

Facility: North Anna Power StationScenario No.: (2016) NRC -1Op-Test No.: 1Examiners: Bruno Cabarello

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

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Initial Conditions: 100% MOL, 1-SW-P-1A is tagged out for major repairs. 1-BC-P-1B is tagged out for shaft replacement. 2H is the protected train.

Turnover: Maintain current plant conditions. Assist maintenance with work on 1-SW-P-1A, and 1-BC-P-1B.

Event No.	Malf. No.	Event Type*	Event Description
1	RC2002	I/C (RO)	"B" Pressurizer spray valve (1-RC-PCV-1455B) fails open. Can be closed with SOV. (CT)
2	SW0104	I/C (B) TS (S)	SW pump, 2-SW-P-1A, trips
3	RD07	I/C (RO)	Continuous automatic control rod insertion which can be stopped in manual (CT)
4	MS0103	I/C (B) TS (S)	Selected Ch III steam flow channel (1-MS-FI-1484) fails low on "B" SG (CT)
5	CH1601 CH2101	I/C (RO) TS (S)	Charging pump "A" trips with failure of standby pump ("B") to auto start and discharge check valve on "A" pump sticks open (CT)
6	MS1002		Steam leak outside containment requiring power reduction
6a		R (RO) N (B)	Power reduction (with control rods in manual from event 3)
7	MS1002	M(ALL)	Steam break outside containment requiring unit trip (CT)
8	TU03	I/C (B)	No automatic turbine trip will occur/"A" MSTV will not close automatically
9		I/C (B)	Turbine-driven AFW pump (1-FW-P-2) fails to start in auto
			Events 8 and 9 are part of event 7 and are numbered only for use on subsequent forms.
			The scenario can be terminated once the crew transitions out of 1-E-2.

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

DOMINION  
NORTH ANNA POWER STATION

LICENSED OPERATOR REQUALIFICATION EXAMINATION  
SIMULATOR EXAMINATION GUIDE  
SCENARIO 2016 NRC 1

## SIMULATOR EXAMINATION GUIDE

<u>EVENT</u>	<u>DESCRIPTION</u>
1.	"B" Pressurizer spray valve (1-RC-PCV-1455B) fails open. Can be closed with SOV. (CT)
2.	SW pump, 2-SW-P-1A, trips
3.	Continuous automatic rod insertion which will stop when rods in manual (CT)
4.	Selected Ch III steam flow channel (1-MS-FI-1484) fails low on "B" SG (CT)
5.	Charging pump "A" trips with failure of standby pump ("B") to auto start and discharge check valve on "A" pump sticks open (CT)
6.	Steam leak outside containment requiring a power reduction
6a.	Power reduction
7.	Steam break outside containment requiring reactor trip (CT)
8.	No automatic turbine trip/ "A" MSTV doesn't close automatically
9.	Turbine-driven AFW pump (1-FW-P-2) fails to start in auto

### Scenario Recapitulation:

Malfunctions after EOP entry	<b>2</b>	No automatic turbine trip/"A" MSTV doesn't close automatically, turbine-driven AFW pump doesn't automatically start
Total Malfunctions	<b>9</b>	Failed pressurizer spray valve, SW pump trip, continuous rod insertion, failed steam flow channel, charging pump trip/failure of standby pump/discharge check valve failure, steam leak, steamline break, no automatic turbine trip/"A" MSTV doesn't close automatically, turbine-driven AFW pump doesn't automatically start
Abnormal Events	<b>6</b>	Failed pressurizer spray valve, SW pump trip, continuous rod insertion, failed steam flow channel, charging pump trip/failure of standby/discharge check valve failure, steam leak
Major Transients	<b>1</b>	Faulted SG
EOPs Entered	<b>1</b>	E-2
EOP Contingencies	<b>0</b>	
Critical Tasks	<b>5</b>	

### SCENARIO DURATION

90 Minutes

**SIMULATOR EXAMINATION SCENARIO SUMMARY**  
**SCENARIO 2016 NRC 1**

The scenario begins with the unit at 100% power, MOL. 1-SW-P-1A, Unit 1 "A" SW pump, is tagged out for major repairs. 1-BC-P-1B is tagged for shaft replacement, not expected back for several days. 2H is the protected train.

Once the crew has taken the unit one of the pressurizer spray valves (1-RC-PCV-1455B) will fail open. The crew will respond in accordance with 1-AP-44, "Loss of RCS Pressure," and the RO will be required to use the remote close SOV in order to close the spray valve (CT). Once the crew has stabilized the unit, or at the direction of the lead evaluator, the next event can occur.

2-SW-P-1A will trip, leaving no pump running on the "B" SW header. The crew will enter 0-AP-12, "Loss of Service Water," and start 1-SW-P-1B. The unit supervisor will consult TS and enter the action of 3.7.8B. Once SW flow has been restored and TS reviewed, or at the direction of the lead evaluator, the next event can occur.

Next, the control rods will begin to insert for no reason. The crew will enter 1-AP-1.1, "Uncontrolled Continuous Rod Motion," and place control rods in manual (CT). Once the crew has stabilized the unit, or at the direction of the lead evaluator, the next event can occur.

At this time channel III steam flow (1-MS-FI-1484) on "B" SG will fail low, the crew will enter 1-AP-3, "Loss of Vital Instrumentation," and take manual control of "B" main feed regulation valve (MFRV) (CT). The crew will swap instrumentation to an operable channel. The US will review Tech Specs for the failure. Once the channels have swapped and TS reviewed, or at the direction of the lead evaluator, the next event can occur.

1-CH-P-1A, "A" charging pump, will trip and the standby pump ("B") will not auto start. The discharge check valve on the previously running pump ("A") will stick open. The crew will start a standby pump (either "B" or "C") and enter 1-AP-49, "Loss of Normal Charging," and close the discharge MOVs on the "A" pump (CT) The crew will restore letdown flow and the US will consult TS 3.5.2 and may make arrangements to swap to the "C" charging pump (if not already running). Once letdown is restored and TS have been reviewed, or at the direction of the lead evaluator, time the next event can occur.

A steam leak will develop on the "B" steam line outside containment. The crew will enter 1-AP-38, "Excessive load Increase," and begin reducing turbine power. The RO will be required to insert rods in manual. Once a sufficient load decrease has occurred, the next event can occur.

A main steamline break will occur outside containment. The crew will enter 1-E-0, "Reactor Trip or Safety Injection." The turbine will not automatically trip, but will trip when the pushbuttons are pressed. Also, "A" MSTV will not close automatically when required, but can be closed manually. The turbine driven AFW pump, 1-FW-P-2, will fail to start automatically and will have to be manually started. The crew will proceed through 1-E-0 and transition to 1-E-2, "Faulted Steam Generator Isolation," and isolate the faulted SG (CT). The crew will announce transition to 1-ES-1.1, "SI Termination," the scenario can be terminated at this time with direction from the lead

evaluator.

## SCENARIO TURNOVER SHEET

### **Read the following to the crew:**

**Purpose:** This examination is intended to evaluate the crew's performance of various tasks associated with the Initial License Operator Training Program. All activities should be completed in accordance with approved operations standards.

1. You are on a day shift during the week.
2. A rough log should be maintained to aid in making reports and to help during briefs.
3. Respond to what you see. In the unlikely event that the simulator fails such that illogical indications result, the session will be terminated and the crew informed.

### **Unit Status:**

Unit 1 is at 100% power. RCS boron is 1096 ppm and core age is 9,000 MWD/MTU. Aux steam is on unit 2.

Unit 2 is at 100% power.

### **Equipment Status:**

1-SW-P-1A tagged out for major repairs. 1-BC-P-1B is tagged for shaft replacement, not expected back for several days. Maintenance rule window is green. 2H is the protected train. 1-BC-P-1A and both spent fuel pit cooling pumps are protected.

### **Shift Orders:**

Maintain current plant conditions. Assist maintenance with work on 1-SW-P-1A and 1-BC-P-1B, as required.

EVENT 1: Given that the unit is at power and "B" PRZR spray valve has failed open, the crew will be expected to respond in accordance with 1-AP-44, "Loss of Reactor Coolant Pressure."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials)		
<ul style="list-style-type: none"> <li>• PCS alarms for "B" spray valve</li> <li>• PRZR spray valve 1-RC-PCV-1455B has full open indication.</li> <li>• Master pressure controller output decreases.</li> <li>• PRZR pressure decreases.</li> <li>• Annunciators B-F7 and B-H6 illuminate</li> </ul>		
	RO identifies annunciator B-F7, PRZ HI-LO PRESS.	
	RO identifies RCS pressure decreasing.	
	US directs crew to enter 1-AP-44.	
	RO monitors RCS pressure greater than 1870 psig.	
	RO checks PRZR PORVs closed. (YES)	
	RO checks master pressure controller not failed. (YES)	
	RO checks spray valves closed. (NO)	
	<b>NOTE: Valve cannot be manually closed. Crew must use SOV.</b>	
<b>CT1</b>	<b>Crew stops RCS pressure decrease:</b> <ul style="list-style-type: none"> <li>• <b>RO closes REMOTE CLOSE SOV for spray valve.</b></li> </ul>	<b>Critical task</b> *Prior to reaching an automatic reactor trip on low pressure
	RO verifies all PRZR heaters are energized.	
	RO checks that aux spray valve is closed.	
	RO checks PRZR safety valves closed and PRZR PORVs closed or isolated.	
	RO verifies RCS pressure stable or increasing.	
	RO verifies RCS pressure returned to normal.	
	RO adjusts sprays and heaters, as required, to maintain normal pressure.	
	<b>US references Technical Specification 3.4.1, Action A (2 hour), if pressure went below 2205 psig. (TS 3.4.11 and 3.4.13 are not applicable.</b>	*Not counted as TS

EVENT 1: Given that the unit is at power and "B" PRZR spray valve has failed open, the crew will be expected to respond in accordance with 1-AP-44, "Loss of Reactor Coolant Pressure."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	US requests Work Control Center supervisor to inform the OMOC of the failure and initiate CR.	
	<b>NOTE: The next event can occur after the crew has returned RCS pressure to normal, and as directed by the lead evaluator.</b>	<b>Validation time: 7 minutes</b>

EVENT 2: Given the plant in Mode 1 and a trip of 2-SW-P-1A has occurred, the crew will respond in accordance with 0-AP-12, "Loss of Service Water."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Annunciators J-D3, J-B3, then B-B7, B-E8, and B-C8 illuminate</li> <li>• Unit 2 "A" SW pump has amber and green lights lit</li> <li>• "B" SW header flow decreases</li> </ul>		
	Crew identifies annunciator J-D3, SW PP 1-P1A, 2-P1A AUTO TRIP..	
	BOP identifies that unit 2 "A" SW pump has tripped.	
	US directs entry into 0-AP-12.	
	BOP checks SW reservoir level > 310 feet. (SG panels ~314.5)	
	Crew checks SW system for integrity and flooding: <ul style="list-style-type: none"> <li>• AB sump level normal (H&amp;J SG panel)</li> <li>• Chiller room sump level normal (J)</li> <li>• Turbine building valve pit sump level normal (no alarms)</li> <li>• No reports of flooding.</li> </ul>	
	Crew verifies SW supply headers are intact. (Safeguards panels)	
	Crew verifies at least one SW pump running on each supply header. (NO)	
	BOP starts 1-SW-P-1B. (J Safeguards panel)	
	Crew verifies return header flows indicated.	
	Crew verifies SW system is stable: <ul style="list-style-type: none"> <li>• SW pump amps</li> <li>• SW pump discharge pressure</li> <li>• Both supply headers in service</li> <li>• Both return header flows normal.</li> </ul>	
	Crew verifies operability of equipment.	
	<div style="border: 2px solid black; padding: 5px;">             US refers to Tech Spec 3.7.8B and enters action to verify SW throttled within 1 hour and restore one pump to service within 72 hours           </div>	Throttling was previously verified for tagout of 1-SW-P-1A.
	BOP checks SW reservoir level between 313' and 315'.	

EVENT 2: Given the plant in Mode 1 and a trip of 2-SW-P-1A has occurred, the crew will respond in accordance with 0-AP-12, "Loss of Service Water."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<b>NOTE: The next event may occur once SW pump has been started, and at the direction of the lead evaluator.</b>	<b>Validation time: 10 minutes</b>

EVENT 3: Given that the unit is operating at power and control rods are inserting for no apparent reason, the crew will be expected to respond in accordance with 1-AP-1.1, "Continuous Uncontrolled Rod Motion."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials)		
<ul style="list-style-type: none"> <li>Rods step in at maximum speed</li> </ul>		
	RO identifies control rods stepping in at maximum speed.	
	RO/BOP identify no known cause of rod insertion. (NIs, 1 <sup>st</sup> stage pressure, Tave/Tref mismatch)	
	US directs crew to enter AP-1.1.	
<b>CT2</b>	<b>Crew takes action to stop rod motion and stabilize the unit.</b> <ul style="list-style-type: none"> <li><b>RO places rod control in MANUAL.</b></li> <li>RO verifies rod motion stopped.</li> </ul>	<b>Critical Task</b> *Prior to automatic reactor trip
	RO maintains the following using rods/boration: Rods above Lo/Lo-Lo limit AFD in spec (A-H7 not LIT).	
	RO checks RCS Tave > 541°F, above min and below max of attachment 2. Adjusts as directed by the US.	
	RO checks PRZR pressure stable or trending to 2235 psig. Adjusts heaters and spray as required.	
	RO checks PRZR level stable. Adjusts charging, if required.	
	Crew checks controls rods above the lo insertion limit.	
	Crew maintains stable plant conditions.	
	US notifies I&C to investigate.	
	The US reports the failure to the Work Control Center and requests that the reactivity management admin procedure be referenced, appropriate notifications made, and Condition Report be initiated.	
	<b>NOTE: The next event can occur after the crew has stabilized the plant, and as directed by the lead evaluator.</b>	<b>Validation time 8 minutes</b>

EVENT 4: Given that the unit is at power, and a selected steam flow channel (1-MS-FI-1484) has failed low, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Annunciators F-E2 and F-F2 illuminate</li> <li>• 1-MS-FI-1484 fails low in range</li> <li>• "B" MFRV demand decreases</li> <li>• "B" SG feed flow and level decrease</li> </ul>		
	BOP identifies annunciator F-E2, STM GEN 1A FW > STM FLOW CH III-IV, and informs US.	
	Crew identifies "B" SG steam flow channel III failed low.	
	US directs crew to perform immediate actions of 1-AP-3:	
	Crew verifies SG level controlling channels normal (NO)	
<b>CT3</b>	<b>BOP places "B" MFRV in MANUAL and adjusts to control "B" SG level</b>	<b>Critical Task</b> *Prior to a reactor trip due to SG level
	Crew verifies turbine first-stage pressure channels normal	
	RO verifies PRZR level indications are normal.	
	Crew verifies redundant instrument channels normal	
	RO verifies systems affected by PRZR level channels normal: <ul style="list-style-type: none"> <li>• Operable channel selected</li> <li>• Emergency bus B/U heaters restored</li> <li>• L/D in service</li> <li>• Level control in automatic</li> <li>• Control group heaters not tripped.</li> </ul>	
	Crew verifies both turbine first stage pressure channels normal.	
	Crew verifies operable channels selected for SGWLC. (NO)	

EVENT 4: Given that the unit is at power, and a selected steam flow channel (1-MS-FI-1484) has failed low, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<p>Crew swaps SGWLC channels:</p> <ul style="list-style-type: none"> <li>• RO verifies rod control to MANUAL</li> <li>• RO turns steam dumps off or swaps to steam pressure mode as directed by the US</li> <li>• BOP verifies all FRV B/P in MANUAL and places MFRVs in MANUAL</li> <li>• Crew swaps all Steam flow/Feed flow and First-stage pressure channels to channel IV (Vertical board)</li> <li>• BOP verifies SG level median controlling channels are functional</li> <li>• BOP returns MFRVs to AUTOMATIC</li> <li>• RO verifies Steam dumps are available</li> <li>• RO returns steam dumps to T<sub>AVE</sub> mode</li> </ul> <p>Checks both 1<sup>st</sup> stage pressure operable            Verifies/places interlock switches in Off/Reset            Checks P-E4 not lit            Verifies/places mode selector in Tave            Verifies steam dump demand is zero            Place interlock switches in ON</p> <ul style="list-style-type: none"> <li>• RO checks Tave/Tref within 1.5°F and leaves rods in manual due to earlier failure.</li> </ul>	<p>Seven switches are placed to yellow dots</p>
	<p><b>NOTE: During this time the WCC will call and inform the control room that the instrument techs have found a problem in auto rod control, rods will work in manual.</b></p>	
	<p>Crew verifies no other instrument channels are failed.</p>	
	<p>Crew refers to 1-MOP-55.77 for placing the failed channel in trip.</p>	
	<p><b>US refers to Technical Specifications:</b>            3.3.2 Functions 1f, 1g, 4d, and 4e - Condition D            Determines the failed channel must be placed in trip within 72 hours.</p>	

EVENT 4: Given that the unit is at power, and a selected steam flow channel (1-MS-FI-1484) has failed low, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<b>NOTE: The next event can occur after the crew swaps channels and the US has reviewed Tech Specs, as directed by the lead evaluator.</b>	Validation time 15 minutes

