

# **INITIAL SUBMITTAL**

**SURRY SEPTEMBER/2000 EXAM  
50-280/2000-301**

**SEPTEMBER 14 - 21, 2000**

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**OPERATING TEST  
SIMULATOR SCENARIOS**

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**OPERATING TEST  
SIMULATOR SCENARIOS**

Facility: Surry Scenario No.: 1

Op-Test No.: 1

Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Operators: (SRO) \_\_\_\_\_  
(RO) \_\_\_\_\_  
(BOP) \_\_\_\_\_

Initial Conditions: EOL. Condenser steam dumps are in steam pressure control due to a problem with the Tavg input which is under I&C investigation. LT-1(2)-498 & 1(2)A AFW pump are both OOS for corrective maintenance. 1(2)B AFW pump is aligned to train 2 and SD AFW pump is aligned to SG A. No other equipment is OOS

Turnover: Maintain 100% power steady state operation, There are thunderstorms in the area with winds clocking at 60 mph. Large golf ball size hail has also been reported. Slight tremors on the order of 2.1 on the Richter scale have been detected.

POD: Maintain 100% power. PT 17-1 test is due to be performed this shift. Continue corrective maintenance on LT-498 and the A AFW pump.

Event No.	Malf. No.	Event Type*	Event Description
1		N (R)	Conduct rod movement test
2		I (R,B <sup>1</sup> )	PT-1(2)-445 failure high (with failure of turbine to runback in event fail to react timely to PT-445 failure)
3		C (R)	Unisolable PZR PORV leak
4		R (R)	Power reduction due to PZR leak
5		I (B)	PT-1(2)-447 failure low
6		C→M (A)	Main steam line break
6a		M (A)	Reactor trip with main turbine trip & 1(2)B MSIV failures
6b		C (B)	Loss of all auxiliary feed
6c		C (A)	Loss of secondary heat sink with RCS bleed & feed

\* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor  
(R)O (B)OP (A)LL

B<sup>1</sup> Can only take credit if BOP fails to runback the turbine in a timely manner.

Initial submittal. G:\Surry\Initial Examinations\Initial Exam 2000-301\Surry Operating Test\Es-d-1 NRC-1.wpd, 7/28/00

Facility: Surry Scenario No.: 2 Op-Test No.: 1

Examiners: \_\_\_\_\_ Operators: (SRO) \_\_\_\_\_  
 \_\_\_\_\_ (RO) \_\_\_\_\_  
 \_\_\_\_\_ (BOP) \_\_\_\_\_

Initial Conditions: EOL. Mode 1, 561 degrees. B EDG is OOS for corrective governor maintenance. FT-476 is OOS for calibration. No other equipment is OOS. No surveillance tests are in progress.

Turnover: There are thunderstorms in the area with winds clocking at 60 mph. Large golf ball size hail has also been reported. Slight tremors on the order of 2.1 on the Richter scale have been detected.

POD: Conduct a power increase from 60% to 100% following MFP repairs. The system dispatcher has asked that this power increase be expedited to deal with an expected high peak demand towards the end of day shift.

Event No	Malf. No.	Event Type*	Event Description
1a		N (R)	Perform 1-PT-60.1, Reactor Containment Average Air Temperature
1		R (R)	Power increase from 60%
2		I (B)	FT-474 failure low (controlling channel)
3		R,I (R)	TM-408F failure low
3a	MEL1304	C (B)	Loss of Vital bus 1-IV
4		C (R)	RCP thermal barrier failure? CCTV-11A (also fail trip valve)
5		M (A)	Large break LOCA
6		C (A)	LOSP
7		C (A)	A RHR pump trip (Loss of emergency coolant recirc)

\* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor  
 (R)O, (B)OP, (A)LL

Facility: North Anna Scenario No.: 1

Op-Test No.: 1

Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Operators: (RO) \_\_\_\_\_  
(BOP) \_\_\_\_\_  
(SRO) \_\_\_\_\_

Initial Conditions: EOL. Condenser steam dumps are in steam pressure control due to a problem with the Tavg input which is under I&C investigation. LT-1(2)-498 & 1(2)A AFW pump are both OOS for corrective maintenance. 1(2)B AFW pump is aligned to train 2 and SD AFW pump is aligned to SG A. No other equipment is OOS

Turnover: Maintain 100% power steady state operation, There are thunderstorms in the area with winds clocking at 60 mph. Large golf ball size hail has also been reported. Slight tremors on the order of 2.1 on the Richter scale have been detected.

POD: Maintain 100% power. PT 17-1 test is due to be performed this shift. Continue corrective maintenance on LT-498 and the A AFW pump.

Event No.	Malf. No.	Event Type*	Event Description
1		N (R)	Conduct rod movement test
2		I (R,B <sup>1</sup> )	PT-1(2)-445 failure high (with failure of turbine to runback in event fail to react timely to PT-445 failure)
3		C (R)	Unisolable PZR PORV leak
4		R (R)	Power reduction due to PZR leak
5		I (B)	PT-1(2)-447 failure low
6		C→M (A)	Main steam line break
6a		M (A)	Reactor trip with main turbine trip & 1(2)B MSIV failures
6b		C (B)	Loss of all auxiliary feed
6c		C (A)	Loss of secondary heat sink with RCS bleed & feed

\* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor  
(R)O (B)OP (A)LL

B<sup>1</sup> Can only take credit if BOP fails to runback the turbine in a timely manner.

Add 'e'  
for item.

**NORTH ANA POWER STATION  
RO/SRO NRC INITIAL LICENSE EXAM  
SIMULATOR EVALUATION SCENARIO NRC-1**

**PROGRAM:** RO/SRO Initial License Training

**DESCRIPTION:** Main Steam Line Break (Inside Containment) / Loss of All Feedwater

**LENGTH:** 90 minutes

**AUTHOR:** R. Aiello (Chief Examiner North Anna)

**REVISION DATE:** 5/19/00

REVIEWED BY: \_\_\_\_\_ Date  
NRC Senior License Examiner

APPROVED BY: \_\_\_\_\_ Date  
NRC Chief Examiner (Surry)

## EVALUATION SCENARIO OBJECTIVES

**TERMINAL OBJECTIVE:** During normal and abnormal plant conditions, the Shift Operating Crew will perform control room operations in accordance with (IAW) approved plant procedures ensuring that the health and safety of the public is protected and the integrity of the plant maintained.

### ENABLING OBJECTIVES:

1. Conduct control rod movement test
2. Given specific plant conditions, plant procedures, and a shift turnover, respond to the following events IAW approved plant procedures:
  - a. PT-1(2)-445 failure high
  - b. Unisolable PZR PORV leak
  - c. Power reduction due to PZR leak
  - d. PT-1(2)-447 failure low
  - e. Main steam line break
  - f. Reactor trip with main turbine trip & 1(2)B MSIV failures
  - g. Loss of all auxiliary feed
  - h. Loss of secondary heat sink with RCS bleed & feed
3. Given abnormal plant conditions, mitigate the adverse consequences of the following events IAW approved plant procedures:
  - a. Identify abnormalities while assessing actual system response with respect to predicted system response.
  - b. Investigate the cause and effect of abnormalities in system performance.
  - c. Implement applicable procedures.
  - d. Perform immediate actions from memory.
4. Given abnormal plant conditions, implement the applicable on-site and off-site reports and notifications IAW approved plant procedures.
5. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to all operators, conduct plant operations IAW approved plant procedures:
  - a. Plant and control room communication.
  - b. Plant/Control Board monitoring.
  - c. Plant/Control Board manipulation.
  - d. Operational problem solving.
  - e. Use of OPs/APs and Technical Specifications.
  - f. Use of EOPs IAW EOP Rules of Usage.
  - g. Annunciator recognition and response.
  - h. Written communications/logs.
  - i. ALARA awareness.

## **EVALUATION SCENARIO OBJECTIVES (cont'd)**

6. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to the Unit Supervisor (US), conduct plant operations IAW approved plant procedures:
  - a. Team performance management.
  - b. Problem solving.
  - c. Decision analysis.
  - d. Action planning.
  - e. Self-checking.
  
7. During abnormal and emergency events, the shift operating crew shall apply techniques of teamwork and self-checking IAW established work practices and operating guidelines.



## EVALUATION SCENARIO DESCRIPTION

**Initial Conditions:** Mode 1, 574 degrees F

**Turnover:** Maintain 100% power steady state operation. Condenser steam dumps are in steam pressure control due to a problem with the Tavg input which is under I&C investigation. LT-1(2)-498 & 1(2)A AFW pump are both OOS for corrective maintenance. 1(2)B AFW pump is aligned to train 2 and 1(2)C AFW pump is aligned to train 1. Control rod movement surveillance tests are in progress.

**Synopsis:** Shortly after completion of the control rod movement test, PT-1(2)-445 fails high causing PZR PORV PCV-1(2)-1456 to automatically open. Operators respond per \_\_\_\_\_ by manually closing the opened PORV. Following stabilization of plant conditions (or completion of 3-ONOP-041.5 at evaluator discretion), that same PORV (PCV-1(2)-1456) develops a leak. Operators respond by attempting to close MOV-1(2)-535 which trips on breaker overload leaving the leak unisolated. The crew re-enters \_\_\_\_\_, evaluates Tech Specs and determines a plant shutdown is needed due to the unisolable PZR steam space leak (rate at Ops management direction). After a 5% power reduction (or as determined by the evaluator), PT-1(2)-447 fails low. The resulting automatic rod insertion requires the operator to take rod control to manual per \_\_\_\_\_. Once Technical Specifications have been consulted and the crew briefed on the effects of the failure, a steam break occurs on the 1(2)C steam generator inside containment. The crew responds per E-0 and addresses a failure of the main turbine to trip and a failure of the 1(2)B AFW pump to start causing a loss of all auxiliary feed water (1(2)A AFW pump OOS, 1(2)B AFW pump failed, 1(2)C AFW pump aligned to the faulted steam generator for steam supply). Additionally, 1(2)B MSIV fails to close manually from the console switch or in response to Main Steam Isolation Signal on high Containment pressure. Transition to FR-H.1 is made in response to low steam generator levels (B MSIV & turbine trip failures combined) with a loss of all AFW. Steam generator levels are sufficiently low to require RCS bleed and feed initiation. The exercise is concluded upon establishment of adequate RCS heat removal by bleed & feed (FR-H.1 step \_\_) or at the evaluator's discretion. The event is classified after scenario completion as a site area emergency per 0-EPIP-\_\_\_\_\_, Enclosure 1, category 5.

**Event Summary:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
1.	Conduct rod movement test <i>K/A: 001A106 (4.1/4.4)</i>
2	PT-1(2)-445 fails high <i>K/A: APE027; AA215 (3.7/4.0)</i>
3	PZR PORV-1(2)-1456 leak / MOV-1(2)-535 overload trip <i>K/A: 010A203 (4.2/4.2)</i>
4	Power reduction due to Pzr Leak <i>K/A: EPE009; EA115 (3.9/4.1)</i>
5	PT-1(2)-447 fails low <i>K/A: 016A201 (3.0/3.1)</i>
6	1(2)C S/G main steam line break/reactor trip/turbine trip with 1(2)B MSIV, train 2 AFW pump and AFSS-1(2)-007 failures <i>K/A: APE040; AA104 (4.3/4.3)</i>
6cont.	Loss of secondary heat sink (bleed & feed required) <i>K/A: E05; EK12 (3.9/4.5); EK22 (3.9/4.2)</i>

**Crew Critical Steps:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
6	1. Manually actuate steam line isolation (buttons or MSIV switches) prior to orange path on subcriticality or integrity or transition to ECA-2.1 (whichever occurs first) (applicable only after main steam line isolation step is read).
6	1. When required, initiate RCS bleed and feed so that the RCS depressurizes sufficiently for HHSI injection flow to occur.

**Individual Critical Steps:**

The bolded individual actions listed under the respective positions (RO, US, etc.) are for use during evaluations to identify steps that are critical to the individual position.

## EVALUATION SCENARIO PRE-EXERCISE BRIEFING

**1. Review the following with students:**

- a. Primary responsibility of the student is to operate the simulator as if it were the actual plant.
- b. The evaluators will observe teamwork skills, communication, and the crew's ability to safely operate the plant during the simulator examination. This includes individual & crew performance.
- c. If you recognize an incorrect decision, response, answer, analysis, action, or interpretation by another crew member but fail to correct it, then the evaluator may assume that you agree with the incorrect item.
- d. The crew should keep a rough log during each scenario sufficient to complete necessary formal log entries.
- e. The simulator instructor facility operator will perform all of the functions of personnel needed outside the control room area.
- f. Before the examination begins, crew members may perform a control board walkdown for up to 10 minutes.

**2. The following are initial conditions for this exam (in shift turnover package, but may be covered verbally if needed):**

- a. Time in core life - EOL
- b. Reactor power and power history – 100% steady state
- c. Turbine status - online
- d. Boron concentration - 51 ppm
- e. Temperature - 574 degrees F
- f. Pressure - 2235 psig
- g. Xenon – Equilibrium for 100% power.
- h. Core cooling - forced
- i. Tech. Spec. LCO(s) in effect  
- 3.7.1.2 Action 3 (30 days); 1(2)A AFW pump bearing failure
- j. Clearances in effect – 1(2)A AFW pump
- k. Significant problems/abnormalities – Condenser steam dumps in steam pressure (manual) control due to Tavg input problem. I&C investigating. 1(2)C AFW pump aligned to train 1. LT-1(2)-498 OOS; LT-1(2)-496 selected for 1/2C S/G level control.
- l. Evolutions/maintenance for the coming shift – Maintain 100% power steady state operation.
- m. Units 1(2) - mode 5 on RHR

**3. Ensure students understand examination schedule and that a break will be necessary between scenarios to allow simulator initial condition setup. Cover exam security rules to be observed by students both during and after the exam IAW the latest revision of AG-017 or NUREG-1021 as applicable.**

**4. Before the examination begins, make crew position assignments and allow students to ask any questions concerning the administration of the test.**

## EXPECTED OPERATOR ACTIONS

**EVENT:** 1

**BRIEF DESCRIPTION:** Conduct rod movement test. (DETAILS)

## EXPECTED OPERATOR ACTIONS

EVENT: 2

**BRIEF DESCRIPTION:** Pressure transmitter PT-1(2)-445 fails high opening PORV PCV-1(2)-1456 and decreasing pressure. The problem is diagnosed and the PORV / block valve closed stopping the pressure decrease. The plant is stabilized and PT-1(2)-445 is declared OOS.

**INDICATIONS:**

1. PT-1(2)-445 failed high
2. Pressurizer pressure decreases rapidly.
3. Overtemperature Delta T runback occurs **(FAIL THE RUNBACK)**.
4. All pressurizer heaters energize.
2. When pressure returns above 2000 psig, PCV-1456 opens..
3. Pressure oscillates with PCV-1456 cycling around 2000 psig as appropriate.
4. The PRESSURIZER HIGH PRESSURE alarm is actuated.

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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BOP	1.	Assists RO as directed by US
	2.	Recognize failure of Turbine to runback
	3.	<b>manually run back the turbine</b>

RO	1.	Recognizes & reports PZR press control problem
	2.	Verifies PZR press control loop not failed – NO
	a.	Checks PT-1(2)-444 not failed.
	b.	Recognizes PT-1(2)-445 failed high.
	c.	<b>Closes PZR PORV PCV-1(2)-1456 and/or block valve MOV-1(2)-535</b>
	3.	Verifies PZR PORVs closed
	4.	Verifies PZR spray valves closed
	5.	Verifies PZR safety valves closed
	6.	Checks PZR pressure stable/increasing
7.	Checks PZR pressure above normal – NO	
8.	Checks PZR pressure low/decreasing	
9.	Maintains PZR pressure greater than 2000 psig	

## EXPECTED OPERATOR ACTIONS (cont'd)

**EVENT:** 2 (cont'd)

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
<b>RO</b> (cont'd)	10.	Verifies PZR heaters operable
	11.	Checks if PZR PORV is leaking – NO
	12.	Checks if leaking PZR safety is reducing pressure – NO
	13.	Determines if RCS leak is reducing pressure – NO
	14.	Checks if PZR pressure decreasing – NO
	15.	Checks RCS pressure stable
	16.	Checks if auto pressure control can be established
	17.	Establishes auto pressure control
<b>US</b>	18.	Keeps US informed of plant status
	1.	Coordinates/directs performance of AP-_____
	2.	Reviews Technical Specifications
	3.	Ensures I&C notified
	4.	Keeps SS informed of plant status

EVENT: 3

**BRIEF DESCRIPTION:** A pressurizer PORV begins to leak reducing RCS pressure. AP-44 is entered, but the associated block MOV trips on overload before the leak is isolated. Tech Specs are referenced and the decision made to shut down.

