - SGR EVENT - EXE	4.89E-03	2.61E-02	6.32	1.027	9.64E-05
2		39	OPA-OD2-EXE	FAILURE OF RCS COOL DOWN & DEPRESSURIZE AFTER OVERFIL-EXE	5.00E-02	2.49E-02	1.47	1.026	8.97E-06
3	9	40	OPA-RR1-EXE	FAILURE TO ALIGN & START 1 SI OR CCP PUMP - EXE	4.68E-03	2.45E-02	6.2	1.025	9.43E-05
4		41	OPA-OFB-EXE	FAILURE TO ESTABLISH FEED & BLEED COOLING - EXE	2.97E-02	2.40E-02	1.78	1.025	1.46E-05

Technical Specifications exercised:

Event 1: TS 3.3.1, Reactor Trip System Instrumentation, Table 3.3.1-1 FU 9

Cond A: Required function inoperable – enter condition per Table (immediately)

Cond M: One channel inoperable – place channel in trip (72 hours)

TS 3.3.4, Remote Shutdown Instruments, Table 3.3.4-1 FU 12

Minimum channels met – no action required

TS 3.3.3. Accident Monitoring Instrumentation, Table 3.3.3-1, FU 11

Minimum channels met – no action required

Op-Test No.:	Scenario No.:	Event No.:	1	1	Page <u>5</u> of <u>29</u>
Event Description: <u>PZR level channel BB LI-459 failure high</u>					

**BOOTH INSTRUCTIONS:** Set up simulator in IC 49, RBU at 229, CWP enabled, Blue placard on “B” CCP. Run files etc.

When directed, INITIATE Event 1 by activating KEY 1.

**INDICATIONS:**  
Meter BB LI-459 indication high

Main Control Board alarms:  
00-032D, PZR HI LEV DEV HTRS ON  
00-083C, RX PARTIAL TRIP  
Bistable PZR HI WTR LEV LB459A

Time	Position	Applicant’s Actions or Behavior
	CREW	Respond to Main Control Board (MCB) alarms and board indications. Actions taken prior to procedure entry may include: Identifies BB LI-459 failure, Select MANUAL on PZR LEVEL CONTROLLER (BB LK-459)
	CREW	<b>ENTER</b> OFN SB-008, rev 26, Instrument Malfunctions
	CREW	1. Check if Secondary System instrument channel is malfunctioning. a. Determine appropriate attachment for malfunctioning channel or controller <i>a. RNO: If secondary system channel is NOT malfunctioning, then go to step 2.</i>

Op-Test No.:	Scenario No.:	Event No.:	Page <u>6</u> of <u>29</u>
	1	1	
Event Description: <u>PZR level channel BB LI-459 failure high</u>			

Time	Position	Applicant's Actions or Behavior
	CREW	2. Check if RCS instrument channel or controller is malfunctioning a. Determine appropriate attachment for malfunctioning channel or controller  From Table determine: BB LI-459, Go to Att. J, PZR Level Channel Malfunction  b. Go to appropriate attachment for malfunctioning RCS channel or controller
	CRS	<b>ENTER</b> Attachment J, PZR Level Channel Malfunction
	RO	J1. Identify failed instrument channel a. Compare Pressurizer level indications to confirm a Pressurizer level channel failure: <ul style="list-style-type: none"> <li>○ BB LI-459A</li> </ul>
	RO	J2. Check failed Pressurizer level channel selected on PZR LEV CTRL SEL switch. <ul style="list-style-type: none"> <li>○ BB LS-459D</li> </ul>
	RO	J3. Select alternate Pressurizer level channel on PZR LEV CTRL SEL switch. <ul style="list-style-type: none"> <li>○ BB LS-459D</li> </ul> Selection options: L461/L460 or L459/L460 or L459/L461  RO should select L461/L460



Op-Test No.:	Scenario No.:	Event No.:	Page <u>7</u> of <u>29</u>
Event Description: <u>PZR level channel BB LI-459 failure high</u>			
<b>Time</b>	<b>Position</b>	<b>Applicant's Actions or Behavior</b>	
NOTE			
Letdown flow is isolated and Pressurizer control heaters are deenergized if the controlling level falls below 17%. Both must be manually realigned once level control is re-established.			
	RO	J4. Check letdown flow – ESTABLISHED	
	RO	J5. Manually control charging and letdown to stabilize Pressurizer level at level appropriate for plant power.	
	RO	J6. Ensure PZR control heaters – ON	
	RO	J7. Place charging/letdown flow control in automatic	
	RO	J8. Monitor PZR level response to ensure proper control	
	CRS	J9. Check failed PZR level channel – NOT USED FOR RECORDER	

Op-Test No.:	Scenario No.:	Event No.:	1	1	Page <u>8</u> of <u>29</u>
Event Description: <u>PZR level channel BB LI-459 failure high</u>					

Time	Position	Applicant's Actions or Behavior
	CRS	J10. Monitor the following Technical Specification LCO's and comply with Action Statements as appropriate:  TS 3.3.1, Reactor Trip System Instrumentation, Table 3.3.1-1 FU 9 Cond A: Required function inoperable – enter condition per Table (immediately) Cond M: One channel inoperable – place channel in trip (72 hours)  (FYI: TS 3.3.4, Remote Shutdown Instruments, Table 3.3.4-1 FU 12; Minimum channels met – no action required TS 3.3.3. Accident Monitoring Instrumentation, Table 3.3.3-1, FU 11; Minimum channels met – no action required)

**Lead Examiner may direct initiation of the next event at his discretion.**

Op-Test No.:	Scenario No.:	Event No.:	Page 9 of 29
Event Description: Condensate pump "A" trip.		1	2
<b>BOOTH INSTRUCTIONS:</b> When directed, INITIATE Event 2 by activating KEY 2.			
<b>INDICATIONS:</b> AD HIS-1, CNDS Pump A, light indication change from RED to GREEN and AMBER (pump stopped / tripped) AD FIK-7B, CNDS Pump A Recirc CTRL, from AUTO to MAN (0 % output to 100% output) AD ZL-7B, CNDS Pump A Recirc Valve, light indication from GREEN to RED AD PI-25, CNDS Pumps Disch Press, indicates decreasing pressure  Main Control Board alarms: ALR 00-107C, CNDS PMP SUCT STR ΔP HI ALRs 00-120B / 123B, MFP A/B SUCT PRESS LO			
Time	Position	Applicant's Actions or Behavior	
	CREW	Responds to MCB alarms and board indications. Identify "A" Condensate pump is tripped.	
	CREW	<b>ENTER</b> OFN AF-025, rev 28, Unit Limitations	
	CRS	1. Determine applicable step: <ol style="list-style-type: none"> <li>Check Stator Cooling Water System - NORMAL</li> <li>Check Generator Hydrogen System – NORMAL</li> <li>Check Main Transformers – NORMAL</li> <li>Check all the following transformers - NORMAL <ul style="list-style-type: none"> <li>○ Start-up transformer</li> <li>○ XNB01 transformer</li> <li>○ XNB02 transformer</li> <li>○ Unit Auxiliary transformer</li> </ul> </li> <li>Check Condenser Vacuum - NORMAL</li> <li>Go to step 7.</li> </ol>	

Op-Test No.:	Scenario No.:	Event No.:	1	2	Page 10 of 29
Event Description: Condensate pump "A" trip					
Time	Position	Applicant's Actions or Behavior			
	CRS	7. Check Westar Transmission Services (WETS) has reported an actual or predicted switchyard voltage degradation -- NO <i>RNO: go to step 9</i>			
	CRS	9. Check for conditions requiring Unit Load reduction: a. Determine maximum unit load using Attachment A, Unit Load Limits b. Reduce unit load, as necessary, to satisfy load limits using the appropriate procedure * GEN 00-004, Power Operation OR * GEN 00-005, Minimum Load to Hot Standby OR * OFN MA-038, Rapid Plant Shutdown OR * Attachment D, Turbine/Generator Load Decrease using Steam Dumps			
	CRS	Attachment A, Unit Load Limits, Feed & Condensate section: <u>Condition requiring load reduction</u> <u>Maximum Unit Load</u> One Condensate pump out of service → see NOTE (2)  Note 2: If one condensate pump is lost, reduce power as necessary to maintain MFP suction pressure greater than 340 psig on AEP0006 for A MFP and AEP0005 for B MFP.			

Op-Test No.:	Scenario No.:	Event No.:	1	2	Page <u>11</u> of <u>29</u>
Event Description: <u>Condensate pump "A" trip</u>					
<b>Applicant's Actions or Behavior</b>					
<p><b>BOOTH Cue:</b> Call as Shift Manager or Call Superintendent to direct use of OFN MA-038, Rapid Plant Shutdown.</p> <p>If contacted as System OPS Generation or System Transmission, acknowledge Wolf Creek Turbine/Generator load reduction.</p>					
	CREW	<b>ENTER</b> OFN MA-038 rev 11, Rapid Plant Shutdown			
NOTES					
<ul style="list-style-type: none"> <li>○ Foldout page shall be monitored throughout this procedure.</li> <li>○ Steps 1-4 may be performed in any order.</li> <li>○ Load reduction at greater than 5% / minute will arm condenser steam dumps.</li> <li>○ When reducing load with Decrease Loading Rate on, the difference between load set and actual load should be less than 200MW. Prior to depressing the Hold or Off pushbuttons or establishing Load Limit control, ensure the At Set Load light is on to prevent an uncontrolled load decrease.</li> </ul>					

Op-Test Scenario Event  
 No.: \_\_\_\_\_ No.: 1 No.: 2 Page 12 of 29

Event  
 Description: Condensate pump "A" trip

Time	Position	Applicant's Actions or Behavior
	CRS/BOP	1. (ρ) Reduce turbine load <ul style="list-style-type: none"> <li>a. Check desired unloading rate – ≤ 5% / minute</li> <li>b. Place control valves in their operating range as necessary by slowly decreasing load limit pot until a 1-2 MWe load decrease is noted</li> <li>c. Slowly decrease Load Set MW until AT SET LOAD light is on and LOAD LIMIT LIMITING light extinguishes</li> <li>d. Raise Load Limit pot slightly</li> <li>e. Set Loading/Unloading Rate Limit to desired value and adjust as necessary during decrease to maintain desired rate</li> <li>f. Select Decrease Loading Rate – ON</li> <li>g. Decrease Load Set MW toward desired load</li> <li>h. Continue with this procedure while reducing turbine load</li> </ul>
<p><b>BOOTH Cue:</b></p> <p>If called as Work Week Manager (WWM), acknowledge request to repair "A" Condensate Pump &amp; will form a team for the repairs. If asked, repairs shouldn't take more than a few hours.</p>		
	CRS/RO	2. (ρ) Borate RCS and adjust control rods as necessary to maintain the following: <ul style="list-style-type: none"> <li>○ Target Tavg/Tref temperature error between 0°F and +5°F</li> <li>○ Control rods above the rod insertion limits</li> </ul>

Op-Test No.: ___ Scenario No.: <u>1</u> Event No.: <u>2</u>		Page <u>13</u> of <u>29</u>
Event Description: <u>Condensate pump "A" trip – RO actions to Borate (Operator Aid)</u>		
Time	Position	Applicant's Actions or Behavior
	RO	<p>SYS BG-200 rev 35, Attachment B, Boration for Temperature Adjustment in Mode 1 and 2</p> <p style="text-align: center;">NOTE</p> <p>A licensed operator shall peer check reactivity manipulations.</p> <p>B.1 Setup to borate the RCS:</p> <p>B.1.1 (p) Turn on PZR HTR B/U GROUP A &amp; B, as directed by CRS, to mix Reactor Coolant System with Pressurizer water</p> <ul style="list-style-type: none"> <li>* BB HIS-51A for group A - ON</li> <li>* BB HIS-52A for group B – ON</li> </ul> <p>B.1.2 BG HS-26 to Normal-After-Stop</p> <p>B.1.3 BG HS-25 to Borate</p> <p>B.1.4 BG FK-110 in Auto at desired rate</p> <p>B.1.5 BG FY-110B, BA counter, set to desired gallons</p> <p>B.2 Commence Boration</p> <p>B.2.1 BG HS-26 to Normal-After-Run</p> <p>B.2.2. Verify:</p> <ol style="list-style-type: none"> <li>1. One BORIC ACID TRANSFER PUMP running</li> <li>2. BG HIS-110B open</li> <li>3. BG HIS-110A throttles open</li> <li>4. BG FR-110 red pen at proper flowrate</li> </ol> <p>B.3 Ensure boration stops at BG FY-110B setpoint</p> <p style="text-align: center;">NOTE</p> <p>Pressurizer Backup Heaters are normally placed in auto.</p> <p>B.4 As directed by CRS, place PZR HTR B/U GROUP A &amp; B in desired position after sufficient time for mixing as elapsed.</p> <ul style="list-style-type: none"> <li>o BB HIS-51A for group A - _____</li> <li>o BB HIS-51B for group B - _____</li> </ul> <p>B.5 Realign for auto operation:</p> <p>B.5.1 BG HS-26 to Normal-After-Stop</p> <p>B.5.2 BG HS-25 to Auto</p> <p>B.5.3 BG FK-110 set for Auto makeup</p> <p>B.5.4 BG HS-26 to Normal-After-Run</p> <p>B.5.5 If desired, then perform Attachment C, Boric Acid Potentiometer Adjustment</p>

Op-Test No.:	Scenario No.:	Event No.:	Page 14 of 29
	1	2	
Event Description: <u>Condensate pump "A" trip</u>			
<u>(OFN MA-038 procedure steps continued)</u>			
Time	Position	Applicant's Actions or Behavior	
	RO	3. Energize PZR backup heaters <ul style="list-style-type: none"> <li>○ BB HIS-51A</li> <li>○ BB HIS-52A</li> </ul>	
	BOP	4. (ρ) Check AE HV-38 - OPEN <ul style="list-style-type: none"> <li>○ AE HIS-38 CLOSED</li> </ul>	
	RO	5. Check PZR PORVs: <ul style="list-style-type: none"> <li>a. RCS pressure - &lt; 2335 psig</li> <li>b. PZR PORVs – CLOSED</li> <li>c. RCS pressure - &gt; 2185 psig</li> <li>d. PORV block valves - OPEN</li> </ul>	
	RO	6. Check PZR pressure – stable at or trending to 2235 psig	
	RO	7. Check PZR level – stable at or trending to program level	
	BOP	8. Check SG levels – controlling between 45% and 55%	



Op-Test No.:	Scenario No.:	Event No.:	1	2	Page <u>15</u> of <u>29</u>
Event Description: <u>Condensate pump "A" trip</u>					
Time	Position	Applicant's Actions or Behavior			
	CRS	9. Check reactor power – less than 60% -- <b>NO</b> , perform RNO <i>RNO:</i> <i>a. If final desired power level is greater than or equal to 60% then go to step 35</i> <i>b. If final desired power level is less than 60% then do not continue until reactor power is less than 60%</i>			
<b>Lead Examiner may direct initiation of the next event at his discretion.</b> <b>(When Main Feed pump suction pressure AEP0005 / 6 indicates greater than 300 psig, it is acceptable to transition to the next Event, as the plant is stable.)</b>					

Op-Test No.:	Scenario No.:	Event No.:	1	3	Page <u>16</u> of <u>29</u>
Event Description: <u>Seismic event and reactor trip</u>					

**BOOTH INSTRUCTIONS:** When directed, INITIATE Event 3 by activating KEY 3, inserting seismic event and inadvertent reactor trip.