EVENT 5: Given that the unit is at power and a loss of the running charging pump ("A") and a failure of the auto-start of the standby pump ("B") concurrent with a failed open discharge check valve ("A") has occurred, the crew will be expected to respond in accordance with 1-AP-49, "Loss of Normal Charging."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Annunciators C-A5, C-B5, C-C5, and C-G6 are illuminated</li> <li>• 1-CH-P-1A has amber light lit on breaker indication</li> <li>• "B" charging pump does not auto-start</li> <li>• 1-CH-FI-1122A is off-scale low</li> <li>• 1-CH-FCV-1122 ramps open</li> <li>• Charging pump discharge pressure decreases</li> <li>• Letdown isolates</li> </ul>		
	RO identifies annunciator C-A5, CH PP 1A 15H6 LOCKOUT.	
	Crew identifies loss of running charging with no auto start of standby pump and no charging flow.	
	<b>NOTE: Crew may start either the "B" or "C" charging pump based on the fact that it should have auto-started (per the DNOS), or start the pump in 1-AP-49 step 20. These steps were not included.</b>	
	RO starts either 1-CH-P-1B or 1-CH-P-1C.	
	RO identifies there is still no charging flow indicated.	
	US directs crew to enter 1-AP-49.	
	Crew checks the charging pump that auto started for gas binding. (NO)	
	Crew identifies that a charging pump manipulation has taken place.	
CT4	<b>Crew closes discharge MOVs for the previously running pump ("A").</b> <ul style="list-style-type: none"> <li>• 1-CH-MOV-1286A (Vertical Board)</li> <li>• 1-CH-MOV-1287A (Vertical Board)</li> </ul>	<b>Critical Task</b> *Prior to Safety Injection being required by degraded plant conditions. (E-0, Step 4)
	RO verifies charging conditions returning to normal: <ul style="list-style-type: none"> <li>• Discharge pressure</li> <li>• Charging flow</li> <li>• Motor amps.</li> </ul>	

EVENT 5: Given that the unit is at power and a loss of the running charging pump ("A") and a failure of the auto-start of the standby pump ("B") concurrent with a failed open discharge check valve ("A") has occurred, the crew will be expected to respond in accordance with 1-AP-49, "Loss of Normal Charging."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<b>NOTE: If sent, operator will report that the breaker for the "A" Charging pump (15H6) has a timed overcurrent drop.</b>	
	Crew returns letdown to service: <ul style="list-style-type: none"> <li>• Crew controls charging</li> <li>• Crew puts 1-CH-PCV-1145 in manual and opens to 100%</li> <li>• Crew verifies/opens letdown isolation valves: 1-CH-TV-1204A/B (Safeguards panels) 1CH-LCV-1460A/B 1-CH-HCV-1200B</li> <li>• Crew opens letdown orifice valve</li> <li>• Crew adjusts 1-CH-PCV-1145 to establish 300 psig letdown pressure and places valve in AUTO</li> <li>• When level is returned to normal, crew places charging back in automatic.</li> </ul>	
	RO checks standby charging pumps in auto-after-stop. ("C" has no auto)	
	US verifies that CRs are being submitted.	
	US reviews TS 3.5.2A for having only one HHSI pump (72 hours).	At minimum, once discharge valves are closed, SRO should note entry into TS 3.5.2A
	<b>NOTE: Crew may also discuss an entry into TS 3.0.3, which was applicable until the discharge MOVs were closed.</b>	
	<b>NOTE: Crew may discuss starting the "C" pump on the 1H bus.</b>	
	<b>NOTE: Once the US has referred to Tech Specs, pressurizer level has stabilized, and as directed by the Lead Evaluator, the next event can occur.</b>	Validation time 10 minutes

EVENT 6: Given a faulted steam generator outside containment the crew will respond in accordance with "1-AP-38," Excessive Load Increase."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Annunciator D-C8 illuminates</li> <li>• Reactor power increases</li> <li>• RCS temperature decreases</li> <li>• Megawatts decrease</li> </ul>		
	RO identifies 1D-C8, SMOKE DET SYS SMOKE INDICATION TROUBLE, annunciator and notifies US.	
	Crew identifies smoke detectors alarming in MSVH.	
	Crew identifies reactor power increasing and temperature decreasing.	
	US directs crew to enter 1-AP-38.	
	RO checks steam dumps closed.	
	BOP checks SG PORVs closed.	
	Crew begins ramping the turbine down to stabilize power $\leq 100\%$ .	
	<b>NOTE: Step directs reducing reactor power using either OPERATOR AUTO or TURBINE MANUAL. BOP may use either Attach. 3 of 1-AP-38 or the RO turnover GOP to prepare the turbine for ramping in automatic.</b>	Attached
	BOP places turbine in OPER AUTO and IMP-IN.	
	BOP removes turbine from limiter.	
	BOP begins ramping turbine down.	
	RO verifies proper auto rod control. (NO)	Rods are in manual.
	RO uses control rods in manual to control Tave within 1.5°F of Tref.	Annunciator B-A7 alarms at $\pm 5$ degrees
	RO energizes additional PRZR heaters, as required.	
	BOP checks reactor power reduced to the power level before the event started.	

EVENT 6: Given a faulted steam generator outside containment the crew will respond in accordance with "1-AP-38," Excessive Load Increase."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	RO maintains rods above limits and AFD within limits.	
	BOP checks main generator output stable.	
	<b>NOTE: When sent, an operator will report that steam is coming from the upper louvers on the MSVH.</b>	
	RO checks Tave on program with Tref (RO may start a boration.)	
	Crew checks steam flow channel indications are normal.	
	BOP checks turbine in OPER AUTO.	
	Crew checks SG PORVS are closed.	
	Crew checks SG safety valves are closed.	
	BOP checks MSR inlet FCV operation is normal.	
	BOP checks 1-AS-PCV-105 is operating normally. (MS to AS PCV)	
	Crew checks plant steam systems are intact.	
	<b>NOTE: Once enough of a load reduction has been seen, and with direction of the lead evaluator, the next event can occur. If the crew decides to trip the reactor, the next event can be inserted at that time.</b>	<b>Validation time 8 minutes</b>

EVENT 7: Given that the unit is at power and a steam break has occurred, the unit will respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," 1-E-2, "Faulted Steam Generator," and 1-ES-1.1, "SI Termination.		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• "B" SG pressure rapidly decreases</li> <li>• RCS pressure and temperature decrease</li> <li>• Turbine does not trip automatically</li> <li>• Turbine-driven AFW pump does not start automatically</li> <li>• "A" MSTV does not close automatically</li> </ul>	
	RO reports that RCS conditions are rapidly degrading.	
	BOP reports that "B" SG pressure is decreasing.	
	US determines that the unit should be tripped due to the severity of the steam leak.	
	US directs crew to enter 1-E-0.	
	Crew manually trips the reactor. <ul style="list-style-type: none"> <li>• Rx trip and bypass breakers open</li> <li>• Rod bottom lights lit</li> <li>• Flux lowering..</li> </ul>	
	BOP trips turbine: <ul style="list-style-type: none"> <li>• Presses manual trip pushbuttons</li> <li>• Turbine stop valves closed</li> <li>• Reheaters reset</li> <li>• Reheater FCVs closed</li> <li>• After 30 sec: G-12 open</li> </ul>	<b>NOTE: "A" MSTV will not automatically close.</b>
	RO verifies emergency busses are energized.	
	Crew checks if safety injection has actuated, or should have actuated. SI first out or LHSI pumps running (YES)	
	RO/BOP manually safety inject.	
	RO verifies that no CAP items 1-5 are applicable.	
	US hold brief and hands out attachments 4(5), 7.	Attached
	Crew verifies SI flow indicated. ("C" charging pump may be started at this time)	
	Crew checks RCS pressure < 225 psig. (NO)	

EVENT 7: Given that the unit is at power and a steam break has occurred, the unit will respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," 1-E-2, "Faulted Steam Generator," and 1-ES-1.1, "SI Termination.		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<b>NOTE: Attachment 7 of 1-E-0 will isolate "B" SG</b>	
	Crew checks AFW flow indicated to all SGs. (NO)	
	BOP starts 1-FW-P-2.	Could also be done by attachment 4
	BOP verifies that total AFW flow is > 340 gpm.	
	*RO checks RCS average temperature stable at or trending to 547°F. (NO)	
	RO verifies that no steam is being dumped.	
	BOP/crew adjust AFW flows to maintain > 340 gpm to "A" and "C" SGs until NR level in at least one SG is > 11%.	
	*RO checks pressurizer PORVS are closed.	
	*RO checks that pressurizer spray valves are responding to control pressure at 2235 psig, or are closed with zero demand.	
	*RO checks at least one PORV block valves is open.	
	RO checks that RCS subcooling based on CETCs is < 25°F. (NO)	
	Crew checks if all SG pressures are > 80 psig and under control of operator. (NO)	Decision making step
	US directs transition to 1-E-2.	
	<b>NOTE: Some of the following actions will have been done by attachment 7 of 1-E-0.</b>	
	BOP verifies MSTVs and MSTV bypass valves closed. (attach 7) (NO)	
	BOP closes "A" MSTV using either PB on safeguards panels or using APP R switch on BB2.	
	BOP checks pressures in all SGs: Any > 80 psig and stable.	
	Crew identifies that "B" SG is faulted. (attach 7)	

EVENT 7: Given that the unit is at power and a steam break has occurred, the unit will respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," 1-E-2, "Faulted Steam Generator," and 1-ES-1.1, "SI Termination.		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
<b>CT5</b>	<p><b>Crew isolates the faulted SG.</b></p> <p>* Items above line are done by attach 7 of 1-E-0</p> <ul style="list-style-type: none"> <li>• BOP verifies all 1-FW-MOV-154A/B/C closed</li> <li>• BOP verifies all MFRVs and bypass MFRVs</li> <li>• <b>BOP closes 1-FW-MOV-100B.</b></li> <li>• BOP verifies 1-FW-HCV-100B closed.</li> <li>• BOP verifies "B" SG PORV closed.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Verifies attachment 7 of 1-E-0 is complete.</li> <li>• BOP verifies all SG blowdown trip valves closed.</li> <li>• Crew dispatches an operator to locally close 1-MS-56. (attach 1 of 1-E-2)</li> <li>• Crew dispatches an operator to verify closed 1-MS-58. (attach 1 of 1-E-2)</li> </ul>	<p><b>Critical Task</b></p> <p>Prior to transitioning to 1-E-1 (Complicating mitigating strategy as transition should be to 1-ES-1.1).</p>
	BOP checks ECST level.	
	BOP verifies outside instrument air is supplying containment.	
	<p>Crew checks for secondary radiation.</p> <ul style="list-style-type: none"> <li>• RO resets SI</li> <li>• RO resets Phase A</li> <li>• RO resets AMSAC</li> <li>• Crew verifies secondary radiation indications are normal on AE, SG blowdown, SG main steam lines and TT exhaust.</li> </ul>	
	<p>Crew checks if SI can be terminated.</p> <ul style="list-style-type: none"> <li>• RCS subcooling based on CETCs &gt; 25°F</li> <li>• Total AFW flow &gt; 340 gpm or one intact SG &gt; 11%</li> <li>• RCS pressure stable or increasing</li> <li>• PRZR level &gt; 21%</li> </ul>	
	US directs crew to transition to 1-ES-1.1.	
	<b>NOTE: Scenario can be ended when crew transitions out of 1-E-2, or as directed by the lead evaluator.</b>	<b>Validation time: 14 minutes</b>

REFERENCES

PROCEDURE	REV.
Abnormal Procedure 1-AP-44, "Loss of Reactor Coolant System Pressure."	19
Abnormal Procedure 0-AP-12, "Loss of Service Water."	39
Abnormal Procedure 1-AP-1.1, "Continuous Uncontrolled Rod Motion."	9
Abnormal Procedure 1-AP-3, "Loss of Vital Instrumentation."	28
Abnormal Procedure 1-AP-49, "Loss of Normal Charging."	14
Abnormal Procedure 1-AP-38, "Excessive Load Increase."	19
Emergency Procedure 1-E-0, "Reactor Trip or Safety Injection."	49
Emergency Procedure 1-E-2, "Faulted Steam Generator Isolation."	14
Emergency Procedure 1-ES-1.1, "SI Termination."	23
Station Annunciator Response Procedures.	N/A
Administrative Procedure PI-AA-5000, "Human Performance."	8
INPO, Guideline for Teamwork and Diagnostic Skill Development: INPO 88-003,	Jan. 1988
INPO, ACAD 07-002 Simulator Training Guidelines	Jan. 2007

ATTACHMENT 1  
SIMULATOR OPERATOR'S COMPUTER PROGRAM

**SIMULATOR OPERATOR'S COMPUTER PROGRAM  
2016 NRC 1**

**Initial conditions**

1. Recall IC 321
2. Ensure Tave, Tref, PDTT level, and VCT level are selected on trend recorders.
3. **2H is the protected train.**
4. Place **red stickers** on 1-BC-P-1B and 1-SW-P-1A.
5. Have copy of 1-E-2, Attachment 1 for booth.

**PRELOADS PRIOR TO SCENARIO START**

CONDITION	MALFUNCTION/OVERRIDE/ETC.
Tagout 1-SW-P-1A	Place pump in PTL. Rack out breaker and close discharge valve. <b>Remote functions:</b> SWP1A_RACKIN SW_6 = 0
Tagout 1-BC-P-1B	Place pump in PTL and Rack out breaker. <b>Remote function:</b> BCP1B_RACKIN = RACKOUT
Failure of 1-CH-P-1B to start in AUTO	<b>Switch override:</b> CHP1B_ASTP = False
Failure of "A" MSTV to close automatically	<b>Malfunction:</b> MS0501  Set up trigger 30 to allow valve to be close manually TVMS101A_1_CLOSE .OR. TVMS101A_2_CLOSE .OR. MSTV_APP_R_CLOSE DMF MS0501
Failure of turbine to trip automatically	<b>Malfunction:</b> TU03
Terry Turbine fails to start automatically	<b>Remote Function:</b> FWP2_AUTO_DEFEAT = T
	<b>Monitor:</b> MTC_FLAG = F

**SCENARIO EVENTS**

<b>EVENT 1</b>	<b>"B" spray valve fails open</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> RC2002, Delay time = 5, Value = True, Trigger = 1</p> <p><b>The next event will occur after the crew has returned RCS pressure to normal, or at the direction of the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	

<b>EVENT 2</b>	<b>Loss of 2-SW-P-1A</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> SW0104, Delay time = 5, Trigger = 2</p> <p><b>The next event may occur once SW pump has been started, and at the direction of the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>Outsides operator can report after 10 minutes</b> that there is nothing wrong with 2-SW-P-1A locally and that 1-SW-P-1B is running normally.</p> <p><b>If sent, a Safeguards operator</b> can report after 3 minutes an overcurrent drop on breaker (25H5) for 2-SW-P-1A. Unit 2 SRO and WCC have been informed.</p>	

<b>EVENT 3</b>	<b>Rod Insertion</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> RD07, Delay time = 5, Trigger = 3</p> <p><b>The next event will occur after the crew has stabilized the plant, and as directed by the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If operator is sent to rod drive</b>, wait 3 minutes and then report back that you do not see anything obvious on the cabinets.</p> <p><b>If permission is requested for moving rods:</b></p> <p>If through WCC be sure you have their recommendation. Then call back in 3-5 minutes and say the OMOC concurs.</p> <p>If OMOC directly contacted: Ask for their recommendation, then concur.</p>	

<b>EVENT 4</b>	<b>"B" SG Steam flow fails low</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> MS0103, Delay time = 5, Severity = -0.5, Trigger = 4</p> <p><b>The next event can occur after the crew swaps channels and the US has reviewed Tech Specs, as directed by the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>After crew has swapped control channels call as WCC and report that the Instrument shop has found a problem that affects auto rod control only. Control rods will operate normally in manual.</b></p>	

<b>EVENT 5</b>	<b>Failure of 1-CH-P-1A with a stuck open check valve "B" charging pump fails to auto-start</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunctions:</b>  CH1601, Delay time = 5, Trigger = 5  CH2101, Delay time = 5, Trigger = 5</p> <p><b>Once the US has referred to Tech Specs, pressurizer level has stabilized, and as directed by the Lead Evaluator, the next event can occur.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If sent to investigate the charging pumps and breaker, after 5 minutes report the "B" Charging pump is running normally, "A" Charging pump is not running and looks normal.</b></p> <p>After 3 minutes report that the breaker for the "A" Charging pump (15H6) has a timed overcurrent drop.</p>	

<b>EVENT 6</b>	<b>Steam leak outside containment on "B" SG</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> MS1002, Delay time = 5, Ramp = 600, Severity = 4, Trigger = 6</p> <p><b>Once enough of a load reduction has been seen, and with direction of the lead evaluator, the next event can occur. If the crew decides to trip the reactor, the next event can be inserted at that time.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>When sent to look for steam leak:</b> wait 5 minutes and then report that steam is coming from the upper louvers (only) on the MSVH. Will remain in area to keep personnel from entering.</p> <p><b>If asked,</b> verify with lead evaluator and report that you cannot safely enter the building. <b>(If lead evaluator wants to delay this communication,</b> first report that you will get a "buddy" and see if you can get in.)</p>	

<b>EVENT 7</b>	<b>Large steam break outside containment (turbine fails to trip automatically/"A" MSTV does not close automatically, TT fails to auto start)</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p>Update Steam break by inserting trigger 7</p> <p>On trigger screen: Setup trigger 7 to increase severity of steam leak. IMF MS1002 (7 5) 40 30</p> <p><b>Remote function:</b> MS_57 = 0, Delay = 30, Ramp = 30 Trigger = 10 CH_217 = 0, Delay = 30, Ramp = 30, Trigger = 20</p> <p><b>NOTE: Scenario can be ended when the crew announces transition to 1-ES-1.1, and as directed by the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>When called to close 1-CH-217</b>, use trigger 20 and call back 3-5 minutes later to report it is done.</p> <p><b>When sent to do attachment 1 of 1-E-2</b>, use trigger 10 and then call back in 5-6 minutes to report the attachment is done.</p>	

ATTACHMENT 3  
SCENARIO PERFORMANCE OBJECTIVES

## SIMULATOR REQUALIFICATION EXAMINATION

### TERMINAL PERFORMANCE OBJECTIVE

Given equipment failures and operational situations, operate the plant in accordance with Technical Specifications to bring the unit to a safe condition, using applicable procedures, and applying effective teamwork, communication, and diagnostic skills.

### GENERIC PERFORMANCE OBJECTIVES

- A. During shift operations the shift manager will take a conservative course of action, especially when uncertain conditions exist, when dealing with core cooling or heat sink availability, primary system and containment integrity, and reactivity control associated with plant evolutions.
- B. During shift operations the shift manager will provide overall crew guidance by prioritizing and integrating the actions of the shift crew in accordance with administrative procedures.
- C. During shift operations each crew member will participate in a team effort that resolves conflicts, provides input into the team decision and communicates all the necessary information to enhance teamwork in accordance with administrative procedures.
- D. During shift operations the Shift Technical Advisor will independently assess events and based on those assessments make recommendations to the crew regarding mitigation strategy.
- E. During shift operations each crew member will utilize operator fundamentals to ensure Teamwork Effectiveness, High Standards for Controlling Evolutions, Indications Monitored Closely, a Natural Bias for Conservatism, and Knowledge of Plant Design and Theory.