- INDICATIONS:**
1. Annunciator \_\_\_\_\_, PZR CONTROL HI/LO PRESS
  2. Annunciator \_\_\_\_\_, "PRZR SAFETY VALVE OR PORV OPEN"
  3. Annunciator \_\_\_\_\_, PZR PORV HI TEMP
  4. RCS/PZR pressure decreasing
  5. PZR PORV acoustic monitor flow indicators lit

**POSITION      TIME      EXPECTED ACTIONS**

- BOP**
1. Verifies PZR PORV leak using acoustic monitors
  2. Informs US of plant status

- RO**
1. RO identifies annunciator \_\_\_\_\_, "PRZR SAFETY VALVE OR PORV OPEN".
  2. **Recognizes PZR PORV leaking and notifies US.**
  3. **Performs 1-AP-44 actions at US direction:**
    - a. Checks PT-1(2)-444/445 not failed (445 failed but previously addressed)
    - b. Checks PZR PORVs/safeties/spray vlvs closed
    - c. Identifies leaking PZR PORV, attempts to manually close block valve and reports loss of block valve position indication to US
    - d. Determines PZR press < normal / decreasing
    - e. **Maintains PZR press > 2000 psig with PZR heaters ON – finds PZR press low but stable**
    - f. Determines PORV is leaking and not isolated
    - g. Determines PZR safeties are not leaking
  4. Informs US of plant status

- US**
1. Directs PZR safety leak response per AP-\_\_\_\_\_
    - a. **Directs MOV-1(2)-535 closure & response to ensuing overload trip including direction to locally reclose MOV-1(2)-535 breaker (will not reclose)**
    - b. **Ensures all PZR htrs on to keep pressure > 2000 psig**

## EXPECTED OPERATOR ACTIONS (cont'd)

EVENT: 3 (cont'd)

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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US  
(con't)

- |  |    |  |
|--|----|--|
|  | c. | Directs STA to perform RCS leak rate   |
|  | d. | Concludes PZR pressure low/stable and > 2000 psig due to unisolable leaking PZR PORV |

2. Reviews T.S. 3.4.4 & 3.2.5 and determines action for leaking PORV can not be met requiring s/d to HSD (also DNB T.S. requires press >2200 psig in 2 hrs or power < 5% in following 4 hours).
3. Informs SS of plant status & requests electrical maintenance support with block MOV bkr



## EXPECTED OPERATOR ACTIONS

EVENT: 4

**BRIEF DESCRIPTION:** With reactor power initially at 100% power, a power reduction to Hot Standby is commenced in response to an unisolable PZR PORV leak.

**INDICATIONS:** 1. SS/Ops Management direction

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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**BOP**

- |  |    |  |
|--|----|--|
|  | 1. | Reduces turbine load IAW AP- _____ or GOP- _____ <ul style="list-style-type: none"><li>a. Maintains Tref within 3°F of Tavg if rods in manual (1°F if rods in auto)</li><li>b. Monitors gland seal steam pressure &amp; directs local operation of supply/spillover as req'd</li></ul> |
|  | 2. | Performs secondary plant s/d generator-load-dependent activities IAW AP- _____ or GOP- _____   |
|  | 3. | Performs activities as directed by US <ul style="list-style-type: none"><li>a. Inhibits MIMS if in service</li><li>b. Notifies Chemistry of need to sample RCS if reactor power reduced &gt; 15%</li></ul>   |
|  | 4. | Keeps US informed of plant status  |

**RO**

- |  |    |   |
|--|----|---|
|  | 1. | Reduces Rx power IAW AP- _____ or GOP- _____ <ul style="list-style-type: none"><li>a. Calculates r change req'd to reduce power and borates at rate directed by US</li><li>b. Energizes PZR backup heaters</li><li>c. Coordinates w/BOP to keep Tref w/i 3°F of Tavg w/rods in manual (1°F w/rods in auto)</li><li>d. Observes AFD limitations</li><li>e. Starts additional charging pump</li></ul> |
|  | 2. | Keeps US informed of plant status   |

### EXPECTED OPERATOR ACTIONS (cont'd)

**EVENT:** 4 (cont'd)

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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**US**

- |  |    |   |
|--|----|---|
|  | 1. | Coordinates power reduction activities of RO & BOP                  |
|  | 2. | Performs other activities IAW AP- _____ or GOP- _____               |
|  | a. | Evaluates Xe changes and directs boration rate changes as necessary |
|  | 3. | Notifies System Dispatcher of load reduction                        |
|  | 4. | Keeps SS informed of plant status                                   |

## EXPECTED OPERATOR ACTIONS

**EVENT:** 5

**BRIEF DESCRIPTION:** First stage pressure transmitter PT-1(2)-447 fails low. The crew recognizes the failure, selects PT-1(2)-446 for control, and regains control of S/G level. The channel is declared OOS and compensatory actions taken per 3-ONOP-049.1.

**INDICATIONS:**

1. Failure low of PI-1(2)-447 (VPA)
2. Control rods insert (if in auto rod control)
3. S/G levels decrease
4. Annunciators \_\_\_\_\_, SG A(B)(C) STEAMLINE HI FLOW
5. Annunciator \_\_\_\_\_, STEAM DUMP ARMED/ACTUATED
6. Annunciator \_\_\_\_\_, TAVG/TAVG-TREF DEVIATION

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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<b>BOP</b>	<ol style="list-style-type: none"> <li>1. Recognizes failure of PT-1(2)-447 and responds as directed by US                             <ol style="list-style-type: none"> <li>a. Compares to other turb 1st stage impulse PT's</li> <li>b. Verifies no off-normal conditions on related indications</li> </ol> </li> <li>2. Notifies US of failure</li> <li>3. Takes manual control of S/G level if necessary</li> </ol>
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<b>RO</b>	<ol style="list-style-type: none"> <li>1. <b>Selects manual rod control (if in auto) in response to inward rod movement (may refer to AP-_____)</b></li> <li>2. Selects PT-1(2)-446 as controlling channel</li> <li>3. Informs US of plant status</li> </ol>
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<b>US</b>	<ol style="list-style-type: none"> <li>1. Directs stabilization of plant conditions. May suspend load reduction to perform actions of AP-_____ or may continue load reduction and trip bistables later.</li> <li>2. Directs compensatory action per AP-_____                             <ol style="list-style-type: none"> <li>a. Verifies related instrument status</li> <li>b. Determines which bistables to trip and effects on plant of tripping bistables. Provides this info to RO/BOP for guidance.</li> <li>c. Directs bypass of inputs to AMSAC</li> </ol> </li> <li>3. Notifies SS of plant status</li> <li>4. Ensures Tech. Spec. 3.3.1/2 requirements met</li> <li>5. Ensures I&amp;C notification of PT-1(2)-447 failure and directs initiation of PWO.</li> </ol>
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## EXPECTED OPERATOR ACTIONS

EVENT: 6

**BRIEF DESCRIPTION:** In response to a 1/2C S/G steam break inside Containment, reactor trip and SI occur. Operators perform actions of E-0. The auto & manual turbine trip fails. When MSIVs are closed/verified closed, 1(2)BMSIV fails open. No AFW flow exists (no pumps available: 1(2)A OOS, 1(2)B start fail, C aligned to faulted S/G). Transition to FR-H.1 is made.

**INDICATIONS:**

1. Reactor trip & SI directed or actuates
2. Turbine stop valves & 1(2)B MSIV remain open
3. GCBs do not open
4. 1(2)B & 1(2)C S/G Pressures dropping
5. Containment temperature & pressure rising
6. No AFW flow & AFW pump speeds at/near zero

**CREW CRITICAL STEPS:**

1. Manually actuate steam line isolation (buttons or MSIV switches) prior to orange path on subcriticality or integrity or transition to ECA-2.1 (whichever occurs first) (applicable only after main steam line isolation step is read).

**POSITION      TIME EXPECTED ACTIONS**

**BOP**

1. Performs IOAs in response to reactor trip with turbine trip failure per E-0:
  - a. Verifies all turb. stop valves closed – NO
    - 1) Manually trips turb/verifies trip – NO
    - 2) **Closes MSIVs/byp vlvs – 1(2)B fails open**
  - b. Verifies MSR purge steam & steam stop MOVs closed with timing cam @ zero
  - c. Verifies open Mid/East GCBs – NO
    - 1) **Manually opens Mid/East GCBs (may also open exciter field breaker)**
2. Performs other E-0 immediate actions:
  - a. Verifies power to A/B/D 4kV buses and A/B/C/D/H 480V load centers.

## EXPECTED OPERATOR ACTIONS (cont'd)

**EVENT:** 6 (cont'd)

**POSITION**      **TIME**      **EXPECTED ACTIONS**

**BOP**  
(cont'd)

3. Performs E-0 prompt actions at US direction:
  - a. Verifies feedwater isolation
  - b. Verifies AFW pumps running – NO
    - 1) Manually open valves to start 2 AFW pumps
    - 2) **Determines NO AFW pumps available (1(2)A OOS, 1(2)B start fail & 1(2)C steam supply from faulted S/G). Dispatches local operators to check 1(2)BAFW pump.**
  - c. Verifies proper ICW operation
  - d. Checks if main steamlines should be isolated (already isolated in IOAs)-1(2)BMSIV still open
  - e. Verifies all EDGs running
4. Performs subsequent actions of E-0 as directed by US
  - a. Directs SNPO to place PAHMS in service
  - b. Verifies proper AFW alignment and flow – NO
    - 1) Checks S/G NR level >6%[32%] – NO
    - 2) Verifies AFW flow > 390 gpm – NO
    - 3) Manually starts pumps / directs ANPO/NPO valve realignment as directed by US to get AFW > 390 gpm – NO
5. Keeps US informed of plant status

**RO**

1. Performs IOAs in response to rx trip per E-0
  - a. Verifies reactor tripped
  - b. Checks if SI actuated/required – YES
    - 1) If not auto actuated, manually actuates SI & phase A as req'd by SI setpoint, PZR level or RCS subcooling
  - c. Recognizes loss of subcooling and trips RCPs (if applicable)

**EXPECTED OPERATOR ACTIONS (cont'd)**

EVENT:6 (cont'd)

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
RO cont	2.	Performs prompt actions of E-0
	a.	Verifies containment isolation phase A
	b.	Verifies SI pumps running
	c.	Verifies proper CCW system operation
	d.	Verifies containment cooling and containment/control room vent isolation
	e.	Verifies containment spray & phase 1(2) B isolation actuated if hi-hi CNMT pressure
	f.	<b>Trips all RCPs as required by phase B</b>
	g.	Verifies SI valve amber lights bright
	3	Recognizes loss of subcooling and trips RCPs per E-0 (if applicable)
	4.	Performs subsequent actions of E-0 as directed by US
	a.	Resets & realigns SI then verifies SI flow
	5.	Notifies US of safety injection and cause
US	6.	Keeps US informed of plant status
	1.	Directs response to reactor trip and failure of auto/manual turbine trip per E-0
	a.	Verification of reactor trip
	b.	Response to auto/manual turb. trip failure
	1)	ensures closure of 1(2)A & 1(2)C MSIVs
	2)	<b>notes 1(2) BMSIV failure to close and directs NLO investigation into problem</b>
	3)	ensures mid/east GCBs opened (may direct exciter field breaker opening)
	c.	Determination of electric plant status
	d.	Manual SI/phase A

## EXPECTED OPERATOR ACTIONS (cont'd)

EVENT: 6 (cont'd)

POSITION      TIME      EXPECTED ACTIONS

US cont

- e. Monitors foldout page including direction to RO to stop all RCPs if subcooling lost
- 2. Directs trip of RCPs if phase1(2)B actuates**
- 3. Verifies at least 2 AFW pumps running – NO
- a. Directs local check of trn 2 (B) AFWP
- b. Directs local opening of 10-007 to align trn 2 strn to trn 1 (C) AFWP
- 4. Response to loss of AFW flow & determination that no AFW pumps available.
  - a. Evaluates field operator reports to determine no AFW pumps available
  - b. **Directs transition to 3-FR-H.1**
- 5. Informs SS of plant status

## EXPECTED OPERATOR ACTIONS

**EVENT:** 6 cont

**BRIEF DESCRIPTION:** Feedwater flow (both main & AFW) has been completely lost following a 1(2)C S/G main steam break in Containment. Plant conditions require entry into -FR-H.1. RCPs are stopped and feed and bleed is initiated (1(2)C S/G faulted/dry & 1(2)BS/G inventory lost thru failed MSIV to turbine which failed to trip).

**INDICATIONS:**

1. All steam generators less than 6[32]% level
2. Less than 390 gpm AFW flow
3. Wide range S/G levels decreasing (<22% on 1(2)B& 1(2)C S/Gs)

**CREW CRITICAL STEPS:**

1. **When required, initiate RCS bleed and feed so that the RCS depressurizes sufficiently for HHSI injection flow to occur.**

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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<b>BOP</b>		<ol style="list-style-type: none"><li>1. Performs actions of FR-H.1 for RCS bleed &amp; feed when secondary heat sink lost as directed by US<ol style="list-style-type: none"><li>a. Resets CIS <math>\Phi A</math></li><li>b. Verifies E-0 immediate and prompt actions</li><li>c. Directs PAHMS placed in service per OP-094</li><li>d. Checks charging pumps aligned to offsite power</li><li>e. Attempts to restore secondary heat sink</li><li>f. Aligns equipment for hot standby conditions</li><li>g. Checks if EDGs should be stopped</li><li>h. Checks for adequate secondary heat sink</li></ol></li></ol>
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## EXPECTED OPERATOR ACTIONS (cont'd)

EVENT: 6 (cont'd)

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
RO	1.	Performs actions of FR-H.1 to restore feed flow as directed by US <ul style="list-style-type: none"> <li>a. Checks if secondary heat sink is required</li> <li>b. Stops all RCPs (should be stopped already)</li> </ul>
	2.	Performs actions of FR-H.1 for RCS feed & bleed when secondary heat sink lost as directed by US <ul style="list-style-type: none"> <li>a. <b>Actuates manual SI and CIS <math>\Phi</math>A</b></li> <li>b. Verifies RCPs all stopped</li> <li>c. Verifies RCS feed path</li> <li>d. <b>Establishes RCS bleed path - PORVs/block valves open (leaking PORV will open &amp; failed block MOV never closed, so both PORV flow paths available)</b></li> <li>e. Verifies instrument air to containment</li> <li>f. Verifies adequate RCS bleed path</li> </ul>
US	1.	<b>Directs performance of FR-H.1 including RCS bleed and feed</b>
	2.	Informs SS of status of plant
	3.	<b>Classifies the event as a SITE AREA EMERGENCY per EPIP-_____</b>

## SIMULATOR INSTRUCTOR FACILITY OPERATING INSTRUCTIONS

### I. SETUP

- A. Reset to IC \_\_\_\_\_ (includes steps C & D below).
- B. Load \_\_\_\_\_.
- C. Following switch check, unfreeze the simulator.
- D. Perform the following
  - 1. Realign 1(2)C AFW pump to train 1 & isolate 1(2)A AFW pump.
  - 2. Place the condenser steam dump control selector switch to MANUAL.
  - 3. Take LT-1(2)-498 out of service as follows:
    - a. Select LT-1(2)-496 for 1(2)C S/G level control.
    - b. Fail LT-1(2)-498.
  - 4. Enter the following failures:
    - a. Turbine trip failure.
    - b. B AFW pump loss of governor oil.
    - c. B MSIV failure to close.
  - 5. Freeze simulator.
- E. Delete all conditional events from Parameter Controller Event Summary **except** those indicated on the Parameter Controller Event Summary pages in this exercise guide. Direct events may be deleted at instructor discretion.
- F. Place turnover sheet on RO desk.
- G. Clearance information tags - 1(2)A AFWP.
- H. Information tags - Steam Dump Control Mode Selector Switch to MANUAL..
- I. Select 1(2)A QSPDS and ERDADS.