**INDICATIONS:**

Main Control Board alarms:  
 00-098E, Seismic recorder ON  
 00-098D, OBE  
 00-098B, SSE

Reactor trip occurs – DRPI indicates all rods on bottom, MCB alarms annunciate

Time	Position	Applicant’s Actions or Behavior
	CREW	Respond to MCB indications.
	CRS	<b>ENTER</b> and Direct OFN SG-003 rev 16, Natural Events.
	CRS	1. Determine appropriate attachment for Natural Event: Attachment A, Earthquake Response
	CRS	2. Go to appropriate attachment
	CRS	Directs Attachment A, Earthquake Response

**BOOTH Cue:** Report as Security that an Earthquake has been felt.

	CRS	A1. Check EQ magnitude – GREAT ENOUGH TO START SEISMIC RECORDER
	CRS/CREW	<u>A2</u> . Stabilize Plant Conditions

Op-Test No.:	Scenario No.:	Event No.:	Page <u>17</u> of <u>29</u>
Event Description:		Seismic event and reactor trip	
Time	Position	Applicant's Actions or Behavior	
	CREW	ENTER EMG E-0, rev 23, Reactor trip or Safety Injection	
<b>FOLDOUT PAGE FOR EMG E-0</b>			
<p><b>1. RCP TRIP CRITERIA</b>                  IF all conditions listed below occur, THEN trip all RCPs:</p> <ul style="list-style-type: none"> <li>o RCS pressure - LESS THAN 1400 PSIG</li> <li>o CCPs or SI pumps - AT LEAST ONE RUNNING</li> <li>o Operator controlled cooldown - NOT IN PROGRESS</li> </ul> <p><b>2. SI ACTUATION CRITERIA</b>                  IF either condition listed below occurs, THEN actuate SI and go to EMG E-0, REACTOR TRIP OR SAFETY INJECTION, Step 1:</p> <ul style="list-style-type: none"> <li>* RCS subcooling - LESS THAN 30°F [45°F]</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>* Pressurizer level - CANNOT BE MAINTAINED GREATER THAN 6% [33%]</li> </ul> <p><b>3. FAULTED S/G ISOLATION CRITERIA</b>                  IF any S/G pressure decreasing in an uncontrolled manner OR any S/G completely depressurized, THEN the following may be performed:</p> <ul style="list-style-type: none"> <li>a. Close main steam isolation valves.</li> <li>b. Isolate feed flow to faulted S/G(s).</li> <li>c. Maintain total feed flow greater than 270,000 lbm/hr until narrow range level in at least one S/G is greater than 6% [29%].</li> </ul> <p><b>4. RUPTURED S/G ISOLATION CRITERIA</b>                  IF any S/G level increases in an uncontrolled manner OR any S/G has abnormal radiation, AND narrow range level in affected S/G(s) is greater than 6% [29%], THEN the following may be performed.</p> <ul style="list-style-type: none"> <li>a. Close ruptured S/G AFW flow control valves.</li> <li>b. IF any ruptured S/G AFW flow control valve cannot be closed AND total AFW flow to intact S/Gs can be maintained greater than 270,000 lbm/hr without associated AFW Pump, THEN perform the following:                         <ul style="list-style-type: none"> <li>1) Stop associated MD AFWP and place in PTL OR decrease TDAFWP speed to 2000 rpm.</li> <li>2) Dispatch an Operator to locally isolate affected AFW flow control valve.</li> <li>3) WHEN affected AFW flow control valve is isolated, THEN restart MD AFWP OR Restore TD AFWP speed as necessary.</li> </ul> </li> </ul> <p><b>5. COLD LEG RECIRCULATION CRITERIA</b>                  IF RWST level decreases to less than 36%, THEN go to EMG ES-12, TRANSFER TO COLD LEG RECIRCULATION, Step 1.</p> <p><b>6. AFW SUPPLY SWITCHOVER CRITERIA</b>                  IF CST suction pressure decreases to less than 2.6 psig, THEN switch to alternate AFW suction supply.</p>			
<b>CAUTION:</b>			
Accident conditions can cause higher than normal radiation levels. Health Physics monitoring may be required while performing local operator actions.			
<b>NOTES</b>			
<ul style="list-style-type: none"> <li>o Steps 1 through 4 are immediate action steps.</li> <li>o Foldout page shall be monitored throughout this procedure.</li> </ul>			

Op-Test No.:	Scenario No.:	Event No.:	Page 18 of 29
Event Description:		NB01 & NB02 trip. EDG A autostart feature disabled – manual start available.	
<b>Time</b>	<b>Position</b>	<b>Applicant's Actions or Behavior</b>	
<b>BOOTH INSTRUCTIONS:</b> Event 4 is preloaded (EDG A autostart feature disabled).			
<b>INDICATIONS:</b> Various MCB alarms No WHITE light LIT, NB ZL-5, 4.16 KV bus NB01 No WHITE light LIT, NB ZL-6, 4.16 KV bus NB02			
	CRS	<b>ENTER</b> EMG E-0, rev 23, Reactor Trip or Safety Injection	
	RO	<ol style="list-style-type: none"> <li>1. Verify Rx trip. <ol style="list-style-type: none"> <li>a. Check all rod bottom lights lit</li> <li>b. Ensure reactor trip breakers and bypass breakers open</li> <li>c. Check neutron flux decreasing</li> </ol> </li> </ol>	
	BOP	<ol style="list-style-type: none"> <li>2. Verify turbine trip. <ol style="list-style-type: none"> <li>a. Check the following: <ul style="list-style-type: none"> <li>* Main Stop valves – all closed OR</li> <li>* Turbine auto stop bistable light – at least two lit</li> </ul> </li> </ol> </li> </ol>	
	RO	<ol style="list-style-type: none"> <li>3. Check AC emergency busses – at least one energized; <b>NO</b>, perform RNO <ul style="list-style-type: none"> <li>* NB01 voltage- normal</li> <li>* NB02 voltage – normal</li> </ul> </li> </ol>	

Op-Test No.:	Scenario No.:	Event No.:	1	4	Page <u>19</u> of <u>29</u>
Event Description: NB01 & NB02 trip. EDG A autostart feature disabled – manual start available.					
Time	Position	Applicant’s Actions or Behavior			
NB01 & NB02 trip. EDG A autostart feature disabled – manual start available					
Recall: NB02 bus unavailable because EDG “B” out of service as part of Turnover item					
	RO	<p><u>3.RNO</u> Perform the following: (CT)</p> <p><b>CT: Starting the EDG “A” to re-energize NB01 bus before placing safeguards equipment in pull-to-lock or prior to any needless Orange or Red path entry conditions.</b></p> <p><b>Success: Start EDG A using KJ HS-8A</b></p> <p><i>a. Depress the Start/reset pushbutton for any stopped Diesel Generator</i></p> <ul style="list-style-type: none"> <li>○ KJ HS-8A for EDG A</li> <li>○ KJ HS-108A for EDG B</li> </ul> <p><i>b. If at least one AC emergency bus is now energized, then go to step 4.</i></p> <p><i>c. Direct operator to monitor Critical Safety Functions for information only using EMG F-0, Critical Safety Function Status Trees (CSFST).</i></p> <p><i>d. Go to EMG C-0, Loss of all AC Power, step 1</i></p>			
<b>Examiner Note:</b> Bus NB01 is energized by the EDG “A” once the Control Room starts the EDG.					

Op-Test Scenario Event  
 No.: \_\_\_\_\_ No.: 1 No.: 3, 4 Page 20 of 29

Event  
 Description: Seismic event, Reactor trip, EDG A autostart feature disabled (started From Control Room)

Time	Position	Applicant's Actions or Behavior
	RO	4. Check if Safety Injection is actuated: a. Check any indication SI is actuated – lit <ul style="list-style-type: none"> <li>* Ann. 00-030A/00-0031A, NF039A/B LOCA SEQ ACTUATED – lit OR</li> <li>* ESFAS status panel SIS section – any white lights lit OR</li> <li>* Partial trip status Permissive / Block status panel – SI red light lit</li> </ul> b. Check both trains of SI actuated <ul style="list-style-type: none"> <li>o Ann. 00-030A/00-031A, NF039A/B LOCA SEQ ACTUATED – lit</li> </ul> <i>RNO Perform the following:</i> <ol style="list-style-type: none"> <li>1. Check SI required:                             <ul style="list-style-type: none"> <li>* RCS pressure <math>\leq 1830</math> psig OR</li> <li>* Any SG <math>\leq 615</math> psig OR</li> <li>* CTMT pressure <math>\geq 3.5</math> psig OR</li> <li>* RCS subcooling <math>&lt; 30^{\circ}F</math> OR</li> <li>* PZR level <math>&lt; 6\%</math></li> </ul> </li> </ol>



Op-Test No.:	Scenario No.:	Event No.:	5	Page <u>22</u> of <u>29</u>
Event Description: <u>Loss of all Auxiliary Feedwater</u> <u>TDAFW pump trip (broken linkage), MDAFW pump "A" trip (shaft seizure) and CCP "A"</u> <u>pump trip.</u>				
<b>Time</b>	<b>Position</b>	<b>Applicant's Actions or Behavior</b>		
<b>BOOTH INSTRUCTIONS:</b> Event 5 failures are preloaded				
<p><b>BOOTH Cue:</b> If contacted as Building watches to investigate pump trips, respond: I will investigate.</p> <p>If contacted as Building watch to investigate TDAFW pump, report: TDAFW pump has a broken linkage.</p> <p>If contacted as Building watch to investigate MDAFW pump, report: MDAFW pump A has a shaft seizure.</p>				
<b>INDICATIONS:</b>				
Main Control Board alarms: 00-128A, AFP DISCH PRESS LO; 00-128E, TDAFP SPD HILO; 00-129A, MDAFP A TROUBLE; 00-042E, CHARGING PMP TROUBLE				
<b>Examiner Note:</b> STA/SE performing CSF trees. Diagnosis of valid entry into EMG FR-H1, Response to Loss of Secondary Heat Sink.				
	CRS	<b>ENTER</b> and Direct EMG FR-H1, rev 21, Response to Loss of Secondary Heat Sink		
<b>CAUTIONS</b>				
<ul style="list-style-type: none"> <li>○ If total feed flow is less than 270,000 lbm/hr due to operator action, this procedure shall not be performed.</li> <li>○ If a non-faulted S/G is available, feed flow shall not be reestablished to any faulted S/G.</li> </ul>				
<b>NOTE:</b>				
Foldout page shall be monitored throughout this procedure.				