## **EVENT 1 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and "B" PRZR spray valve has failed open, the crew will be expected to respond in accordance with 1-AP-44, "Loss of Reactor Coolant Pressure."

### **NORTH ANNA SPECIFIC TASKS:**

R634 Respond to a loss of Reactor Coolant System pressure

### **CRITICAL TASK:**

See next page

CT Statement:

Crew stops RCS pressure decrease.

Safety Significance:

Failure to close the RCS spray valve under the postulated plant conditions constitutes "mis-operation or incorrect crew performance which leads to degradation of any barrier to fission product release." In this case, DNBR is reduced. Therefore, failure to close the spray valve represents a "demonstrated inability by the crew to take an action or combination of actions that would prevent a challenge to plant safety."

Cues:

Valid indication of pressure decreasing by the presence of various annunciators, indication of RCS spray valve open, and RCS pressure indication decreasing and procedurally directed by 1-AP-44.

Performance Indicator:

RO places REMOTE CLOSE SOV in CLOSE for associated spray

Feedback:

RCS pressure decrease stopped.

WOG Reference:

Based on Appendix B CT-10

Conditions:

Prior to reaching an automatic reactor trip on low pressure.

## **EVENT 2 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given the plant in Mode 1 and a trip of 2-SW-P-1A has occurred, the crew will respond in accordance with 0-AP-12, "Loss of Service Water."

### **NORTH ANNA SPECIFIC TASKS:**

R653 Respond to a loss of a service water pump.

S70 Evaluate compliance with technical specifications.

### **CRITICAL TASK:**

N/A

### **EVENT 3 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is operating at power and control rods are inserting for no apparent reason, the crew will be expected to respond in accordance with 1-AP-1.1, "Continuous Uncontrolled Rod Motion."

#### **NORTH ANNA SPECIFIC TASKS:**

R475 Perform the immediate operator actions in response to a continuous uncontrolled rod motion.

#### **CRITICAL TASK:**

See next page

CT Statement:

Crew takes action in accordance with AP-1.1, to stop rod motion and stabilize the unit.

Safety Significance:

Core reactivity is not under control of the operator due to the failed control channel. "It is expected that the operator will attempt to take manual actions to correct for anomalous conditions during power operation."

Cues:

Continuous inward control rod motion with  $T_{AVE}$  and  $T_{REF}$  matched.

Performance Indicator:

RO places rod control to manual.

Feedback:

Rod motion stops

WOG Reference:

None

Conditions:

Prior to automatic reactor trip

## **EVENT 4 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power, and a selected steam flow channel (1-MS-FI-1484) has failed low, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

### **NORTH ANNA SPECIFIC TASKS:**

R626 Respond to a steam generator water level control channel failure

S70 Evaluate compliance with technical specifications

### **CRITICAL TASK:**

See next page

CT Statement:

Crew takes manual control of main feed reg valve to control steam generator level

Safety Significance:

Failure to control steam generator level can result in a reactor trip (on either high or low SG level) which will complicate plant recovery actions and could result in damage to SG components or MS lines.

Cues:

Indication of loss of steam generator level control include:

- Annunciators. (i.e. SG level error, FW < (or >) steam flow)
- Indications that a controlling steam flow, steam pressure, or feed flow instrument has failed hi or lo
- Associated MFRV opening or closing to control level due to failed instrument
- Steam generator level increasing or decreasing to reactor trip setpoint

Performance Indicator:

Crew takes manual control of associated MFRV and returns level to program

Feedback:

Steam generator level returns to program

WOG Reference:

None

Conditions:

Prior to receiving an automatic reactor trip on high or low steam generator level

## **EVENT 5 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and a loss of the running charging pump ("A") and a failure of the auto-start of the standby pump ("B") concurrent with a failed open discharge check valve ("A") has occurred, the crew will be expected to respond in accordance with 1-AP-49, "Loss of Normal Charging."

### **NORTH ANNA SPECIFIC TASKS:**

R704 Respond to a loss of normal charging.

S70 Evaluate compliance with technical specifications.

### **CRITICAL TASK:**

See next page

CT Statement:

Crew takes action to prevent charging pump run-out due to a stuck open discharge check valve on a non-running charging pump.

Safety Significance:

Failure to prevent charging pump run-out constitutes a "mis-operation or incorrect crew performance which leads to degraded ECCS capacity."

Cues:

- Indication/annunciation that one charging pump has tripped or been shutdown with a stuck open discharge check valve.
- High amps on the running charging pump.
- Low/no charging flow or seal injection indicated.

Performance Indicator:

Crew closes charging pump discharge MOVs on the previously running charging pump.

Feedback:

Discharge MOVs for the previously running pump indicate closed and charging and seal injection flow returns to normal.

WOG Reference:

None.

Conditions:

Prior to Safety Injection being required by degraded plant conditions.

## **EVENT 6 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given a faulted steam generator outside containment the crew will respond in accordance with "1-AP-38," Excessive Load Increase."

### **NORTH ANNA SPECIFIC TASKS:**

R539 Perform the immediate operator actions in response to an excessive load increase

### **CRITICAL TASK:**

N/A

## **EVENT 7 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and a steam break has occurred, the unit will respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," 1-E-2, "Faulted Steam Generator," and 1-ES-1.1, "SI Termination."

### **NORTH ANNA SPECIFIC TASKS:**

- R185 Perform the immediate operator actions in response to a reactor trip or safety injection
- R183 Identify and isolate a faulted steam generator
- R189 Terminate safety injection

### **CRITICAL TASK:**

See next page

CT Statement:

Crew isolates faulted Steam Generator.

Safety Significance:

Failure to isolate a faulted SG that can be isolated causes challenges to the integrity CSF beyond those irreparably introduced by the postulated conditions. For the reference plant, neither of these transients (blowdown of a single SG with or without RCPs running) constitutes an orange-path challenge to the integrity CSF. However, if the faulted SG is not isolated, the cooldown transient for reactor vessel inlet temperature could result in an orange-path challenge to the integrity CSF, especially if RCPs are not running.

Cues:

- "B" SG is depressurizing in an uncontrolled manner or is completely depressurized and
- Valve position and flow rate indication that AFW continues to be delivered to the faulted SG

Performance Indicator:

BOP closes 1-FW-MOV-100B to secure AFW flow to "B" steam generator.

Feedback:

AFW flow indication to "B" steam generator decreases to zero.

WOG Reference:

Appendix B CT-17

Conditions:

Prior to transitioning to 1-E-1. (Complication of mitigating strategy)

ATTACHMENT 2

SIMULATOR PERFORMANCE DATASHEET

### **Scenario Performance Datasheet**

EVENT 1: Given that the unit is at power and "B" PRZR spray valve has failed open, the crew will be expected to respond in accordance with 1-AP-44, "Loss of Reactor Coolant Pressure."

SPD Verified: \_\_\_\_\_ (Initials)

- PCS alarms for "B" spray valve
- PRZR spray valve 1-RC-PCV-1455B has full open indication.
- Master pressure controller output decreases.
- PRZR pressure decreases.
- Annunciators B-F7 and B-H6 illuminate

EVENT 2: Given the plant in Mode 1 and a trip of 2-SW-P-1A has occurred, the crew will respond in accordance with 0-AP-12, "Loss of Service Water."

SPD Verified: \_\_\_\_\_ (Initials)

- Annunciators J-D3, J-B3, then B-B7, B-E8, and B-C8 illuminate
- Unit 2 "A" SW pump has amber and green lights lit
- "B" SW header flow decreases

EVENT 3: Given that the unit is operating at power and control rods are inserting for no apparent reason, the crew will be expected to respond in accordance with 1-AP-1.1, "Continuous Uncontrolled Rod Motion."

SPD Verified: \_\_\_\_\_ (Initials)

- Rods step in at maximum speed

EVENT 4: Given that the unit is at power, and a selected steam flow channel (1-MS-FI-1484) has failed low, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

SPD Verified: \_\_\_\_\_ (Initials)

- Annunciators F-E2 and F-F2 illuminate
- 1-MS-FI-1484 fails low in range
- "B" MFRV demand decreases
- "B" SG feed flow and level decrease

EVENT 5: Given that the unit is at power and a loss of the running charging pump ("A") and a failure of the auto-start of the standby pump ("B") concurrent with a failed open discharge check valve ("A") has occurred, the crew will be expected to respond in accordance with 1-AP-49, "Loss of Normal Charging."

SPD Verified: \_\_\_\_\_ (Initials)

- Annunciators C-A5, C-B5, C-C5, and C-G6 are illuminated
- 1-CH-P-1A has amber light lit on breaker indication
- "B" charging pump does not auto-start
- 1-CH-FI-1122A is off-scale low
- 1-CH-FCV-1122 ramps open
- Charging pump discharge pressure decreases
- Letdown isolates

EVENT 6: Given a faulted steam generator outside containment the crew will respond in accordance with "1-AP-38," Excessive Load Increase."

SPD Verified: \_\_\_\_\_ (Initials)

- Annunciator D-C8 illuminates
- Reactor power increases
- RCS temperature decreases
- Megawatts decrease

EVENT 7: Given that the unit is at power and a steam break has occurred, the unit will respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," 1-E-2, "Faulted Steam Generator," and 1-ES-1.1, "SI Termination."

SPD Verified: \_\_\_\_\_ (Initials)

- "B" SG pressure rapidly decreases
- RCS pressure and temperature decrease
- Turbine does not trip automatically
- Turbine-driven AFW pump does not start automatically
- "A" MSTV does not close automatically

Facility: <u>North Anna Power Station</u>		Scenario No.: <u>(2016) NRC-2</u>		Op-Test No.: <u>1</u>	
Examiners: <u>Bruno Cabarello</u>		Operators: _____			
<u>Newton Lacy</u>		_____			
<u>Gary Callaway</u>		_____			
Initial Conditions: 100% MOL, 1-SW-P-1A is tagged out for major repairs. 1-BC-P-1B is tagged out for shaft replacement. 2H is the protected train.					
Turnover: Maintain current plant conditions. Assist maintenance with work on 1-SW-P-1A, and 1-BC-P-1B.					
Event No.	Malf. No.	Event Type*	Event Description		
1		I/C (B)	Running Service Air compressor (2-SA-C-1) trips/ standby compressor (1-SA-C-1) fails to start automatically (CT)		
2	CH27	I/C (RO)	Failure of 1-CH-TE-1144, Non-regen HX temperature element		
3	CN0901		Main Condenser vacuum leak		
3a		R (RO) N (B)	Unit power reduction due to vacuum leak		
3b	RD14	I/C (RO)	Rods stop stepping in automatic		
4	RC0803	I/C (RO) TS (S)	Selected pressurizer level channel (1-RC-LT-1461) fails low (CT)		
4a		N (RO)	Restore letdown		
5	TU1101	I/C (B)	EHC pump (1-TM-P-3) trips/standby pump (1-TM-P-4) fails to auto-start (CT)		
6	RC04	TS (S)	RCS leak		
7	RC0101	M (ALL)	LBLOCA		
8	QS03	I/C (ALL)	Containment Depressurization Actuation does not work automatically (CT)		
9		I/C (B)	LHSI pumps don't automatically start (CT) 1-SI-P-1A shaft shears when started		
10		I/C (ALL)	Loss of emergency recirc (loss of 1 LHSI pump and 1 containment sump suction valve) (CT)		
11		I/C (B)	1-CH-MOV-1381 (Seal return isolation) does not close automatically		
			Events 8, 9, 10 and 11 happen during event 7 and are numbered for use on subsequent forms.		
			The scenario can be terminated once a charging pump has been stopped in 1-ECA-1.1.		
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor					



DOMINION  
NORTH ANNA POWER STATION

LICENSED OPERATOR REQUALIFICATION EXAMINATION  
SIMULATOR EXAMINATION GUIDE  
SCENARIO 2016 NRC 2

## SIMULATOR EXAMINATION GUIDE

<u>EVENT</u>	<u>DESCRIPTION</u>
1.	Service Air compressor (2-SA-C-1) trips/standby fails to auto-start (CT)
2.	1-CH-TE-1144 failure (Non-regen HX temperature element)
3.	Condenser vacuum leak
3a.	Power reduction to stabilize vacuum
3b.	Rods stop working in automatic during ramp
4.	Selected pressurizer level channel (1-RC-LT-1461) fails low (CT)
4a.	Letdown is restored
5.	EHC pump trips (1-TM-P-3)/standby pump (1-TM-P-4) does not auto start (CT)
6.	RCS leak that eventually requires a unit trip
7.	LBLOCA
8.	No auto CDA (CT)
9.	LHSI pumps don't auto start/sheared shaft on 1-SI-P-1A (CT)
11	1-CH-MOV-1381 does not close on SI/Phase A
10.	Loss of Emergency recirc (CT)

### Scenario Recapitulation:

Malfunctions after EOP entry	<b>4</b>	Failure of automatic CDA, LHSI pumps do not automatically start/shaft shears on 1-SI-P-1A, loss of emergency recirc, 1-CH-MOV-1381 does not close on SI/phase A
Total Malfunctions	<b>12</b>	Service Air compressor trips/standby compressor fails to auto-start, 1-CH-TE-1144 failure, Condenser vacuum leak, rods stop working in auto, pressurizer level channel failure, EHC pump trips/standby pump fails to start, RCS leak, LBLOCA, failure of automatic CDA, LHSI pumps do not automatically start/shaft shears on 1-SI-P-1A, loss of emergency recirc, 1-CH-MOV-1381 does not close on SI/phase A
Abnormal Events	<b>6</b>	Service Air compressor trips/standby compressor fails to auto-start, 1-CH-TE-1144 fails, condenser vacuum leak, pressurizer level channel failure, EHC pump trips/standby pump fails to start, RCS leak,
Major Transients	<b>1</b>	LBLOCA
EOPs Entered	<b>2</b>	E-1, ECA-1.1
EOP Contingencies	<b>1</b>	ECA-1.1
Critical Tasks	<b>6</b>	

### SCENARIO DURATION

95 Minutes

**SIMULATOR EXAMINATION SCENARIO SUMMARY**  
**SCENARIO 2016 NRC 2**

The scenario begins with the unit at 100% power, MOL. 1-SW-P-1A, Unit 1 "A" SW pump, is tagged out for major repairs. 1-BC-P-1B is tagged for shaft replacement, not expected back for several days. 2H is the protected train.

The first event will be the trip of the running service air compressor (2-SA-C-2) and the failure of the standby compressor (1-SA-C-1) to start.) The crew will enter 1-AP-28, "Loss of Instrument Air," and start the standby compressor. (CT) Once instrument air pressure has been restored and the next event can occur.

Next, 1-CH-TE-1144, Non-regen HX temperature element, will fail low causing letdown temperature to increase. The crew will use the AR for C-C6 to take manual control of 1-CC-TCV-106 and restore letdown temperature. When temperature has decreased sufficiently, the crew will restore flow through the demin train. Once letdown temperature has been restored, the next event can occur.

At this time a condenser vacuum leak will ramp in due to the failure of the loop seals. The crew will identify the loss of condenser vacuum and enter 1-AP-14, "Loss of Condenser Vacuum." The crew will begin a load reduction to try to stabilize vacuum. The control rods will fail to move in automatic when required and the RO will have to insert rods in manual. The operator sent to the turbine building will report the loop seal problem, and state that the isolation valve will not move and ask for permission to use a valve leverage device to assist in closing the valve. Once the valve is closed condenser vacuum will recover and the crew will hold the ramp. Once vacuum has improved and the ramp stopped, the next event can occur.

A selected pressurizer level channel (1-RC-LT-1461) will fail low causing letdown to isolate. The crew will enter 1-AP-3, "Loss of Vital Instrumentation," and take actions to place 1-CH-LCV-1122 in manual and reduce charging flow to zero. The RO will then swap to an operable pressurizer level channel. The crew will restore letdown at this time (Normal event) (CT). The SRO will review TS and note that the channel must be placed in trip within 72 hours. After letdown has been restored and TS actions reviewed, the next event can occur.

Now, the operating EHC pump (1-TM-P-3) will trip and the standby pump (1-TM-P-4) will not start. The BOP will recognize the loss of EHC and start the standby pump based either on the DNOS, or the AR for low EHC pressure (CT). During this time, a RCS leak (approximately 60 gpm) will occur inside containment. The crew should respond in accordance with 1-AP-16, "Increasing Primary Plant Leakage," and 1-AP-5, "Unit 1 Radiation Monitoring System." The US should refer to Technical Specifications and either direct the crew to commence a unit shutdown or make preparations for a containment entry due to excessive RCS leakage.

The crew will receive indications of a LBLOCA and will enter 1-E-0, "Reactor Trip or Safety Injection." No LHSI pumps will start and the crew will attempt to manually start the pumps. 1-SI-P-1A will start, but will have a sheared shaft. 1-SI-P-1B will start and flow (CT). 1-CH-MOV-1381 will not close on the SI/Phase A signal and will have to closed manually. Also, when a CDA is required it will not happen automatically and the crew will have to manually actuate CDA (CT).

The crew will transition to 1-E-1 and when they check power available to the "B" train of LHSI, they will find that 1-SI-MOV-1860B has no power. An operator sent to the valve will report that the actuator is broken on the MOV. At this time the crew will transition to 1-ECA-1.1, "Loss of Emergency Coolant Recirculation." Once the crew has pressed the SI RECIRC MODE reset buttons and established a single train of SI flow (CT), the scenario can be stopped with direction from the lead evaluator.

## SCENARIO TURNOVER SHEET

### **Read the following to the crew:**

**Purpose:** This examination is intended to evaluate the crew's performance of various tasks associated with the Initial License Operator Training Program. All activities should be completed in accordance with approved operations standards.

1. You are on a day shift during the week.
2. A rough log should be maintained to aid in making reports and to help during briefs.
3. Respond to what you see. In the unlikely event that the simulator fails such that illogical indications result, the session will be terminated and the crew informed.