### II. CONDUCTING THE EXAMINATION:

Unfreeze the simulator and begin the exam.

- A. **Conduct rod movement test (Event 1)**
- B. **PT-1(2)-445 Fails High (event 2).**

1. **Initiation:** Shortly after turnover, enter the MOV-1(2)-535 overload trip conditional.....

2. **Response:** Respond as SS/NWE/I&C. As SS/NWE, state that a work request will be generated and I&C will be notified. As I&C, reply that a planner will initiate a work package for troubleshooting & repair. In the event that an attempt is made to close MOV-1(2)-535, it will trip on overload now rather than in event 2. See event 2 for the response to MOV-1(2)-535 failure.

C. **PZR PORV-1(2)-1456 Leak / MOV-1(2)-535 Overload Trip (event 2).**

1. **Initiation:** After completion of AP-\_\_\_\_, actuate the PZR PORV-1(2)-1456 leak. The leak is sized at 25-30 gpm to slowly reduce pressure to < 2200 psig.

2. **Response:** With the leaking PORV identified, the RO should attempt (if not done in event 1) to close the associated block MOV which will trip on overload as it starts to close. When asked as NPO/NWE to check out the MOV-1(2)-535 breaker on 1(2)B MCC, wait 1-3 minutes and report a burnt insulation smell in the area around the breaker. If directed to attempt to close the breaker, delay action until after pressure < 2200 psig and reduce PORV-1(2)-1456 leakage to 15 gpm by setting \_\_\_\_\_ sec ramp. (This leak rate will keep the acoustic monitor LEDs lit while allowing all PZR heaters to keep up with the effects of the leak without returning pressure to normal.) Then tell the crew that the switch won't stay in the ON position and the burnt insulation smell just got stronger. Respond as electrical maintenance when directed to investigate the breaker and respond after 5-7 minutes that the breaker internals appear burnt. Also state that the 1(2)B MCC will have to be deenergized and a Containment entry performed to allow a complete damage evaluation and subsequent repair of the MOV and its breaker.

Acknowledge load dispatcher/plant management notifications of the required load reduction.

D. **Power Reduction (event 4).**

1. **Initiation:** In response to event 2, the Operations Manager directs that an AP-\_\_\_\_ shutdown be performed due to the inability to restore normal PZR pressure from the PORV leak.

2. **Response:** PZR PORV leak response and initiation of load reduction is covered in event 2. Acknowledge notification as Chemistry of the need to sample the RCS in response to a 15% power change. Respond as field operator in response to notification of stopping secondary pumps and if requested to manually control gland seal steam pressure.

E. **PT-1(2)-447 Fails Low (event 5).**

1. **Initiation:** After a 5% power reduction (or at lead examiner direction) ensure that rod control is in AUTO, then actuate PT-1(2)-447 failure.

2. **Response:** Respond as SS, NWE or I&C to notification of PT-1(2)-447 failure. As SS/NWE state that a PWO will be generated and I&C will be notified. As I&C, reply that a planner will initiate a work package for troubleshooting & repair. Respond as NPO/NWE when directed to bypass AMSAC power 2 inputs by acknowledging the order, waiting 3-5 minutes, then bypassing the requested inputs (\_\_\_\_\_\_). Report completion to the crew.

**F. 1(2)C S/G Main Steam Line Break / Reactor Trip / Turbine Trip with 1(2)B MSIV, Train 2 AFW Pump & AFSS-1(2)-007 Failures (event 6).**

1. **Initiation:** Following the PT-1(2)-447 failure crew brief, actuate the 1(2)C S/G steam break in Containment. Turbine trip, 1(2)B MSIV & 1(2)BAFW pump failures and A AFW pump OOS are entered during setup.

2. **Response:** When dispatched as field operator to check the 1(2)BAFW pump, wait 3 minutes and tell crew that there is an oil leak on the governor and with oil spilled on the West end of the pump/pedestal. When asked to align train 2 steam to the 1(2)C AFW pump, wait 2-4 minutes and state that the stem snapped on valve AFSS-1(2)-007 and that the valve is stuck shut.

**G. 1(2)C S/G Main Steam Line Break / Reactor Trip / Turbine Trip & 1(2)BMSIV Failures (event 6 cont).**

2. **Response (cont'd):** If asked as maintenance about the status of the 1(2)A AFW pump, state that pump end is disassembled with the impeller removed and bearings being replaced - ETR 3 days. Respond as maintenance if asked to investigate the 1(2)BAFW pump governor oil leak and the AFSS-1(2)-007 valve stem failure. Neither of these problems will be fixed during the scenario.

Respond as SNPO to place PAHMs in service per OP-094 (parameter controller trigger composite "PAHM"). After approximately 15 minutes inform the crew that PAHM is aligned. Respond as NPO to place unloaded EDGs in standby per OP-023.

**H. Loss of Secondary Heat Sink (bleed & feed required) (event 6 cont).**

1. **Initiation:** A result of event 5 and the scenario setup, this event entered by procedural transition from E-0 to FR-H.1 (adverse containment with loss of all AFW). The 1(2)BMSIV & turbine trip failures combine to reduce wide range level to < 22% in this (as well as the faulted 1(2)C S/G) requiring performance of feed & bleed per FR-H.1 step 2 CAUTION.

2. **Response:** Consistent with event 5.

**III. TERMINATION CRITERIA:**

A. Upon establishment of RCS bleed & feed (step 24 of FR-H.1),

OR

B. At the discretion of the evaluator.

**EVALUATION SCENARIO REFERENCES**

**Reference List:**

PROCEDURE # PROCEDURE TITLE

**EVALUATION SCENARIO CONTENT SUMMARY**

1.	Total Number of Malfunctions:	7
2.	Malfunctions Occurring During EOP Performance:	2
1.	Turbine trip failure	
2.	1(2)B MSIV failure	
3.	Abnormal Events:	3
1.	PT-1(2)-445 fails high	
2.	PORV-1(2)-1456 leak & MOV-1(2)-535 failure to close	
3.	PT-1(2)-447 fails low	
4.	Major Transients:	2
1.	1(2)C S/G Steam Break in Containment	
2.	Loss of secondary heat sink (B AFW start failure)	
5.	EOPs Used:	1
6.	EOP Contingencies Entered:	1
7.	Simulator Run Time:	90 minutes
8.	EOP Run Time:	45 minutes
9.	Crew Critical Tasks:	2

## Appendix D

## Scenario Outline

Form ES-D-1

Facility: North Anna Scenario No.: 1 Op-Test No.: 1

Examiners: \_\_\_\_\_ Operators: (RO) \_\_\_\_\_  
 \_\_\_\_\_ (BOP) \_\_\_\_\_  
 \_\_\_\_\_ (SRO) \_\_\_\_\_

Initial Conditions: EOL. Condenser steam dumps are in steam pressure control due to a problem with the Tavg input, which is under I&C investigation. A AFW pump is OOS for corrective maintenance. No other equipment is OOS.

Turnover: There are thunderstorms in the area with winds clocking at 60 mph. Large golf ball size hail has also been reported. Slight tremors on the order of 2.1 on the Richter scale have been detected.

PCD: Maintain 100% power. Complete 1-PT-17.1 rod operability test, which was commenced by the offgoing shift. Continue corrective maintenance on the A AFW pump.

Event No.	Mal. No.	Event Type*	Event Description
1		N (R)	Conduct rod movement test <i>IC 'D' BANK ONLY</i>
2		I (R)	PT-1445 failure high (with failure of turbine to runback in event fail to react timely to PT-445 failure) <i>1 minute to prevent trip.</i>
3		C (R)	Unisolable PZR PORV leak
4		R (R)	Power reduction due to PZR leak
5		I (B)	A S/G level channel III (LT-1476) failure low
6		C (B)	Steam-driven AFW pump failure
7		C→M (A)	Main steam line break
7a		M (A)	Reactor trip with MS isolation failure
7b		C (B)	Loss of all auxiliary feed
7c		C (A)	Loss of secondary heat sink with RCS bleed & feed

\* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor  
 (R)O (B)OP (A)LL

**NORTH ANA POWER STATION  
RO/SRO NRC INITIAL LICENSE EXAM  
SIMULATOR EVALUATION SCENARIO NRC-1**

**PROGRAM:** RO/SRO Initial License Training  
**DESCRIPTION:** Main Steam Line Break / Loss of All Feedwater  
**LENGTH:** 90 minutes  
**AUTHOR:** R. Aiello (Chief Examiner North Anna)  
**REVISION DATE:** 5/19/00

**REVIEWED BY:** \_\_\_\_\_  
NRC Senior License Examiner Date

**APPROVED BY:** \_\_\_\_\_  
NRC Chief Examiner (Surry) Date

## EVALUATION SCENARIO OBJECTIVES

**TERMINAL OBJECTIVE:** During normal and abnormal plant conditions, the Shift Operating Crew will perform control room operations in accordance with (IAW) approved plant procedures ensuring that the health and safety of the public is protected and the integrity of the plant maintained.

### ENABLING OBJECTIVES:

1. Conduct control rod movement test
2. Given specific plant conditions, plant procedures, and a shift turnover, respond to the following events IAW approved plant procedures:
  - a. PT-1445 failure high
  - b. Unisolable PZR PORV leak
  - c. Power reduction due to PZR leak
  - d. LT-1476 failure low
  - e. Steam-driven AFW pump failure
  - f. Main steam line break on MS manifold
  - g. Reactor trip with MS isolation failure
  - h. Loss of all auxiliary feed
  - i. Loss of secondary heat sink with RCS bleed & feed
3. Given abnormal plant conditions, mitigate the adverse consequences of the following events IAW approved plant procedures:
  - a. Identify abnormalities while assessing actual system response with respect to predicted system response.
  - b. Investigate the cause and effect of abnormalities in system performance.
  - c. Implement applicable procedures.
  - d. Perform immediate actions from memory.
4. Given abnormal plant conditions, implement the applicable on-site and off-site reports and notifications IAW approved plant procedures.
5. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to all operators, conduct plant operations IAW approved plant procedures:
  - a. Plant and control room communication.
  - b. Plant/Control Board monitoring.
  - c. Plant/Control Board manipulation.
  - d. Operational problem solving.
  - e. Use of OPs/APs and Technical Specifications.
  - f. Use of EOPs IAW EOP Rules of Usage.
  - g. Annunciator recognition and response.
  - h. Written communications/logs.
  - i. ALARA awareness.



**EVALUATION SCENARIO OBJECTIVES (cont'd)**

6. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to the Unit Supervisor (US), conduct plant operations IAW approved plant procedures:
  - a. Team performance management.
  - b. Problem solving.
  - c. Decision analysis.
  - d. Action planning.
  - e. Self-checking.
  
7. During abnormal and emergency events, the shift operating crew shall apply techniques of teamwork and self-checking IAW established work practices and operating guidelines.

## EVALUATION SCENARIO DESCRIPTION

**Initial Conditions:** Mode 1, 581 degrees F

**Turnover:** Maintain 100% power steady state operation. Condenser steam dumps are in steam pressure control due to a problem with the Tavg input, which is under I&C investigation. A AFW pump is OOS for corrective maintenance.. Control rod movement surveillance testis in progress.

**Synopsis:** Shortly after completion of the control rod movement test, PT-1445 fails high causing PZR PORV PCV-1456 to automatically open. Operators respond per 1-AP-44 by manually closing the opened PORV. Following stabilization of plant conditions (or completion of 1-AP-44 at evaluator discretion), that same PORV (PCV-1456) develops a leak. Operators respond by attempting to close MOV-1535 which trips on breaker overload leaving the leak unisolated. The crew evaluates Tech Specs and determines a plant shutdown is needed due to the unisolable PZR steam space leak (rate at Ops management direction). After a 5% power reduction (or as determined by the evaluator), the A S/G level channel III (LT-1476) fails low. The resulting transient requires the BOP to take A S/G level control to manual per 1-AP-3. Once Technical Specifications have been consulted and the crew briefed on the effects of the failure, the steam-driven AFW pump spuriously auto-starts. When the crew identifies the failure and stops the AFW pump, the overspeed trip mechanism fails, rendering the pump inoperable. Once Technical Specifications have been consulted and the crew briefed on the effects of the failure, a steam break occurs on the main steam manifold in the turbine building. The crew responds per E-0 and addresses a failure of main steamline isolation and a failure of the B AFW pump to start causing a loss of all auxiliary feed water (A AFW pump OOS, B AFW pump failed, steam-driven AFW pump previously failed). Transition to FR-H.1 is made in response to low steam generator levels with a loss of all AFW. Steam generator levels are sufficiently low to require RCS bleed and feed initiation. The exercise is concluded upon establishment of adequate RCS heat removal by bleed & feed (FR-H.1 step     ) or at the evaluator's discretion. The event is classified after scenario completion as a notification of unusual event per EPIP-1.01, tabs A-10 and G-3 (note that SRO may elect to classify the event as an Alert per tab M-3 based on SEM judgment.)

**Event Summary:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
3.	Conduct rod movement test <i>K/A: 001A106 (4.1/4.4)</i>
2	PT-1445 fails high <i>K/A: APE027; AA215 (3.7/4.0)</i>
3	PZR PORV-1456 leak / MOV-1535 overload trip <i>K/A: 010A203 (4.2/4.2)</i>
4	Power reduction due to Pzr Leak <i>K/A: EPE009; EA115 (3.9/4.1)</i>
5	LT-1476 fails low <i>K/A: 016A201 (3.0/3.1)</i>
6	Steam-driven AFW spurious auto-start/failure <i>K/A 061A2.04</i>
7	Main steam line break/reactor trip with B AFW pump and MS isolation failures <i>K/A: APE040; AA104 (4.3/4.3)</i>
7cont.	Loss of secondary heat sink (bleed & feed required) <i>K/A: E05; EK12 (3.9/4.5); EK22 (3.9/4.2)</i>

**Crew Critical Steps:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
7	1. Manually actuate steam line isolation (MSTV pushbuttons) prior to orange path on subcriticality or integrity or transition to ECA-2.1 (whichever occurs first) (applicable only after main steam line isolation step is read).
7	1. When required, initiate RCS bleed and feed so that the RCS depressurizes sufficiently for HHSI injection flow to occur.

**Individual Critical Steps:**

The bolded individual actions listed under the respective positions (RO, US, etc.) are for use during evaluations to identify steps that are critical to the individual position.

### EVALUATION SCENARIO PRE-EXERCISE BRIEFING

1. **Review the following with students:**
  - a. Primary responsibility of the student is to operate the simulator as if it were the actual plant.
  - b. The evaluators will observe teamwork skills, communication, and the crew's ability to safely operate the plant during the simulator examination. This includes individual & crew performance.
  - c. If you recognize an incorrect decision, response, answer, analysis, action, or interpretation by another crew member but fail to correct it, then the evaluator may assume that you agree with the incorrect item.
  - d. The crew should keep a rough log during each scenario sufficient to complete necessary formal log entries.
  - e. The simulator instructor facility operator will perform all of the functions of personnel needed outside the control room area.
  - f. Before the examination begins, crew members may perform a control board walkdown for up to 10 minutes.
2. **The following are initial conditions for this exam (in shift turnover package, but may be covered verbally if needed):**
  - a. Time in core life – 14,000 MWD/MTU
  - b. Reactor power and power history – 100% steady state
  - c. Turbine status - online
  - d. Boron concentration - 51 ppm
  - e. Temperature - 581 degrees F
  - f. Pressure - 2235 psig
  - g. Xenon – Equilibrium for 100% power.
  - h. Core cooling - forced
  - i. Tech. Spec. LCO(s) in effect  
- 3.7.1.2 Action 3 (30 days); A AFW pump bearing failure
  - j. Tagouts in effect – A AFW pump
  - k. Significant problems/abnormalities – Condenser steam dumps in steam pressure (manual) control due to Tavc input problem. I&C Investigating.
  - l. Evolutions/maintenance for the coming shift – Complete rod operability surveillance and maintain 100% power steady state operation.
  - m. Unit 2 - mode 5 on RHR
3. **Ensure students understand examination schedule and that a break will be necessary between scenarios to allow simulator initial condition setup. Cover exam security rules to be observed by students both during and after the exam IAW the latest revision of AG-017 or NUREG-1021 as applicable.**
4. **Before the examination begins, make crew position assignments and allow students to ask any questions concerning the administration of the test.**

**EXPECTED OPERATOR ACTIONS****EVENT:** 1**BRIEF DESCRIPTION:** Conduct rod movement test.**INDICATIONS:** 1. Shift orders direct completion of 1-PT-17.1, Rod Operability.**POSITION   TIME   EXPECTED ACTIONS****BOF** 1. Assists RO as directed by US

**RO**

1. Verifies shutdown bank A step counter readings.
2. Selects SBA on bank selector switch.
3. Records initial position for shutdown bank A in PT data sheet.
4. Inserts shutdown bank A 18 steps and observes plant response.
5. Records final position for shutdown bank A in PT data sheet.
6. Withdraws shutdown bank A 18 steps and observes plant response.
7. Calculates rod travel and record in PT data sheet.
8. Places bank selector switch in MANUAL.
9. Verifies "D" bank position.
10. Ensures  $T_{avg}$  and  $T_{ref}$  are within 1°F.
11. Requests watchstander to observe bank overlap counter reading.
12. Records bank overlap counter reading and "D" bank position in PT.
13. Calculates difference between bank overlap counter and "D" bank position and records in PT.
14. Places bank selector switch in AUTO.
15. Performs follow-on tasks and informs US that PT is complete.