Op-Test No.:	Scenario No.:	Event No.:	1	5	Page <u>23</u> of <u>29</u>
Event Description: <u>Loss of all Auxiliary Feedwater TDAFW pump trip (broken linkage), MDAFW pump "A" trip (shaft seizure) and CCP "A" pump trip.</u>					
Time	Position	Applicant's Actions or Behavior			
FOLDOUT PAGE FOR EMG FR-H1					
<p><b>1. BLEED AND FEED CRITERIA</b>                  IF RCS bleed and feed has NOT been established AND RCS pressure is greater than any non-faulted S/G pressure AND any condition listed below occurs, THEN OBSERVE CAUTION PRIOR TO STEP 29 and go to Step 29.</p> <ul style="list-style-type: none"> <li>* Wide range level in any 3 S/Gs - LESS THAN 26% [47%]</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>* RCS pressure - GREATER THAN 2335 PSIG DUE TO LOSS OF SECONDARY HEAT SINK</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>* CCPs - NONE AVAILABLE</li> </ul>					
<p><b>2. COLD LEG RECIRCULATION CRITERIA</b>                  IF RWST level decreases to less than 36%, THEN go to EMG ES-12, TRANSFER TO COLD LEG RECIRCULATION, Step 1.</p>					
<p><b>3. AFW SUPPLY SWITCHOVER CRITERIA</b>                  IF CST suction pressure decreases to less than 2.6 psig, THEN switch to alternate AFW suction supply.</p>					
<p><b>Examiner Note:</b> CRS may direct an attempt to "Reset" the CPP (BG HIS-1A). Crew diagnoses No CCPs available and goes to step 29.</p>					

Op-Test No.:	Scenario No.:	Event No.:	1	5	Page <u>24</u> of <u>29</u>
Event Description: <u>Loss of Auxiliary Feedwater (AFW)</u>					
<b>Applicant's Actions or Behavior</b>					
<b>Time</b>	<b>Position</b>				
<p><b>BOOTH Cue:</b> If dispatched to investigate CCP “A pump trip, report: I will investigate. If dispatched to CCP pump breaker, report an Overcurrent flag is dropped.</p>					
	CRS	1. Check if Secondary heat sink is required a. RCS pressure - > any non-faulted S/G pressure b. RCS hot leg temp - > 350°F			
	CREW	2. Verify RCS Bleed and Feed – not required a. Check WR level in all S/Gs - ≥ 26% [47%] b. Check RCS press - ≤ 2335 psig			
	RO	3. Check CCP status – at least one available -- <b>NO</b> , perform RNO <i>RNO: Observe CAUTION prior to step 29 and go to step 29</i>			

Op-Test No.:	Scenario No.:	Event No.:	Page <u>25</u> of <u>29</u>
Event Description:		<u>Loss of Auxiliary Feedwater.</u>	
Time	Position	Applicant's Actions or Behavior	
<b>CAUTION:</b>			
Steps 29 through 33 must be performed quickly in order to establish heat removal by RCS bleed and feed.			
<b>CT: Establish RCS bleed and feed before Steam Generators dry out establishing a heat sink for the core.</b>			
<b>Success: SI actuated and PORV Block valves OPEN</b>			
	RO	29. Reduce heat input to RCS a. Stop all RCPs <ul style="list-style-type: none"> <li>○ BB HIS-37 for RCP A</li> <li>○ BB HIS-38 for RCP B</li> <li>○ BB HIS-39 for RCP C</li> <li>○ BB HIS-40 for RCP D</li> </ul> b. Turn off all PZR heaters <ul style="list-style-type: none"> <li>○ BB HIS-50</li> <li>○ BB HIS-51A</li> <li>○ BB HIS-52A</li> </ul>	
	RO	30. Actuate SI ( <b>CT – see above</b> ) <ul style="list-style-type: none"> <li>○ SB HS-27</li> <li>○ SB HS-28</li> </ul>	

Op-Test No.:	Scenario No.:	Event No.:	Page <u>26</u> of <u>29</u>
	1	5	
Event Description: Loss of Auxiliary Feedwater			

Time	Position	Applicant's Actions or Behavior
	CRS	31. Verify ECCS feed path a. Check high pressure ECCS pumps <ul style="list-style-type: none"> <li>* CCPs – at least one running OR</li> <li>* SI pumps – at least one running</li> </ul> b. Verify SI feed path alignment: <ul style="list-style-type: none"> <li>* Check CCP to BIT flow meters – flow indicated OR                             <ul style="list-style-type: none"> <li>o EM FI-917A</li> <li>o EM FI-917B</li> </ul> </li> <li>* Check SI pump discharge flow meters – flow indicated OR                             <ul style="list-style-type: none"> <li>o EM FI-918</li> <li>o EM FI-922</li> </ul> </li> <li>* Check ESFAS status SIS section – System level white lights all lit                             <ul style="list-style-type: none"> <li>o Red train</li> <li>o Yellow train</li> </ul> </li> </ul>

Op-Test No.:	Scenario No.:	Event No.:	Page <u>27</u> of <u>29</u>
	1	5	
Event Description: <u>Loss of Auxiliary Feedwater</u>			

Time	Position	Applicant's Actions or Behavior
	CREW	32. Establish RCS bleed path: <ul style="list-style-type: none"> <li>a. Check power to block valves – AVAILABLE                             <ul style="list-style-type: none"> <li>○ BB HIS-8000A</li> <li>○ BB HIS-8000B</li> </ul> </li> <li>b. Place both cold overpressure Block/Arm switch in ARM position                             <ul style="list-style-type: none"> <li>○ BB HS-8000A</li> <li>○ BB HS-8000B</li> </ul> </li> <li>c. Check PZR PORV block valves – BOTH OPEN (CT – see page 25)                             <ul style="list-style-type: none"> <li><i>RNO: OPEN both block valves</i></li> <li>○ BB HIS-8000A</li> <li>○ BB HIS-8000B</li> </ul> </li> <li>d. Open both PZR PORVs                             <ul style="list-style-type: none"> <li>○ BB HIS-455A</li> <li>○ BB HIS-456A</li> </ul> </li> </ul>

Op-Test No.:	Scenario No.:	Event No.:	Page 28 of 29
	1	5	
Event Description: <u>Loss of Auxiliary Feedwater</u>			
<hr/>			
<hr/>			
Time	Position	Applicant's Actions or Behavior	
	CREW	<p>33. Verify adequate RCS bleed path:</p> <ul style="list-style-type: none"> <li>○ PZR PORV block valves – both open – <b>NO</b>, perform RNO</li> <li>○ PZR PORV's – both open – <b>NO</b>, perform RNO</li> </ul> <p><i>33.RNO</i></p> <p><i>a. Open reactor vessel head vent valves</i></p> <ul style="list-style-type: none"> <li>○ <i>BB HIS-8001A</i></li> <li>○ <i>BB HIS-8001B</i></li> <li>○ <i>BB HIS-8002A</i></li> <li>○ <i>BB HIS-8002B</i></li> </ul> <p><i>b. Align ESW through AFW System to S/G's</i></p> <p><i>c. If ESW can NOT be supplied to AFW system, then align fire main water to S/Gs – N/A: ESW can be aligned to AFW system</i></p> <p><i>d. If a low pressure water source can NOT be aligned, then go to step 34 – N/A: ESW can be aligned to AFW system</i></p> <p><i>e. Depressurize at least one intact S/G to atmospheric pressure using S/G ARV.</i></p> <p><b>Examiner Note:</b> CRS may direct one or all four S/G's be depressurized to atmospheric pressure.</p>	
	CRS	34. Perform steps 1-7 of EMG E-0, Reactor Trip or Safety Injection, while continuing with this procedure.	

Op-Test No.:	Scenario No.:	Event No.:	Page <u>29</u> of <u>29</u>
Event Description:		<u>Loss of Auxiliary Feedwater</u>	
Time	Position	Applicant's Actions or Behavior	
	CRS	35. Maintain RCS heat removal: <ul style="list-style-type: none"> <li>○ Maintain ECCS flow to RCS</li> <li>○ Maintain PZR PORVs – Both OPEN</li> </ul>	
CAUTION:			
If offsite power is lost after SI reset, manual action may be required to restore safeguards equipment to the required configuration.			
	RO	36. Reset SI <ul style="list-style-type: none"> <li>○ SB HS-42A</li> <li>○ SB HS-43A</li> </ul>	
	RO	37. Reset Containment Isolation Phase A and Phase B <ul style="list-style-type: none"> <li>○ SB HS-56 for phase A</li> <li>○ SB HS-53 for phase A</li> <li>○ SB HS-55 for phase B</li> <li>○ SB HS-52 for phase B</li> </ul>	
	BOP	38. Establish Instrument Air to Containment	
	CRS	39. Continue attempts to establish Secondary heat sink in at least one SG	
<b>When Bleed and Feed is established, Lead Examiner may terminate scenario at his discretion.</b>			

Facility: Wolf Creek Scenario No.: 2 Op-Test No.: \_\_\_\_\_

Examiners: \_\_\_\_\_ Operators: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Initial Conditions: 65% power

Turnover: Load reduction in progress per GEN 00-004, Power Operations, section 6.2, in order to remove “A” Main Feed pump from service due to high vibration. Main Feed Pump “A” is not expected to be out of service very long.

Use SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown.

Event No.	Malf. No.	Event Type*	Event Description
1 t+1		R – ATC  N – BOP, SRO	Reduce power using GEN 00-004, Power Operations and remove “A” Main Feed Pump from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown  (crew may reference / enter OFN AF-025, Unit Limitations, also)
2 t+15	mBB01 D	I – ATC, SRO	Primary Loop D Thavg (BB TI-441) high failure  OFN SB-008, Instrument Malfunctions, Attachment L
3 t+20	mAE15 C4	I – BOP, SRO	S/G C level AE LI-553 failure high  OFN SB-008, Instrument Malfunctions, Attachment F ALR 00-110C, SG C Flow Mismatch ALR 00-110B, SG C Lev Dev ALR 00-110A, SG C Lev Hi/Lo



4 t+27	mBG13 C	C – ATC, SRO	Normal Charging Pump (NCP) trip; a Centrifugal Charging Pump must be started, letdown restored etc  ALR 00-042A, Charging Line Flow HiLo (SYS BG-120, CVCS Startup or SYS BG-201, Shifting Charging Pumps – either may be used to restore letdown) ALR 00-042E, Charging Pump Trouble (Step 7 re-establishes letdown)
5 t+35	mBB02 B	M – All	500 gpm Steam Generator Tube Rupture on S/G A OFN BB-07A, Steam Generator Tube Leakage (eventually EMG E-0, Reactor Trip or Safety Injection & EMG E-3, Steam Generator Tube Rupture)
5			EMG E-3, Steam Generator Tube Rupture actions: <b>CT – Isolate feed flow to the ruptured SG before Steam Generator overfills.</b>  <b>CT – Cooldown &amp; Depressurize RCS to minimize RCS inventory leakage into the ruptured Steam Generator.</b>
6 t+43	mSA27 EM01 and mSA27 EM02	C – ATC, SRO	Post trip: BIT outlet valves (EM HIS-8801A and EM HIS-8801B) do not open. Manual open available  <b>CT - Open BIT outlet valves (EM HIS-8801A and EM HIS-8801B) before the end of the scenario or before needless Red or Orange path occurs.</b>  EMG E-0, Reactor Trip or Safety Injection, Attachment F or allowed post Immediate Action completion
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor			

**Scenario summary**

Plant is at 65% power with a load reduction in progress to remove “A” Main Feed Pump (MFP) from service due to high vibration. GEN 00-004, Power Operations, section 6.2 in progress for load reduction. Crew will use SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown, to remove “A” MFP from service.

Crew reduces power per GEN 00-004, Power Operations, section 6.2, Power Decrease. Crew may reference OFN AF-025, Unit Limitations, Attachment A (one main feedwater pump from service requires plant at 62% power). Crew removes “A” MFP from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown (see step 6.2.12 of GEN 00-004).

- Crew stabilizes unit at lower power and removes pump from service.

Primary Loop D Thavg failure high – BB TI-441 fails high. Control rods begin to step inward. Crew responds by placing rods into manual control and performing OFN SB-008, Instrument Malfunctions.

- OFN SB-008, Instrument Malfunctions, Attachment L.
- Crew stabilizes the plant.

Steam Generator (S/G) C level channel AE LI-553 failure high. Crew responds by performing OFN SB-008, Instrument Malfunctions, Attachment F. An alternate level channel is selected for control.

- ALR 00-110A, SG C Lev Hi/Lo, may be used prior to entry of OFN SB-008, Instrument Malfunctions.
- Crew stabilizes the plant.

Normal Charging Pump (NCP) trip. Crew responds using ALR guidance. A Centrifugal Charging Pump is started. Normal letdown must be restored.

- ALR 00-042A, Charging Line Flow HiLo
- ALR 00-042E, Charging Pump Trouble
- Crew stabilizes the plant.

Major event: A 500 gpm Steam Generator Tube Rupture (SGTR) on S/G A is diagnosed per OFN BB-07A, Steam Generator Tube Leakage.

SGTR requiring a manual Reactor trip and Safety Injection Signal actuation per Foldout page criteria of OFN BB-07A. Mitigation procedure will be EMG E-3, Steam Generator Tube Rupture.

1. Crew responds using OFN BB-07A, Steam Generator Tube Leakage.
2. Crew responds using EMG E-0, Reactor Trip or Safety Injection.
3. Crew responds using EMG E-3, Steam Generator Tube Rupture.

EMG E-3, Steam Generator Tube Rupture, Major Actions:

- Identify and isolate ruptured S/Gs
- Cooldown and establish RCS subcooling margin
- Depressurize RCS to restore inventory
- Terminate SI to stop primary to secondary leakage
- Prepare for cooldown to cold shutdown

Scenario has three Critical Tasks (CT):

1. Open BIT outlet valves (EM HIS-8801A and EM HIS-8801B) before the end of the scenario or before needless Red or Orange path occurs.
2. Isolate feed flow to ruptured Steam Generator before Steam Generator overfills.
3. Cooldown & Depressurize RCS to minimize RCS inventory leakage into the ruptured Steam Generator.