### **Unit Status:**

Unit 1 is at 100% power. RCS boron is 1096 ppm and core age is 9,000 MWD/MTU. Aux steam is on unit 2.

Unit 2 is at 100% power.

### **Equipment Status:**

1-SW-P-1A tagged out for major repairs. 1-BC-P-1B is tagged for shaft replacement, not expected back for several days. Maintenance rule window is green. 2H is the protected train. 1-BC-P-1A and both Spent Fuel Pit Cooling pumps are protected

### **Shift Orders:**

Maintain current plant conditions. Assist maintenance with work on 1-SW-P-1A and 1-BC-P-1B, as required.

EVENT 1: Given that the unit is at power, and a loss of an air compressor (2-SA-C-1) has occurred, the crew will be expected to respond in accordance with 1-AP-28, "Loss of Instrument Air."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials)		
<ul style="list-style-type: none"> <li>• 2-SA-C-1 trips</li> <li>• Annunciator J-D1, and possibly F-F8, J-E8 illuminate</li> <li>• Instrument air pressure decreases</li> <li>• 1-SA-C-1 does not start automatically</li> </ul>		
	BOP identifies annunciator 1J-D1, SERVICE AIR COMPRESSOR TROUBLE.	
	Crew identifies lowering IA pressure.	
	US directs crew to enter 1-AP-28.	
<b>CT1</b>	<b>BOP starts all available air compressors in HAND</b> <ul style="list-style-type: none"> <li>• 1-IA-C-1</li> <li>• 1-SA-C-1</li> <li>• 1-IA-C-2A</li> <li>• 1-IA-C-2B</li> </ul>	<b>Critical Task</b> <b>*Prior to IA pressure decreasing to &lt;70 psig, requiring a reactor trip</b>
	*Crew checks IA pressure outside containment <ul style="list-style-type: none"> <li>• BOP checks IA pressure &lt; 70 PSIG. (NO)</li> </ul>	
	Crew determines cause of loss of IA to be a failed compressor with an auto-start failure of 1-SA-C-1.	
	Crew verifies cause of the loss of IA is corrected.	
	BOP verifies IA pressure > 94 psig or trending to 94 psig.	
	Crew checks if either 1-IA-TV-102A or 102B is closed. (NO)	
	Crew returns air compressors to normal.	
	Crew dispatches operator to ensure 2-IA-TV-211 is closed.	
	RO checks letdown in service.	
	Crew verifies attachment 6 was not initiated.	

EVENT 1: Given that the unit is at power, and a loss of an air compressor (2-SA-C-1) has occurred, the crew will be expected to respond in accordance with 1-AP-28, "Loss of Instrument Air."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	US directs WCC to submit a CR.	
	<b>NOTE: The next event can occur once IA is verified to be increasing.</b>	<b>Validation time: 9 minutes</b>

EVENT 2: Given that the unit is at power and 1-CH-TE-1144 has failed low causing letdown temperature to increase, the crew will be expected to respond in accordance with the AR for C-C6, DEMIN INLET DIVERT HI TEMP.		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• 1-CH-TI-1143 indication increases</li> <li>• 1-CH-TI-1144 indication decreases</li> <li>• 1-CC-TCV-106 output decreases</li> <li>• Annunciator C-C6 illuminates</li> <li>• 1-CH-TCV-1143 bypasses the demin train</li> </ul>	
	RO identifies annunciator C-C6, DEMIN INLET DIVERT HI TEMP.	
	Crew identifies 1-CH-TCV-1143 is bypassing the demins due to a high temperature indicated on 1-CH-TI-1143.	
	<b>NOTE: VCT temperature could increase to high alarm setpoint.</b>	C-A3 VCT high temperature may alarm
	RO takes manual control of 1-CC-TCV-106 to stabilize temperature, per the AR.	
	Crew verifies that no more SW flow to the CC HXs is required.	
	Crew monitors reactor power.	
	RO ensures adequate charging flow to cool letdown flow.	
	RO verifies that temperature has decreased to < 115°F on 1-CH-TI-1143, and then holds 1-CH-TCV-1143 in the IX position until red light is lit and amber light is not lit. RO releases switch to auto position	
	RO verifies that flow continues through the demins when the switch is released.	
	<b>NOTE: The next event can occur once letdown temperature has been restored to normal.</b>	<b>Validation time: 9 minutes</b>

EVENT 3/3a/3b: Given that the unit is at power and loss of condenser vacuum is occurring, the crew will respond in accordance with 1-AP-14, "Low Condenser Vacuum."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Condenser vacuum degrades</li> <li>• Annunciator A-G1 alarms if vacuum reaches setpoint</li> <li>• Rods do not insert automatically to control temperature</li> </ul>		
	<p><b>NOTE: The following condenser vacuum limits/setpoints apply:</b></p> <p><b>G-F3 (Vacuum pre-trip) &lt; 25"HgV (~5" HgA)</b></p> <p><b>A-G1 (Loss of C-9) &gt; 4"HgA</b></p> <p><b>E-D2 (Turbine trip) 20"-23"HgV (6.9-9.8"HgA) AND ASO pressure &lt; 45 psig</b></p> <p><b>Monitor &gt; 5.5"HgA – Trip reactor</b></p>	
	Crew identifies degrading condenser vacuum.	
	US directs crew to enter 1-AP-14.	
	Crew checks that generator output breaker is closed.	
	RO initiates RCS boration using either attachment 4 or the standard ramp plan and 1-GOP-8.3.4.	Attach 4 and GOP attached

EVENT 3/3a/3b: Given that the unit is at power and loss of condenser vacuum is occurring, the crew will respond in accordance with 1-AP-14, "Low Condenser Vacuum."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<p>*Reduce plant load at <math>\leq 5\%/min</math> until vacuum is stable</p> <p>BOP places turbine in OPERATOR AUTO:</p> <ul style="list-style-type: none"> <li>• Verifies GV tracking meter is <math>\sim</math> zero</li> <li>• Ensures turbine reference and setter are matched</li> <li>• Presses OPER AUTO pushbutton.</li> </ul> <p>BOP removes turbine from valve position limiter, as required, using attachment 3 or turnover GOP:</p> <ul style="list-style-type: none"> <li>• Uses Down PB to lower Reference control</li> <li>• Sets ramp rate thumbwheel to desired rate</li> <li>• Presses GO</li> <li>• When VPL light goes out – presses HOLD</li> </ul> <p>BOP places turbine control in IMP-IN:</p> <ul style="list-style-type: none"> <li>• Ensures turbine reference and setter are matched</li> <li>• Presses IMP-IN pushbutton.</li> </ul> <p>BOP commences manual turbine load reduction per attachment 3:</p> <ul style="list-style-type: none"> <li>• Sets Reference control using down PB</li> <li>• Sets designated ramp rate using thumbwheel</li> <li>• Presses GO.</li> </ul>	
	RO verifies rods are in automatic.	
	RO/ energizes pressurizer heaters as required to maintain RCS pressure $> 2205$ psig.	
	<b>NOTE: During the ramp the RO will determine that control rods are not inserting in automatic.</b>	Verify crew manually moves rods to control Tavg within $5^\circ$ of Tref.
	*RO verifies proper auto control rod insertion. (NO)	
	RO places control rods in manual and adjusts as required to maintain Tavg within $5^\circ F$ of Tref.	
	*Crew monitors condenser vacuum $3.5''$ hg abs or less. If not and reactor power $> 30\%$ then verifies vacuum $< 5.5''$ hg abs.	

EVENT 3/3a/3b: Given that the unit is at power and loss of condenser vacuum is occurring, the crew will respond in accordance with 1-AP-14, "Low Condenser Vacuum."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	Crew dispatches operator with attachment for local turbine building operations.	
	BOP verifies condenser vacuum breaker, 1-AS-MOV-100, is closed.	
	BOP inlet and outlet water box MOVs are full open.	
	Crew checks CW pump discharge MOVs are open (or throttled open) on all running pumps.	
	BOP verifies air ejector lineup. <ul style="list-style-type: none"> <li>AS pressure between 180 and 210 psig</li> <li>1-AS-FCV-100A/B open</li> <li>1-SV-TV-102-2, open</li> <li>1-SV-TV-103, 102-1 closed</li> </ul>	
	BOP verifies gland steam operation: Gland steam header pressure 120-130 psig HP TB GS pressure 1.5 to 15 psig	
	<b>NOTE: When dispatched, the field operator will try to isolate the loop seal per the AP-14 attachment and inform the control room that the isolation valve will not turn. Will get permission to use a valve leverage device. Once enough of a power decrease has been observed, the operator will report that the valve is now closed. At this time vacuum will begin to improve.</b>	Verify crew manually moves rods to control Tave before allowing vacuum loss to be "fixed"
	Crew checks vacuum stable or improving. If so, US directs crew to hold the ramp.	
	US directs entry into either 1-OP-2.2 or 1-AP-2.2 while continuing with 1-AP-14.	
	Crew checks condensate system: <ul style="list-style-type: none"> <li>Condensate hotwell level normal</li> <li>Condensate pumps running</li> <li>Sends operator to check system operation.</li> </ul>	
	Crew checks circ water systems: <ul style="list-style-type: none"> <li>Water boxes primed</li> <li>Running SW pump amps normal..</li> </ul>	
	Crew verifies vacuum stable or improving.	
	Crew verifies main turbine on line	

EVENT 3/3a/3b: Given that the unit is at power and loss of condenser vacuum is occurring, the crew will respond in accordance with 1-AP-14, "Low Condenser Vacuum."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	Crew checks cause of vacuum loss identified and repaired.	
	Crew returns main condenser to normal, as required.	
	Crew goes to 1-OP-2.1 to restore power to 100%.	
	US makes report to Work Control Center and requests that CR be submitted and management notifications be made.	
	<b>NOTE: Once the vacuum leak is stopped and the crew has stabilized the unit, and with direction of the lead evaluator, the next event can occur.</b>	<b>Validation time: 15 minutes</b>

EVENT 4/4a: Given that the unit is at power and a selected pressurizer level channel, 1-RC-LI-1461, has failed low, the crew will respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>Annunciators B-F8, B-G7, and B-E2 are illuminated</li> <li>1-RC-LI-1461 fails low</li> <li>Letdown isolates</li> </ul>		
	RO identifies annunciators B-F8, PRZ LO LEVEL, and B-G7, PRZ LO LEV HTRS OFF – LETDWN ISOL.	
	US directs crew to enter 1-AP-3.	
	RO identifies that the selected pressurizer level channel 1461 has failed low.	
	BOP verifies SG level controlling channels are normal.	
	BOP verifies turbine first stage pressure indication normal.	
	RO verifies pressurizer level indications are normal. (NO)	
<b>CT2</b>	RO places 1122 in manual and minimizes charging. (May go to zero due to no letdown.)	<b>Part of CT2 (next page)</b>
	Crew verifies redundant instrument channel indication normal.	
	RO verifies systems affected by pressurizer level channels are normal. (NO)	
<b>CT2</b>	RO selects operable channel of pressurizer level for control (459/460).	<b>Part of CT2 (next page)</b>
	RO verifies proper annunciator configuration.	
	RO verifies emergency backup heater configuration.	
	RO verifies letdown in service. (NO)	

EVENT 4/4a: Given that the unit is at power and a selected pressurizer level channel, 1-RC-LI-1461, has failed low, the crew will respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
CT2	<p><b>RO restores letdown</b> using attach 2.</p> <ul style="list-style-type: none"> <li>• Ensures charging flow at least 25 gpm</li> <li>• Ensures 1-CH-LCV-1460A/B are open</li> <li>• Ensures 1-CH-TV-1204A/B are open</li> <li>• Places 1-CH-PCV-1145 in manual &amp; opens</li> <li>• Opens 1-CH-HCV-1200B (or 1200A or C)</li> <li>• Adjusts 1-CH-PCV-1145 to obtain 300 psig letdown pressure and places in Auto</li> <li>• Adjusts charging and letdown to maintain program PRZR level.</li> </ul>	<p><b>Critical task</b> Normal evolution *Prior to a PRZR hi level reactor trip</p>
	<p>RO verifies PRZR level control in auto (NO):</p> <ul style="list-style-type: none"> <li>• RO restores pressurizer level to program</li> <li>• RO adjusts 1-RC-LCV-1459G, if required</li> <li>• RO places 1-CH-FCV-1122 in automatic</li> <li>• RO resets PRZR control group heaters.</li> </ul>	<p>This will likely take a few minutes. Want to return to automatic for identification of next event.</p>
	<p>BOP verifies both turbine first stage pressure channels normal.</p>	
	<p>BOP verifies operable channels selected for SGWLC.</p>	
	<p>Crew verifies operation of other vital instrumentation.</p>	
	<p>Crew refers to 1-MOP-55.72 for placing the failed channel in trip.</p>	
	<p>US refers to TS-3.3.1 Function 9, Condition L and determine that the channel must be placed in trip within 72 hours.</p>	
	<p><b>NOTE: The next event will occur after the crew identifies the applicable MOP and pressurizer level control is back in automatic, with the direction of the lead evaluator.</b></p>	<p><b>Validation time: 19 minutes</b></p>

EVENT 5/6: Given that the unit is at power and there are no EHC pumps running, the crew will respond in accordance with the applicable AR. Also, when indications exist of RCS leakage greater than TS limits, the crew will be expected to respond in accordance with 1-AP-16, "Excessive Primary Plant Leakage," and 1-AP-5, "Unit 1 Radiation Monitoring System."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Annunciators K-F5 and T-B3 will illuminate</li> <li>• "A" EHC pump trips</li> <li>• "B" EHC pump does not auto-start</li> </ul> RCS leak <ul style="list-style-type: none"> <li>• Charging flow increasing, VCT level decreasing</li> <li>• Containment sump level increasing</li> <li>• Containment gaseous radiation (RM-160) increases (also RM-163 and 164)</li> <li>• Annunciators K-D2, K-D4, and possible J-F2 will illuminate.</li> </ul>		
	<b>NOTE, Both events will be put in on the same trigger.</b>	
	BOP identifies K-F5, TURB SUPERV PANEL TROUBLE.	
	Crew identifies T-B4, EH FLUID RESERVOIR LOW- PRESSURE.	
	BOP identifies no EHC pump running.	
	US directs BOP to start the standby EHC pump, 1-TM-P-4.	<b>Per DNOS, since it should auto start, or AR.</b>
<b>CT3</b>	<b>BOP manually starts 1-TM-P-4.</b>	<b>Critical task</b> *Prior to reactor trip caused by turbine trip caused by low EHC pressure  Annunciator alarms at 1600 psig and auto-start should occur at 1400 psig
	<b>NOTE: If the crew dispatches an operator to look at EHC pumps, the operator will report that 1-TM-P-3 is unusually hot, and 1-TM-P-4 appears normal.</b>	
	US requests Work Control Center supervisor to make notifications of the failure and initiate WR and CR.	
	Crew identifies charging flow increasing, and/or increasing containment rad levels, and/or increasing containment sump level.	<b>RCS leak</b> <b>AP-5 steps included starting on next page</b>
	US directs entry into 1-AP-16.	Final leak value is $40 \pm 5$ gpm

EVENT 5/6: Given that the unit is at power and there are no EHC pumps running, the crew will respond in accordance with the applicable AR. Also, when indications exist of RCS leakage greater than TS limits, the crew will be expected to respond in accordance with 1-AP-16, "Excessive Primary Plant Leakage," and 1-AP-5, "Unit 1 Radiation Monitoring System."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	Crew verifies unit in mode 1.	
	*RO verifies pressurizer level stable or increasing. If not, then RO will take manual control of charging. May also isolate letdown per RNO.	
	*Verify VCT level stable.	
	Crew starts a VCT makeup, as required.	<b>1-GOP-8.3.3 attached</b>
	RO checks 1-CH-LCV-1115A not diverted: <ul style="list-style-type: none"> <li>• VCT position indicated</li> <li>• In-service gas stripper level is stable (with PDTT pump secure)</li> <li>• In-service gas stripper flow is not indicated.</li> </ul>	
	RO verifies letdown in service with normal indications: <ul style="list-style-type: none"> <li>• Letdown flow</li> <li>• Non-regen temperature</li> <li>• Regen outlet temperature</li> <li>• VCT temperature</li> <li>• VCT pressure</li> <li>• AB general exhaust radiation</li> <li>• AB central exhaust radiation</li> <li>• Vent stack A radiation</li> <li>• Excess letdown temperature and pressure.</li> </ul>	
	RO checks excess letdown parameters.	
	RO checks charging system parameters normal: <ul style="list-style-type: none"> <li>• CHP discharge pressure</li> <li>• Charging flow</li> <li>• Regen outlet temp</li> <li>• Seal injection flows</li> <li>• AB sump level.</li> </ul>	

EVENT 5/6: Given that the unit is at power and there are no EHC pumps running, the crew will respond in accordance with the applicable AR. Also, when indications exist of RCS leakage greater than TS limits, the crew will be expected to respond in accordance with 1-AP-16, "Excessive Primary Plant Leakage," and 1-AP-5, "Unit 1 Radiation Monitoring System."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	Crew checks containment conditions: <ul style="list-style-type: none"> <li>• Sump pumping rate</li> <li>• Temperature</li> <li>• Pressure</li> <li>• Radiation</li> </ul>	
	Crew identifies increasing containment radiation and sump pumping rate.	
	Crew goes to attachment 5 for 1-RM-RMS-160 alarms.	<b>AP-5</b>
	Crew informs HP of alarm(s) and asks them to determine if Containment gaseous samples are required. If so, request them to obtain and analyze samples.	
	Crew verifies not in Modes 5 or 6. Also, that there is no obvious malfunction of rad monitor, nor any fuel handling accident.	
	Crew has SEM refer to EALs.	
	Crew determines that the alarms are due to a RCS leak in containment.	
	Crew performs an RCS leakrate PT, when possible.	
	Crew requests samples of containment sump.	
	Crew stops containment stop pumps, if desired.	<b>AP-16 continued</b>
	US initiates attachment for containment walkdown.	
	US enters Tech. Spec. 3.4.13A. Reduce leakage to within limits with completion time of 4 hours, or Mode 3 in 6 hours and Mode 5 in 36 hours.	
	<b>NOTE: Crew may decide to make a containment entry and look for leak as they have 4 hours to stop the leakage per the T.S.</b>	
	US directs crew to either commence a unit shutdown or make preparations for a containment entry.	