**US**

1. Coordinates/directs performance of PT-17.1
2. Keeps SS informed of plant status

**EXPECTED OPERATOR ACTIONS****EVENT:** 2

**BRIEF DESCRIPTION:** Pressure transmitter PT-1445 fails high opening PORV PCV-1456 and decreasing pressure. The problem is diagnosed and the PORV closed stopping the pressure decrease. The plant is stabilized and PT-1445 is declared OOS.

**INDICATIONS:**

1. PT-1445 failed high
2. Pressurizer pressure decreases rapidly.
3. Overtemperature Delta-T runback occurs in event of failure to react timely to PT-1445 failure (FAIL THE RUNBACK).
4. All pressurizer heaters energize.
5. When pressure returns above 2000 psig, PCV-1456 opens..
6. Pressure oscillates with PCV-1456 cycling around 2000 psig as appropriate.
7. PRESSURIZER HIGH PRESSURE and PRZR SAFETY VALVE OR PORV OPEN alarms are actuated.

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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**BOP**

1. Assists RO as directed by US
2. Recognize failure of turbine to runback
3. Manually run back the turbine (If auto runback called for)

**RO**

1. Recognizes & reports PZR press control problem
2. Verifies PZR press control loop not failed – NO
  - a. Checks PT-1444 not failed.
  - b. Recognizes PT-1445 failed high.
  - c. Closes PZR PORV PCV-1456
3. Verifies PZR PORVs closed
4. Verifies PZR spray valves closed
5. Verifies PZR safety valves closed
6. Checks PZR pressure stable/increasing
7. Checks PZR pressure above normal – NO
8. Checks PZR pressure low/decreasing
9. Maintains PZR pressure greater than 2000 psig

### EXPECTED OPERATOR ACTIONS (cont'd)

EVENT: 2 (cont'd)

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
RO (cont'd)	10.	Verifies PZR heaters operable
	11.	Checks if PZR PORV is leaking – NO
	12.	Checks if leaking PZR safety is reducing pressure – NO
	13.	Determines if RCS leak is reducing pressure – NO
	14.	Checks if PZR pressure decreasing – NO
	15.	Checks RCS pressure stable
	16.	Checks if auto pressure control can be established
	17.	Establishes auto pressure control
US	18.	Keeps US informed of plant status
	1.	Coordinates/directs performance of AP-44
	2.	Reviews Technical Specifications
	3.	Ensures I&C notified
	4.	Keeps SS informed of plant status

**EXPECTED OPERATOR ACTIONS****EVENT: 3**

**BRIEF DESCRIPTION:** A pressurizer PORV begins to leak. Tech Specs are consulted and the decision is made to attempt to isolate the leaking PORV, but the associated block MOV trips on overload before the leak is isolated. Tech Specs are referenced and the decision made to shut down.

**INDICATIONS:**

1. Annunciator, PZR PORV HI TEMP
2. PORV tailpipe high temperature and increased charging flow

**POSITION   TIME   EXPECTED ACTIONS**

**BOP**

1. Assists RO as directed by the US

**RO**

1. RO identifies elevated PRZR tailpipe temperature and increasing charging flow.
2. Recognizes PZR PORV leaking and notifies US.
3. Attempts to close PORV block MOV at US direction.
4. Recognizes PORV block MOV breaker thermal O/L actuated and notifies US.



**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 2 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO**  
(cont'd)

10. Verifies PZR heaters operable
11. Checks if PZR PORV is leaking – NO
12. Checks if leaking PZR safety is reducing pressure – NO
13. Determines if RCS leak is reducing pressure – NO
14. Checks if PZR pressure decreasing – NO
15. Checks RCS pressure stable
16. Checks if auto pressure control can be established
17. Establishes auto pressure control
18. Keeps US informed of plant status

**US**

1. Coordinates/directs performance of AP-44
2. Reviews Technical Specifications
3. Ensures I&C notified
4. Keeps SS informed of plant status

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 3 (cont'd.)**POSITION** **TIME** **EXPECTED ACTIONS****US**

1. Directs PZR PORV leak response per Tech Specs.
  - a. Directs MOV-1535 closure & response to ensuing overload trip including direction to locally reset MOV-1535 breaker overload (will not reset)
  - b. Ensures all PZR htrs on to keep pressure > 2005 psig
  - c. Directs STA to perform RCS leak rate
  - d. Concludes excessive RCS leakage due to unisolable leaking PZR PORV
2. Reviews T.S. 3.4.3.2 and determines action for leaking PORV can not be met requiring s/d to HSD.
3. Informs SS of plant status & requests electrical maintenance support with block MOV bkr

**EXPECTED OPERATOR ACTIONS****EVENT:** 4**BRIEF DESCRIPTION:** With reactor power initially at 100% power, a power reduction to Hot Standby is commenced in response to an unisolable PZR PORV leak.**INDICATIONS:** 1. SS/Ops Management direction**POSITION   TIME   EXPECTED ACTIONS**

- |            |  |
|------------|--|
| <b>BOF</b> | <ol style="list-style-type: none"> <li>1. Reduces turbine load IAW AP-2.2 or OP-2.2</li> <li>2. Performs secondary plant s/d generator-load-dependent activities IAW AP-2.2 or OP-2.2.</li> <li>3. Performs activities as directed by US               <ol style="list-style-type: none"> <li>a. Notifies Chemistry of need to sample RCS if reactor power reduced &gt; 15%</li> </ol> </li> <li>4. Keeps US informed of plant status</li> </ol>   |
| <b>RO</b>  | <ol style="list-style-type: none"> <li>1. Reduces Rx power IAW AP-2.2 or OP-2.2.               <ol style="list-style-type: none"> <li>a. Calculates change req'd to reduce power and borates at rate directed by US</li> <li>b. Energizes PZR backup heaters</li> <li>c. Coordinates w/BOF to keep Tref w/in 3°F of Tavg w/rods in manual (1°F w/rods in auto) (if using AP-2.2, maintains Tave and Tref within 5°F)</li> <li>d. Observes AFD limitations</li> </ol> </li> <li>2. Keeps US informed of plant status</li> </ol> |

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 4 (cont'd)**POSITION      TIME      EXPECTED ACTIONS**

- |           |   |
|-----------|---|
| <b>US</b> | <ol style="list-style-type: none"><li>1. Coordinates power reduction activities of RO &amp; BOP</li><li>2. Performs other activities IAW AP-2.2 or OP-2.2.<ol style="list-style-type: none"><li>a. Evaluates Xe changes and directs boration rate changes as necessary</li></ol></li><li>3. Notifies System Dispatcher of load reduction</li><li>4. Keeps SS informed of plant status</li></ol> |
|-----------|---|

**EXPECTED OPERATOR ACTIONS****EVENT:** 5

**BRIEF DESCRIPTION:** A S/G level transmitter LT-1476 fails low. The crew recognizes the failure, takes manual control of A S/G FRV, and regains control of S/G level. The channel is declared OOS and compensatory actions taken per 1-AP-3.

**INDICATIONS:**

1. Failure low of LI-1476
2. A S/G level decreases
3. Annunciator F-B1, SG A LO-LO LEVEL
4. Annunciator F-D1, SG A FF<SF
5. Annunciator F-F1, SG A LEVEL ERROR

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
-----------------	-------------	-------------------------

<b>BOP</b>		<ol style="list-style-type: none"> <li>1. Recognizes failure of LT-1476 and responds as directed by US               <ol style="list-style-type: none"> <li>a. Compares to other SG level channels</li> <li>b. Verifies no off-normal conditions on related indications</li> </ol> </li> <li>2. Notifies US of failure</li> <li>3. Takes manual control of A S/G level</li> </ol>
<b>RO</b>		<ol style="list-style-type: none"> <li>1. Assists BOP as directed by US</li> <li>2. Informs US of plant status</li> </ol>
<b>US</b>		<ol style="list-style-type: none"> <li>1. Directs stabilization of plant conditions. May suspend load reduction to perform actions of AP-3 or may continue load reduction and trip bistables later.</li> <li>2. Directs compensatory action per AP-3               <ol style="list-style-type: none"> <li>a. Verifies related instrument status</li> <li>b. Determines which bistables to trip and effects on plant of tripping bistables. Provides this info to RO/BOP for guidance.</li> </ol> </li> <li>3. Notifies SS of plant status</li> <li>4. Ensures Tech. Spec. 3.3.1.1/2 requirements met</li> <li>5. Ensures I&amp;C notification of LT-1476 failure and directs initiation of PWO.</li> </ol>

**EXPECTED OPERATOR ACTIONS****EVENT: 6**

**BRIEF DESCRIPTION:** Steam-driven AFW pump spuriously auto-starts. The crew recognizes the failure and stops the pump. When the pump is stopped, the overspeed trip mechanism fails, which renders the pump inoperable.

**INDICATIONS:**

1. Steam-driven AFW pump steam supply valves open indication
2. A S/G MFW flow decreasing
3. A S/G AFW flow indicated
4. RCS Tave decreasing
5. Reactor power increasing
6. Annunciator F-D8, TDAFWP TROUBLE

**POSITION   TIME   EXPECTED ACTIONS**

<b>BOP</b>	<ol style="list-style-type: none"> <li>1. Recognizes steam-driven AFW pump auto-start and notifies US               <ol style="list-style-type: none"> <li>a. Observes steam supply valves indicating open</li> <li>b. Observes AFW flow indicated to A S/G</li> <li>c. Observes A S/G MFW flow decreasing</li> </ol> </li> <li>2. Notifies US of failure</li> <li>3. Stops steam-driven AFW pump when directed by US</li> <li>4. Notes TDAFW pump trouble alarm and informs US</li> <li>5. Dispatches watchstander to locally check AFW pump</li> </ol>
<b>RO</b>	<ol style="list-style-type: none"> <li>1. Observes RCS Tave decreasing and reactor power increasing</li> <li>2. Notifies US of RCS parameter changes</li> </ol>
<b>US</b>	<ol style="list-style-type: none"> <li>1. Directs BOP to stop steam-driven AFW pump</li> <li>2. Directs BOP to dispatch watchstander to check AFW pump</li> <li>3. Reviews TS-3.7.1.2</li> <li>4. Notifies SS of plant status</li> <li>5. Ensures Maintenance Dept notified of failure and directs initiation of a PWO.</li> </ol>

**EXPECTED OPERATOR ACTIONS****EVENT:** 7a/b

**BRIEF DESCRIPTION:** In response to a steam break on the main steam manifold in the turbine building, reactor trip and SI occur. Operators perform actions of E-0. When MSTVs are closed/verified closed, all MSTVs fail to close. No AFW flow exists (no pumps available: A OOS, B start fail, steam-driven AFW pump previously failed). Transition to FR-H.1 is made.

**INDICATIONS:**

1. Reactor trip & SI actuates
2. MSTVs remain open
3. All S/G Pressures dropping
4. No AFW flow

**CREW CRITICAL STEPS:**

1. Manually actuate steam line isolation (MSTV pushbuttons) prior to orange path on subcriticality or integrity or transition to ECA-2.1 (whichever occurs first) (applicable only after main steam line isolation step is read).

**POSITION    TIME EXPECTED ACTIONS**

**BOP**

1. Performs IOAs in response to reactor trip with SI per E-0:
  - a. Verifies all turbine stop valves closed
  - b. Resets MSR steam supply FCVs
  - c. Verifies open generator output breaker
2. Performs other E-0 immediate actions:
  - a. Manually initiates SI.

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7a/b (cont'd)**POSITION   TIME   EXPECTED ACTIONS****BOI<sup>2</sup>**  
**(cont'd)**

3. Performs subsequent E-0 actions at US direction:
  - a. Verifies feedwater isolation
  - b. Manually initiates containment isolation phase A
  - c. Verifies AFW pumps running – NO
    1. Manually starts AFW pumps - NO
    2. Determines NO AFW pumps available (A OOS, B start fail & steam-driven AFW pump overspeed trip). Dispatches local operators to check B AFW pump.
  - d. Verifies LHSI pumps running
  - e. Verifies SW pumps running
  - f. Checks if main steamlines should be isolated
    1. Verifies MSTVs and bypass valves closed – NO
    2. Manually closes MSTVs
  - g. Checks if CDA or QS is required – NO
  - h. Verifies SI flow indicated
  - i. Verifies AFW flow – NO
    1. Checks S/G NR level >11%[22%] – NO
    2. Verifies AFW flow > 340 gpm – NO
    3. Manually starts pumps/directs local valve realignment as directed by US to get AFW > 340 gpm – NO
4. Keeps US informed of plant status



**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7a/b (cont'd)**POSITION   TIME   EXPECTED ACTIONS**

- |           |   |
|-----------|---|
| <b>RO</b> | <ol style="list-style-type: none"><li>1. Performs IOAs in response to reactor trip with SI per E-0<ol style="list-style-type: none"><li>a. Verifies reactor tripped</li><li>b. Verifies AC emergency busses energized</li><li>c. Manually initiates SI</li></ol></li><li>2. Performs subsequent actions of E-0 as directed by US<ol style="list-style-type: none"><li>a. Manually initiates containment isolation phase A</li><li>b. Verifies HHSI pumps running</li></ol></li><li>3. Keeps US informed of plant status</li></ol> |
| <b>US</b> | <ol style="list-style-type: none"><li>1. Directs response to reactor trip and failure of main steam isolation per E-0<ol style="list-style-type: none"><li>a. Obtains verification of reactor and turbine trip</li><li>b. Determines electric plant status</li></ol></li></ol>  |

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7a/b (cont'd)**POSITION   TIME   EXPECTED ACTIONS****US cont**

- c. Directs manual SI/phase A
- d. Monitors foldout page including direction to RO to stop all RCPs if subcooling lost
- e. Directs subsequent actions
  - 1. Ensures manual closure of MSTVs
  - 2. Transitions to FR-H.1
  - 3. Keeps SS informed of plant status

**EXPECTED OPERATOR ACTIONS****EVENT:** 7c**BRIEF DESCRIPTION:** Loss of secondary heat sink with RCS bleed and feed

**INDICATIONS:**

1. No AFW flow indicated
2. All SGs narrow-range levels <11%
3. All SGs wide-range levels <12%
4. RCS pressure > SG pressures
5. Hot-leg temperatures >350°F

**POSITION   TIME   EXPECTED ACTIONS**

<b>BOI'</b>	<ol style="list-style-type: none"> <li>1. Observes all SG wide-range levels &lt;12%</li> <li>2. Verifies HHSI flow indicated</li> <li>3. Verifies instrument air aligned to containment</li> <li>4. Verifies applicable E-0 actions per FR-H.1 attachment 5</li> <li>5. Keeps US informed of plant status</li> </ol>
<b>RO</b>	<ol style="list-style-type: none"> <li>1. Checks RCS pressure &gt; SG pressures</li> <li>2. Checks hot-leg temperatures &gt;350°F</li> <li>3. Stops all RCPs</li> <li>4. Places all PRZR heaters in PULL-TO-LOCK</li> <li>5. Checks SI actuated</li> <li>6. Checks at least one charging pump running</li> <li>7. Checks SI valve alignment</li> <li>8. Resets both trains of SI and containment isolation phase A</li> <li>9. Checks PRZR block MOVs energized and open</li> <li>10. Opens both PRZR PORVs</li> <li>11. Verifies adequate RCS bleed path</li> <li>12. Closes charging pump recirc valves</li> <li>13. Keeps US informed of plant status</li> </ol>

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7c (cont'd)**POSITION   TIME   EXPECTED ACTIONS**

- |           |  |
|-----------|--|
| <b>US</b> | <ol style="list-style-type: none"><li>1.     Determines secondary heat sink is required</li><li>2.     Determines bleed and feed is immediately required</li><li>3.     Directs response to loss of secondary heat sink per FR-H.1<ol style="list-style-type: none"><li>a.     Directs RCPs stopped and PRZR heaters in PTL</li><li>b.     Directs bleed and feed alignment</li></ol></li><li>4.     Transitions to ES-1.3 if RWST level decreases to &lt;23%</li><li>5.     Classifies event as a Notification of Unusual Event per EPIP-1.01, tabs A-10 and G-3 (may elect to classify as an Alert per tab M-3 based on SEM judgment)</li><li>6.     Keeps SS informed of plant status</li></ol> |
|-----------|--|

**SIMULATOR INSTRUCTOR FACILITY OPERATING INSTRUCTIONS****I. SETUP**

- A. Recall IC #
- B. Verify 1-FW-P-3A tagged out per MOP-31.01
- C. Verify steam dumps in steam pressure mode
- D. Verify analog trend pens set up for Tave, Tref, CTMT temperature & VCT level
- E. Verify the following malfunctions are preloaded:
  - 1. MMS0501/02/03 (MSTV fails to close when req'd); TD = 0 sec; trigger = N/A
  - 2. MFW2302 (B AFW pump trips on overcurrent); TD = 0 sec; trigger = ???