Probabilistic Risk Analysis for this scenario includes:

**Top 10 Human Action Failures by the Importance Measure Rankings**

F-V Rank	RRW Rank	Total Rank	Event Name	Description	Point Est.	F-V	RAW	RRW	Birnbaum
1	8	34	OPA-OD1-EXE	FAILURE OF RCS COOL DOWN & DEPRESSURIZE - SGR EVENT - EXE	4.89E-03	2.61E-02	6.32	1.027	9.64E-05

**Core Damage Frequency by Initiating Event and by Event Tree**

Event Tree	Core Damage Frequency (/yr)	Percent Contribution
Station Blackout	6.46E-06	35.79%
Small LOCA	5.35E-06	29.65%
Interfacing Systems LOCA	1.93E-06	10.68%
Very Small LOCA	1.27E-06	7.05%
Steam Generator Tube Rupture	8.77E-07	4.86%

Technical Specifications exercised:

Event 2 TS 3.3.1, Reactor Trip System Instrumentation, Table 3.3.1-1, FU 6 and 7

Cond. A: Function / channel inoperable – enter condition per table (immediately)

Cond. E: One channel inoperable – place channel in trip (72 hours)

Event 3 TS 3.3.1, Reactor Trip System Instrumentation, Table 3.3.1-1, FU 14

Cond A: Function / channel inoperable – enter condition per table (immediately)

Cond E: One channel inoperable – place channel in trip (72 hours)

TS 3.3.2, Engineered Safety Features Actuation System Instrumentation, Table 3.3.2-1, FU 5c and 6d

Cond A: Function / channel inoperable – enter condition per table (immediately)

Cond D: One channel inoperable – place channel in trip (72 hours)

FINAL

Cond I: One channel inoperable – place channel in trip (72 hours)

NOTE: Event 4 TR 3.1.9, Boron Injection System – Operating -- may be looked at

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  1  </u>		Page <u>6</u> of <u>57</u>
Event Description: Reduce power using GEN 00-004, Power Operations and remove "A" Main Feed Pump from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown		
Time	Position	Applicant's Actions or Behavior
	CREW	Using Gen 00-004, rev 62, Power Operations, section 6.2.2.2, continue power reduction.  <b>Examiner Note:</b> These steps have already been performed, the crew may review them to ensure completeness and begin at 6.2.12.2
	BOP	6.2.2.2 If MTC is negative or zero, then perform the following:  a. If automatic Turbine unloading is desired, then control turbine load using automatic turbine-generator unloading selected to ½% per minute OR as directed by SM/CRS.  b. If automatic Turbine unloading is NOT desired, then perform Turbine load decrease using load limit potentiometer or the standby potentiometer in a slow controlled manner.  c. (ρ) Adjust control rods as necessary to maintain Tavg within 1.5°F of Tref.
	CRS/RO	<b>6.2.3 (ρ) During power reduction, use boration, dilution, or control rods, as necessary, to maintain the axial flux difference within the target band and control rods above the rod insertion limit.</b>  <i>RO uses Operator Aid for Boration – see next page.</i>
	CRS/RO	<b>6.2.4 Ensure AE HV-38, HP FW HEATERS BYPASS VALVE, is closed using SYS AE-125, HP FW HEATER BYPASS THROTTLING OPERATIONS.</b>
	CRS/RO	6.2.5 Ensure one set of PZR backup heaters is energized.

NOTE: 6.2.6 is N/A. Crew determines which method to use for Turbine unloading.

**Appendix D**

**Required Operator Actions**

**Form ES-D-2**

Op-Test No.: \_\_\_\_\_ Scenario No.: 2 Event No.: 1

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Event Description: RO actions for Boration using Operator Aid, SYS BG-200, rev 35, Attachment B, Boration for Temperature Adjustment in Mode 1 and 2

<b>Time</b>	<b>Position</b>	<b>Applicant's Actions or Behavior</b>
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RO	<p style="text-align: center;">NOTE</p> <p>A licensed operator shall peer check reactivity manipulations.</p> <p>B.1 Setup to borate the RCS:</p> <p>B.1.1 (<math>\rho</math>) Turn on PZR HTR B/U GROUP A &amp; B, as directed by CRS, to mix Reactor Coolant System with Pressurizer water</p> <ul style="list-style-type: none"> <li>* BB HIS-51A for group A - ON</li> <li>* BB HIS-52A for group B – ON</li> </ul> <p>B.1.2 BG HS-26 to Normal-After-Stop</p> <p>B.1.3 BG HS-25 to Borate</p> <p>B.1.4 BG FK-110 in Auto at desired rate</p> <p>B.1.5 BG FY-110B, BA counter, set to desired gallons</p> <p>B.2 Commence Boration</p> <p>B.2.1 BG HS-26 to Normal-After-Run</p> <p>B.2.2. Verify:</p> <ol style="list-style-type: none"> <li>1. One BORIC ACID TRANSFER PUMP running</li> <li>2. BG HIS-110B open</li> <li>3. BG HIS-110A throttles open</li> <li>4. BG FR-110 red pen at proper flowrate</li> </ol> <p>B.3 Ensure boration stops at BG FY-110B setpoint</p> <p style="text-align: center;">NOTE</p> <p>Pressurizer Backup Heaters are normally placed in auto.</p> <p>B.4 As directed by CRS, place PZR HTR B/U GROUP A &amp; B in desired position after sufficient time for mixing as elapsed.</p> <ul style="list-style-type: none"> <li>o BB HIS-51A for group A - _____</li> <li>o BB HIS-51B for group B - _____</li> </ul> <p>B.5 Realign for auto operation:</p> <p>B.5.1 BG HS-26 to Normal-After-Stop</p> <p>B.5.2 BG HS-25 to Auto</p> <p>B.5.3 BG FK-110 set for Auto makeup</p> <p>B.5.4 BG HS-26 to Normal-After-Run</p> <p>B.5.5 If desired, then perform Attachment C, Boric Acid Potentiometer Adjustment</p>
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Op-Test No.: \_\_\_\_\_ Scenario No.:   2   Event No.:   1  Page   8   of   57  

Event Description: Reduce power using GEN 00-004, Power Operations and remove “A” Main Feed Pump from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown

Time	Position	Applicant’s Actions or Behavior
	CRS/BOP	<p>6.2.7 If <b>automatic Turbine unloading is desired, then place EHC control on load set as follows:</b></p> <ol style="list-style-type: none"> <li>1. (ρ) If desired <b>to position Control Valves in their controlling range, then slowly decrease load limit pot until a 1-2 MWe load decrease is noted.</b></li> <li>2. <b>Slowly decrease load set MW until the following conditions are met:</b> <ul style="list-style-type: none"> <li>○ At set load light – LIT AND</li> <li>○ Load limit limiting light – NOT LIT</li> </ul> </li> <li>3. Raise load limit pot slightly.</li> <li>4. Select ½% / minute loading rate.</li> <li>5. Select decrease loading rate – ON</li> </ol>
	CRS/BOP	6.2.8 (ρ) Decrease Turbine load as desired while continuing with this procedure
	CRS	6.2.9 Ensure <b>Chemistry is promptly notified of each power change that is greater than or equal to 15% RTP within a 1 hour period so that RCS DEI can be verified to satisfy SR 3.4.16.2.</b>
	CRS	6.2.10 <b>When SM or CRS desires to stop one heater drain pump, THEN stop one heater drain pump using SYS AF-121, HEATER DRAIN PUMP OPERATION. NA – not desired to remove a Heater Drain Tank pump.</b>
	CRS	6.2.11 If operating with a positive MTC and reactor power is less than 65%, then open Steam Dumps as follows: <i>NA – operating with a negative MTC</i>



Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  1  </u>		Page <u>  9  </u> of <u>  57  </u>
Event Description: Reduce power using GEN 00-004, Power Operations and remove “A” Main Feed Pump from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown		
Time	Position	Applicant’s Actions or Behavior
<b>Examiner Note:</b> Unit Limitations OFN allows one MFP to be secured at 62 % power. Turnover item: continue power reduction in order to remove the Main Feed Pump.		
	CRS	6.2.12.2. If two Main Feedwater Pumps are running, then secure one using SYS AE-320, Turbine Driven Main feedwater Pump Shutdown
	CRS/CREW	Direct SYS AE-320, (rev 21), Turbine Driven Main feedwater Pump Shutdown, section 6.1
CAUTION: If a secondary cooldown is in progress, ensure a flowpath for feed to SGs can be maintained.  NOTE: At 62% power, two MFPs at 4400 rpm will equate to one MFP at 5400 rpm.		
	BOP	6.1.1 Place MFP turb A speed control in manual. ○ FC SK-509B – MANUAL
CAUTION: Monitor feedwater flow and SG levels, during performance of the following steps.		
	BOP	6.1.2 Place MFP A recirc ctrl valve in manual and open ○ AE FIC-2B – MANUAL AND ○ AE FIC-2B – OPEN

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  1  </u>		Page <u>10</u> of <u>57</u>
Event Description: Remove “A” Main Feed Pump from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown		
Time	Position	Applicant’s Actions or Behavior
	BOP	6.1.3 Slowly decrease MFP turb A speed ctrl to 3800 rpm <ul style="list-style-type: none"> <li>○ FC SK-509C – OUTPUT DECREASED</li> <li>○ FC SI-33 – 3800 rpm</li> </ul>
	BOP	6.1.4 Adjust MFP turb A man speed ctrl pot, to achieve a zero indication on MFP Turb A man/auto sig match indicator <ul style="list-style-type: none"> <li>○ FC HK-88 – SETTING ADJUSTED</li> <li>○ FC EI-88 - ZERO</li> </ul>
	BOP	6.1.5 Depress MFP turb A speed ctrl transfer switch manual pushbutton <ul style="list-style-type: none"> <li>○ FC HIS-88 – manual</li> </ul>
	BOP	6.1.6 Slowly decrease MFP turb A man speed ctrl pot to 1100 rpm <ul style="list-style-type: none"> <li>○ FC HK-88 – SETTING DECREASED</li> <li>○ FC SI-33 – 1100 rpm</li> </ul>
NOTE: ESFAS should not be blocked, unless both Main feedwater pumps are being secured.		

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Event Description: Remove "A" Main Feed Pump from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown

Time	Position	Applicant's Actions or Behavior
	BOP	6.1.7. To prevent a spurious AFW system actuation, ensure one of the following conditions is met: <ul style="list-style-type: none"> <li>* MFP turb B trip/test switch is reset <ul style="list-style-type: none"> <li>○ FC HIS-118 – RESET</li> </ul> </li> <li>* Ensure AFP ESFAS block train A &amp; B switches are in the block position <ul style="list-style-type: none"> <li>○ FC HS-25 – BLOCK</li> <li>○ FC HS-26 – BLOCK</li> </ul> </li> </ul>
	BOP	6.1.8 Depress MFP turb A trip/reset switch trip pushbutton <ul style="list-style-type: none"> <li>○ FC HIS-18 – TRIPPED</li> </ul>
	BOP	6.1.9 Ensure MFP A disch vlv closes <ul style="list-style-type: none"> <li>○ AE HIS-16 – CLOSED</li> </ul>
	BOP	6.1.10 Close MFP A recirc ctrl valve <ul style="list-style-type: none"> <li>○ AE FIC-2B - CLOSED</li> </ul>
	BOP	6.1.11 When MFP A coasts down to zero speed, then ensure MFP turb A Turn gear engage light illuminated <ul style="list-style-type: none"> <li>○ FC ZL-82A - LIT</li> </ul>

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  1  </u>		Page <u>12</u> of <u>57</u>
Event Description: Remove “A” Main Feed Pump from service using SYS AE-320, Turbine Driven Main Feedwater Pump Shutdown		
Time	Position	Applicant’s Actions or Behavior
	BOP	<p>6.1.12 Open the following MFP turbine A drains:</p> <ol style="list-style-type: none"> <li>1. MFP turb A 1<sup>st</sup> stg S/U drn vlv <ul style="list-style-type: none"> <li>○ FC HIS-71 – OPEN</li> </ul> </li> <li>2. MFP turb A HPSV above seat drn valve <ul style="list-style-type: none"> <li>○ FC HIS-4 – OPEN</li> </ul> </li> <li>3. MFP turb A HPSV below seat drn valve <ul style="list-style-type: none"> <li>○ FC HIS-7 - OPEN</li> </ul> </li> </ol>
	BOP	<p>6.1.13 Open MFP A disch valve</p> <ul style="list-style-type: none"> <li>○ AE HIS-16 – OPEN</li> </ul>
	BOP	<p>6.1.14 If MFP A will be shutdown for a prolonged period, then close the following valves, to prevent seal water flow from overflowing the Miscellaneous Condensate Drain Tank:</p> <ol style="list-style-type: none"> <li>1. SG FWP A seal water supply reg vlv PDV-58 inlet iso vlv <ul style="list-style-type: none"> <li>○ AE-V995 - CLOSED</li> </ul> </li> <li>2. SG FWP A seal water supply reg vlv PDV-58 bypass vlv <ul style="list-style-type: none"> <li>○ AE-V994 – CLOSED</li> </ul> </li> </ol>
<b>BOOTH CUE:</b> If called as building watch to close valves AE-V995 and AE-V994, report back in ~ four minutes that the valves are closed. These valves are not modeled.		
	BOP	<p>6.1.15 If desired to secure MFP A lube oil system, then perform section 6.3, Shutdown of MFP A lube oil system.</p> <p><i>NA – not required</i></p>



Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  2  </u>		Page <u>14</u> of <u>57</u>
Event Description: Primary Loop D Thavg (BB TI-441) high failure.		
Time	Position	Applicant's Actions or Behavior
<p><b>INDICATIONS:</b> Main Control Board alarms: 65C, 65E, 66B, 66D, 67B, 67D, 68B, 68D, 81C, 81D, 82B, 82C, 83C</p> <p>Partial Trip Status Panel (SB069): bistable lights TB 441C (OTΔT L4) and TB441G (OPΔT L4) are illuminated</p> <p>Control rods step in.</p> <p>Loop 4 ΔT meter BB TI-441 is pegged high.</p>		
	CRS/CREW	Actions may be taken before procedure entry: Once no runback/load rejection is determined, the Control rods are taken to manual.
	CREW	<b>ENTER</b> OFN SB-008, rev 26, Instrument Malfunctions
	CRS	<p>1. Check if Secondary system instrument channel is malfunctioning</p> <p>a. Determine appropriate attachment for malfunctioning channel from table below; <b>NO</b> perform RNO</p> <p><i>RNOa. If secondary system channel is not malfunctioning, then go to step 2</i></p>
	CRS/RO	<p>2. Check if RCS instrument channel or controller is malfunctioning:</p> <p>a. Determine appropriate attachment for malfunctioning channel or controller from table below:</p>
Variable	Channels	Attachment
RCS temperature (BB)	T-411, T-421, T-431, <b>T-441</b>	<b>Attachment L</b>
		b. Go to appropriate attachment for malfunctioning RCS system channel or controller

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Event Description: Primary Loop D Tavag (BB TI-441) high failure.