EVENT 5/6: Given that the unit is at power and there are no EHC pumps running, the crew will respond in accordance with the applicable AR. Also, when indications exist of RCS leakage greater than TS limits, the crew will be expected to respond in accordance with 1-AP-16, "Excessive Primary Plant Leakage," and 1-AP-5, "Unit 1 Radiation Monitoring System."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<p><b>NOTE: The next event can occur after the crew either makes preparations to ramp, makes preparations for a containment entry, and as directed by the lead evaluator.</b></p>	<p><b>Validation time: 16 minutes</b></p>

EVENT 7: Given that the unit is at power, and a large break LOCA has occurred inside containment, the crew will be expected to respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," and 1-E-1, "Loss of Secondary or Reactor Coolant."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials)		
<ul style="list-style-type: none"> <li>• Pressurizer pressure and level rapidly decreasing</li> <li>• 1-SI-P-1A and 1-SI-P-1B fail to auto-start</li> <li>• 1-SI-P-1A shears its shaft when started</li> <li>• 1-CH-MOV-1381 does not close automatically</li> </ul>		
	RO identifies PRZR pressure and level rapidly decreasing.	
	US directs crew to enter 1-E-0.	
	Crew manually trips the reactor. <ul style="list-style-type: none"> <li>• Rx trip and bypass breakers open</li> <li>• Rod bottom lights lit</li> <li>• Flux lowering..</li> </ul>	
	BOP verifies turbine trip. <ul style="list-style-type: none"> <li>• Turbine trip PBs pressed</li> <li>• Turbine stop valves closed</li> <li>• Reheaters reset</li> <li>• Reheater FCVs closed</li> <li>• After 30 sec. G-12 open.</li> </ul>	
	RO verifies AC emergency busses energized.	
	Crew checks if safety injection has actuated, or should have actuated. (YES) SI first out (YES) or LHSI pumps running (NO)	
	Crew manually actuates SI.	
	RO identifies that CAPs 1,2,3, and 5 apply.	
	Crew discusses that adverse numbers are in effect.	CAP 1
<b>CT4</b>	<b>Crew manually starts SI pumps.</b> <ul style="list-style-type: none"> <li>• <b>RO manually starts "B" LHSI pump.</b></li> <li>• Notes that "A" has a sheared shaft.</li> </ul>	CAP 2 <b>Critical task</b> *Prior to entering FR-C.1 (3 chances in E-0, CAP, procedure step, attachment 4)
	RO stops all RCPs and closes charging pump recircs.	CAP 3

EVENT 7: Given that the unit is at power, and a large break LOCA has occurred inside containment, the crew will be expected to respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," and 1-E-1, "Loss of Secondary or Reactor Coolant."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
CT5	<p><b>RO/BOP manually actuates CDA</b></p> <ul style="list-style-type: none"> <li>• <b>RO/BOP actuate CDA by simultaneously turning 2 CDA switches</b> (Only one set required)</li> <li>• BO ensures CC pumps are stopped</li> <li>• RO verifies RCPs are stopped</li> <li>• BOP ensures QS pumps are running with discharge MOVs open</li> <li>• US initiates attachments 4 (5, 2, and 3).</li> </ul>	<p>CAP 5  <b>Critical Task</b>  *Prior to transitioning to FR-Z.1 (two chances in 1-E-0, CAP and attachment 4)</p> <p>Attached</p>
	<b>NOTE: 1-CH-MOV-1381 does not close automatically and will be closed manually per page 6 of attachment 5.</b>	
	Crew verifies SI flow (HHSI and LHSI). (This step will also cover starting LHSI pumps.)	
	BOP verifies AFW flow. <ul style="list-style-type: none"> <li>• Flow to all SG indicated</li> <li>• Total flow &gt; 340 gpm.</li> </ul>	
	RO checks RCS Tave stable at or trending to desired temperature. (NO)	
	BOP adjusts AFW flow.	
	RO checks PRZR PORVs and spray valves closed and block valves at least one open.	
	RO checks RCS subcooling <25°F [85°F].	[ ] adverse number
	Crew checks at least one charging pump running and flowing to the RCS.	
	RO stops all RCPs (previously done by CAP).	
	RO checks RCS pressure < 1275 psig [1475 psig] and verifies RCPs stopped.	
	RO verifies charging pump recirc valves are closed.	
	BOP checks SGs not faulted. (YES)	Decision making step
	BOP checks SGs not ruptured. (YES)	Decision making step
	Crew checks if RCS is intact inside containment. (NO)	Decision making step

EVENT 7: Given that the unit is at power, and a large break LOCA has occurred inside containment, the crew will be expected to respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," and 1-E-1, "Loss of Secondary or Reactor Coolant."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	US directs crew to transition to 1-E-1.	
	Crew begins monitoring Critical Safety Function Status Trees.	
	US directs crew to transition to 1-FR-P.1 (when applicable).	<b>FR-P.1</b>
	RO check RCS pressure greater than 225 [450] psig. (NO)	
	BOP verifies either low-head flow greater than 1000 gpm. (YES)	
	US directs crew to transition to 1-E-1.	
	RO checks PRZR PORVs and spray valves closed and block valves at least one open.	
	RO checks RCS subcooling <25°F [85°F]/	
	Crew checks at least one charging pump running and flowing to the RCS.	
	RO stops all RCPs (previously done by CAP).	
	RO checks RCS pressure < 1275 psig [1475 psig] and verifies RCPs stopped.	
	RO verifies charging pump recirc valves are closed.	
	Crew checks SGs not faulted. All pressures > 80 psig and all under the control of the operator. (YES)	
	*Crew checks intact SG levels >11% [22%].	
	Crew checks secondary radiation. <ul style="list-style-type: none"> <li>• RO resets SI, Phase A</li> <li>• Crew verifies IA TV open (NO)</li> <li>• Crew resets Phase B</li> <li>• Crew opens IA TVs</li> <li>• Crew opens IA TVs</li> <li>• RO resets AMSAC</li> <li>• Crew checks radiation monitors</li> <li>• Crew lines up for SG samples</li> <li>• Crew calls chemistry.</li> </ul>	
	*RO checks PRZR PORVs and block valves.	

EVENT 7: Given that the unit is at power, and a large break LOCA has occurred inside containment, the crew will be expected to respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," and 1-E-1, "Loss of Secondary or Reactor Coolant."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	*Crew checks if SI can be terminated: RCS subcooling > 25°F [75°F](NO)	
	*Crew checks if manual CDA is required: QS pumps not running (NO)	
	*Crew checks QS pump status: <ul style="list-style-type: none"> <li>• QS pumps – any running</li> <li>• Both of the Following</li> <li>• RWST level &lt; 3% (NO)</li> <li>• QS pump amps fluctuating (NO)</li> </ul>	
	*Crew checks if Casing Cooling pumps should be stopped: Casing cooling tank level < 10% (NO)	
	*Crew checks if redundant RS pumps can be stopped: <ul style="list-style-type: none"> <li>• RS pumps any running</li> <li>• Containment pressure &lt;13 psia</li> </ul> If so: <ul style="list-style-type: none"> <li>• SM approval</li> <li>• Verify/reset CDA</li> <li>• Crew secures one train of RS pumps</li> <li>• Crew closes SW supply to RSHX isolation valves for pumps that were stopped</li> </ul>	
	*Crew maintains containment pressure: <ul style="list-style-type: none"> <li>• Checks RS sump level &gt; 4' 10"</li> </ul> If so: <ul style="list-style-type: none"> <li>• Operates at least one train of RS to maintain containment pressure &lt; 13 psia.</li> </ul>	
	*Crew checks if LHSI pumps should be stopped due to RCS pressure >225 psig [450 psig].(NO)	
	Crew checks if EDGs should be stopped: <ul style="list-style-type: none"> <li>• AC emergency busses energized by off-site power (YES)</li> <li>• Initiates attachment 2 for stopping EDGs.</li> </ul>	Attached

EVENT 7: Given that the unit is at power, and a large break LOCA has occurred inside containment, the crew will be expected to respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," and 1-E-1, "Loss of Secondary or Reactor Coolant."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	Crew checks recirculation capability: <ul style="list-style-type: none"> <li>• Verify at least one train of CL recirc is available:</li> <li>• 1-SI-P-1A (NO)</li> <li>• 1-SI-P-1B</li> <li>• 1-SI-MOV-1860B (NO) has no lights</li> <li>• Try to restore at least one train of CL recirc</li> <li>• If power not available: check if equipment can be manually operated. (NO)</li> </ul>	Reports on the MOV will come in once operators are dispatched. This will take a few minutes due to having to access the 2 <sup>nd</sup> level of Safeguards.  Breaker 1J1-2N J3 will be checked and reported as tripped with acrid smell in area
	US announces transition to 1-ECA-1.1.	<b>Validation time: 27 minutes</b>

EVENT 8: Given that a loss of emergency coolant recirc has occurred with a LBLOCA in progress, the crew will respond in accordance with 1-ECA-1.1, "Loss of Emergency Coolant Recirculation."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials)		
<ul style="list-style-type: none"> <li>None</li> </ul>		
	RO resets both trains of SI, if required. (Already reset.)	
	BOP presses both SI RECIRC MODE RESET buttons.	
	Crew verifies emergency coolant recirculation equipment available: LHSI pumps LHSI pump suctions from containment. (NO)	
	Crew tries to restore one train of emergency coolant recirculation equipment.	
<b>CT6</b>	<b>Crew establishes one train of SI flow:</b> <ul style="list-style-type: none"> <li>Verifies only one charging pump running (NO)</li> <li>Stops one charging pump</li> <li>Places all non-running charging pumps in PTL</li> <li>Verifies RCS pressure &lt; 225 psig [450 psig]</li> <li>Verifies only one LHSI pump running</li> </ul>	<b>Critical task</b> *Prior to 8% RWST level
	<b>NOTE: Scenario may be stopped once a charging pump has been stopped, with concurrence from the lead evaluator.</b>	<b>Validation time: 5 minutes</b>

## REFERENCES

PROCEDURE	REV.
Abnormal Procedure 1-AP-28, "Loss of Instrument Air."	36
Abnormal Procedure 1-AP-14, "Low Condenser Vacuum."	31
Abnormal Procedure 1-AP-3, "Loss of Vital Instrumentation."	28
Abnormal Procedure 1-AP-16, "Increasing Primary Plant Leakage."	30
Abnormal Procedure 1-AP-5, "Unit One Radiation Monitoring System."	39
Emergency Procedure 1-E-0, "Reactor Trip or Safety Injection."	49
Emergency Procedure 1-E-1, "Loss of Reactor or Secondary Coolant."	27
Functional Restoration Procedure 1-FR-C.2, "Response to Degraded Core Cooling."	14
Functional Restoration Procedure 1-FR-P.1, "Response to Imminent Pressurized Thermal Shock."	20
Emergency Contingency Action 1-ECA-1.1, "Loss of Emergency Coolant Recirculation."	20
Station Annunciator Response Procedures.	N/A
Administrative Procedure PI-AA-5000, "Human Performance."	8
INPO, Guideline for Teamwork and Diagnostic Skill Development: INPO 88-003,	Jan. 1988
INPO, ACAD 07-002 Simulator Training Guidelines	Jan. 2007

ATTACHMENT 1  
SIMULATOR OPERATOR'S COMPUTER PROGRAM

**SIMULATOR OPERATOR'S COMPUTER PROGRAM  
2016 NRC 2**

**Initial conditions**

1. Recall IC 322
2. Ensure Tave, Tref, PDTT level, and VCT level are selected on trend recorders.
3. **2H is the protected train.**
4. Place **red stickers** on 1-SW-P-1A and 1-BC-P-1B.
5. Have copy of AP-14 attachment 2, page 1 for booth.

**PRELOADS PRIOR TO SCENARIO START**

CONDITION	MALFUNCTION/OVERRIDE/ETC.
Tagout 1-SW-P-1A	Place pump in PTL. Rack out breaker and close discharge valve. <b>Remote functions:</b> SWP1A_RACKIN = 0 SW_6 = 0
Tagout 1-BC-P-1B	Place pump in PTL and Rack out breaker. <b>Remote function:</b> BCP1B_RACKIN = RACKOUT
1-SA-C-1 fails to start automatically	<b>Switch override:</b> SAC1_AUTO = OFF
Auto start failure of EHC pump	<b>Switch override:</b> TMP4_ASTP = Off
Failure of auto CDA	<b>Malfunction:</b> QS03
"A" LHSI pump sheared shaft	<b>Malfunction:</b> SI0901
Low head SI pumps fail to auto start	<b>Switch override:</b> SIP1A_AUTO = OFF SIP1B_AUTO = OFF
1-CH-MOV-1381 fails to close automatically but will work when close button pressed	<b>Monitor:</b> CHMOV381_RATE = 0  On trigger screen for trigger 22: MOV381_C SET CHMOV381_RATE = 180

## SCENARIO EVENTS

<b>EVENT 1</b>	<b>Instrument air compressor trips</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Remote function:</b> U2_SAC1_FAULT = TRUE, Delay time = 5, Trigger = 1</p> <p><b>Malfunction:</b> CA0402, Delay time = 5, Severity = 15, Trigger = 1</p> <p>Set up Trigger 30 to delete leak when IA compressor started SAC1_HAND DMF CA0402</p> <p><b>The next event can occur once the crew has restored instrument air pressure, and with direction from the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If sent to 2-SA-C-1:</b> wait 5 minutes and then report a Motor Overload alarm. (If electricians are sent can report a fault in compressor motor.) This has been reported to Unit 2 and WCC.</p> <p><b>If called to check 2-IA-TV-211 closed,</b> report that red light is NOT lit and dryer appears to be operating normally.</p>	

<b>EVENT 2</b>	<b>Failure of 1-CH-TE-1144</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> CH27, Delay time = 5, Severity = -1, Trigger = 2</p>	
<b>COMMUNICATIONS</b>	
<p><b>If I&amp;C sent to cabinet and/or AB operator sent to transmitter:</b> wait 5 minutes and report back that you see nothing obviously wrong.</p>	

<b>EVENT 3/3a/3b</b>	<b>Loss of Condenser Vacuum/Unit ramp/Auto rod control faults</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b>  CN0901, Delay time = 5, Ramp = 120, Severity = 100, Trigger = 3  RD14, Delay time = 5, Trigger = 3</p> <p><b>When the vacuum leak is stopped and the crew has stabilized the unit, and with direction of the lead evaluator, the next event can occur.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If would take at least 5 minutes to get attachment and find this.</b></p> <p><b>When sent to perform attachment, verify that enough of a ramp has occurred, then delete malfunction CN0901. (If no one dispatched with attachment in hand, than initially report the loop seal is hot and get direction to isolate.)</b></p> <p><b>If enough of a ramp has NOT occurred, than first report back that the isolation valve, 1-VP-22, is difficult to turn and request permission to use a valve wrench (torque amplifying device)</b></p> <p><b>You will slowly reopen in 15 minutes and report back any problems.</b></p>	

<b>EVENT 4</b>	<b>Pressurizer level channel 1461 fails</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> RC0803, Delay time = 5, Ramp = 1, Severity = -1, Trigger = 4</p> <p><b>The next event can occur after the crew identifies the applicable MOP and pressurizer level control is back in automatic, and as directed by the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	

<b>EVENT 5/6</b>	<b>EHC pump trips/RCS leak</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b>  TU1101, Delay time =5, Trigger = 5  RC04, Delay time = 5, Ramp = 300, Severity = 10, Trigger = 5</p> <p><b>The next event will occur after the crew either makes preparations to ramp, makes preparations for a containment entry, and as directed by the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If the crew dispatches an operator to look at EHC pumps,</b> wait 3 minutes and then report that 1-TM-P-3 is unusually hot, and 1-TM-P-4 appears normal. No EHC leaks and pressure is normal.</p> <p><b>If consulted about decision to either ramp or make containment entry:</b> ask what they recommend and agree with it.</p>	

<b>EVENT 7</b>	<b>LBLOCA</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> RC0101, Delay time = 5, Ramp = 60, Severity = 30, Trigger = 7</p> <p><b>MOV control:</b> SIMOV860B_RACKIN = RACKOUT, Delay time = 120, Trigger = 7</p> <p><b>WILL GET A U-2 ALARM WHEN CDA ACTUATED. SILENCE IT ON EXTREMEVIEW.</b></p> <p><b>Remote function:</b> CH_217 = 0, Delay time = 30, Ramp = 30, Trigger = 20</p> <p><b>The next event occurs when the crew reaches the point in the procedure to check containment recirc capability</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If called:</b> SM gives permission to stop redundant RS pumps.</p> <p><b>If sent:</b> 1-SI-P-1A has a sheared shaft.</p> <p><b>If sent to breaker for 1-SI-MOV-1860B</b> wait 3 minutes and then report that 1J1-2N J3 has tripped open. There is an acrid smell in the area.</p> <p><b>If sent to check 1-SI-MOV-1860B,</b> you will need HP coverage. Report that the actuator is broken on the MOV. Pieces of it are on the floor.</p>	

<b>EVENT 8</b>	<b>Loss of containment Recirc</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Preloaded.</b></p> <p><b>Scenario may be stopped once a charging pump has been stopped, with concurrence from the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
Empty space for communications	

ATTACHMENT 3  
SCENARIO PERFORMANCE OBJECTIVES

## SIMULATOR REQUALIFICATION EXAMINATION

### TERMINAL PERFORMANCE OBJECTIVE

Given equipment failures and operational situations, operate the plant in accordance with Technical Specifications to bring the unit to a safe condition, using applicable procedures, and applying effective teamwork, communication, and diagnostic skills.