**II. CONDUCTING THE EXAMINATION:**

- A. Unfreeze the simulator and begin the exam.
- B. Perform 1-PT-17.1, Control Rod Operability Test
  - 1. Initiation: Shift orders
  - 2. Response: Respond as safeguards watchstander when requested to obtain bank overlap counter reading (counter reads 613)
- C. PT-1445 falls high (event 2).
  - 1. Initiation: MRC0702: TD = 10 sec; ramp = 10 sec; start deg = 50; stop deg = 100; trigger = N/A
  - 2. Response: As SS, state that a work request will be generated and I&C will be notified of the failure. As I&C, reply that a planner will initiate a work package for troubleshooting & repair.
- D. PORV-1456 leak (event 3).
  - 1. Initiation: MRC32: TD = 20 sec; ramp = 10 sec; start deg = 0; stop deg = 2; trigger = N/A

NOTE: Ensure PORV leak does NOT result in pressure decrease (preclude entry into AP-44, which requires a unit trip if the block MOV cannot be closed)

- 2. Response:
- E. Power reduction due to PORV block MOV failure (event 4).
  - 1. Initiation:

2. Response:

**F. LT-1476 fails low (event 5)**

1. Initiation: MFW\_\_\_\_; TD = 30 sec; ramp = 10 sec; start deg = 50; stop deg = 0; trigger = N/A

2. Response: As SS, state that a work request will be generated and I&C will be notified of the failure. As I&C, reply that a planner will initiate a work package for troubleshooting & repair.

**G. Steam-driven AFW pump spuriously starts/falls (event 6).**

1. Initiation: MFW09 (overspeed trip); TD = 40 sec; trigger = N/A

2. Response: Respond as safeguards watchstander when requested to locally check steam-driven AFW pump that the overspeed trip latch is broken. As SS, state that a work request will be generated and mechanical maintenance will be notified of the failure. As mechanical maintenance, reply that the trip latch repair will require approximately one hour to accomplish.

**H. Steam break with failure of MS isolation (event 7a/b)**

1. Initiation: MMS0901: TD = 50 sec; ramp = 5 sec; start deg = 0; stop deg = 100; trigger = N/A

2. Response:

**I. Loss of secondary heat sink with RCS bleed and feed (event 7c)**

1. Initiation:

2. Response:

**III. TERMINATION CRITERIA:**

A. Upon completion of RCS bleed and feed alignment by closing charging pump recirc valves (step 26 of FR-H.1),

OR

B. At the discretion of the evaluator.

**EVALUATION SCENARIO CONTENT SUMMARY**

1.	Total Number of Malfunctions:	8
2.	Malfunctions Occurring During EOP Performance:	2
	a. B AFW pump start failure	
	b. MS isolation failure	
3.	Abnormal Events:	4
	a. PT-1445 fails high	
	b. PCV-1456 block MOV fails to close	
	c. LT-1476 fails low	
	d. Steam-driven AFW pump spurious start/failure	
4.	Major Transients:	2
	a. MS line break in turbine bldg	
	b. RCS bleed and feed	
5.	EOPs Used:	2
6.	EOP Contingencies Entered:	0
7.	Simulator Run Time:	90 minutes
8.	EOP Run Time:	45 minutes
9.	Crew Critical Tasks:	2

Facility: North Anna Scenario No.: 2

Op-Test No.: 1

Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Operators: (RO) \_\_\_\_\_  
(BOP) \_\_\_\_\_  
(SRO) \_\_\_\_\_

Initial Conditions: EOL. Mode 1, 561 degrees. B EDG is OOS for corrective governor maintenance. FT-476 is OOS for calibration. No other equipment is OOS. No surveillance tests are in progress.

Turnover: There are thunderstorms in the area with winds clocking at 60 mph. Large golf ball size hail has also been reported. Slight tremors on the order of 2.1 on the Richter scale have been detected.

POD: Conduct a power increase from 60% to 100% following MFP repairs. The system dispatcher has asked that this power increase be expedited to deal with an expected high peak demand towards the end of day shift.

Event No	Malf. No.	Event Type*	Event Description
1a		N (R)	Perform 1-PT-60.1, Reactor Containment Average Air Temperature
1		R (R)	Power increase from 60%
2		I (B)	FT-474 failure low (controlling channel)
3		R,I (R)	TM-408F failure low
3a	MEL1304	C (B)	Loss of Vital bus 1-IV
4		C (R)	RCP thermal barrier failure? CCTV-11A (also fail trip valve)
5		M (A)	Large break LOCA
6		C (A)	LOSP
7		C (A)	A RHR pump trip (Loss of emergency coolant recirc)

\* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor  
(R)O, (B)OP, (A)LL



**NORTH ANNA POWER STATION**

**RO/SRO NRC INITIAL LICENSE EXAM**

**SIMULATOR EVALUATION SCENARIO NRC-2**

**PROGRAM:** RO/SRO Initial License Training

**DESCRIPTION:** Large Break Loss of Coolant Accident /  
Loss of Offsite Power

**LENGTH:** 90 minutes

**AUTHOR:** R. F. Aiello

**REVISION DATE:** 5/17/00

**REVIEWED BY:** \_\_\_\_\_  
Senior Operations Engineer Date

**APPROVED BY:** \_\_\_\_\_  
NRC Chief Examiner (Surry) Date

## EVALUATION SCENARIO OBJECTIVES

**TERMINAL OBJECTIVE:** During normal and abnormal plant conditions, the Shift Operating Crew will perform control room operations in accordance with (IAW) approved plant procedures ensuring that the health and safety of the public is protected and the integrity of the plant maintained.

### ENABLING OBJECTIVES:

1. Given specific plant conditions, plant procedures, and a shift turnover, respond to the following events IAW approved plant procedures:
  - a. Perform 1-PT-60.1, Reactor Containment Average Air Temperature
  - b. Power increase from 60%
  - c. FT-474 failure low (controlling channel)
  - d. TM-408F failure low
  - e. Loss of Vital bus 1-IV
  - f. RCP thermal barrier failure / MOV-626 auto close failure
  - g. Large break LOCA
  - h. Loss of offsite power
  - i. A RHR pump trip (loss of emergency coolant recirculation)
2. Given abnormal plant conditions, mitigate the adverse consequences of the following events IAW approved plant procedures:
  - a. Identify abnormalities while assessing actual system response with respect to predicted system response.
  - b. Investigate the cause and effect of abnormalities in system performance.
  - c. Implement applicable procedures.
  - d. Perform immediate actions from memory.
3. Given abnormal plant conditions, implement the applicable on-site and off-site reports and notifications IAW approved plant procedures.
4. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to all operators, conduct plant operations IAW approved plant procedures:
  - a. Plant and control room communication.
  - b. Plant/Control Board monitoring.
  - c. Plant/Control Board manipulation.
  - d. Operational problem solving.
  - e. Use of OPs/ONOPs and Technical Specifications.
  - f. Use of EOPs IAW EOP Rules of Usage.
  - g. Annunciator recognition and response.
  - h. Written communications/logs.
  - i. ALARA awareness.

### **EVALUATION SCENARIO OBJECTIVES (cont'd)**

5. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to the Assistant Nuclear Plant Supervisor (US), conduct plant operations IAW approved plant procedures:
  - a. Team performance management.
  - b. Problem solving.
  - c. Decision analysis.
  - d. Action planning.
  - e. Self-checking.
  
6. During abnormal and emergency events, the shift operating crew shall apply techniques of teamwork and self-checking IAW established work practices and operating guidelines.

## EVALUATION SCENARIO DESCRIPTION

**Initial Conditions:** Mode 1, 561 degrees F

**Turnover:** Power increase from 60% to 100% power is in progress following main feed pump breaker repair. The system dispatcher has asked that this power increase be expedited to deal with an expected high peak demand towards the end of day shift. \_\_\_ EDG is OOS for corrective governor maintenance. FT-476 is OOS for calibration. Perform 1-PT-60.1, Reactor Containment Average Air Temperature PT.

**Synopsis:** Perform 1-PT-60.1, Reactor Containment Average Air Temperature. After a 5% power increase (or at lead examiner direction) the controlling steam flow channel on \_\_\_ S/G (FT-474) fails low causing FCV-478 to automatically close. Operator action is required to manually control \_\_\_ S/G level and select the other steam flow channel for level control input. The crew responds per \_\_\_\_\_. Once the plant is stabilized, Technical Specifications are consulted and the crew briefed on the effects of the failure. Next, TM-408F fails low generating erroneous Tref input to rod control. If rods are in AUTO, inward rod movement occurs and operators respond per \_\_\_ taking rod control to manual. Next, the Vital Bus Inverter for Vital Bus 1-IV will fail resulting in a loss of vital bus 1-IV. The crew should identify the bus failure and enter 0-AP-10, "Loss of Electrical Power". The crew will be informed that the Inverter has failed and they will need to re-energize the vital bus via the SOLA transformer. The Unit Supervisor (US) should refer to technical specifications and declare the vital bus inoperable since it is being supplied by the SOLA transformer. Once the bus is re-energized the next event will occur. Following plant stabilization, the \_\_\_ RCP thermal barrier HX experiences a large leak and CCTV-11A fails to automatically close on high flow. The operators respond per \_\_\_ and \_\_\_. CR may also be used as time permits prior to ONOP entry. After thermal barrier return isolation, \_\_\_ RCP shaft vibration begins to increase enough to eventually require a reactor & B RCP trip per \_\_\_\_\_. When \_\_\_ RCP is tripped, the leak becomes a large break loss of coolant accident on the B RCS loop. The crew responds per E-0. After SI reset, a loss of offsite power occurs. Since the B EDG is OOS, only the \_\_\_ 4kV bus re-energizes on the A EDG. Train A safeguards loads must be manually restarted. The crew transitions to FR-P.1 momentarily and then to E-1. Then, the \_\_\_ RHR pump trips causing a loss of all LHSI. If RWST level gets <155,000 gallons, transition is made to ES-1.3. With no RHR pumps running whether in E-1 or in ES-1.3 transition is made to ECA-1.1. The exercise is concluded upon reduction of SI flow to minimum (ECA-1.1 step \_\_\_), stopping all SI flow (ECA-1.1 step \_\_\_) or at the evaluator's discretion. The event is classified after scenario completion as a General Emergency per 0-EPIP-, Enclosure \_\_\_, category \_\_\_.

**Event summary:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
1a	Perform 1-PT-60.1, Reactor Containment Average Air Temperature <i>K/A: 2.1.23 (3.9/4.0)</i>
1	Power increase from 60% <i>K/A: 2.2.2 (4.0/3.5)</i>
2	FT-474 fails low (A S/G FRV closes) <i>K/A: 035K401 (3.6/3.8)</i>
3	TM-408F fails low <i>K/A: 001K602 (2.8/3.3)</i>
3a	Loss of Vital bus 1-IV <i>K/A: 062K301 (3.5/3.9)</i>
4	B RCP TBHX failure / CCTV-11A auto close failure <i>K/A: 008K104 (3.3/3.8); 003K112 (3.0/3.3)</i>
5	Large break loss of coolant accident <i>K/A: EPE 011; EK309 (4.2/4.5); EK312 (4.4/4.6)</i>
6	Loss of offsite power (loss of B 4kV bus) <i>K/A: EPE055; EA106 (4.1/4.5)</i>
7	A RHR pump trip (loss of emergency coolant recirc) <i>K/A: E01; EA11 (3.7/3.7); EK22 (3.5/3.8)</i>

**Crew Critical Steps:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
6	1. Ensure one train of safeguards is actuated and running prior to transitioning from from E-0
7	1. Stop SI and RHR pumps upon reaching 60,000 gallons in the RWST 2. Make up to the RWST and minimize RWST outflow per ECA-1.1

**Individual Critical Steps:**

The bolded individual actions listed under the respective positions (RO, US, etc.) are for use during evaluations to identify steps that are critical to the individual position.

## EVALUATION SCENARIO PRE-EXERCISE BRIEFING

**1. Review the following with students:**

- a. Primary responsibility of the student is to operate the simulator as if it were the actual plant.
- b. The evaluators will observe teamwork skills, communication, and the crew's ability to safely operate the plant during the simulator examination. This includes individual & crew performance.
- c. If you recognize an incorrect decision, response, answer, analysis, action, or interpretation by another crew member but fail to correct it, then the evaluator may assume that you agree with the incorrect item.
- d. The crew should keep a rough log during each scenario sufficient to complete necessary formal log entries.
- e. The simulator instructor facility operator will perform all of the functions of personnel needed outside the control room area.
- f. Before the examination begins, crew members may perform a control board walkdown for up to 10 minutes.

**2. The following are initial conditions for this exam** (in shift turnover package, but may be covered verbally if needed):

- a. Time in core life - BOL
- b. Reactor power and power history - 100%-60% 4 hr ago
- c. Turbine status - online
- d. Boron concentration - 1390 ppm
- e. Temperature - 561 degrees F
- f. Pressure - 2235 psig
- g. Xenon - Increasing following 100%-60% downpower 4 hr ago.
- h. Core cooling - forced
- i. Tech. Spec. LCO(s) in effect
  - 3.3.1 Action 7 (bistables tripped); FT-476 OOS for cal
  - 3.8.1.1 Action b (1 hrs); B EDG OOS (governor)
- j. Clearances in effect - B EDG
- k. Significant problems/abnormalities - None
- l. Evolutions/maintenance for the coming shift - Return to 100% power this shift. Expedite to meet system peak.
- m. Units 1 and 2 status - unit 1 online; unit 2 s/d

**3. Ensure students understand examination schedule** and that a break will be necessary between scenarios to allow simulator initial condition setup. **Cover exam security rules** to be observed by students both during and after the exam IAW the latest revision of AG-017 or NUREG-1021 as applicable.

**4. Before the examination begins, make crew position assignments and allow students to ask any questions concerning the administration of the test.**

NRC 2

### EXPECTED OPERATOR ACTIONS

EVENT: 1a

**BRIEF DESCRIPTION:** Reactor Containment Average Air Temperature Test (1-PT-60.2) with Annulus Temperature Element (1-LM-TE-100-15) OOS .