Time	Position	Applicant's Actions or Behavior
	CREW	Performs OFN SB-008, Attachment L, Narrow Range RTD Malfunctions
	BOP	L1. Check load rejection – NOT in progress <ul style="list-style-type: none"> <li>○ Generator load MW - STABLE</li> <li>○ Generator load set MW - STABLE</li> </ul>
	RO	L2. Switch ROD BANK AUTO/MAN SEL switch (SE HS-9) to - MANUAL
	BOP	L3. Check steam dumps <ul style="list-style-type: none"> <li>a. Check STEAM DUMP SEL switch in Tavag mode (handswitch AB US-500Z)</li> <li>b. Check steam dumps – CLOSED (meter AB ZL-34/35)</li> </ul>
	RO	L4. Identify failed instrument <ul style="list-style-type: none"> <li>a. Compare loop Tavag and ΔT indications to confirm a Narrow Range RTD failure</li> </ul> <i>RO identifies Loop 4 failure (BB TI-441A, BB TI-442)</i>

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Event Description: Primary Loop D Thavg (BB TI-441) high failure.

Time	Position	Applicant's Actions or Behavior
	RO	<p>L5. Remove failed temperature channel from Tavg and <math>\Delta T</math> auctioneering circuits, using DELTA T DEFEAT and ROD CTRL T AVG INPUT CHANNEL DEFEAT switches</p> <ul style="list-style-type: none"> <li>○ BB TS-411F</li> <li>○ BB TS-412T</li> </ul> <p><b>Examiner Note:</b> MCB alarms clear and 69A and 69C actuate.</p>
	RO	<p>L6. Check (Tavg/Tref) error signal within 1°F; <b>NO</b>, perform RNO</p> <p><i>RNO: (<math>\rho</math>) Manually adjust control rod position, to maintain Tavg within 1 °F of Tref.</i></p>
NOTES		
<ul style="list-style-type: none"> <li>○ Several minutes must be allowed for power and temperature rate circuitry outputs to return to normal before switching back to automatic rod control.</li> <li>○ Control Rods should be restored to their parked position when plant conditions allow at the direction of the CRS.</li> </ul>		
	RO	<p>L7. Check ROD BANK AUTO/MAN SEL switch to – AUTO</p> <ul style="list-style-type: none"> <li>○ SE HS-9</li> </ul>
	RO	L8. Monitor Rod Control System response to ensure proper control
	RO	L9. Check C-7 Loss of Load Interlock – NOT LIT



Op-Test No.: _____ Scenario No.: <u>2</u> Event No.: <u>2</u>		Page <u>17</u> of <u>57</u>
Event Description: Primary Loop D Thavg (BB TI-441) high failure.		
Time	Position	Applicant's Actions or Behavior
	BOP	L10. Check STEAM DUMP BYPASS INTERLOCK switches in – ON <ul style="list-style-type: none"> <li>○ AB HS-63</li> <li>○ AB HS-64</li> </ul>
	BOP	L11. Monitor steam dump control system to ensure proper operation
	RO	L12. Check failed temperature channel not selected on OP ΔT and OTΔT LOOP RECORD SEL  <i>RNO: Select alternate temperature channel for OPΔT and OTΔT recorders (SC TS-411E)</i>
	CRS	L13. Monitor the following Technical Specification LCOs and comply with Action Statements as appropriate: <ul style="list-style-type: none"> <li>○ 3.3.1, Reactor Trip System Instrumentation, Table 3.3.1.-1, function 6 and 7</li> </ul> <p>Cond. A: Function / channel inoperable – enter condition per table (immediately)</p> <p>Cond. E: One channel inoperable – place channel in trip (72 hours)</p>
<b>Once Technical Specifications are identified and at Lead Examiner discretion, initiate Event 3 by activating KEY 3.</b>		

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  3  </u>		Page <u>18</u> of <u>57</u>
Event Description: S/G C level AE LI-553 failure high.		
Time	Position	Applicant's Actions or Behavior
<b>BOOTH INSTRUCTIONS:</b> At Lead Examiner discretion, activate Event 3 by inserting KEY 3.		
<b>INDICATIONS:</b> Meter indication AE LI-553 increasing, Main Control Board alarms: 00-110C, SG C Flow Mismatch; 00-110B, SG C Lev Dev; 00-110A, SG C Lev Hi/Lo		
	CRS/BOP	Actions may be taken before procedure entry: Identify failed instrument, AE LI-533 failure; Place MFW Reg Valve in Manual (AE FK-530) and match steam and feed flow.
	CREW	May enter ALR 00-110A rev 5, or go directly to OFN SB-008, rev 26, Instrument Malfunctions
	CRS/CREW	<b>ENTER</b> ALR 00-110A, rev 5, SG C Lev Hi/Lo 1. Check SG C controlling level channel * Less than 30% OR * Greater than 70%

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Event Description: S/G C level AE LI-553 failure high.

Time	Position	Applicant's Actions or Behavior
	BOP	<p>2. Check for Instrument failure:</p> <ul style="list-style-type: none"> <li>○ SG C controlling level channel – WITHIN 7% OF REMAINING SG C LEVEL CHANNELS -- <b>NO</b></li> <li>* AE LI-539</li> <li>* <b>AE LI-553</b></li> </ul> <p><i>RNO: Perform the following:</i></p> <p><i>a. Place Feedwater Reg Valve (FRV) or Feedwater Reg Bypass Control Valve (FRBV) in manual</i></p> <ul style="list-style-type: none"> <li>* <b>AE FK-530</b></li> <li>* AE LK-570</li> </ul> <p><i>b. Adjust FRV or FRBV as necessary to establish SG level at program value</i></p> <ul style="list-style-type: none"> <li>* <b>AE FK-530</b></li> <li>* AE LK-570</li> </ul> <p><i>c. Select alternate channel for control</i></p> <ul style="list-style-type: none"> <li>* <b>AE LS-539C</b></li> </ul> <p><i>d. Return FRV or FRBV to automatic</i></p> <ul style="list-style-type: none"> <li>* <b>AE FK-530</b></li> <li>* AB LK-570</li> </ul> <p><i>e. Go to OFN SB-008, Instrument Malfunctions step 1,</i></p>

Op-Test No.: _____ Scenario No.: <u>2</u> Event No.: <u>3</u>		Page <u>20</u> of <u>57</u>
Event Description: S/G C level AE LI-553 failure high.		
Time	Position	Applicant's Actions or Behavior
	CRS/CREW	<b>ENTER</b> OFN SB-008, Instrument Malfunctions (rev 26)
	BOP	1. Check if Secondary System instrument channel is malfunctioning: a. Determine appropriate attachment for malfunctioning channel from table below:
<b>VARIABLE</b> Steam level (AE)		<b>CHANNELS</b> <b>L-553</b>
		<b>ATTACHMENT</b> <b>Attachment F</b>
	CRS	Directs Attachment F, SG Level Channel Malfunction
NOTE: If crew performed the ALR first, it may alter how they proceed through the OFN attachment.		
	BOP	F1. Identify failed narrow range SG level instrument channel: a. Compare narrow range SG level indication to confirm a narrow range SG level channel failure <ul style="list-style-type: none"> <li>o SG "C":                         <ul style="list-style-type: none"> <li>• AE-LI-537</li> <li>• AE LI-538</li> <li>• AE LI-539</li> <li>• <b>AE LI-553</b></li> </ul> </li> </ul>

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  3  </u>		Page <u>21</u> of <u>57</u>
Event Description: S/G C level AE LI-553 failure high.		
Time	Position	Applicant's Actions or Behavior
	BOP	F2. Check failed SG level channel selected on SG LEV CHANNEL SEL switch  * AE LS-539C (others are also listed in the procedure), <i>RNO</i> <i>F2. Go to Step F7</i>
	BOP	F3. Place affected SG MFW REG VLV CTRL – in MANUAL  * AE FK-530 (other FRVs are listed in the procedure)
	BOP	F4. Adjust affected SG MFW REG VLV CTRL, as necessary, to establish steam generator level at program  * AE FK-530
	BOP	F5. Select alternate SG level channel on SG LEV CHANNEL SEL switch  * AE LS-539C
	CRS	F6. Restore affected SG MFW REG VLV CTRL to – AUTO
<b>BOOTH Cue:</b> If called as Call Sup /WWM, respond: I will assemble a team.		

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Event Description: S/G C level AE LI-553 failure high.

Time	Position	Applicant's Actions or Behavior
	CRS	<p>F7. Monitor the following TS for LCO's and comply with appropriate Action Statements as appropriate:</p> <p>TS 3.3.1, Reactor Trip System Instrumentation, Table 3.3.1-1, FU 14                      Cond A: Function / channel inoperable – enter condition per table (immediately)                      Cond E: One channel inoperable – place channel in trip (72 hours)</p> <p>TS 3.3.2, Engineered Safety Features Actuation System Instrumentation, Table 3.3.2-1, FU 5c and 6d                      Cond A: Function / channel inoperable – enter condition per table (immediately)                      Cond D: One channel inoperable – place channel in trip (72 hours)                      Cond I: One channel inoperable – place channel in trip (72 hours)</p>
<p><b>BOOTH INSTRUCTIONS:</b> At Lead Examiner discretion, initiate Event 4 by activating KEY 4.</p>		

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  4  </u>		Page <u>23</u> of <u>57</u>
Event Description: Normal Charging Pump (NCP) trip. (ALR 00-042A, rev 14, CHG LINE FLOW HILO)		
Time	Position	Applicant's Actions or Behavior
<p><b>INDICATIONS:</b>  NCP indication (BG HIS-3) goes from Red light LIT to Green light LIT</p> <p>Various MCB Alarms:  00-042A, Charging Line Flow HiLo and 00-042E, Charging Pump trouble  00-041A, Seal Inj to RCP Flow Lo and 00-038A, LTDN Regen HX Temp Hi</p>		
<p><b>BOOTH Cue:</b> If dispatched to investigate NCP trip, respond: I will investigate. If dispatched to NCP breaker, respond: Overcurrent flag is tripped.  If contacted as WWM, respond : I will assemble a team.  If contacted as Electrical Maintenance (MTN): I will assemble a team....overcurrent flag is dropped.</p>		
<p><b>Examiner Note:</b> Either ALR 00-042A and 00-042E (see page 27) may be entered. Steps are included for both.</p>		
	CRS	<b>ENTER</b> and directs ALR 00-042A, rev 014, Charging Line Flow HiLo
	CRS/RO	1. Check charging header flow - > 150 gpm ○ BG FI-121A, <i>RNOI. Go to step 5.</i>
	CRS/RO	5. Check charging header flow - < 45 gpm ○ BG FI-121A
<p style="text-align: center;"><b>CAUTION:</b>  If gas binding or pumps is suspected, performance of OFN BG-045, Gas Binding of CCPs or SI Pumps, should be considered.</p>		

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  4  </u>		Page <u>24</u> of <u>57</u>
Event Description: Normal Charging Pump (NCP) trip. (ALR 00-042A, rev 14, CHG LINE FLOW HILO)		
Time	Position	Applicant's Actions or Behavior
	CRS/RO	<p>6. Check charging pumps – ANY RUNNING</p> <ul style="list-style-type: none"> <li>* BG HIS-1A for CCP A</li> <li>* BG HIS-2A for CCP B</li> <li>* BG HIS-3 for NCP</li> </ul> <p><i>RNO6. Perform the following:</i></p> <p><i>6RNOa. Close letdown orifice isolation valves</i></p> <ul style="list-style-type: none"> <li>o BG HIS-8149AA</li> <li>o BG HIS-8149BA</li> <li>o BG HIS-8149CA</li> </ul> <p><i>6RNOb. Start any available charging pump</i></p> <ul style="list-style-type: none"> <li>* BG HIS-1A for CCP A</li> <li>* BG HIS-2A for CCP B</li> <li>* BG HIS-3 for NCP</li> </ul>
	RO	<p>7. Check PZR level – at program value</p> <ul style="list-style-type: none"> <li>o BB LR-459</li> </ul> <p><i>RNO7. Perform the following:</i></p> <p><i>a. Place running charging pump flow controller in manual and adjust charging flow as necessary to establish PZR level at program value.</i></p> <ul style="list-style-type: none"> <li>* <b>BG FK-121 for CCP</b></li> <li>* <b>BG FK-462 for NCP</b></li> </ul>



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Event Description: Normal Charging Pump (NCP) trip.