### GENERIC PERFORMANCE OBJECTIVES

- A. During shift operations the shift manager will take a conservative course of action, especially when uncertain conditions exist, when dealing with core cooling or heat sink availability, primary system and containment integrity, and reactivity control associated with plant evolutions.
- B. During shift operations the shift manager will provide overall crew guidance by prioritizing and integrating the actions of the shift crew in accordance with administrative procedures.
- C. During shift operations each crew member will participate in a team effort that resolves conflicts, provides input into the team decision and communicates all the necessary information to enhance teamwork in accordance with administrative procedures.
- D. During shift operations the Shift Technical Advisor will independently assess events and based on those assessments make recommendations to the crew regarding mitigation strategy.
- E. During shift operations each crew member will utilize operator fundamentals to ensure Teamwork Effectiveness, High Standards for Controlling Evolutions, Indications Monitored Closely, a Natural Bias for Conservatism, and Knowledge of Plant Design and Theory.

## **EVENT 1 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power, and a loss of an air compressor (2-SA-C-1) has occurred, the crew will be expected to respond in accordance with 1-AP-28, "Loss of Instrument Air."

### **NORTH ANNA SPECIFIC TASKS:**

R530 Respond to a loss of instrument air outside of containment.

### **CRITICAL TASK:**

See next page

CT Statement:

Crew starts all available air compressors.

Safety Significance:

Failure to start all available air compressors under the postulated plant conditions constitutes mis-operation or incorrect crew performance which leads to degradation of plant conditions which could result in a unit trip and/or safety injection. In this case, the instrument air pressure can be maintained above the trip set point by starting the air compressors. Therefore, failure to start the air compressors also represents a "demonstrated inability by the crew to take an action or combination of actions that would prevent a challenge to plant safety."

Cues:

Instrument air low pressure alarm.  
Meter indication of low instrument air pressure.

Performance Indicator:

BOP starts all available air compressors.

Feedback:

Instrument air pressure stabilizes above the trip set point.

WOG Reference:

None.

Conditions:

Prior to reaching the trip set point of 70 PSIG.

## **EVENT 2 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and 1-CH-TE-1144 has failed low causing letdown temperature to increase, the crew will be expected to respond in accordance with the AR for C-C6, DEMIN INLET DIVERT HI TEMP.

### **NORTH ANNA SPECIFIC TASKS:**

None

### **CRITICAL TASK:**

N/A

### **EVENT 3 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and loss of condenser vacuum is occurring, the crew will respond in accordance with 1-AP-14, "Low Condenser Vacuum."

#### **NORTH ANNA SPECIFIC TASKS:**

R518 Respond to a partial loss of condenser vacuum.

#### **CRITICAL TASK:**

N/A

## **EVENT4 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and a selected pressurizer level channel, 1-RC-LI-1461, has failed low, the crew will respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

### **NORTH ANNA SPECIFIC TASKS:**

R633 Respond to a failure of the controlling pressurizer level channel.

S70 Evaluate compliance with technical specifications.

### **CRITICAL TASK:**

See next page

CT Statement:

Crew takes manual control of PRZR level, minimizes charging, and restores letdown.

Safety Significance:

Failure to take manual control of PRZR level constitutes a "mis-operation or incorrect crew performance" which will result in an unnecessary reactor trip on high PRZR level.

Cues:

The controlling PRZR level channel is failed low, letdown is isolated.

Performance Indicator:

RO verifies/places controller for 1-CH-FCV-1122 in manual and controls PRZR level.  
RO performs RNO step and selects operable channel.  
Crew restores charging and letdown as directed by the US.

Feedback:

PRZR level does not exceed trip setpoint.

WOG Reference:

None.

Conditions:

Prior to a PRZR high level reactor trip.

## **EVENT 5/6 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and there are no EHC pumps running, the crew will respond in accordance with the applicable AR. Also, when indications exist of RCS leakage greater than TS limits, the crew will be expected to respond in accordance with 1-AP-16, "Excessive Primary Plant Leakage," and 1-AP-5, "Unit 1 Radiation Monitoring System."

### **NORTH ANNA SPECIFIC TASKS:**

R520 Respond to increasing primary plant leakage.

### **CRITICAL TASK:**

See next page

CT Statement:

Crew starts the standby EHC pump

Safety Significance:

Failure to maintain/recover EHC pressure will cause an unnecessary turbine trip/reactor trip that could have been prevented by starting the standby pump.

Cues:

- Annunciators (Turb superv panel trouble, EH fluid reservoir lo pressure)
- Indications that there is EHC pump running

Performance Indicator:

Crew manually starts standby EHC pump

Feedback:

EH fluid reservoir low pressure alarm clears

WOG Reference:

None

Conditions:

Prior to receiving an automatic reactor trip due to a turbine trip caused by low EHC pressure

## **EVENT 7 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power, and a large break LOCA has occurred inside containment, the crew will be expected to respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," and 1-E-1, "Loss of Secondary or Reactor Coolant."

### **NORTH ANNA SPECIFIC TASKS:**

R185 Perform the immediate operator actions in response to a reactor trip or safety injection.

S69 Identify a reportable occurrence and make appropriate notifications.

S85 Notify the appropriate personnel of emergency events.

### **CRITICAL TASK:**

See Following Pages

CT Statement:

Crew starts at least one LHSI pump.

Safety Significance:

Failure to manually start at least one low-head ECCS pump under the postulated conditions constitutes "mis-operation or incorrect crew performance which leads to degraded ECCS...capacity." In this case, at least one low-head ECCS pump can be manually started from the control room. Therefore, failure to manually start a low-head ECCS pump also represents a "demonstrated inability by the crew to:

- \* Recognize a failure/incorrect auto actuation of an ESF system or component
- \* Effectively direct/manipulate ESF controls"

Cues:

Indication and/or annunciation that low-head ECCS pumped injection is required

- \* SI actuation
- \* RCS pressure below the shutoff head of the low-head ECCS pumps and  
Indication and/or annunciation that no low-head ECCS pump is injecting into the core
- \* Control switch indication that the circuit breakers or contactors for both low-head  
ECCS pumps are open
- \* All low-head ECCS pump discharge pressure indicators read zero
- \* All flow rate indicators for low-head pumped injection read zero

Performance Indicator:

BOP manually starts an available Low Head SI pump.

Feedback:

Indication and/or annunciation that at least one low-head ECCS pump is injecting  
Flow rate indication of injection from at least one low-head ECCS pump

WOG Reference:

Appendix B CT 5

Conditions:

Prior to entering 1-FR-C.1.

CT Statement:

Crew manually actuates CDA.

Safety Significance:

Failure to manually actuate CDA under the postulated conditions constitutes a "demonstrated inability by the crew to recognize a failure of an ESF system or component."

Cues:

Indication/annunciation that containment pressure has exceeded the CDA setpoint with indication that CDA did not automatically initiate.

Performance Indicator:

RO/BOP manually actuates CDA.

Feedback:

Indication/annunciation that CDA has actuated.

WOG Reference:

Appendix B CT 3

Conditions:

Prior to transitioning to 1-FR-Z.1.

## **EVENT 8 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that a loss of emergency coolant recirc has occurred with a LBLOCA in progress, the crew will respond in accordance with 1-ECA-1.1, "Loss of Emergency Coolant Recirculation."

### **NORTH ANNA SPECIFIC TASKS:**

None

### **CRITICAL TASK:**

See next page

CT Statement:

Crew establishes one train of SI flow.

Safety Significance:

Failure to stop the ECCS pumps taking a suction on the RWST before it empties results in cavitation, air binding, and loss of suction. All of these results can lead to pump damage sufficient to [reduce the availability of the pumps when a suction source subsequently becomes available].

Cues:

Procedurally directed by ECA-1.1.

Performance Indicator:

RO stops 1 HHSI pump.

Feedback:

Decreased RCS makeup flow.  
Pump amps at zero.

WOG Reference:

Appendix B CT 28

Conditions:

Prior to 8% RWST level

ATTACHMENT 2

SIMULATOR PERFORMANCE DATASHEET

### Scenario Performance Datasheet

EVENT 1: Given that the unit is at power, and a loss of an air compressor (2-SA-C-1) has occurred, the crew will be expected to respond in accordance with 1-AP-28, "Loss of Instrument Air."

SPD Verified: \_\_\_\_\_ (Initials)

- 2-SA-C-1 trips
- Annunciator J-D1, and possibly F-F8, J-E8 illuminate
- Instrument air pressure decreases
- 1-SA-C-1 does not start automatically

EVENT 2: Given that the unit is at power and 1-CH-TE-1144 has failed low causing letdown temperature to increase, the crew will be expected to respond in accordance with the AR for C-C6, DEMIN INLET DIVERT HI TEMP.

SPD Verified: \_\_\_\_\_ (Initials)

- 1-CH-TI-1143 indication increases
- 1-CH-TI-1144 indication decreases
- 1-CC-TCV-106 output decreases
- Annunciator C-C6 illuminates
- 1-CH-TCV-1143 bypasses the demin train

EVENT 3/3a/3b: Given that the unit is at power and loss of condenser vacuum is occurring, the crew will respond in accordance with 1-AP-14, "Low Condenser Vacuum."

SPD Verified: \_\_\_\_\_ (Initials)

- Condenser vacuum degrades
- Annunciator A-G1 alarms if vacuum reaches setpoint
- Rods do not insert automatically to control temperature

EVENT 4/4a: Given that the unit is at power and a selected pressurizer level channel, 1-RC-LI-1461, has failed low, the crew will respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

SPD Verified: \_\_\_\_\_ (Initials)

- Annunciators B-F8, B-G7, and B-E2 are illuminated
- 1-RC-LI-1461 fails low
- Letdown isolates

EVENT 5/6: Given that the unit is at power and there are no EHC pumps running, the crew will respond in accordance with the applicable AR. Also, when indications exist of RCS leakage greater than TS limits, the crew will be expected to respond in accordance with 1-AP-16, "Excessive Primary Plant Leakage," and 1-AP-5, "Unit 1 Radiation Monitoring System."

SPD Verified: \_\_\_\_\_ (Initials)

- Annunciators K-F5 and T-B3 will illuminate
- "A" EHC pump trips
- "B" EHC pump does not auto-start

RCS leak

- Charging flow increasing, VCT level decreasing
- Containment sump level increasing
- Containment gaseous radiation (RM-160) increases (also RM-163 and 164)
- Annunciators K-D2, K-D4, and possible J-F2 will illuminate.

EVENT 7: Given that the unit is at power, and a large break LOCA has occurred inside containment, the crew will be expected to respond in accordance with 1-E-0, "Reactor Trip or Safety Injection," and 1-E-1, "Loss of Secondary or Reactor Coolant."

SPD Verified: \_\_\_\_\_ (Initials)

- Pressurizer pressure and level rapidly decreasing
- 1-SI-P-1A and 1-SI-P-1B fail to auto-start
- 1-SI-P-1A shears its shaft when started
- 1-CH-MOV-1381 does not close automatically

EVENT 8: Given that a loss of emergency coolant recirc has occurred with a LBLOCA in progress, the crew will respond in accordance with 1-ECA-1.1, "Loss of Emergency Coolant Recirculation."

SPD Verified: \_\_\_\_\_ (Initials)

- None

Facility: <u>North Anna Power Station</u>		Scenario No.: <u>(2016) NRC-4</u>		Op-Test No.: <u>1</u>	
Examiners: <u>Bruno Cabarello</u>		Operators: _____			
<u>Newton Lacy</u>		_____			
<u>Gary Callaway</u>		_____			
<p>Initial Conditions: 79% power, MOL. Power was held here due to a severe thunderstorm warning for the area. The warning has now been lifted. The unit is being returned to service after maintenance on the voltage regulator following a unit trip. Xenon is at equilibrium. 1-SW-P-1A is tagged out for major repairs. 1-BC-P-1B is tagged out for shaft replacement. 2H is the protected train.</p> <p>Turnover: Ramp the unit to 100% power. Support maintenance on repair of 1-SW-P-1A and 1-BC-P-1B, as required.</p>					
Event No.	Malf. No.	Event Type*	Event Description		
1		R (RO) N (B)	Ramp the unit up		
2		I/C (RO)	Median/Tave unit fails high (CT)		
3		TS (S)	IRPI (K2) fails low		
4		I/C (B)	"B" SG PORV opens unexpectedly. Can be closed from the control room		
5		I/C (RO) TS (S)	Letdown leak, isolable from control room		
5a		N (B)	Place excess letdown in service		
6		I/C (B)	(Selected) "A" Ch. IV feed flow transmitter, 1-FW-FT-1476, fails low		
7		M (All)	Trip of normal feeder breaker for "A" station service bus (15A2) (swaps to alternate power source 15A1) Trip of "A" Main Feedwater pump with failure of standby pump ("B") to start ATWS (CT)		
8		I/C (RO)	Control rods will not insert in auto or manual		
9		I/C (B)	Turbine stop valves will not close, must close MSTVs		
			Events 8 and 9 are part of event 7 and are numbered for use on subsequent forms.		
			The scenario can be terminated once crew transitions back to 1-E-0.		
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor					

DOMINION  
NORTH ANNA POWER STATION

LICENSED OPERATOR REQUALIFICATION EXAMINATION  
SIMULATOR EXAMINATION GUIDE  
SCENARIO 2016 NRC 4

## SIMULATOR EXAMINATION GUIDE

<u>EVENT</u>	<u>DESCRIPTION</u>
1.	Ramp unit up
2.	Median/Tave unit fails high
3.	IRPI (K2) fails low
4.	"B" SG PORV opens unexpectedly. Can be closed from the control room
5.	Letdown leak, isolable from control room
5a.	Place excess letdown in service
6.	(Selected) "A" Channel IV feed flow transmitter, 1-FW-FT-1476, fails low
7.	"A" SS swap to alternate power/Trip of MFP/failure of standby pump to start/ATWS
8.	Control rods will not work in automatic or manual.
9.	Turbine stop valves will not close

### Scenario Recapitulation:

Malfunctions after EOP entry	<b>3</b>	ATWS, rods do not insert in auto or manual, turbine will not trip and stop valves will not close
Total Malfunctions	<b>8</b>	IRPI fails low, Tave unit fails low, SG PORV opens, letdown leak, selected feed flow channel fails, swap of "A" SS to alternate/trip of main feed pump with failure of standby pump to start/ATWS, rods do not insert in auto or manual, turbine will not trip and stop valves will not close
Abnormal Events	<b>4</b>	Tave unit fails low, SG PORV opens, letdown leak, selected feed flow channel fails
Major Transients	<b>1</b>	Main feed pump trip with failure of standby pump to start/ATWS
EOPs Entered	<b>1</b>	FR-S.1
EOP Contingencies	<b>1</b>	FR-S.1
Critical Tasks	<b>2</b>	

### SCENARIO DURATION

110 Minutes

**SIMULATOR EXAMINATION SCENARIO SUMMARY**  
**SCENARIO 2016 NRC 4**

The scenario begins with the unit at 79% power, MOL. Power was held here due to a severe thunderstorm warning for the area. The warning has now been lifted. The unit is being returned to service after maintenance on the voltage regulator following a unit trip. Xenon is at equilibrium. 1-SW-P-1A, Unit 1 "A" SW pump, is tagged out for major repairs. 1-BC-P-1B is tagged for shaft replacement, not expected back for several days. 2H is the protected train. Shift orders are to continue the unit ramp to 100% power.

The first event will be a ramp up in power. This event can be pre-briefed. Once enough of a ramp has been seen, the next event can occur.

The next event will be the failure of the median/select Tave unit high. The crew will be expected to respond IAW 1-AP-1.1, "Continuous Uncontrolled Rod Motion," and place rod control in MANUAL (CT). Also, crew should address annunciators B-A7, MEDIAN/HI TAVG < > TREF DEVIATION, and B-A8, LOOP 1A-B-C TAVG DEVIATION, take manual control of charging flow, and place steam dumps in steam pressure mode. After these actions have been completed and plant conditions are stable, or as directed by the lead evaluator, the next event will occur.

At this time, the IRPI for rod K-2 in control bank "A" will drop to zero. The US will review technical specification 3.1.7 and notify the instrument shop. Once this failure has been addressed, the next event can occur.

The next failure to occur will be the "B" SG PORV failing open due to the failure of the E/P. The crew may reduce power per 1-AP-38, "Excessive Load Increase." They will close the PORV using the controller and stabilize the unit. The next event will occur after the crew has stabilized the unit, and at the direction of the lead evaluator.

Next, there will be a leak on the letdown line in the Auxiliary building. The crew will enter 1-AP-16, "Increasing Primary Plant Leakage," and isolate the leak. They will place excess letdown in service using 1-OP-8.5, "Operation of Excess Letdown." The US will review Tech Specs for primary plant leakage.

The selected feed flow channel (1476) on "A" steam generator will fail low. The crew should respond in accordance with 1-AP-3, "Loss of Vital Instrumentation," and place the "A" steam generator level control in manual to restore normal operating level. The crew will swap steam generator water level control channels to channel III. Once the crew has identified the MOP, and with direction of the lead evaluator, the next event can occur.

Breaker 15A2, "A" station service bus normal supply breaker, will open unexpectedly. Breaker 15A1, RSST supply to station service will close in to supply power to the "A" station service bus. The crew should notify the Electrical Department to investigate the fault. At this time the "A" Main Feed pump will trip and the standby pump will not auto-start. The crew will attempt to trip the reactor in accordance with 1-E-0, but the reactor will not trip. The crew will enter 1-FR-S.1, "Response to Nuclear Power Generation/ATWS." Rods will not insert in auto or manual and the

turbine stop valves will not close. The crew will close the MSTVs (CT) and inject the BIT to have sufficient negative reactivity addition (CT). At this time the reactor will be tripped locally. The crew will transition back to 1-E-0, "Reactor Trip or Safety Injection," and perform the immediate actions. At this time the scenario may be terminated with the direction of the lead evaluator.

## SCENARIO TURNOVER SHEET

### **Read the following to the crew:**

**Purpose:** This examination is intended to evaluate the crew's performance of various tasks associated with the Initial License Operator Training Program. All activities should be completed in accordance with approved operations standards.

1. You are on a day shift during the week.
2. A rough log should be maintained to aid in making reports and to help during briefs.
3. Respond to what you see. In the unlikely event that the simulator fails such that illogical indications result, the session will be terminated and the crew informed.