(DETAILS)

**EXPECTED OPERATOR ACTIONS****EVENT:** 1**BRIEF DESCRIPTION:** Unit is at reduced power (60%) and is directed to return to 100% power.**INDICATIONS:** 1. Notification by System  
2. Shift turnover**POSITION   TIME   EXPECTED ACTIONS**

<b>BOP</b>	1. At 400-435 MW, starts the 2nd SGFP per OP-____ 2. At 450 MW, starts the 2nd HDP per OP-____ and verifies adequate heater drain flow 3. Maintains Tref/Tavg approx equal during uppower 4. Keeps US informed of plant status
<b>RO</b>	1. Prior to exceeding 70% power, consults with Reactor Engineering concerning MTC 2. Maintains Tref/Tavg approx equal during uppower 3. Prior to 90% power, verifies all rods within 12 steps of group step counter 4. At steady state power with Tavg within 1 F of Tref, places rods in AUTO 5. Verifies Gamma-Metric wide range power meter within 1.5% of PRNIs when Rx power 98.5-100% 6. Keeps US informed of plant status
<b>US</b>	1. Coordinates and directs uppower evolution 2. Verifies MTC limits are met prior to exceeding 70% power 3. Keeps SS informed of plant status



**EXPECTED OPERATOR ACTIONS****EVENT:** 2

**BRIEF DESCRIPTION:** A S/G controlling steam flow FT-474 fails low. The A S/G FRV requires manual operation. The channel is called OOS and compensatory actions are initiated per AP-\_\_.

**INDICATIONS:**

1. Annunciator \_\_, SG A FEED > STEAM
2. Annunciator \_\_, SG A STEAM > FEED
3. FI-474 off scale low
4. FCV-478 closing in AUTO
5. Decreasing level in A S/G

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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<b>BOP</b>	1.	Recognizes failure of FT-474 and responds as directed by US
	a.	Compares to other SG FT's and verifies no off-normal conditions on other SG FT's
	2.	Notifies US of failure
	3.	<b>Takes manual control of FCV-478, restores steam/feed flow balance and stabilizes SG level</b>
	4.	Selects alternate SG steam FT channel for control and returns FCV-478 to automatic

<b>RO</b>	<b>NONE</b>
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<b>US</b>	1.	Directs stabilization of plant conditions
	2.	Directs compensatory action per AP-__
	a.	Verifies BOP determination of SG FT status
	b.	Determines which b/s to trip and effects on plant of tripping b/s. Provides this info to RO/BOP for guidance.
	3.	Notifies SS of plant status

**EXPECTED OPERATOR ACTIONS (cont'd)**

**EVENT:** 2 (cont'd)

**POSITION**    **TIME**    **EXPECTED ACTIONS**

<b>US</b> (cont'd)		4. Ensures Tech Spec requirements are met
		5. Notifies I&C of FT-474 failure and directs initiation of PWO

**EXPECTED OPERATOR ACTIONS****EVENT:** 3

**BRIEF DESCRIPTION:** TM-408F loses power. Rod control Tref fails low. Rods step in if in AUTO. The crew responds per ARP-\_\_\_\_ using AP-\_\_\_\_ as needed.

**INDICATIONS:**

1. Annunciator \_\_\_\_, Tavg-Tref DEVIATION
2. Tavg input on Tavg-Tref recorder failed low
3. Control rods stepping in if in AUTO

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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<b>BOP</b>	1.	Assists RO as directed by US.
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<b>RO</b>	1.	Responds to TM-408F failure per ARP-____:
	a.	Checks Tavg-Tref recorder (TR-408) and VPA Tavg & Pimp indication
	b.	Places/verifies rods in MANUAL
	2.	Responds to TM-408F failure per AP-____ (if directed):
	a.	Places rods in MANUAL & adjusts rods to maintain Tavg = Tref
	b.	Verifies rod insertion limits not exceeded
	c.	Checks for failure of TM-408F
	d.	Initiates caution tag for rod control selector switch
	2.	Informs US of plant status

<b>US</b>	1.	Directs response per ARP-____ and uses AP-____ as needed
	2.	Informs SS/I&C of TM-408F failure
	3.	Directs PWO initiation

**SCENARIO EVENTS/RESPONSE GUIDELINES**

**EVENT 3a:** Given that the unit is at power, and a loss of Vital Bus 1-IV has occurred, the crew will be expected to respond IAW 0-AP-10, "Loss of Electrical Power".

<b><u>POSITION</u></b>	<b><u>TIME</u></b>	<b><u>EXPECTED ACTIONS</u></b>
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**BOP**

1. Identifies annunciator 1H-A4 "Vital Bus 1-IV Trouble".
2. Identifies loss of vital bus 1-IV.
3. Notifies US of vital bus loss.
4. Directs safeguards operator to investigate loss of vital bus 1-IV.
5. Enter 0-AP-10.

**US**

1. Directs BOP to enter 0-AP-10.

**NOTE:** Safeguards operator will report that the 1-IV inverter appears to have smoked, the outside is charred.

**NOTE:** After the electricians are dispatched to investigate, report that the inverter is damaged and cannot be re-energized. Report that the 1-IV vital bus has been checked and has been given the "OK" to re-energize.

2. US directs electrical department to investigate 1-IV vital bus inverter.
3. US directs backboards to energize the vital bus via the SOLA transformer.
4. US refers to TS 3.8.2.1 and MOP-26.63 and declares the vital bus inoperable.
5. Backboards energizes the vital bus via the SOLA transformer.

**EXPECTED OPERATOR ACTIONS****EVENT:** 4

**BRIEF DESCRIPTION:** B RCP thermal barrier HX (TBHX) fails. PRMS R-17A/B alarms. MOV-626 fails to auto close on high flow requiring manual closure. AP-\_\_\_ & \_\_\_ are entered (as is ARP-\_\_\_ if time permits). After MOV-626 closure, shaft vibration increases requiring a reactor trip.

**INDICATIONS:**

1. PRMS R-17A and B alarm
2. CCW surge tank level increases
4. Annunciator \_\_\_, PRMS HI RADIATION, actuates
4. Annunciator \_\_\_, RCP THERMAL BARR COOLING WATER HI FLOW, alarms (MOV-626 fails)
5. Annunciator \_\_\_, RCP THERMAL BARR COOLING WATER HI TEMP, alarms
6. Annunciator \_\_\_, RCP MOTOR/SHAFT HI VIB

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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**BOP**

- |    |  |
|----|--|
| 1. | Performs actions as directed per AP-___:                                   |
| a. | Checks R-17A/B alarm valid   |
| 2. | <b>Performs actions as directed per AP-___:</b>                            |
| a. | In response to affected RCP TBHX DP low, verifies seal injection 6-13 gpm  |
| b. | <b>Recognizes/reports shaft high vibration condition (annunciator ___)</b> |

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 4 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO**

1. Recognizes RCP TBHX failure & informs US
2. Performs actions as directed by ARP-\_\_\_\_:
  - a. **In response to annunciator \_\_\_\_:**
    - 1) **Verifies/manually closes CCTV-11A**
    - 2) Checks R-17A/B for increasing activity
    - 3) Contacts Chemistry for CCW activity sample
  - b. **In response to annunciator \_\_\_\_:**
    - 1) Checks CCW header flow & HX outlet temp.
    - 2) **Checks R-17A/B increasing activity – YES - verifies seal injection & closes CCTV-11A**
    - 3) Checks for #1 seal leakoff high flow
    - 4) Monitors thermal barrier DP, RCP temps
  - c. Notifies US to go to AP-\_\_ & \_\_
3. Performs actions as directed per AP-\_\_\_\_:
  - a. Verifies CCWST vent closed (RCV-609)
  - b. Requests CCW activity sample from Chemistry

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 4 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO**  
(cont'd)

- 4. Performs actions as directed per AP-\_\_\_:**
  - a. Monitors #1 seal leakoff, lower pump guide bearing, seal return & CCW supply temps.
  - b. **If CCTV-11A not yet closed** (B RCP thermal barrier DP = 0 inches):
    - 1) Verifies proper seal injection flow
    - 2) Maintains thermal barrier cooling
    - 3) Checks #1 seal leakoff <Encl 1 limits
    - 4) Checks Annunciator \_\_\_\_, 1/3 OFF – NO
    - 5) Checks CNMT fB isolation not actuated & RCP seal return temp < 235°F
    - 6) Checks R-17A/B normal – NO
    - 7) **Manually closes CCTV-11A.**
  - c. **Verifies shaft high vibration condition**
  - d. **Trips reactor & affected RCP when directed**

**US**

- 1. Directs mitigative actions IAW ARP-\_\_\_, AP-\_\_\_ & \_\_\_**
  - a. **Directs CCTV-11A closure**
  - b. **Directs reactor trip followed by B RCP trip due to high shaft vibration (foldout)**
- 2. Informs SS of plant status**
- 3. Directs announcement to stand clear of CCW piping**

**EXPECTED OPERATOR ACTIONS****EVENT:** 5 & 6

**BRIEF DESCRIPTION:** In response to plant conditions, a reactor trip & SI has occurred. Operators perform actions of E-0. Just before transition to E-1, a loss of offsite power occurs requiring manual restart of train A ESF loads (SI reset & B EDG OOS). Transition is then made to E-1.

**INDICATIONS:**

1. Reactor trip directed or actuates
2. Rod bottom lights on and RTBs/BYBs open
3. SI alarms & ESF equipment auto starts
4. Switchyard deenergizes & only train A safety electrical distribution reenergizes (B EDG OOS)

**CREW CRITICAL STEPS:**

1. **Ensure one train of safeguards is actuated and running prior to transitioning from fromE-0**

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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<b>BOP</b>	1.	Responds to reactor trip per E-0
	a.	Verifies turbine trip
	a.	Verifies power to _A/B/D 4kV buses
	b.	Verifies feedwater isolation
	c.	Verifies AFW pumps running
	d.	Verifies proper ICW operation
	e.	Checks if main stm lines should be isolated
	f.	Verifies EDGs all running
	g.	Directs SNPO to place PAHMS in service
	h.	Verifies proper AFW alignment and flow
	i.	Checks RCS cold leg temperatures stable
	j.	Performs MSLB & SGTR diagnostics



**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 5 & 6 (cont'd)**POSITION    TIME    EXPECTED ACTIONS**

**BOP(cont)**                      **2.**        **Performs E-0 foldout steps as directed including restoring ESF equipment to required configuration (train A only) after LOOP.**

a.        If directed by the US, restores power to the D 4kV bus from A 4kV bus using either AP-\_\_ or guidance from E-0 step \_ RNO. (Allows C CCWP & ICWP start.)

3.        Informs US of plant status

**RO**                                      **1.**        **Responds to reactor trip per E-0**

a.        Verifies reactor tripped & SI/Phase A

b.        Verifies containment isolation phase A

c.        Verifies SI pumps running & proper CCW system operation

d.        Verifies CNMT cooling & CNMT/CR vent isolation

**e.        Verifies Cntmt spray not required – NO**

1)        Verifies containment spray actuation & B containment isolation

**2)        Stops all RCPs (if still running)**

f.        Verifies SI valve amber lights bright

g.        Resets/realigns SI & verifies SI flow

h.        Checks cooling of RCPs & RCP seals

i.        Checks letdown/PORVs/spray valves closed

j.        Performs LOCA diagnostics

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 5 & 6 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO**  
(cont'd)

2.    **Performs E-0 foldout page steps as directed:**
  - a.    **Recognizes loss of subcooling/Phase B actuation and trips RCPs per E-0 (if needed)**
  - b.    **Starts train A ESF loads as directed by the US following loss of offsite power.**
3.    **Notifies US of safety injection and cause**

**US**

1.    **Directs response to reactor trip per E-0**
  - a.    **Obtains verification of reactor trip**
  - b.    **Determines electric plant status**
  - c.    **Directs manual SI/phase A if required**
  - a.    **Monitors foldout page items:**
    - 1)    **Direction to RO to stop all RCPs if required by subcooling/Phase B actuation**
    - 2)    **Following loss of offsite power, directs start of train A ESF loads.**
  - b.    **Directs prompt and subsequent actions**
  - c.    **May reenergize D 4kV bus from A 4kV bus by directing BOP per guidance of E-0 step 3 RNO or by directing use of AP-\_\_\_ (Allows use of C CCWP & ICWP)**
2.    **Transitions to appropriate plant procedure (E-1 or appropriate FRP)**
3.    **Informs SS as to status of plant**

**EXPECTED OPERATOR ACTIONS****EVENT:** 7

**BRIEF DESCRIPTION:** With a large break LOCA/LOOP, only train A ESF is running (B EDG OOS). From E-0, FR-P.1 is briefly entered followed by transition to either FR-Z.1 if needed or E-1 after which A RHRP trips. From E-1, if RWST level < 155 kgal, ES-1.3 is entered. With no RHR pumps, ECA-1.1 is entered.

**INDICATIONS:**

1. Cntmt radiation & sump lvl indications abnormal
2. Safety injection actuated and injecting
1. RWST level dropping (<155kgal for ES-1.3)
2. RCS cold leg temperature (<290°F for FR-P.1)
3. Annunciator \_\_\_\_, RHR PP A/B MOTOR OVERLOAD
4. Annunciator \_\_\_\_, RHR PP A/B TRIP

**CREW CRITICAL STEPS:**

1. Stop SI pumps upon reaching 60,000 gallons in the RWST
2. Make up to the RWST and minimize RWST outflow per ECA-1.1

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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BOP	1.	Performs actions of E-1 as directed:
	a.	Checks S/G fault, S/G levels & sec. rad.
	b.	Resets cntmt isol Phase A/B & verifies IA press.
	c.	Checks chg pump power from offsite - NO - power available for only two chg pumps
	d.	Checks for presence of MSLB (SG pressures)
	e.	Checks if EDGs should be stopped - NO
	2.	Assists RO with EOPs as directed.
	3.	Maintains intact S/G levels 15-50% per ECA-1.1 as directed
	4.	Informs US of plant status

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO**

1. Performs actions of FR-P.1 as directed:
  - a. Checks RCS press > 650psig – NO - RHR flow > 1000gpm
2. **Performs actions of E-1 as directed:**
  - a. Checks PORVs and block valves
  - b. Verifies SI-reset
  - c. Checks for max chg flow (2 pumps)
  - d. Checks if SI should be terminated – NO
  - e. Checks if cntmt spray should be stopped
  - f. Checks if RHR pumps should be stopped – NO
  - g. **Verifies cold leg recirc capability – NO**
  - h. **Identifies RWST lvl <155kgal & informs US**
3. **Performs actions of ES-1.3 as directed:**
  - a. Verifies SI reset
  - b. Takes B CSP to PTL; MOV-880B deenergized
  - a. Checks A HHSIP running, takes RHRPs to PTL
  - b. Verifies RHR aligned for injection
  - c. Stops chg pumps if VCT m/u not available
  - d. Establishes hot leg recirc capability
  - e. Closes HHSIP recirc to RWST valves
  - f. Stops HHSIPs & isolates from HHSI

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO**  
(cont'd)

- 3. Performs actions of ES-1.3 as directed (cont'd):**
  - g. Verifies cold leg recirc valves energized
  - h. Verifies RHR alt dischg isolated
  - i. Realigns RHR suction from RWST to CNMT sump
  - j. Verifies CNMT recirc sump level
  - k. Verifies adequate CCW for RHR cooling
  - l. Starts one RHR pump – NO
- 4. Performs actions of ECA-1.1 as directed:**
  - a. Checks CL recirc capability available – NO
  - b. Aligns makeup to the RWST**
  - c. Verifies only two ECCs running & at least one computer room chiller running
  - d. If RWST level < 60kgal, then stops running HHSI, charging and containment spray pumps**
  - e. Reduces containment cooling as directed**
    - a. Verifies SI reset
    - b. Establishes one HHSI pump running**
    - c. Verifies no RWST -> Sump backflow
    - d. Checks RCS subcooling (approx. zero)
    - e. Establishes minimum SI as directed**

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO**  
(cont'd)

5. Performs actions of FR-Z.1 as directed:
  - a. Verifies RCPs stopped with all NCCs OFF/ISOLATED
  - b. Verifies CNMT FA/B VPB valve white lights all bright
  - c. Verifies CNMT/CR ventilation isolated
  - d. Checks CL recirculation capability - NO
6. Informs US of plant status

**US**

1. Determines FR-P.1 n/a for LBLOCA
2. **Directs response to LBLOCA per E-1:**
  - a. Directs max charging aligned (2 pumps)
  - b. **Transitions to appropriate procedure or FRP if required by red/orange path CSFST:**
    - 1) **FR-Z.1 if CNMT pressure > 20 psig**
    - 2) **ES-1.3 if RWST level < 155 kgal**
    - 3) **ECA-1.1 for loss of both RHRPs**
3. **If applicable, directs response to LBLOCA per ES-1.3 but determines no RHR pumps operable and transition required to ECA-1.1**
4. **Directs response to LBLOCA per ECA-1.1:**
  - a. **Directs addition of makeup to the RWST**
  - b. **Determines RCS cooldown not applicable**
  - c. **If RWST level > 60 kgal:**
    - 1) **Reduces containment spray to minimum**

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****US (cont)**

- 2) Verifies no backflow from RWST to sump & determines RCP could not be started
- 3) Determines minimum SI flow (figure 1) & directs NLO action accordingly
- d. If RWST level < 60 kgal, stops all HHSI pumps, cnmt spray pumps & charging pumps
- 5. Classifies event as a GENERAL EMERGENCY (RCS leak > charging w/containment pressure > 20 psig) per EPIP-\_\_
- 6. Informs SS of status of unit

## **SIMULATOR INSTRUCTOR FACILITY OPERATING INSTRUCTIONS**

### **I. SETUP**

### **II. CONDUCTING THE EXAMINATION:**

**A. Unfreeze the simulator and begin the exam.**

**B. Perform 1-PT-60.1, Reactor Containment Average Air Temperature**

1. Initiation:

2. Response:

**C. Power increase from 60% (event 1).**

1. Initiation: Crew should begin in response to shift turnover. If slow to begin, call as System Dispatcher and prompt commencement of load increase.