Time	Position	Applicant's Actions or Behavior
	RO	8. Check letdown isolated
	RO	9. Reestablish letdown <ol style="list-style-type: none"> <li>a. Check RCS letdown to regen HX valves open.               <ul style="list-style-type: none"> <li>○ BG HIS-459</li> <li>○ BG HIS-460</li> </ul> </li> <li>b. Place Letdown HX outlet pressure control in manual               <ul style="list-style-type: none"> <li>○ BG PK-131</li> </ul> </li> <li>c. Open Letdown HX outlet pressure control between 90% and 100%               <ul style="list-style-type: none"> <li>○ BG PK-131</li> </ul> </li> <li>d. Open desired Letdown orifice isolation valve(s)               <ul style="list-style-type: none"> <li>* BG HIS-8149AA</li> <li>* BG HIS-8149BA</li> <li>* BG HIS-8149CA</li> </ul> </li> <li>e. Adjust Letdown HX outlet pressure control to establish Letdown HX outlet pressure between 340 psig and 360 psig               <ul style="list-style-type: none"> <li>○ BG PI-131</li> </ul> </li> <li>f. Place letdown HX outlet pressure control in auto               <ul style="list-style-type: none"> <li>○ BG PK-131</li> </ul> </li> </ol>
	RO	10. Check letdown heat exchanger outlet temperature - < 130°F <ul style="list-style-type: none"> <li>○ BG TI-130</li> </ul>

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  4  </u>		Page <u>26</u> of <u>57</u>
Event Description: Normal Charging Pump (NCP) trip.		
Time	Position	Applicant's Actions or Behavior
	RO	11. Check charging header flow and letdown flow – BALANCED <i>RNO11. Adjust charging &amp; letdown as necessary to maintain PZR level at program</i>
CAUTION: Total pump flow should be maintained above 175 gpm to minimize the effects of low flow cavitation.		
	RO	12. Verify CCP adequate flow: a. Check CCPs – ANY RUNNING * BG HIS-1A for CCP A * BG HIS-2A for CCP B b. Check CCP recirc valve – OPEN * BG-HIS-8110 for CCP A * BG HIS-8111 for CCP B
	CRS	13. Return to procedure and step in effect.

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  4  </u>		Page <u>27</u> of <u>57</u>
Event Description: Normal Charging Pump (NCP) trip. ALR 00-042E, rev 10		
Time	Position	Applicant's Actions or Behavior
	CRS	<b>ENTER</b> and directs ALR 00-042E, rev 10, Charging Pump Trouble
	RO	1. Check previously running charging pump - tripped <ul style="list-style-type: none"> <li>○ BG HIS-1A for CCP A</li> <li>○ BG HIS-2A for CCP B</li> <li>○ <b>BG HIS-3 for NCP</b></li> </ul>
	CRS	2. Contact Electrical Maintenance to determine cause of pump trip
<p><b>BOOTH Cue:</b> If dispatched as building watch to investigate NCP trip, respond: I will investigate. If dispatched to NCP breaker, respond: Overcurrent flag is tripped.  If contacted as WWM, respond: I will assemble a team.  If contacted as Electrical MTN: I will assemble a team....overcurrent flag is dropped.</p>		
	RO	3. Check charging pumps – none running <ul style="list-style-type: none"> <li>○ BG HIS-1A for CCP A</li> <li>○ BG HIS-2A for CCP B</li> <li>○ BG HIS-3 for NCP</li> </ul>
	RO	4. Close letdown orifice isolation valves. <ul style="list-style-type: none"> <li>○ BG HIS-8149AA</li> <li>○ BG HIS-8149BA</li> <li>○ BG HIS-8149CA</li> </ul>
<p><b>CAUTION:</b> If gas binding of pumps is suspected, performance of OFN BG-045, Gas Binding of CCPs or SI Pumps, should be performed.</p>		

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  4  </u>		Page <u>28</u> of <u>57</u>
Event Description: Normal Charging Pump (NCP) trip.		
Time	Position	Applicant's Actions or Behavior
	RO	5. Establish charging flow a. Check RCS temperature - > 350°F b. Start CCP aligned for normal charging. * BG HIS-1A for CCP A * BG HIS-2A for CCP B 5c. Go to step 6
	RO	6. Ensure RCP seal injection – between 8 gpm and 13 gpm to each RCP ○ BG FR-157 for RCP A ○ BG FR-156 for RCP B ○ BG FR-155 for RCP C ○ BG FR-154 for RCP D
		(Step 7 on next page.)

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Event Description: Normal Charging Pump (NCP) trip.

Time	Position	Applicant's Actions or Behavior
	RO	7. Reestablish letdown a. Check RCS letdown to regen HX valves open ○ BG HIS-459 ○ BG HIS-460 b. Place letdown HX outlet pressure control in manual ○ BG PK-131 c. Open letdown HX outlet pressure control between 90% and 100% ○ BG PK-131 d. Open desired letdown orifice isolation valve(s). * BG HIS-8149AA * BG HIS-8149BA * BG HIS-8149CA e. Adjust letdown HX outlet pressure control to establish letdown HX outlet pressure between 340 psig and 360 psig ○ BG PI-131 f. Place letdown HX outlet pressure control in auto ○ BG PK-131
	RO	8. Check charging header flow and letdown flow – BALANCED <i>RNO8. Adjust charging &amp; letdown as necessary to maintain PZR level at program value.</i>

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Event Description: Normal Charging Pump (NCP) trip.

Time	Position	Applicant's Actions or Behavior
NOTE		
Total pump flow should be maintained above 175 gpm to minimize the effects of low flow		
	RO	9. Verify CCP adequate flow: a. Check CCPs – any running * BG HIS-1A for CCP A * BG HIS-2A for CCP B b. Check CCP recirc valve - open * BG HIS-8110 for CCP A * BG HIS-8111 for CCP B
	CRS	10. Ensure compliance with Technical Specifications and TRM: a. Check plant – in Modes 1, 2, or 3 b. Refer to TR 3.1.9 and Technical Specification 3.5.2
	CRS/CREW	11. Return to procedure and step in effect.
<b>BOOTH INSTRUCTIONS:</b> At Lead Examiner discretion, initiate Event 5 by activating KEY 5.		

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  5  </u>		Page <u>31</u> of <u>57</u>
Event Description: 500 gpm Steam Generator Tube Rupture on Steam Generator A (OFN BB-07A, Steam Generator Tube Leakage)		
Time	Position	Applicant's Actions or Behavior
<b>INDICATIONS:</b> Decreasing level PZR MCB annunciators 00-061B, Process Rad Hi, followed by 00-061A, Process Rad HiHi RM-11R (SP056A) shows and alarms increasing radiation on process radiation monitor GE RE-92, Condenser Air Discharge Monitor		
	CREW/CRS	Begin diagnostics for Steam Generator Tube Rupture (SGTR) and <b>ENTER</b> OFN BB-07A, rev 9, Steam Generator Tube Leakage
<b>FOLDOUT PAGE FOR OFN BB-07A</b>		
<b>1. SI ACTUATION CRITERIA</b> IF any condition listed occurs, THEN trip the reactor, actuate SI, and go to EMG E-0, REACTOR TRIP OR SAFETY INJECTION Step 1. <ul style="list-style-type: none"> <li>* RCS subcooling based on subcooling monitor - LESS THAN 30°F SUBCOOLING WITH REACTOR TRIPPED OR</li> <li>* <b>Pressurizer pressure - CANNOT BE MAINTAINED</b> OR</li> <li>* Pressurizer level - CANNOT BE MAINTAINED GREATER THAN 6% OR</li> <li>* <b>All of the following conditions exist:</b> <ul style="list-style-type: none"> <li>○ <b>Normal charging is maximized from one pump.</b> AND</li> <li>○ <b>Letdown is isolated.</b> AND</li> <li>○ <b>Pressurizer level is decreasing.</b></li> </ul> </li> </ul>		
<b>CAUTION</b>		
If reactor trip or safety injection actuates during this procedure, go to EMG E-0, Reactor Trip or Safety Injection, step 1.		

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Event Description: 500 gpm Steam Generator Tube Rupture on Steam Generator A

Time	Position	Applicant's Actions or Behavior
	RO	1. Check PZR level - > 6%
	RO	<u>2.</u> Check PZR level - > 17%
	RO	<p><u>3.</u> Check PZR level – stable or increasing – <b>NO</b>, perform RNO</p> <p><i>RNO3 If PZR level &lt; program, then perform the following:</i></p> <p><i>a. Control charging flow as necessary to maintain PZR level</i></p> <p><i>b. If PZR level cannot be maintained, then close letdown orifice isolation valves as necessary to stabilize PZR level</i></p> <ul style="list-style-type: none"> <li>* BG HIS-8149AA</li> <li>* BG HIS-8149BA</li> <li>* BG HIS-8149CA</li> </ul>
	CREW	<p>4. Try to identify the leaking SG</p> <ul style="list-style-type: none"> <li>* Unexpected increase in any SG narrow range level OR</li> <li>* Radiation from any SG steam line radiation monitor OR</li> <li>* Radiation from any SG steam line survey OR</li> <li>* Radiation from any SG sample</li> </ul> <p><i>RNO4. Try to identify leaking SG:</i></p> <p><i>a. Direct HP to survey steamlines &amp; blowdown lines as necessary to determine leaking SG</i></p>
<p><b>BOOTH Cue:</b> Respond as HP: I will survey the steam lines &amp; blowdown lines.</p>		





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Event Description: 500 gpm Steam Generator Tube Rupture on Steam Generator A (EMG E-0, Reactor Trip or Safety Injection)

Time	Position	Applicant's Actions or Behavior
<b>FOLDOUT PAGE FOR EMG E-0</b>		
<b>1. RCP TRIP CRITERIA</b>		
IF all conditions listed below occur, THEN trip all RCPs:		
<ul style="list-style-type: none"> <li>○ RCS pressure - LESS THAN 1400 PSIG</li> <li>○ CCPs or SI pumps - AT LEAST ONE RUNNING</li> <li>○ Operator controlled cooldown - NOT IN PROGRESS</li> </ul>		
<b>2. SI ACTUATION CRITERIA</b>		
IF either condition listed below occurs, THEN actuate SI and go to EMG E-0, REACTOR TRIP OR SAFETY INJECTION, Step 1:		
* RCS subcooling - LESS THAN 30°F [45°F]		
OR		
* Pressurizer level - CANNOT BE MAINTAINED GREATER THAN 6% [33%]		
<b>3. FAULTED S/G ISOLATION CRITERIA</b>		
IF any S/G pressure decreasing in an uncontrolled manner OR any S/G completely depressurized, THEN the following may be performed:		
a. Close main steam isolation valves.		
b. Isolate feed flow to faulted S/G(s).		
c. Maintain total feed flow greater than 270,000 lbm/hr until narrow range level in at least one S/G is greater than 6% [29%].		
<b>4. RUPTURED S/G ISOLATION CRITERIA</b>		
IF any S/G level increases in an uncontrolled manner OR any S/G has abnormal radiation, AND narrow range level in affected S/G(s) is greater than 6% [29%], THEN the following may be performed.		
a. Close ruptured S/G AFW flow control valves.		
b. IF any ruptured S/G AFW flow control valve cannot be closed AND total AFW flow to intact S/Gs can be maintained greater than 270,000 lbm/hr without associated AFW Pump, THEN perform the following:		
1) Stop associated MD AFWP and place in PTL OR decrease TDAFWP speed to 2000 rpm.		
2) Dispatch an Operator to locally isolate affected AFW flow control valve.		
3) WHEN affected AFW flow control valve is isolated, THEN restart MD AFWP OR Restore TD AFWP speed as necessary.		
<b>5. COLD LEG RECIRCULATION CRITERIA</b>		
IF RWST level decreases to less than 36%, THEN go to EMG ES-12, TRANSFER TO COLD LEG RECIRCULATION, Step 1.		
<b>6. AFW SUPPLY SWITCHOVER CRITERIA</b>		
IF CST suction pressure decreases to less than 2.6 psig, THEN switch to alternate AFW suction supply.		

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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection		
Time	Position	Applicant's Actions or Behavior
<p><b>CAUTION</b></p> <p>Accident conditions can cause higher than normal radiation levels. Health Physics monitoring may be required while performing local operator actions.</p> <p><b>NOTES</b></p> <ul style="list-style-type: none"> <li>○ Steps 1 through 4 are immediate action steps.</li> <li>○ Foldout page shall be monitored throughout this procedure.</li> </ul>		
	RO/CRS	<p>1. Verify reactor trip</p> <ul style="list-style-type: none"> <li>a. Check all rod bottom lights – LIT</li> <li>b. Ensure reactor trip &amp; bypass breakers – OPEN</li> <li>c. Check IR neutron flux – DECREASING</li> </ul>
	BOP/CRS	<p>2. Verify turbine trip</p> <ul style="list-style-type: none"> <li>a. Check the following: <ul style="list-style-type: none"> <li>* Main stop valves – ALL CLOSED OR</li> <li>* Turbine auto stop bistables – AT LEAST TWO LIT</li> </ul> </li> </ul>
	RO/CRS	<p><u>3.</u> Check AC emergency busses – at least one energized</p> <ul style="list-style-type: none"> <li>* NB01 voltage – NORMAL</li> <li>* NB02 voltage – NORMAL</li> </ul>

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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection

Time	Position	Applicant's Actions or Behavior
	RO/CRS	4. Check if Safety Injection is Actuated: a. Check any indication SI is actuated – LIT <ul style="list-style-type: none"> <li>* 00-030A, NF039A LOCA Seq Actuated – LIT OR</li> <li>* 00-031A, NF039B LOCA Seq Actuated – LIT OR</li> <li>* ESFAS status panel SIS section – any white lights LIT OR</li> <li>* Partial Trip Status Permissives/Block status panel – SI red light lit</li> </ul> b. Check both trains of SI actuated <ul style="list-style-type: none"> <li>o 00-030A, NF039A LOCA Seq Actuated – LIT</li> <li>o 00-031A, NF039B LOCA Seq Actuated – LIT</li> </ul>
<b>CAUTION</b>		
If offsite power is lost after SI reset, manual action may be required to restore safeguards equipment to the required configuration.		
	CRS	5. Check if SI is required: <ul style="list-style-type: none"> <li>* SI was manually actuated AND was required OR</li> <li>* RCS pressure is currently or has been - <math>\leq 1830</math> psig OR</li> <li>* Any SG pressure is currently or has been - <math>\leq 615</math> psig OR</li> <li>* Containment pressure is currently or has been - <math>\geq 3.5</math> psig OR</li> <li>* RCS subcooling is currently or has been - <math>&lt; 30^{\circ}\text{F}</math> [<math>45^{\circ}\text{F}</math>] OR</li> <li>* PZR level is currently or has been - <math>&lt; 6\%</math> [<math>33\%</math>]</li> </ul>