### **Unit Status:**

Unit 1 is at approximately 79% power by calorimetric. Power was held here due to a severe thunderstorm warning for the area. The warning has now been lifted. The unit is being returned to service after maintenance on the voltage regulator following a unit trip. Xenon is at equilibrium. RCS boron is 1171 ppm and core age is 9,000 MWD/MTU. Aux steam is on unit 2.

Unit 2 is at 100% power.

### **Equipment Status:**

1-SW-P-1A is tagged out for major repairs. 1-BC-P-1B is tagged for shaft replacement, not expected back for several days. 2H is the protected train. Maintenance rule window is green. 1-BC-P-1A and both Spent Fuel Pit Cooling pumps are protected.

### **Shift Orders:**

Shift orders are to continue the unit ramp to 100% power using auto rod control. Assist maintenance with work on 1-SW-P-1A and 1-BC-P-1B, as required.

EVENT 1: Given that the unit is at approximately 79% power and the crew has been instructed to increase power, the crew will ramp the unit up in accordance with 1-OP-2.1, "Unit Startup from Mode 2 to Mode 1."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Reactor power increases</li> <li>• Turbine power increases</li> <li>• Tavg/Tref increase</li> <li>• Generator megawatts increase</li> </ul>	
	<b>NOTE: The crew may raise primary temperature prior to ramping the turbine. Turbine operation is done using attachment 9 (Guidance for main turbine operations) of 1-OP-2.1.</b>	<b>Copy will be attached</b>
	BOP verifies turbine in Auto.	
	BOP verifies/sets desired ramp rate (0.3% per minute).	
	BOP adjusts limiter position, as required.	
	BOP increases turbine setter to desired position. (.3%/min)	
	BOP presses GO on turbine.	
	BOP monitors turbine ramp.	
	RO starts a dilution when required using 1-GOP-8.3.1 or 1-GOP-8.3.2.	
	RO monitors control rods to maintain Tave within 1.5°F of Tref with rods above insertion limits.	Rods were directed to be operated in automatic per pre-brief.
	<b>NOTE: The next event can occur once the crew has ramped a sufficient amount, and as directed by the lead evaluator.</b>	<b>Validation time: 27 minutes</b>

EVENT 2: Given that the unit is operating at power, and the T <sub>ave</sub> MSS unit has failed high, the crew will be expected to respond in accordance with 1-AP-1.1, "Continuous Uncontrolled Rod Motion."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials)		
<ul style="list-style-type: none"> <li>• Rods stepping in at maximum speed</li> <li>• Annunciators B-A7 and B-A8 illuminate</li> <li>• Annunciators B-F8 and C-C5 may also illuminate.</li> </ul>		
	RO identifies rods stepping in at maximum speed.	
	RO identifies median/select Tave unit failed.	
	<b>NOTE: Crew may reference 1-AP-3</b>	
	US directs crew to enter AP-1.1.	
	US directs crew to hold the ramp.	
<b>CT1</b>	<b>Crew takes action to stop rod motion and stabilize the unit:</b> <ul style="list-style-type: none"> <li>• <b>RO places rod control in MANUAL</b></li> <li>• RO verifies rod motion stopped.</li> </ul>	<b>Critical task</b> *Prior to reactor trip on PRZR low pressure
	RO verifies 1-RC-TI-1408A Median/Hi Tavg is normal. (NO)	MEDIAN/HI TAVG <> TREF DEVIATION
	Crew initiates actions of annunciator B-A7 while continuing with the AP.	See next page for actions
	*RO maintains the following using control rods and boration: Rod bank LO/LOLO limit annunciators NOT lit AFD monitor annunciator NOT lit	*Continuous action
	RO checks RCS Tave > 541°F, above min and below max of attachment 2. Adjusts as directed by the US. RO will need to find a method of monitoring Tavg other than the benchboard indication. (Can use indications on VB or PCS.)	
	Crew adjusts temperature, as required, using control rods/boration, or turbine load.	
	RO checks PRZR pressure stable or trending to 2235 psig. Adjusts heaters and spray as required.	

EVENT 2: Given that the unit is operating at power, and the T <sub>ave</sub> MSS unit has failed high, the crew will be expected to respond in accordance with 1-AP-1.1, "Continuous Uncontrolled Rod Motion."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	RO checks PRZR level stable, and adjusts charging flow as required.	
	Crew checks controls rods above the LO insertion limit.	
	Crew maintains stable plant conditions.	
	US requests Work Control Center supervisor to inform the OMOC of the failure and to notify Instrument Department to investigate the cause of the failure. Requests initiation of CR.	
	<b>NOTE: The following actions are IAW AR for annunciators B-A7.</b>	MEDIAN/HI TAVG <math>\diamond</math> TREF DEVIATION. Attached
	Crew verifies 1-RC-TI-1408A is normal. (NO)	
	Crew verifies control rods are in manual.	
	Crew places 1-CH-FCV-1122 in MANUAL and controls PRZR level at program.	
	RO transfers condenser steam dumps to steam pressure mode: <ul style="list-style-type: none"> <li>• Places both interlock switches to OFF/RESET</li> <li>• Places steam dump controller to MANUAL</li> <li>• Places mode selector switch to steam pressure</li> <li>• Ensures steam dump demand is zero</li> <li>• Places steam dump controller to AUTO</li> <li>• Verifies steam dump demand is zero</li> <li>• Places both interlock switches to ON.</li> </ul>	
	Crew verifies unit conditions are stable or under control: Reactor power Secondary load Steam Generator levels.	
	<b>NOTE: The next event can occur after the crew stabilizes the unit, or as directed by the lead evaluator.</b>	<b>Validation time: 14 minutes</b>

EVENT 3: Given that the unit is at power and indications of failed IRPI (K2) exist, the crew will respond in accordance with annunciator response A-G2 and technical specifications.		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>IRPI for rod K-2 in Control Bank A will drop to zero</li> <li>Rod Bottom Light for K-2 will illuminate</li> <li>Annunciators A-G2 and A-F1 will illuminate</li> </ul>		
	RO identifies annunciators A-G2, RPI ROD BOT ROD DROP, and A-F1, CMPTR ALARM ROD DEV/SEQ.	
	<b>NOTE: If unsure of conditions, the crew may enter 1-AP-1.2 for a dropped rod. Steps in this procedure were not included.</b>	
	RO identifies IRPI K-2 in control bank "A" is reading zero.	
	RO checks for other indications of a dropped rod.	
	RO identifies that no rod has dropped, IRPI problem.	
	Crew notifies I&C of IRPI problem.	
	<b>NOTE: If I&amp;C is asked to investigate the K-2 rod, they will report that it is an IRPI problem.</b>	
	<b>US reviews Technical Specification 3.1.7A and determines that a flux map must be done within 8 hours (or power reduced to &lt;50%).</b>	
	<b>NOTE: The next event can occur once the IRPI failure has been addressed, or at the direction of the lead examiner.</b>	Validation time: 8 minutes

EVENT 4: Given that the unit is at power and "B" SG PORV has failed open, the crew will respond in accordance with 1-AP-38, "Excessive Load Increase."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Reactor power slowly increases.</li> <li>• Megawatts slowly decrease</li> <li>• PCS alarm PCV-MS101B Low Flow is received.</li> </ul>		
	RO/BOP identifies increase in reactor power/decrease in MW or PCS alarm on MS-PCV-101B.	
	US directs crew to enter 1-AP-38.	
	RO verifies all steam dumps closed.	
	<b>NOTE: Crew may identify "B" PORV open from PCS alarm and/or PNID screen.</b>	
	BOP verifies all SG PORVs indicate closed. (NO)	
	BOP places SG PORV in manual and closes it.	
	BOP verifies turbine load normal.	
	RO verifies reactor power is less than or equal to 100% power and stable.	
	<b>NOTE: If crew decides that power is not stable they may ramp the unit down slightly. These steps are not included.</b>	
	RO verifies proper rod control (NO, rods are in manual)	
	RO controls Tave within 1.5°F of Tref.	
	RO energizes additional PRZR heaters to maintain pressure. (Already energized)	
	*Crew checks turbine load control: Reactor power reduced to the power level before the event occurred Valve Position Limit light – Off Turbine in operator auto Turbine in IMP-IN.	
	*RO maintains rod bank LO/LOLO limit annunciators NOT lit and AFD annunciator NOT lit.	

EVENT 4: Given that the unit is at power and "B" SG PORV has failed open, the crew will respond in accordance with 1-AP-38, "Excessive Load Increase."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	Crew checks plant status is stable: Main generator output stable Tave on program with Tref.	
	BOP checks steam flow channel indications are normal.	
	BOP checks turbine is in operator auto.	
	Crew checks plant steam systems: SG PORVs SG safeties MSR inlet FCVs AS PCV.	
	Crew checks for RCS dilution due to improper demin operation, 1-CC-TCV-106 operation, or PG water leakby.	
	Crew verifies cause of load increase has been corrected.	
	Crew checks steam dumps in OFF. (NO)	
	Crew enters a CR to document the reactivity management event.	
	<b>US consults Technical Specifications:</b> 3.7.4 Condition A and determines that the PORV is operable.	
	<b>NOTE: The next event can occur after the crew has stabilized the unit, and at the direction of the lead evaluator.</b>	<b>Validation time: 8 minutes</b>

EVENT 5/5a: Given that the unit is at power, and indications exist of a letdown leak outside containment, the crew will be expected to respond in accordance with 1-AP-16, "Increasing Primary Plant Leakage."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Letdown flow decreases on 1-CH-FI-1150</li> <li>• VCT level steadily decreases</li> <li>• Auxiliary building sump level steadily increases</li> <li>• PCS alarm Non-regen Hx Letdown out F is received</li> </ul>	
	RO identifies decrease in letdown flow.	
	RO identifies decrease in VCT level.	
	BOP identifies increase in Aux building sump level.	
	Crew directs an operator to walkdown the Auxiliary Building and look for primary leaks.	
	US directs entry into 1-AP-16.	
	Crew verifies unit in mode 1.	
	*RO verifies PRZR level stable or increasing. If not, the RO adjusts charging flow to control PRZR level.	Already in manual
	*RO verifies VCT level stable. If not, the crew starts a makeup from the blender as required.	
	RO checks LCV-1115A not diverted.	
	<b>NOTE: If sent, operator will report that a leak exists on the letdown piping in the Auxiliary Building penetration area. If the leak is already isolated, he will report that the floor is wet back at the letdown penetration.</b>	
	RO verifies letdown in service with normal indications. (NO)	
	RO isolates letdown by closing 1-CH-HCV-1200B and 1-CH-LCV-1460A and B Minimizes/isolates charging.	
	Crew verifies that the leak stopped.	

EVENT 5/5a: Given that the unit is at power, and indications exist of a letdown leak outside containment, the crew will be expected to respond in accordance with 1-AP-16, "Increasing Primary Plant Leakage."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<p><b>NOTE: Crew will initiate 1-OP-8.5 while continuing with 1-AP-16.</b></p>	
<p><b>5a</b></p>	<p>Crew places excess letdown in service using 1-OP-8.5:</p> <ul style="list-style-type: none"> <li>• Verifies initial conditions</li> <li>• Reviews Ps&amp;Ls</li> <li>• Checks calorimetric power, VCT level, Seal injections flows, PRZR heater status, CC flow to excess L/D HX</li> <li>• Closes 1-CH-HCV-1137</li> <li>• Checks 1-CH-MOV 1380 and 1381 are open</li> <li>• Has operator energize loop drains</li> <li>• Places 1-CH-HCV-1389 in the PDTT position to flush the heat exchanger</li> <li>• Deletes F0134A point from processing, as necessary</li> <li>• Opens a loop drain valve and verifies the other 2 loop drains are closed</li> <li>• Opens 1-CH-HCV-1201</li> <li>• Slowly opens 1-CH-HCV-1137</li> <li>• Adjusts 1137 as required to maintain temperatures and pressure</li> <li>• When PDTT level has increased at least 14% - throttles 1-CH-HCV-1137 closed and places 1-CH-HCV-1389 in VCT position</li> <li>• Maintains pressurizer level</li> <li>• Logs appropriate parameters</li> <li>• Places 1-CH-PCV-1145 in manual</li> <li>• Verifies letdown is isolated.</li> <li>• Closes 1-CH-FCV-1122 in manual (already done)</li> <li>• Fully opens 1-CH-PCV-1145</li> <li>• Monitors accumulator levels.</li> <li>• Makes notifications..</li> </ul>	<p><b>Normal for BOP (or possibly RO)</b></p>
	<p>US directs WCC to make notifications and initiate WR and CR.</p>	

EVENT 5/5a: Given that the unit is at power, and indications exist of a letdown leak outside containment, the crew will be expected to respond in accordance with 1-AP-16, "Increasing Primary Plant Leakage."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<p>US reviews RCS leakage Tech Spec 3.4.13A (4 hours); applicable until letdown was isolated and the leak stopped.            Also TS 3.6.1A for containment being inoperable. Restore within 1 hour.            May Also reference 3.6.3A for containment isolation valves. This one is 4 hours.</p>	<p>Post exam comments: deleted TS 3.6.1A (ML ML16214A301)</p>
	<p>Crew initiates leak rate PT.</p>	
	<p><b>NOTE: Once excess letdown is in service, the next event can occur.</b></p>	<p><b>Validation time: 26 minutes</b></p>

EVENT 6: Given that the unit is at power and "A" SG selected feed flow transmitter, 1-FW-FT-1476, has failed, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials) <ul style="list-style-type: none"> <li>• Annunciators F-E1, F-D1 and possibly F-F1 illuminate</li> <li>• "A" MFRV ramps open</li> <li>• "A" SG Channel IV feed flow is off-scale low</li> </ul>		
	BOP identifies annunciator F-E1, SG 1A FW > STM FLOW CH III – IV.	
	BOP identifies "A" SG feedwater flow channel IV has failed low.	
	US directs crew to perform immediate actions of 1-AP-3: <ul style="list-style-type: none"> <li>• Crew verifies SG level controlling channels normal (NO)</li> <li>• BOP places "A" MFRV in MANUAL and adjusts to control "A" SG level</li> <li>• Crew verifies turbine first-stage pressure channels normal</li> <li>• RO verifies PRZR level indications are normal.</li> </ul>	
	Crew verifies redundant instrument channels normal	
	Crew verifies first stage pressure indications normal.	<b>AP-3 continues</b>
	RO verifies pressurizer level indications are normal.	
	RO verifies systems affected by pressurizer level channels are normal: <ul style="list-style-type: none"> <li>• RO verifies operable pressurizer level channels are selected</li> <li>• RO verifies emergency bus backup heaters are restored</li> <li>• RO verifies letdown is in service</li> <li>• RO verifies pressurizer level control is in automatic</li> <li>• RO verifies pressurizer control group heaters are not tripped.</li> </ul>	
	Crew verifies both first stage pressure channels normal.	
	Crew verifies all SGWLC channels selected to an operable channel. (NO)	

EVENT 6: Given that the unit is at power and "A" SG selected feed flow transmitter, 1-FW-FT-1476, has failed, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	Crew swaps SGWLC channels: <ul style="list-style-type: none"> <li>• RO verifies rod control to MANUAL</li> <li>• RO reports steam dumps in steam pressure mode</li> <li>• BOP places all MFRVs in MANUAL and verifies FRV B/Ps in MANUAL</li> <li>• Crew swaps all Steam flow/Feed flow and First-stage pressure channels to channel III</li> <li>• BOP verifies median levels are functional</li> <li>• BOP returns MFRVs to AUTOMATIC</li> <li>• RO leaves steam dumps in steam pressure mode</li> <li>• RO leaves rod control in manual.</li> </ul>	Seven switches to blue dot
	Crew checks for other failed channels.	
	Crew enters 1-MOP-55.78.	
	<b>NOTE: The next event may occur after the crew has identified the MOP and as directed by the lead evaluator.</b>	<b>Validation time: 17 minutes</b>

EVENT 7: Given that the unit is at power and a loss of the normal feeder for "A" station service bus and then a loss of two feedwater pumps has occurred and the reactor has will not trip, the crew will respond in accordance with 1-AP-31, "Loss of Main Feedwater," 1-FR-S.1, "Response to Nuclear Power Generation/ATWS," and 1-E-0, "Reactor Trip or Safety Injection."		
TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
SPD Verified: _____ (Initials)		
<ul style="list-style-type: none"> <li>• "A" SS bus normal feeder breaker opens</li> <li>• "A" MFP trips and "B" MFP does not auto-start</li> <li>• Reactor will not trip automatically or manually</li> <li>• Rods will not step in auto or manual</li> <li>• Turbine does not trip or runback</li> </ul>		
	Crew identifies annunciator 1H-C8, SS BUSSES NOR SUP BKR AUTO TRIP.	
	Crew identifies breaker 15A2 has tripped open and breaker 15A1 has automatically closed to supply the "A" station service bus via the RSST.	15A2 is the normal feeder breaker to "A" SS bus 15A1 is the alternate feed from "A" RSST
	<b>NOTE: Feed pump will trip 85 seconds later. This is unexpected.</b>	
	Crew identifies that "A" FW pump has tripped with no auto-start of "B" FW pump.	
	US directs crew to enter 1-AP-31.	
	Crew determines that power is >70% with only 1 MFP running.	
	US directs crew to enter 1-E-0.	
	RO/BOP attempt to trip the reactor.	