2. Response: Acknowledge load dispatcher/plant management notifications of the load increase. Respond as field operator in response to notification of starting/stopping plant equipment and as Reactor Engineering concerning MTC (reply that MTC is within limits and that power may increase above 70%).

**D. FT-474 fails low (A S/G FRV closes) (event 2).**

1. Initiation:

2. Response: As SS/NWE state that a work request will be generated and I&C will be notified of the failure. As I&C, reply that a planner will initiate a work package for troubleshooting & repair.

**E. TM-408F fails low (event 3).**

1. Initiation:

2. Response: Respond as SS/NWE/I&C to notification of TM-408F failure. As SS/NWE state that a work request will be generated and I&C will be notified. As I&C, reply that a planner will initiate a work package for troubleshooting/repair.

**F. Loss of Vital bus 1-IV**

1. Initiation:



2. Response:

**G. B RCP TBHX failure / CCTV-11A auto close failure (event 4).**

1. Initiation:

2. Response: Acknowledge direction to SNPO/NWE regarding CCTV-11A operation or verification of RCP seal injection flows. Acknowledge direction as Chemistry to sample CCW for activity (RCS inleakage). After 10-15 minutes, report CCW activity with counting in progress. As HP, direction may be received to survey CCW piping for increased radiation levels. After 8-10 minutes, report radiation above background exists on CCW piping. Request PA announcements be made for personnel to stand clear of CCW piping (if not made already).

**H. Large break loss of coolant accident (event 5)**

1. Initiation: When the B RCP is tripped in response to event 4, actuate the large break LOCA using parameter controller direct trigger.

2. Response: Respond as HP if directed to survey the main steam lines and outside containment. After 10-15 minutes, report elevated general area radiation in all areas near containment. When requested as SNPO to place PAHMs in service, report alignment completion after 10-15 minute delay (parameter controller trigger composite "PAHM").

**I. Loss of offsite power (loss of B 4kV bus) (event 6)**

1. Initiation: Just before the diagnostic steps (27-29) in E-0, actuate a ground on the unit \_\_ startup transformer using parameter controller direct trigger \_\_\_\_

2. Response:

**J. A RHR pump trip (loss of emergency coolant recirc) (event 7).**

1. Initiation: Immediately after transition from FR-P.1 to either FR-Z.1 or back to E-1, actuate increasing bearing wear on A RHR pump using \_\_\_\_ to cause the pump to trip on overcurrent.

2. Response: When directed as SNPO to check out the A RHR pump, wait 1-3 minutes and report as follows:

- If the pump is still running, state that the pump is much noisier than usual and getting worse.
- If the pump has tripped, state that top of the motor casing is very hot with burnt insulation smell in the room. The pump shaft will not rotate (seized) by hand.

### **SIMULATOR INSTRUCTOR FACILITY OPERATING INSTRUCTIONS (cont'd)**

If asked as mechanical maintenance about B EDG, state that the governor is disassembled and awaiting parts arriving tomorrow. Respond as HP as in event 5. Surveys may now include areas around containment. Acknowledge requests as Chemistry to take periodic S/G activity samples (no activity), (provide value from ERDADS) and align PASS.

LCV-115C is deenergized requiring local closure to allow charging pump suction from the RWST per E-1 step 10.

If directed as NPO/SNPO to close in cold leg recirc breakers (E-1 step 17 or ES-1.3 step 10), after a 1-3 minute delay, actuate parameter controller trigger composite \_\_\_\_\_. Since only train A has power available, local operation of train B valves outside containment (MOV-62B/863B/864B only) can be accomplished, if directed, using the RHR PROCESS & SI PROCESS system mimics and taking each valve to FAIL OPEN with a 3-5 minute delay per valve.

After transition to ECA-1.1 (from FR-Z.1 step 5, E-1 step 17 or ES-1.3 step 16), respond as SNPO when directed to manipulate 356/365A/365B. Allow 3-5 minutes before reporting completion. Also respond as SNPO when directed to throttle valve 888B for minimum SI flow from A HHSIP. Allow 2-4 minutes before reporting the initial valve repositioning.

### **III. TERMINATION CRITERIA:**

- A. Upon reduction of SI flow to minimum or trip of all pumps with RWST suction (step 17 or 30 of ECA-1.1),

**OR**

- B. At the discretion of the evaluator.

**EVALUATION SCENARIO CONTENT SUMMARY**

1.	Total Number of Malfunctions:	8
2.	Malfunctions Occurring During EOP Performance:	1
	a. A RHR pump trip /	
	b. loss of emergency coolant recirc	
3.	Abnormal Events:	5
	a. FT-474 fails low	
	b. TM-408 fails low	
	c. Loss of Vital bus 1-IV	
	d. RCP thermal barrier failure	
	e. CCTV-11A auto close failure (Fail trip valve)	
4.	Major Transients:	2
	a. Large break loss of coolant accident	
	b. Loss of offsite power	
5.	EOPs Used:	2
6.	EOP Contingencies Entered:	1
7.	Simulator Run Time:	90 minutes
8.	EOP Run Time:	45 minutes
9.	Crew Critical Tasks:	3

Facsimile notice

To: Rick Baldwin

From: Steve Crawford (North Anna)

Re: Scenarios 1 & 2 for September, 2000 exam

## Appendix D

## Scenario Outline

Form ES-D-1

Facility: North Anna Scenario No.: 2 Op-Test No.: 1

Examiners: \_\_\_\_\_ Operators: (RO) \_\_\_\_\_  
 \_\_\_\_\_ (BOP) \_\_\_\_\_  
 \_\_\_\_\_ (SRO) \_\_\_\_\_

Initial Conditions: BOL. Mode 1, 564 degrees. J EDG is OOS for corrective governor maintenance. No other equipment is OOS. No surveillance tests are in progress.

Turnover: There are thunderstorms in the area with winds clocking at 60 mph. Large golf ball size hail has also been reported. Slight tremors on the order of 2.1 on the Richter scale have been detected.

POD: Perform 1-PT-60.2 Reactor Containment Average Air Temperature, with annulus temperature element 1-LM-TE-100-15 inoperable. Conduct a power increase from 50% to 100%. The system dispatcher has asked that this power increase be expedited to deal with an expected high peak demand towards the end of day shift.

Event No.	Malf. No.	Event Type*	Event Description
1a		N (R)	Perform 1-PT-60.2, Reactor Containment Average Air Temperature <i>Don't have - (1 SLG - B/D)</i>
1		R (R)	Power increase from 50%
2		I (B)	FT-475 failure low (controlling channel)
3		R,I (R)	TM-408F failure low
3a	MEL1304	C (B)	Loss of Vital bus 1-IV <i>Auto br trip - <input type="checkbox"/></i>
4		C (R)	RCP thermal barrier failure CC-TV-116B
5		M (A)	Large break LOCA
6		C (A)	LOOP <i>SPLITS TEAM AP 1007 (Loop)</i>
7		C (A)	A LHSI pump trip (Loss of emergency coolant recirc)

\* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor  
 (R)O, (B)OP, (A)LL

**NORTH ANNA POWER STATION****RO/SRO NRC INITIAL LICENSE EXAM****SIMULATOR EVALUATION SCENARIO NRC-2**

**PROGRAM:** RO/SRO Initial License Training

**DESCRIPTION:** Large Break Loss of Coolant Accident /  
Loss of Offsite Power

**LENGTH:** 90 minutes

**AUTHOR:** R. F. Aiello

**REVISION DATE:** 5/17/00

**REVIEWED BY:** \_\_\_\_\_  
Senior Operations Engineer Date

**APPROVED BY:** \_\_\_\_\_  
NRC Chief Examiner (Sunny) Date

NRC 2

### EVALUATION SCENARIO OBJECTIVES

**TERMINAL OBJECTIVE:** During normal and abnormal plant conditions, the Shift Operating Crew will perform control room operations in accordance with (IAW) approved plant procedures ensuring that the health and safety of the public is protected and the integrity of the plant maintained.

#### ENABLING OBJECTIVES:

1. Given specific plant conditions, plant procedures, and a shift turnover, respond to the following events IAW approved plant procedures:
  - a. Perform 1-PT-60.2, Reactor Containment Average Air Temperature
  - b. Power increase from 50%
  - c. FT-475 failure low (controlling channel)
  - d. TM-408F failure low
  - e. Loss of Vital bus 1-IV
  - f. RCP thermal barrier failure / CC-TV-116B auto close failure
  - g. Large break LOCA
  - h. Loss of offsite power
  - i. A LHSI pump trip (loss of emergency coolant recirculation)
2. Given abnormal plant conditions, mitigate the adverse consequences of the following events IAW approved plant procedures:
  - a. Identify abnormalities while assessing actual system response with respect to predicted system response.
  - b. Investigate the cause and effect of abnormalities in system performance.
  - c. Implement applicable procedures.
  - d. Perform immediate actions from memory.
3. Given abnormal plant conditions, implement the applicable on-site and off-site reports and notifications IAW approved plant procedures.
4. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to all operators, conduct plant operations IAW approved plant procedures:
  - a. Plant and control room communication.
  - b. Plant/Control Board monitoring.
  - c. Plant/Control Board manipulation.
  - d. Operational problem solving.
  - e. Use of OPs/APs and Technical Specifications.
  - f. Use of EOPs IAW EOP Rules of Usage.
  - g. Annunciator recognition and response.
  - h. Written communications/logs.
  - i. ALARA awareness.

NRC 2

**EVALUATION SCENARIO OBJECTIVES (cont'd)**

5. Given normal and abnormal plant conditions, using the following principles for operational effectiveness as they apply to the Unit Supervisor (US), conduct plant operations IAW approved plant procedures:

- a. Team performance management.
- b. Problem solving.
- c. Decision analysis.
- d. Action planning.
- e. Self-checking.

6. During abnormal and emergency events, the shift operating crew shall apply techniques of teamwork and self-checking IAW established work practices and operating guidelines.



NRC 2

### EVALUATION SCENARIO DESCRIPTION

**Initial Conditions:** Mode 1, 50% power

**Turnover:** Power increase from 50% to 100% power is in progress following main feed pump breaker repair. The system dispatcher has asked that this power increase be expedited to deal with an expected high peak demand towards the end of day shift. J EDG is OOS for corrective governor maintenance. Perform 1-PT-60.2, Reactor Containment Average Air Temperature PT with annulus temperature element 1-LM-TE-100-15 inoperable.

**Synopsis:** Perform 1-PT-60.2, Reactor Containment Average Air Temperature. After a 5% power increase (or at lead examiner direction) the controlling steam flow channel on A S/G (FT-475) fails low causing FCV-478 to automatically close. Operator action is required to manually control A S/G level and select the other steam flow channel for level control input. The crew responds per 1-AP-3. Once the plant is stabilized, Technical Specifications are consulted and the crew briefed on the effects of the failure. Next, TM-408F fails low generating erroneous Tref input to rod control. If rods are in AUTO, inward rod movement occurs and operators respond per 1-AP-1.1 taking rod control to manual. Next, the Vital Bus Inverter for Vital Bus 1-IV will fail resulting in a loss of vital bus 1-IV. The crew should identify the bus failure and enter 0-AP-10, "Loss of Electrical Power". The crew will be informed that the Inverter has failed and they will need to re-energize the vital bus via the SOLA transformer. The Unit Supervisor (US) should refer to technical specifications and declare the vital bus inoperable since it is being supplied by the SOLA transformer. Once the bus is re-energized the next event will occur. Following plant stabilization, the B RCP thermal barrier HX experiences a large leak and CC-TV-116B fails to automatically close on high flow. The operators respond per 1-AP-16. After thermal barrier return isolation, RCP shaft vibration begins to increase enough to eventually require a reactor & B RCP trip per AR-A-E6. When B RCP is tripped, the leak becomes a large break loss of coolant accident on the B RCS loop. The crew responds per E-0. While verifying FW isolation, a loss of offsite power occurs. Since the J EDG is OOS, only the H 4kV bus re-energizes on the H EDG. Train A safeguards loads fail to restart and must be manually restarted. The crew transitions to FR-P.1 momentarily and then to E-1. Then, the A LHSI pump trips causing a loss of all LHSI. If RWST level gets <23%, transition is made to ES-1.3. With no LHSI pumps running whether in E-1 or in ES-1.3 transition is made to ECA-1.1. The exercise is concluded upon reduction of SI flow to minimum (ECA-1.1 step 15), stopping all SI flow (ECA-1.1 step 19) or at the evaluator's discretion. The event is classified after scenario completion as a General Emergency per EPIP-1.01, Tab\_\_.

NRC 2

**Event summary:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
1a	Perform 1-PT-60.2, Reactor Containment Average Air Temperature K/A: 2.1.23 (3.9/4.0)
1	Power increase from 50% K/A: 2.2.2 (4.0/3.5)
2	FT-475 fails low (A S/G FRV closes) K/A: 035K401 (3.6/3.8)
3	TM-408F fails low K/A: 001K602 (2.8/3.3)
3a	Loss of Vital bus 1-IV K/A: 062K301 (3.5/3.9)
4	B RCP TBHX failure / CC-TV-116B auto close failure K/A: 008K104 (3.3/3.8); 003K112 (3.0/3.3)
5	Large break loss of coolant accident K/A: EPE 011; EK309 (4.2/4.5); EK312 (4.4/4.6)
6	Loss of offsite power (loss of J 4kV bus) K/A: EPE055; EA106 (4.1/4.5)
7	A LHSI pump trip (loss of emergency coolant recirc) K/A: E01; EA11 (3.7/3.7); EK22 (3.5/3.8)

**Crew Critical Steps:**

<u>EVENT #</u>	<u>DESCRIPTION</u>
6	1. Ensure one train of safeguards is actuated and running prior to transitioning from E-0
7	1. Stop SI and RHR pumps upon reaching 60,000 gallons in the RWST 2. Make up to the RWST and minimize RWST outflow per ECA-1.1

**Individual Critical Steps:**

The bolded individual actions listed under the respective positions (RO, US, etc.) are for use during evaluations to identify steps that are critical to the individual position.