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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection		
Time	Position	Applicant's Actions or Behavior
	BOP	6. Check Main Generator Breakers & Exciter Breaker – open <ul style="list-style-type: none"> <li>○ MA ZL-3A</li> <li>○ MA ZL-4A</li> <li>○ MB ZL-2</li> </ul>
	CRS	7. Verify Automatic Actions using Attachment F, Automatic Signal Verification
		Attachment F, Automatic Signal Verification
	RO/BOP	F1. Verify Feedwater Isolation F2. Verify Containment Isolation Phase A F3. Verify AFW Pumps running F4. Verify ECCS pumps running F5. Verify CCW alignment F6. Check ESW pumps – both running F7. Check Containment fan coolers – running in slow speed F8. Verify Containment purge isolation F9. Verify both trains of Control Room ventilation isolation F10. Verify Main Steamline isolation not required F11. Verify Containment Spray not required

Op-Test No.: _____ Scenario No.: <u>  2  </u> Event No.: <u>  6  </u>		Page <u>38</u> of <u>57</u>
Event Description: BIT outlet valves EM HIS-8801A & EM HIS-8801B do not open upon SI actuation – manual open available.		
Time	Position	Applicant's Actions or Behavior
<b>INDICATION:</b> No ECCS flow indication on EM FI-917A or EM FI-917B. BIT outlet valves EM HIS-8801A/B indicate closed (Green lights are LIT).		
	RO/BOP	Determine BIT outlet valves EM HIS-8801A and EM HIS-8801B are not open. (EMG E-0, Att F, step F12)
	RO/BOP	<b>CT: Open BIT outlet valves (EM HIS-8801A and EM HIS-8801B) before the end of the scenario or before needless Red or Orange path occurs.</b>  <b>Success: Opens BIT outlet valves EM HIS-8801A and EM HIS-8801B after completion of Immediate Action steps OR they may be opened using Attachment F of EMG E-0 (F12).</b>
	RO/BOP	F12. Verify ECCS flow: (CT) a. Check CCP to BIT flow meters – <b>NO</b> flow indicated, perform RNO <ul style="list-style-type: none"> <li>○ EM FI-917A</li> <li>○ EM FI-917B</li> </ul> <i>RNOa. Perform the following</i> <i>1) If BIT valves have not been closed by operator action then manually start pumps and align valves</i>  <i>NOTE: EM HIS 8801A and EM HIS-8801B are depressed OPEN, Red lights LIT, flow indicated on EM FI-917A/B</i>  <i>2) If BIT valves are closed by operator action, then go to step 13</i>



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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection

Time	Position	Applicant's Actions or Behavior
<p style="text-align: center;"><b>FOLDOUT PAGE ITEM</b></p> <p><b>4. RUPTURED S/G ISOLATION CRITERIA</b>                      IF any S/G level increases in an uncontrolled manner OR any S/G has abnormal radiation, AND narrow range level in affected S/G(s) is greater than 6% [29%], THEN the following may be performed.</p> <p>a. Close ruptured S/G AFW flow control valves. <b>(CT – see below)</b></p> <p>b. IF any ruptured S/G AFW flow control valve cannot be closed AND total AFW flow to intact S/Gs can be maintained greater than 270,000 lbm/hr without associated AFW Pump, THEN perform the following:</p> <ol style="list-style-type: none"> <li>1) Stop associated MD AFWP and place in PTL OR decrease TDAFWP speed to 2000 rpm.</li> <li>2) Dispatch an Operator to locally isolate affected AFW flow control valve.</li> <li>3) WHEN affected AFW flow control valve is isolated, THEN restart MD AFWP OR Restore TD AFWP speed as necessary.</li> </ol>		
	CRS/BOP	Directs Foldout Item #4, Ruptured SG Isolation Criteria when level in ruptured SG > 6% [29%]  <b>CT: Isolate feed flow to ruptured Steam Generator before Steam Generator overfills.</b>  <b>Success: Close ruptured steam generator AFW flow control valves, AL HK-8A and AL HK-7A.</b>



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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection		
Time	Position	Applicant's Actions or Behavior
	RO	<p><u>9.</u> Check RCS cold leg temperatures</p> <ul style="list-style-type: none"> <li>* Stable at to trending to 557°F for condenser steam dumps, <b>NO</b>, perform RNO</li> <li>* Stable at or trending to 561°F for SG ARVs</li> </ul> <p><i>RNO9. Perform the following:</i></p> <p><i>a. If temp. is &lt; setpoint and decreasing, then perform the following:</i></p> <ol style="list-style-type: none"> <li>1) Stop dumping steam</li> <li>2) If any MSIV is open, then close Main Turbine Stop &amp; Control Valves Startup Drains (AC HIS-134)</li> <li>3) If cooldown continues then control total feed flow to limit RCS cooldown. Maintain total feed flow &gt; 270,000 lbm/hr until NR level &gt; 6% [29%] in at least one SG</li> <li>4) If any RCS Cold Leg temperature reaches 555 °F, then isolate main steamlines by depressing both MS ISO VLV ALL CLOSE pushbuttons.             <ul style="list-style-type: none"> <li>o AB HS-79</li> <li>o AB HS-80</li> </ul> </li> </ol> <p><i>b. If temperature is &gt; setpoint and increasing, then perform one of the following:</i></p> <ul style="list-style-type: none"> <li>* Dump steam to condenser</li> <li>* Dump steam using SG ARVs</li> </ul>

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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection

Time	Position	Applicant's Actions or Behavior
	BOP	10. Establish SG pressure control <ul style="list-style-type: none"> <li>a. Check condenser - AVAILABLE               <ul style="list-style-type: none"> <li>○ C-9 lit</li> <li>○ MSIV – OPEN</li> <li>○ Circ water pumps – RUNNING</li> </ul> </li> <li>b. Place steam header pressure control in manual               <ul style="list-style-type: none"> <li>○ AB PK-507</li> </ul> </li> <li>c. Manually set steam header pressure control output to zero               <ul style="list-style-type: none"> <li>○ AB PK-507</li> </ul> </li> <li>d. Place steam dump select switch to STEAM PRESS position               <ul style="list-style-type: none"> <li>○ AB US-500Z</li> </ul> </li> <li>e. Place steam header pressure control in Automatic               <ul style="list-style-type: none"> <li>○ AB PK-507</li> </ul> </li> </ul>
	RO	11. Check PZR PORVs <ul style="list-style-type: none"> <li>a. Check PZR PORVs – CLOSED               <ul style="list-style-type: none"> <li>○ BB HIS-455A</li> <li>○ BB HIS-455B</li> </ul> </li> <li>b. Power to block valves- AVAILABLE</li> <li>c. RCS pressure - &lt; 2185 psig</li> </ul>
	RO	12. Check normal PZR spray valves – CLOSED <ul style="list-style-type: none"> <li>○ BB ZL-455B</li> <li>○ BB ZL-455C</li> </ul>

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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection		
Time	Position	Applicant's Actions or Behavior
	RO	13. Check PZR safety valves – CLOSED <ul style="list-style-type: none"> <li>○ BB ZL-8010A</li> <li>○ BB ZL-8010B</li> <li>○ BB ZL-8010C</li> </ul>
NOTE:		
Seal injection flow shall be maintained to all RCPs.		
	RO	14. Check if RCPs should be stopped: <ul style="list-style-type: none"> <li>a. Check RCPs – any running</li> <li>b. Check RCS pressure - &lt; 1400 psig <i>RNOB. Go to step 15</i></li> <li>c. Check ECCS pumps - at least one running               <ul style="list-style-type: none"> <li>* CCP or</li> <li>* SI pump</li> </ul> </li> <li>d. Check operator controlled cooldown – not in progress</li> <li>e. Stop all RCPs</li> </ul>
	CRS	15. Direct Operator to monitor Critical Safety Functions using EMG F-0, Critical Safety Function Status trees (CSFST)

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Event Description: 500 gpm SGTR, EMG E-0, rev 23, Reactor Trip or Safety Injection		
Time	Position	Applicant's Actions or Behavior
	BOP	<p>16. Check is SGs are not faulted:</p> <p>a. Check pressures in all SGs -</p> <ul style="list-style-type: none"> <li>○ No SG pressure decreasing in an uncontrolled manner</li> <li>○ No SG completely depressurized</li> </ul>
	BOP	<p>17. Check if SG tubes are intact:</p> <ul style="list-style-type: none"> <li>* Direct HP to survey steamlines in Area 5 of the Aux Building</li> <li>* Condenser air discharge radiation – Normal before isolation <ul style="list-style-type: none"> <li>○ GEG 925 – <b>NO</b>, perform RNO</li> </ul> </li> </ul> <p><i>RNO17. Perform the following:</i></p> <p>a. <i>Ensure BIT inlet and outlet valves are open</i></p> <ul style="list-style-type: none"> <li>○ <i>EM HIS-8803A</i></li> <li>○ <i>EM HIS-8803B</i></li> <li>○ <i>EM HIS-8801A</i></li> <li>○ <i>EM HIS-8801B</i></li> </ul> <p>b. <i>Go to EMG E-3, Steam Generator Tube Rupture, step 1</i></p>
<b>BOOTH Cue:</b> Respond as HP: I will survey the steam lines in Area 5. Later, call back with a report of higher than normal radiation on SG "A" main steam line.		

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)

Time	Position	Applicant's Actions or Behavior
	CRS	Crew transitions from EMG E-0 to EMG E-3
	CREW	<b>ENTER</b> and Direct EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)

**FOLDOUT PAGE FOR EMG E-3****1. SI REINITIATION CRITERIA**

IF following performance of Step 31, either condition listed below occurs, THEN start ECCS pumps as necessary to reestablish RCS subcooling and PZR level and go to EMG C-31, SGTR WITH LOSS OF REACTOR COOLANT - SUBCOOLED RECOVERY DESIRED, Step 1.

\* RCS subcooling - LESS THAN 30°F [45°F]

OR

\* Pressurizer level - CANNOT BE MAINTAINED GREATER THAN 6% [33%]

**2. SECONDARY INTEGRITY CRITERIA**

IF all conditions listed below are satisfied, THEN go to EMG E-2, FAULTED STEAM GENERATOR ISOLATION, Step 1:

- Any S/G pressure is decreasing in an uncontrolled manner OR any S/G has completely depressurized
- Affected S/G has NOT been isolated using EMG E-2, FAULTED STEAM GENERATOR ISOLATION
- Affected S/G is NOT needed for RCS cooldown

**3. MULTIPLE TUBE RUPTURE CRITERIA**

IF any intact S/G level increases in an uncontrolled manner OR any intact S/G has abnormal radiation, THEN stop any RCS cooldown and depressurization in progress, stabilize the plant, and go to EMG E-3, STEAM GENERATOR TUBE RUPTURE, Step 1.

**4. COLD LEG RECIRCULATION CRITERIA**

IF RWST level decreases to less than 36%, THEN go to EMG ES-12, TRANSFER TO COLD LEG RECIRCULATION, Step 1.

**5. AFW SUPPLY SWITCHOVER CRITERIA**

IF CST suction pressure decreases to less than 2.6 psig, THEN switch to alternate AFW suction supply.

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)		
Time	Position	Applicant's Actions or Behavior
NOTES		
<ul style="list-style-type: none"> <li>○ Foldout page shall be monitored throughout this procedure.</li> <li>○ Personnel should be available for sampling during this procedure.</li> <li>○ Seal injection flow shall be maintained to all RCPs.</li> </ul>		
	CRS	<ol style="list-style-type: none"> <li>1. Check if RCPs should be stopped:               <ol style="list-style-type: none"> <li>a. Check RCPs - ANY RUNNING</li> <li>b. Check RCS pressure - &lt; 1400 psig; <b>NO</b>, perform RNO</li> <li>c. Check ECCS pumps – AT LEAST ONE RUNNING                   <ul style="list-style-type: none"> <li>* CCP or</li> <li>* SI pump</li> </ul> </li> <li>d. Check operator controlled cooldown – NOT IN PROGRESS</li> <li>e. Stop all RCPs</li> </ol> </li> </ol> <p><i>RNO for a-d: Observe CAUTION prior to step 2 and go to step 2</i></p>
CAUTION		
If steamlines are not intact, extreme caution will be necessary when performing local surveys.		
	CRS	<ol style="list-style-type: none"> <li>2. Identify ruptured SGs:               <ul style="list-style-type: none"> <li>* Level increasing in an uncontrolled manner OR</li> <li>* High turbine driven AFW exhaust radiation OR</li> <li>* High radiation from any SG steamline radiation monitor OR</li> <li>* High radiation from any SG steamline survey OR</li> <li>* High radiation from any SG sample</li> </ul> </li> </ol>

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)		
Time	Position	Applicant's Actions or Behavior
<b>BOOTH CUE:</b> If contacted as HP to survey steam lines in Area 5: respond I will perform the survey.		
<b>CAUTION</b>		
If the turbine driven AFW pump is the only available source of feed flow, steam supply to the turbine driven AFW pump must be maintained from at least one S/G.		
	RO/BOP	3. Isolate flow from ruptured SGs: <ul style="list-style-type: none"> <li>a. Adjust ruptured SG ARV controller setpoint to 1160 psig</li> <li>b. Check ruptured SG ARV – CLOSED</li> <li>c. Locally close steam supply to turbine driven AFW pump from ruptured SG(s) <i>NA for SG A</i> <ul style="list-style-type: none"> <li>* AB-V085 for SG B</li> <li>* AB-V087 for SG C</li> </ul> </li> <li>d. Locally isolate main steamline low point drain valve from ruptured SG(s)                             <ul style="list-style-type: none"> <li>* <b>Close AB-V062 for SG A</b></li> <li>* Close AB-V072 for SG B</li> <li>* Close AB-V082 for SG C</li> <li>* Close AB-V052 for SG D</li> </ul> </li> </ul>
<b>BOOTH INSTRUCTION:</b> AB-V062 not modeled; wait ~ two minutes and report that AB-V062 is closed.		