EVENT 7: Given that the unit is at power and a loss of the normal feeder for "A" station service bus and then a loss of two feedwater pumps has occurred and the reactor has will not trip, the crew will respond in accordance with 1-AP-31, "Loss of Main Feedwater," 1-FR-S.1, "Response to Nuclear Power Generation/ATWS," and 1-E-0, "Reactor Trip or Safety Injection."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	<p><b>Crew identifies reactor did not trip, transitions to 1-FR-S.1, Nuclear Power Generation/ATWS, and takes actions to bring the reactor subcritical.</b></p> <ul style="list-style-type: none"> <li>• RO/BOP attempt to manually trip the reactor.</li> <li>• RO places rods in auto and determines they are not inserting</li> <li>• RO attempts to manually insert control rods. (NO)</li> <li>• BOP attempts to manually trip the turbine (NO)</li> <li>• BOP attempts to runback the turbine to close stop valves (NO)</li> <li>• BOP closes the MSTVs</li> <li>• BOP verifies/starts all AFW pumps running.</li> <li>• RO verifies at least one charging pump running.</li> <li>• RO places in-service boric acid transfer pump in fast speed.</li> <li>• RO opens emergency borate valve 1-CH-MOV-1350</li> <li>• RO verifies adequate negative reactivity insertion. (NO)</li> </ul>	
	<p><b>NOTE: Injecting the BIT or locally tripping the reactor is part of the same CT as above. Trip breakers will not be opened until BIT is being injected unless directed by lead evaluator.</b></p>	

EVENT 7: Given that the unit is at power and a loss of the normal feeder for "A" station service bus and then a loss of two feedwater pumps has occurred and the reactor has will not trip, the crew will respond in accordance with 1-AP-31, "Loss of Main Feedwater," 1-FR-S.1, "Response to Nuclear Power Generation/ATWS," and 1-E-0, "Reactor Trip or Safety Injection."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
CT2	<p><b>Crew manually injects BIT:</b></p> <ul style="list-style-type: none"> <li>• RO opens charging pump suction valves from the RWST</li> <li>• RO closes charging pump suction valves from the VCT</li> <li>• BOP closes BIT recirc valves</li> <li>• <b>BOP opens at least one BIT outlet valve</b></li> <li>• <b>BOP opens at least one BIT inlet valve</b></li> <li>• RO closes letdown valves</li> <li>• RO closes normal charging line isolations</li> <li>• RO checks pressurizer pressure less than 2335 PSIG.</li> </ul>	<p><b>Critical Task</b>            *Before returning to step 5 from step 15 (i.e. not subcritical)</p>
CT2	<p>Crew checks if reactor trip has occurred. (NO)</p> <ul style="list-style-type: none"> <li>• <b>Crew dispatches operator to trip reactor locally.</b></li> <li>• <b>Reactor trip breakers are opened locally</b></li> </ul>	<p>Only critical if BIT not injected            *Before returning to step 5 from step 15</p>
	<p><b>NOTE: Reactor will be tripped after crew starts injecting the BIT.</b></p>	
	<p><b>NOTE: Crew may choose to perform attachment for isolating the BIT and restoring charging and letdown since they have emergency boration flow. If so let them at least isolate the BIT before continuing.</b></p>	<p>Crew may have chosen to remove excess letdown from service. If so, they will be required to place it back in service per this attachment.</p>
	<p>RO verifies reactor subcritical.</p>	
	<p>US directs transition to 1-E-0.</p>	
	<p>RO verifies reactor tripped.</p>	
	<p>BOP verifies turbine tripped.</p>	
	<p>RO verifies emergency busses energized.</p>	
	<p>Crew verifies SI is not actuated or required.</p>	

EVENT 7: Given that the unit is at power and a loss of the normal feeder for "A" station service bus and then a loss of two feedwater pumps has occurred and the reactor has will not trip, the crew will respond in accordance with 1-AP-31, "Loss of Main Feedwater," 1-FR-S.1, "Response to Nuclear Power Generation/ATWS," and 1-E-0, "Reactor Trip or Safety Injection."

TIME	EXPECTED ACTION	INSTRUCTOR REMARKS
	US directs transition to 1-ES-0.1.	
	<b>NOTE: Scenario can be terminated at this time with direction of the lead evaluator.</b>	<b>Validation time: 10 minutes</b>

## REFERENCES

PROCEDURE	REV.
Operating Procedure 1-OP-2.1, "Unit Startup from Mode 2 to Mode 1."	
Abnormal Procedure 1-AP-1.1, "Continuous Uncontrolled Rod Motion."	9
Abnormal Procedure 1-AP-38, "Excessive Load Increase."	19
Abnormal Procedure 1-AP-16, "Increasing Primary Plant Leakage."	30
Operating Procedure 1-OP-8.5, "Operation of Excess Letdown."	23
Abnormal Procedure 1-AP-3, "Loss of Vital Instrumentation."	28
Emergency Procedure 1-E-0, "Reactor Trip or Safety Injection."	49
Functional Restoration Procedure 1-FR-S.1, "Response to Nuclear Power Generation/ATWS."	17
Emergency Procedure 1-ES-0.1 "Reactor Trip Response."	32
Station Annunciator Response Procedures.	N/A
Administrative Procedure PI-AA-5000, "Human Performance."	8
INPO, Guideline for Teamwork and Diagnostic Skill Development: INPO 88-003,	Jan. 1988
INPO, ACAD 07-002 Simulator Training Guidelines	Jan. 2007

ATTACHMENT 1  
SIMULATOR OPERATOR'S COMPUTER PROGRAM

**SIMULATOR OPERATOR'S COMPUTER PROGRAM  
2016 NRC 4**

**Initial conditions**

1. Recall IC 324
2. Ensure Tave (570-580), Tref, PDTT level, and VCT level are selected on trend recorders.
3. **2H is the protected train.**
4. Place instrument channels in channel IV position.
5. Rods at 189 steps on D.
6. Calorimetric = 2
7. Verify 1-OP-8.5 copies in drawer

**PRELOADS PRIOR TO SCENARIO START**

CONDITION	MALFUNCTION/OVERRIDE/ETC.
Tagout 1-SW-P-1A	Place pump in PTL. Rack out breaker and close discharge valve. <b>Remote functions:</b> SWP1A_RACKIN = RACKOUT SW_6 = 0
Tagout 1-BC-P-1B	Place pump in PTL and Rack out breaker. <b>Remote function:</b> BCP1B_RACKIN = RACKOUT
"B" FW pump does not start in auto	<b>Switch overrides:</b> FWP1B1_ASTOP, Override = OFF FWP1B2_ASTOP, Override = OFF
Auto trip failure/ Manual trip failure	<b>Malfunctions:</b> RD32 RD38  <b>Remote function (RPS)</b> AMSAC_DEFEAT = T

CONDITION	MALFUNCTION/OVERRIDE/ETC.
Failure of auto/manual turbine trip/failure of stop valves to runback	<p><b>Malfunctions:</b>  TU03  TU02</p> <p><b>Switch Overrides:</b>  GV_FAST = OFF, Trigger = 7  GV_DOWN = OFF, Trigger = 7  VV_POS_LIM_DOWN = OFF, Trigger = 7</p>

**SCENARIO EVENTS**

<b>EVENT 1</b>	<b>Unit ramp</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<b>COMMUNICATIONS</b>	
Answer calls to SOC, MOC, chemistry, etc, as required.	

<b>EVENT 2</b>	<b>Tave unit failure</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> RC1501, Delay time = 5, Ramp = 10, Severity = 1, Trigger = 2</p> <p><b>The next event will occur after the crew stabilizes the unit, and as directed by the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If OMOC asked about withdrawing rods to match temperature:</b> wait 3 minutes and then call back and give permission.</p> <p><b>If asked any other way:</b> Ask for recommendation. Call back after 3 minutes (if WCC) and concur with their recommendation.</p>	

<b>EVENT 3</b>	<b>IRPI failure</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> RD0121, Delay time = 5, Severity = -1, Trigger = 3</p> <p><b>The next event can occur once the IRPI failure has been addressed and at the direction of the lead examiner.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If I&amp;C is contacted to check rod K-2, wait 10 minutes and then report back that it is an IRPI problem.</b></p> <p><b>If I&amp;C is contacted to tell them of the IRPI failure. Just acknowledge the communication.</b></p>	

<b>EVENT 4</b>	<b>Failure of "B" SG PORV</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Controller override:</b>  PCVMS101B, Analog value = 0, Trigger = 4</p>	
<b>COMMUNICATIONS</b>	
<p><b>When sent to locally check PORVs and safeties:</b> wait 5 minutes and report that there is no steam from any of them.</p> <p><b>If sent to look at PORVS (before procedure step)</b> then wait 3 minutes and report that there is no steam coming from the roof of the MSVH.</p>	

<b>EVENT 5</b>	<b>Letdown leak</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunction:</b> CH02, Delay time = 5, Ramp = 120, Severity = 100, Trigger = 5</p> <p><b>Remote function:</b> HCV1557_ENERGIZE = T, Trigger = 20</p> <p><b>The next event can occur once excess letdown is in service, and with the direction of the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>When sent to penetration area,</b> wait 5 minutes and then give a cue for current plant conditions, if leak not isolated then water is leaking out, if isolated then floor is wet and pipes are dripping water. Can later report that leak was <b>Upstream</b> of 1-CH-TV-1204B (or between containment wall and trip valve).</p> <p><b>NOTE: Must be reported as upstream to get correct TS call.</b></p> <p><b>When sent to close breaker for loop drains:</b> base time on whether you were sent to stand by. Put in trigger 20 and then report back that <b>1-EP-CB-26B BKR 22</b> is closed.</p> <p><b>When sent to get numbers for 1-OP-8.5:</b> wait 5 minutes and then give the following values: 1-CH-TI-1136 (Seal Return HX Outlet) is 87 degrees 1-CC-FI-102 (Seal water HX CC outlet flow) 183 GPM</p> <p>(Note the above numbers are from a unit 1 procedure done 1/28/16</p>	

<b>EVENT 6</b>	<b>"A" SG channel IV feed flow (1476) fails low</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>Malfunctions:</b> FW1202, Delay time = 5, Ramp = 20, Severity = -1, Trigger = 6</p> <p><b>After the crew has identified MOPs, consulted TS, and with direction of the lead evaluator, the next event may occur.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>If dispatched to check MFRV operation due to failure and valve in manual, wait 5 minutes and report that all MFRVs look normal.</b></p> <p><b>If dispatched to check RWST level transmitter, wait at least 5 minutes and then report that there is nothing obviously wrong at the transmitter.</b></p>	

<b>EVENT 7</b>	<b>Loss of "A" SS bus normal feed/Loss of 2 MFW pumps/ATWS/Rod control failure</b>
<b>MALFUNCTIONS/OVERRIDES</b>	
<p><b>ATWS is preloaded, failure of turbine to trip is preloaded, failure of turbine TVs to close is preloaded</b></p> <p><b>Remote function:</b> EL15A2_BKR = OPEN, Delay time = 5, Trigger = 7</p> <p><b>Malfunctions:</b> FW2201, Delay time = 90, Trigger = 7 RD14, Delay time = 30, Trigger = 7 RD15, Delay time = 30, Trigger = 7</p> <p><b>Use the following to trip the reactor. MAKE SURE CREW HAS STARTED INJECTING BIT (at least has BIT inlets and outlets open. Unless directed otherwise by the lead evaluator.</b></p> <p><b>Remote functions:</b> SP_RTA_BKR = F, Delay time = 0, Trigger = 10 SP_RTb_BKR = F, Delay time = 2, Trigger = 10</p> <p><b>Scenario can be terminated once the crew has announced transition to 1-ES-0.1 and as directed by the lead evaluator.</b></p>	
<b>COMMUNICATIONS</b>	
<p><b>When sent to trip reactor locally: once the crew is injecting the BIT put in trigger 10, and then report back that you have opened all the breakers.</b></p> <p><b>NOTE: If crew does not begin injecting the BIT in a timely manner, lead evaluator can direct the opening of the reactor trip breakers if he desires.</b></p>	

ATTACHMENT 3  
SCENARIO PERFORMANCE OBJECTIVES

## **EVENT 1 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at approximately 79% power and the crew has been instructed to increase power, the crew will ramp the unit up in accordance with 1-OP-2.1, "Unit Startup from Mode 2 to Mode 1."

### **NORTH ANNA SPECIFIC TASKS:**

R705 Dilute the Reactor Coolant System using the blender.

### **CRITICAL TASK:**

N/A

## **EVENT 2 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is operating at power, and the T<sub>ave</sub> MSS unit has failed high, the crew will be expected to respond in accordance with 1-AP-1.1, "Continuous Uncontrolled Rod Motion."

### **NORTH ANNA SPECIFIC TASKS:**

R475 Perform the immediate operator actions in response to a continuous uncontrolled rod motion.

### **CRITICAL TASK:**

See next page

CT Statement:

Crew takes action in accordance with AP-1.1, to stop rod motion and stabilize the unit.

Safety Significance:

Core reactivity is not under control of the operator due to the failed control channel. "It is expected that the operator will attempt to take manual actions to correct for anomalous conditions during power operation."

Cues:

Indication of a failed MMS Unit.

Continuous inward control rod motion with Tave and Tref matched.

Performance Indicator:

RO places rod control in manual.

Feedback:

Rod motion stops

WOG Reference:

None

Conditions:

Prior to reactor trip on low pressurizer pressure.

### **EVENT 3 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and indications of failed IRPI (K2) exist, the crew will respond in accordance with annunciator response A-G2 and technical specifications.

#### **NORTH ANNA SPECIFIC TASKS:**

S70 Evaluate compliance with technical specifications.

#### **CRITICAL TASK:**

N/A

## **EVENT 4 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and "B" SG PORV has failed open, the crew will respond in accordance with 1-AP-38, "Excessive Load Increase."

### **NORTH ANNA SPECIFIC TASKS:**

R539 Perform the immediate operator actions in response to an excessive load increase.

### **CRITICAL TASK:**

N/A

## **EVENT 5 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power, and indications exist of a letdown leak outside containment, the crew will be expected to respond in accordance with 1-AP-16, "Increasing Primary Plant Leakage."

### **NORTH ANNA SPECIFIC TASKS:**

R520 Respond to increasing primary plant leakage.

### **CRITICAL TASK:**

N/A

## **EVENT 6 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and "A" SG selected feed flow transmitter, 1-FW-FT-1476, has failed, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

### **NORTH ANNA SPECIFIC TASKS:**

R626 Respond to a steam generator water level control channel failure.

S70 Evaluate compliance with technical specifications.

### **CRITICAL TASK:**

N/A

## **EVENT 7 PERFORMANCE OBJECTIVES**

**EVENT GOAL:** Given that the unit is at power and a loss of the normal feeder for "A" station service bus and then a loss of two feedwater pumps has occurred and the reactor has will not trip, the crew will respond in accordance with 1-AP-31, "Loss of Main Feedwater," 1-FR-S.1, "Response to Nuclear Power Generation/ATWS," and 1-E-0, "Reactor Trip or Safety Injection."

### **NORTH ANNA SPECIFIC TASKS:**

R224 Perform immediate operator actions in response to a nuclear power generation/ATWS.

S69 Identify a reportable occurrence and make appropriate notifications.

S85 Notify the appropriate personnel of emergency events.

### **CRITICAL TASK:**

See next Page

CT Statement:

Crew identifies reactor did not trip, transition to 1-FR-S.1, Nuclear Power Generation/ATWS, and take actions to bring the reactor subcritical.

Safety Significance:

Failure to insert negative reactivity under the postulated plant conditions results in an unnecessary situation in which the reactor remains critical. Failure to insert negative reactivity constitutes "mis-operation or incorrect crew performance which leads to incorrect reactivity control."

Cues:

Valid indication of a required reactor trip by the presence of a first out annunciator, with a failure of the reactor to trip automatically or manually from the control room.

Performance Indicator:

Crew opens valves to inject the BIT.

OR

Reactor trip breakers are opened locally per crew direction

Feedback:

BIT flow is indicated

WOG Reference:

Appendix B CT 52

Conditions:

Prior to returning to step 5 from step 15 (i.e. not subcritical).

ATTACHMENT 2

SIMULATOR PERFORMANCE DATASHEET

## Scenario Performance Datasheet

EVENT 1: Given that the unit is at approximately 79% power and the crew has been instructed to increase power, the crew will ramp the unit up in accordance with 1-OP-2.1, "Unit Startup from Mode 2 to Mode 1."

SPD Verified: \_\_\_\_\_ (Initials)

- Reactor power increases
- Turbine power increases
- Tavg/Tref increase
- Generator megawatts increase

EVENT 2: Given that the unit is operating at power, and the T<sub>ave</sub> MSS unit has failed high, the crew will be expected to respond in accordance with 1-AP-1.1, "Continuous Uncontrolled Rod Motion."

SPD Verified: \_\_\_\_\_ (Initials)

- Rods stepping in at maximum speed
- Annunciators B-A7 and B-A8 illuminate
- Annunciators B-F8 and C-C5 may also illuminate.

EVENT 3: Given that the unit is at power and indications of failed IRPI (K2) exist, the crew will respond in accordance with annunciator response A-G2 and technical specifications.

SPD Verified: \_\_\_\_\_ (Initials)

- IRPI for rod K-2 in Control Bank A will drop to zero
- Rod Bottom Light for K-2 will illuminate
- Annunciators A-G2 and A-F1 will illuminate

EVENT 4: Given that the unit is at power and "B" SG PORV has failed open, the crew will respond in accordance with 1-AP-38, "Excessive Load Increase."

SPD Verified: \_\_\_\_\_ (Initials)

- Reactor power slowly increases.
- Megawatts slowly decrease
- PCS alarm PCV-MS101B Low Flow is received.

EVENT 5: Given that the unit is at power, and indications exist of a letdown leak outside containment, the crew will be expected to respond in accordance with 1-AP-16, "Increasing Primary Plant Leakage."

SPD Verified: \_\_\_\_\_ (Initials)

- Letdown flow decreases on 1-CH-FI-1150
- VCT level steadily decreases
- Auxiliary building sump level steadily increases
- PCS alarm Non-regen Hx Letdown out F is received

EVENT 6: Given that the unit is at power and "A" SG selected feed flow transmitter, 1-FW-FT-1476, has failed, the crew will be expected to respond in accordance with 1-AP-3, "Loss of Vital Instrumentation."

- Annunciators F-E1, F-D1 and possibly F-F1 illuminate
- "A" MFRV ramps open
- "A" SG Channel IV feed flow is off-scale low

EVENT 7: Given that the unit is at power and a loss of the normal feeder for "A" station service bus and then a loss of two feedwater pumps has occurred and the reactor has will not trip, the crew will respond in accordance with 1-AP-31, "Loss of Main Feedwater," 1-FR-S.1, "Response to Nuclear Power Generation/ATWS," and 1-E-0, "Reactor Trip or Safety Injection."

SPD Verified: \_\_\_\_\_ (Initials)

- "A" SS bus normal feeder breaker opens
- "A" MFP trips and "B" MFP does not auto-start
- Reactor will not trip automatically or manually
- Rods will not step in auto or manual
- Turbine does not trip or runback