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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)

Time	Position	Applicant's Actions or Behavior
	CRS	5. Isolate steamline on ruptured SGs: a. Close main steamline isolation valve * <b>AB HIS-14 for SG A</b> * AB HIS-17 for SG B * AB HIS-20 for SG C * AB HIS-11 for SG D b. Ensure main steamline isolation bypass valves – CLOSED o <b>AB ZL-15A for SG A</b> o AB ZL-18A for SG B o AB ZL-21A for SG C o AB ZL-12A for SG D
<b>CAUTION</b> If any ruptured S/G is also faulted and the affected S/G is not needed for RCS cooldown, feed flow to that S/G shall remain isolated during subsequent recovery actions.		
	BOP	<u>6.</u> Check if feed flow should be isolated to ruptured SG(s): a. Check ruptured SG(s) narrow range level - >6% [29%]

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)		
Time	Position	Applicant's Actions or Behavior
<p><b>CT: Isolate feed flow to ruptured Steam Generator before Steam Generator overfills.</b></p> <p><b>Success: Close ruptured steam generator AFW flow control valves, AL HK-8A and AL HK-7A.</b></p> <p><b>(May have been performed using Foldout page criteria of EMG E-0)</b></p>		
	BOP	<p><u>7</u>. Stop feed flow to ruptured SG(s) (CT)</p> <p>a. Close affected SG(s) MD AFP flow control valve(s)</p> <ul style="list-style-type: none"> <li>* <b>AL HK-7A for SG A</b></li> <li>* AL HK-9A for SG B</li> <li>* AL HK-11A for SG C</li> <li>* AL HK-5A for SG D</li> </ul> <p>b. Close affected SG(s) TD AFWP flow control valve(s)</p> <ul style="list-style-type: none"> <li>* <b>AL HK-8A for SG A</b></li> <li>* AL HK-10A for SG B</li> <li>* AL HK-12A for SG C</li> <li>* AL HK-6A for SG D</li> </ul>
	BOP	<p>8. Establish SG pressure control:</p> <p>a. Check condenser available</p> <p>b. Place steam header pressure control in manual</p> <p>c. Manually set steam header pressure control output to zero</p> <p>d. Place steam dump select switch in STEAM PRESS position</p> <p>e. Place steam header pressure control in automatic</p>

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)

Time	Position	Applicant's Actions or Behavior
	CRS	9. Verify ruptured SG(s) isolation <ul style="list-style-type: none"> <li>a. Check ruptured SG(s) – not needed for RCS cooldown</li> <li>b. Verify ruptured SG(s) steamline has been isolated from at least one intact SG:                             <ul style="list-style-type: none"> <li>* Main steam isolation valve, bypass valve, and drain valve on ruptured SG – CLOSED OR</li> <li>* Attachment A, Main Steam header isolation – Control Room – completed</li> </ul> </li> <li>c. Verify steam supply to turbine driven AFW pump from ruptured SG(s) – CLOSED <i>NA FOR SG A</i> <ul style="list-style-type: none"> <li>* AB-V085 for SG B</li> <li>* AB-V087 for SG C</li> </ul> </li> </ul>
<p><b>CAUTION</b></p> <p>At EOL, if a control rod is stuck or SI flow is reduced, an inadvertent restart may occur. Symptoms for subcriticality red path and transition to EMG FR-S1, RESPONSE TO NUCLEAR POWER GENERATION/ATWS, shall be closely monitored during subsequent steps.</p>		
	CREW	10. Check ruptured SG(s) pressure - > 275 psig

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)			
<b>Time</b>	<b>Position</b>	<b>Applicant's Actions or Behavior</b>	
NOTE			
If high steam pressure rate setpoint (100 psi/50 sec) is exceeded after low steamline pressure SI signal is blocked, main steamline isolation will occur.			
	RO	11. Check if low steamline pressure SI should be blocked: <ul style="list-style-type: none"> <li>a. Check RCS pressure - &lt;1970 psig                             <ul style="list-style-type: none"> <li>o P-11 light – LIT</li> </ul> </li> <li>b. Block low steamline pressure SI                             <ul style="list-style-type: none"> <li>o SB HS-9</li> <li>o SB HS-10</li> </ul> </li> </ul> <p><i>RNOa. When RCS pressure is &lt;1970 psig then block low steamline pressure SI. Continue with step 12.</i></p>	
	CREW	12. Determine target plant conditions from table below:	
LOWEST RUPTURED S/G PRESSURE (PSIG)	TARGET CORE EXIT TEMPERATURE (°F)	TARGET INTACT S/G PRESSURE (PSIG)	TARGET CONDENSER STEAM DUMP CONTROLLER SETPOINT
>1200	519 [504]	791 [691]	5.27 [4.61]
1100 TO 1199	508 [493]	717 [624]	4.78 [4.16]
1000 TO 1099	496 [481]	642 [557]	4.28 [3.71]
900 TO 999	484 [469]	573 [495]	3.82 [3.30]
800 TO 899	470 [455]	500 [430]	3.33 [2.87]
700 TO 799	455 [440]	430 [367]	2.87 [2.45]
600 TO 699	438 [423]	359 [304]	2.39 [2.03]
500 TO 599	420 [405]	294 [247]	1.96 [1.65]
400 TO 499	398 [383]	227 [188]	1.51 [1.25]
300 TO 399	372 [357]	163 [133]	1.09 [0.89]
275 TO 299	364 [350]	147 [118]	0.98 [0.79]

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)

Time	Position	Applicant's Actions or Behavior
<p style="text-align: center;"><b>CAUTION</b></p> <p>If RCPs are NOT running, the cooldown and depressurization steps may cause a red or orange path condition on the integrity status tree for the ruptured loop. Step 48 shall be completed before reevaluating the red or orange path condition and transition to EMG FR-P1, RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITIONS, if required.</p> <p style="text-align: center;"><b>NOTES</b></p> <ul style="list-style-type: none"> <li>○ After operator initiated RCS cooldown has been started, RCP trip criteria no longer applies.</li> <li>○ When RCS average temperature is less than 550°F, the condenser steam dump low temperature interlock must be bypassed to keep cooldown valves open.</li> </ul>		
<p><b>CT: Cooldown &amp; Depressurize RCS to minimize RCS inventory leakage into the ruptured Steam Generator. Success: Initiate Maximum rate RCS Cooldown (see step 13)</b></p>		
	CRS	<p>13. Initiate RCS cooldown (CT)</p> <p>a. Dump steam to condenser at maximum rate:</p> <ol style="list-style-type: none"> <li>1) Ensure STM HDR PRESS CTRL in manual <ul style="list-style-type: none"> <li>○ AB PK-507</li> </ul> </li> <li>2) Set STM HDR PRESS CTRL potentiometer to target setpoint value <ul style="list-style-type: none"> <li>○ AB PK-507</li> </ul> </li> <li>3) Manually adjust STM HDR PRESS CTRL to slowly open a maximum of 3 cooldown valves <ul style="list-style-type: none"> <li>○ AB PK-507</li> </ul> </li> <li>4) When P-12 interlock actuates, then place both STEAM DUMP BYPASS INTERLOCK switches to BYP/INTLK <ul style="list-style-type: none"> <li>○ AB HS-63</li> <li>○ AB HS-64</li> </ul> </li> <li>5) Place STM HDR PRESS CTRL in auto to continue cooldown at maximum rate <ul style="list-style-type: none"> <li>○ AB PK-507</li> </ul> </li> </ol>

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)		
Time	Position	Applicant's Actions or Behavior
	CREW	<u>14.</u> Check intact SG levels: a. Check NR level in at least one SG - > 6% [29%] b. Control feed flow to maintain NR level in all SGs between 29% [29%] and 50%
<b>CAUTION</b>		
If any PZR PORV opens because of high PZR pressure, the PORV shall be monitored to ensure it recloses after pressure decreases to less than 2335 psig.		
	CREW	<u>15.</u> Check PZR PORVs and block valves: a. Power to block valves – AVAILABLE <ul style="list-style-type: none"> <li>○ BB HIS-8000A</li> <li>○ BB HIS-8000B</li> </ul> b. PZR PORVs – CLOSED <ul style="list-style-type: none"> <li>○ BB HIS-455A</li> <li>○ BB HIS-456A</li> </ul> c. RCS pressure - < 2185 psig
	CREW	<u>16.</u> Check PZR Safety valves – CLOSED <ul style="list-style-type: none"> <li>○ BB ZL-8010A</li> <li>○ BB ZL-8010B</li> <li>○ BB ZL-8010C</li> </ul>

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)		
Time	Position	Applicant's Actions or Behavior
CAUTION		
If offsite power is lost after SI reset, manual action may be required to restore safeguards equipment to the required configuration.		
	RO	17. Reset SI <ul style="list-style-type: none"> <li>○ SB HS-42A</li> <li>○ SB HS-43A</li> </ul>
	RO	18. Reset Containment Isolation Phase A & Phase B <ul style="list-style-type: none"> <li>○ SB HS-56 for phase A</li> <li>○ SB HS-53 for phase A</li> <li>○ SB HS-55 for phase B</li> <li>○ SB HS-52 for phase B</li> </ul>
	CREW	19. Establish Instrument Air to Containment <ul style="list-style-type: none"> <li>a. Ensure ESW to air compressor valves - OPEN               <ul style="list-style-type: none"> <li>○ EF HIS-43</li> <li>○ EF HIS-44</li> </ul> </li> <li>b. Reset and close air compressor breaker reset switches               <ul style="list-style-type: none"> <li>○ KA HIS-2C</li> <li>○ KA HIS-3C</li> </ul> </li> <li>c. Check instrument air pressure - &gt; 105 psig               <ul style="list-style-type: none"> <li>○ KA PI-40</li> </ul> </li> <li>d. Check PZR pressure master controller - &lt; 50% output signal               <ul style="list-style-type: none"> <li>○ BB PK-455A</li> </ul> </li> <li>e. Open instrument air supply containment isolation valve               <ul style="list-style-type: none"> <li>○ KA HIS-29</li> </ul> </li> </ul>

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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)		
Time	Position	Applicant's Actions or Behavior
CAUTION		
After RHR pumps have been stopped, RCS pressure shall be monitored for RHR pump restart criteria.		
	CRS	<p><u>20.</u> Check if RHR pumps should be stopped:</p> <ul style="list-style-type: none"> <li>a. Check RHR pumps – any running</li> <li>b. Check RHR system – aligned for injection</li> <li>c. Check RCS pressure - &gt; 325 psig</li> <li>d. Stop RHR pumps and place in standby <ul style="list-style-type: none"> <li>o EJ HIS-1</li> <li>o EJ HIS-2</li> </ul> </li> <li>e. Check RCS pressure &gt; 325 psig during subsequent recovery actions</li> </ul> <p><i>RNOe. If RCS pressure decreases in an uncontrolled manner to &lt; 325 psig, then manually restart RHR pumps to provide injection to the RCS.</i></p>
	CREW	<p>21. Check if RCS cooldown should be stopped:</p> <ul style="list-style-type: none"> <li>a. Check RCS temperatures - &lt; target temperature <ul style="list-style-type: none"> <li>* Core Exit TCs or</li> <li>* RCS hot leg RTDs</li> </ul> </li> <li>b. Ensure steam dump valves - CLOSING <ul style="list-style-type: none"> <li>o Condenser steam dumps</li> <li>o ARVs</li> </ul> </li> <li>c. Adjust steam dump controllers, as necessary, to automatically maintain RCS temperature stable below target temperature <ul style="list-style-type: none"> <li>* AB PK-507 or</li> <li>* Intact ARVs</li> </ul> </li> </ul>



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Event Description: 500 gpm SGTR, EMG E-3, rev 22, Steam Generator Tube Rupture (SGTR)		
Time	Position	Applicant's Actions or Behavior
	CREW	22. Check ruptured SG Pressure – stable or increasing
	CREW	23. Check RCS subcooling - > 50°F [65°F]
	CREW	<p>24. Depressurize RCS using normal Spray to minimize break flow and refill PZR</p> <p>a. Verify normal PZR spray – available</p> <ul style="list-style-type: none"> <li>* RCP D running</li> <li>* RCPs A, B, and C running</li> <li>* All RCPs running</li> </ul> <p>b. Spray PZR with maximum available spray until any of the following conditions</p> <p>Are satisfied:</p> <ul style="list-style-type: none"> <li>* PZR level - &gt; 75% [61%] or</li> <li>* RCS subcooling - &lt; 30°F [45°F] or</li> <li>* Both of the following               <ol style="list-style-type: none"> <li>1) RCS pressure - &lt; ruptured SGs pressure</li> <li>2) PZR level - &gt; 6% [33%]</li> </ol> </li> </ul> <p>c. Close normal spray valves</p> <ul style="list-style-type: none"> <li>o BB PK-455B</li> <li>o BB PK-455C</li> </ul> <p>d. Observe CAUTION prior to step 30 and go to step 30</p>
<b>Terminate scenario at Lead Examiner's discretion.</b>		