NRC 2

**EVALUATION SCENARIO PRE-EXERCISE BRIEFING****1. Review the following with students:**

- a. Primary responsibility of the student is to operate the simulator as if it were the actual plant.
- b. The evaluators will observe teamwork skills, communication, and the crew's ability to safely operate the plant during the simulator examination. This includes individual & crew performance.
- c. If you recognize an incorrect decision, response, answer, analysis, action, or interpretation by another crew member but fail to correct it, then the evaluator may assume that you agree with the incorrect item.
- d. The crew should keep a rough log during each scenario sufficient to complete necessary formal log entries.
- e. The simulator instructor facility operator will perform all of the functions of personnel needed outside the control room area.
- f. Before the examination begins, crew members may perform a control board walkdown for up to 10 minutes.

**2. The following are initial conditions for this exam (in shift turnover package, but may be covered verbally if needed):**

- a. Time in core life - 4000 MWD/MTU
- b. Reactor power and power history - 100%-50% 4 hr ago
- c. Turbine status - online
- d. Boron concentration - ppm
- e. Temperature - 564°F
- f. Pressure - 2235 psig
- g. Xenon - Increasing following 100%-50% downpower 4 hr ago.
- h. Core cooling - forced
- i. Tech. Spec. LCO(s) in effect  
- 3.8.1.1 Action b (1 hrs); J EDG OOS (governor)
- j. Tagouts in effect - J EDG
- k. Significant problems/abnormalities - None
- l. Evolutions/maintenance for the coming shift - Return to 100% power this shift. Expedite to meet system peak.
- m. Units 1 and 2 status - unit 1 online; unit 2 s/d

**3. Ensure students understand examination schedule and that a break will be necessary between scenarios to allow simulator initial condition setup. Cover exam security rules to be observed by students both during and after the exam IAW the latest revision of AG-017 or NUREG-1021 as applicable.****4. Before the examination begins, make crew position assignments and allow students to ask any questions concerning the administration of the test.**

NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT: 1a****BRIEF DESCRIPTION:** Reactor Containment Average Air Temperature Test (1-PT-60.2) with Annulus Temperature Element (1-LM-TE-100-15) inoperable.**INDICATIONS:** 1. Shift orders**POSITION   TIME   EXPECTED ACTIONS****BOP** 1. Assists RO as directed by US

**RO**

1. Prints containment temperature elements group review.
2. Determines average temperature of the operable elements at annulus elevation 329 ft.
3. Enters the average value for the inoperable element into the computer.
4. Waits at least one minute for the computer to update.
5. Prints the containment weighted average temperature.
6. Records data in the PT.
7. Performs follow-on tasks and informs US that PT is complete.

**US**

1. Coordinates/directs performance of PT-60.2
2. Keeps SS informed of plant status

NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT: 1****BRIEF DESCRIPTION:** Unit is at reduced power (50%) and is directed to return to 100% power.**INDICATIONS:**  
1. Notification by System  
2. Shift turnover**POSITION   TIME   EXPECTED ACTIONS****BOI<sup>2</sup>**  
1. Increases turbine load at the rate determined by the US.  
2. Keeps US informed of plant status**RO**  
1. Maintains Tref/Tavg approx equal during uppower  
2. At steady state power with Tavg within 1°F of Tref, places rods in AUTO  
3. Keeps US informed of plant status**US**  
1. Coordinates and directs uppower evolution  
2. Keeps SS informed of plant status

NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT: 2**

**BRIEF DESCRIPTION:** A S/G controlling steam flow FT-475 fails low. The A S/G FRV requires manual operation. The channel is called OOS and compensatory actions are initiated per AP-3.

**INDICATIONS:**

1. Annunciator F-E1, SG A FEED > STEAM
2. Annunciator F-F1, SG A LEVEL ERROR
3. FI-475 off scale low
4. FCV-478 closing in AUTO
5. Decreasing level in A S/G

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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<b>BOP</b>	1.	Recognizes failure of FT-475 and responds as directed by US <ol style="list-style-type: none"> <li>a. Compares to other SG FT's and verifies no off-normal conditions on other SG FT's</li> </ol>
	2.	Notifies US of failure
	3.	Takes manual control of FCV-478, restores steam/feed flow balance and stabilizes SG level
	4.	Selects alternate SG steam FT channel for control and returns FCV-478 to automatic
<b>RO</b>	1.	Assists BOP as directed by US
<b>US</b>	1.	Directs stabilization of plant conditions
	2.	Directs compensatory action per AP-3 <ol style="list-style-type: none"> <li>a. Verifies BOP determination of SG FT status</li> <li>b. Determines which b/s to trip and effects on plant of tripping b/s. Provides this info to RO/BOP for guidance.</li> </ol>
	3.	Notifies SS of plant status

NRC 2

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 2 (cont'd)

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
US (cont'd)	4.	Ensures Tech Spec requirements are met
	5.	Notifies I&C of FT-475 failure and directs initiation of PWO

NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT: 3**

**BRIEF DESCRIPTION:** TM-408F loses power. Rod control Tref fails low. Rods step in if in AUTO. The crew responds per AP-1.1.

**INDICATIONS:**

1. Annunciator B-A7, Tavg-Tref DEVIATION
2. Tref input on Tavg-Tref recorder failed low
3. Control rods stepping in if in AUTO

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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BOIP	1.	Assists RO as directed by US.
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RO	1.	<b>Responds to TM-408F failure per AP-1.1:</b> <ol style="list-style-type: none"> <li>a. Determines rods should NOT be moving, places rods in MANUAL &amp; verifies rod motion stopped</li> <li>b. Verifies rod low-low insertion limits not exceeded</li> <li>c. Increases Tave to match Tref using rods or dilution as directed by US</li> <li>d. Checks PRZR pressure and level stable</li> <li>e. Checks rods above low insertion limit and restores if necessary as directed by US</li> </ol>
	2.	Informs US of plant status

US	1.	Directs response per AP-1.1
	2.	Informs SS/I&C of TM-408F failure
	3.	Directs PWO initiation



NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT:** 3a**BRIEF DESCRIPTION:** A loss of vital bus 1-IV occurs. The crew responds per 0-AP-10.

**INDICATIONS:**

1. Numerous status lights due to de-energized ch IV instruments
2. Vital bus 1-IV voltmeter decreases to zero
3. Annunciator H-A4, VITAL BUS 1-IV INVERTER TROUBLE

**POSITION** **TIME****EXPECTED ACTIONS****BOP**

1. Identifies annunciator 1H-A4, VITAL BUS 1-IV INVERTER TROUBLE
2. Identifies loss of vital bus 1-IV.
3. Notifies US of vital bus loss.
4. Directs safeguards operator to investigate loss of vital bus 1-IV.
5. Enters 0-AP-10 and performs electrical system diagnostic.
6. Restores vital bus per MOP-26.63

**RO**

1. Assists BOP as directed by US.

**US**

1. Directs BOP to enter 0-AP-10.
2. Directs electrical department to investigate 1-IV vital bus and inverter.
3. Directs backboards to energize the vital bus via the SOLA transformer.
4. Refers to TS 3.8.2.1 and MOP-26.63 and declares the vital bus inoperable.
5. Backboards energizes the vital bus via the SOLA transformer.

NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT: 4**

**BRIEF DESCRIPTION:** B RCP thermal barrier HX (TBHX) fails. CC-TV-116B fails to auto close on high flow requiring manual closure. ARP-C-C4 is performed. After CC-TV-116B closure, B RCP shaft vibration increases requiring a reactor trip.

**INDICATIONS:**

1. CCW R/M alarm
2. CCW surge tank level increases
3. Annunciator K-D2, RAD MONITOR SYSTEM HI RAD LEVEL, actuates
4. Annunciator C-C4, RCP A-B-C THERMAL BARR CC HI-LO FLOW, alarms (CC-TV-116B fails)
5. Annunciator C-D4, RCP A-B-C THERM BARR CC HI TEMP, alarms.
6. Annunciator A-E6, RCP 1B VIBRATION ALERT/DANGER

**POSITION   TIME   EXPECTED ACTIONS**

<b>BOF</b>	<ol style="list-style-type: none"> <li>1. Performs actions as directed per AP-5:               <ol style="list-style-type: none"> <li>a. Checks CCHX R/M alarm valid</li> </ol> </li> <li>2. Recognizes/reports shaft high vibration condition (annunciator A-E6)</li> <li>3. Performs E-0 immediate actions when directed by US</li> </ol>
<b>RO</b>	<ol style="list-style-type: none"> <li>1. Recognizes RCP TBHX failure &amp; informs US</li> <li>2. Performs actions as directed by ARP-C-C4               <ol style="list-style-type: none"> <li>a. Verifies/manually closes CC-TV-116B</li> <li>b. Verifies seal injection flow to B RCP</li> <li>c. Monitors B RCP temperatures</li> </ol> </li> <li>3. Performs actions as directed per AP-5:               <ol style="list-style-type: none"> <li>a. Requests CCW activity sample from Chemistry</li> </ol> </li> <li>4. Performs actions as directed by ARP-A-E6               <ol style="list-style-type: none"> <li>a. Trips reactor &amp; B RCP when directed</li> </ol> </li> </ol>

NRC 2

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 4 (cont'd)**POSITION   TIME   EXPECTED ACTIONS**

US	1.	Directs mitigative actions IAW ARP-C-C4, A-E6, and AP-5
	a.	Directs CC-TV-116B closure
	b.	Directs reactor trip followed by B RCP trip due to high shaft vibration
	2.	Informs SS of plant status

NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT: 5 & 6**

**BRIEF DESCRIPTION:** In response to plant conditions, a reactor trip & SI has occurred. Operators perform actions of E-0. While verifying FW isolation per E-0, a loss of offsite power occurs and train A ESF loads fail to restart requiring manual restart. E-0 is completed and transition is then made to E-1.

**INDICATIONS:**

1. Reactor trip directed or actuates
2. Rod bottom lights on and RTBs/BYBs open
3. SI alarms & ESF equipment auto starts
4. Switchyard deenergizes & only H emergency bus reenergizes (J EDG OOS)

**CREW CRITICAL STEPS:**

1. Ensure one train of safeguards is actuated and running prior to transitioning from E-0

<u>POSITION</u>	<u>TIME</u>	<u>EXPECTED ACTIONS</u>
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BOP	1.	Responds to reactor trip and SI per E-0
	a.	Verifies turbine trip
	b.	Manually initiates SI
	c.	Verifies feedwater isolation
	d.	Manually initiates containment isolation phase A
	e.	Verifies AFW pumps running - NO
	1.	Manually starts the A AFW pump
	f.	Verifies LHSI pumps running
	g.	Verifies SW pumps running - NO
	1.	Manually starts the A SW pump
	h.	Checks if main stm lines should be isolated
	i.	Manually initiates CDA

NRC 2

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 5 & 6 (cont'd)**POSITION   TIME   EXPECTED ACTIONS****BOIP(cont)**

1. Responds to reactor trip and SI per E-0 (cont'd)
  - j. Verifies CC pumps stopped
  - k. Verifies QS pumps running
  - l. Verifies HHSI and LHSI flow
  - m. Verifies proper AFW alignment and flow
  - n. Performs MSIB & SGTR diagnostics
2. Informs US of plant status

**RO**

1. Responds to reactor trip per E-0
  - a. Verifies reactor tripped
  - b. Verifies both AC emergency busses energized
  - c. Manually initiates SI
2. Performs continuous action page items as directed by US
  - a. Checks RCS subcooling and HHSI flow, then trips all RCPs
  - b. Closes all charging pump recirc valves
  - c. Manually actuates CDA

NRC 2

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 5 & 6 (cont'd)**POSITION   TIME   EXPECTED ACTIONS****RO**

3. Performs subsequent actions of E-0 as directed by US
  - a. Manually initiates containment isolation phase A
  - b. Verifies charging pumps running
  - c. Checks RCS Tave
  - d. Checks PRZR PORVs/spray valves closed
  - e. Checks RCP trip and charging pump recirc criteria
  - f. Performs LOCA diagnostics

**US**

1. Directs response to reactor trip per E-0
  - a. Obtains verification of reactor trip
  - b. Determines electric plant status
  - c. Directs manual SI/phase A if required
  - d. Monitors continuous action page items:
    1. Direction to RO to stop all RCPs and close charging pump recirc valves if required by subcooling/Phase B actuation/RCS pressure
    2. Directs manual initiation of CDA
  - e. Directs manual start of train A AFW and SW pumps
2. Transitions to appropriate plant procedure (E-1 or appropriate FRP)
3. Informs SS as to status of plant

NRC 2

**EXPECTED OPERATOR ACTIONS****EVENT: 7****BRIEF DESCRIPTION:**

With a large break LOCA/LOOP, only train A ESF is running (J EDG OOS). From E-0, FR-P.1 is briefly entered followed by transition to either FR-Z.1 if needed or E-1 after which A LHSI pump trips. From E-1, if RWST level is <23%, ES-1.3 is entered. With no LHSI pumps, ECA-1.1 is entered.

**INDICATIONS:**

1. Cntmt radiation & sump level indications abnormal
2. Safety injection actuated and injecting
3. RWST level dropping (<23% for ES-1.3)
4. RCS cold leg temperature (<285°F for FR-P.1)
5. Annunciator J-A5, LHSI PP A LO OR OL TRIP

**CREW CRITICAL STEPS:**

1. Stop charging/QS pumps upon reaching 3% in the RWST
2. Make up to the RWST and minimize RWST outflow per ECA-1.1

**POSITION   TIME   EXPECTED ACTIONS****BOF'**

1. Performs actions of E-1 as directed:
  - a. Checks for faulted S/Gs
  - b. Checks S/G levels and secondary radiation
  - c. Checks QS/casing cooling/RS pump status
  - d. Checks if EDGs should be stopped – NO
  - e. Identifies A LHSI pump tripped and informs US
  - f. Checks for cold leg recirc capability - NO
  - g. Identifies RWST lvl <23% & informs US
2. Performs actions of ES-1.3 as directed:
  - a. Verifies proper operation of SW system
  - b. Verifies RS pumps aligned and running
  - c. Verifies LHSI pumps running

NRC 2

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7 (cont'd)**POSITION   TIME   EXPECTED ACTIONS****BOF**  
(cont'd)

3. Performs actions of ECA-1.1 as directed
  - a. Checks for cold leg recirc capability - NO
  - b. Resets SI recirc mode
  - c. Maintains intact S/G levels 11 – 50%
  - d. Initiates RCS cooldown using S/G PORVs
4. Performs actions of FR-Z.1 as directed
  - a. Verifies phase A valves closed
  - b. Checks if CDA is required
  - c. Verifies proper operation of QS/SW/RS systems
  - d. Verifies MS isolation
  - e. Checks if SG feed flow should be isolated
5. Informs US of plant status

**RO**

1. Performs actions of FR-P.1 as directed:
  - a. Checks RCS press > 225 [450] psig – NO
    1. Checks LHSI flow > 650 gpm
2. Performs actions of E-1 as directed:
  - a. Check RCP trip and charging pump recirc criteria
  - b. Verifies SI, phase A and AMSAC reset
  - c. Checks PRZR PORVs and block valves
  - d. Checks if SI should be terminated – NO



NRC 2

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7 (cont'd)**POSITION    TIME    EXPECTED ACTIONS****RO  
(cont'd)**

2. Performs actions of E-1 as directed (cont'd):
  - e. Resets CDA
  - f. Checks if cntmt spray should be stopped
  - g. Checks if LHSI pumps should be stopped – NO
3. Performs actions of ES-1.3 as directed:
  - a. Verifies SI reset
  - b. Checks two charging pumps running - NO
  - c. Verifies LHSI pumps running
  - b. Aligns SI system for cold-leg recirc
  - c. Checks VCT level
4. Performs actions of ECA-1.1 as directed:
  - a. Checks cold-leg recirc capability available – NO
  - b. Verifies SI reset
  - c. Aligns makeup to the RWST
  - b. If RWST level <3%, stops charging/QS pumps
  - e. Checks containment air recirc fans
  - f. Verifies only one charging pump running
  - g. Checks if an RCP should be started - NO
  - h. Establishes minimum SI as directed
6. Informs US of plant status

NRC 2

**EXPECTED OPERATOR ACTIONS (cont'd)****EVENT:** 7 (cont'd)**POSITION   TIME   EXPECTED ACTIONS**

- US**
1. Determines FR-P.1 N/A for LBLOCA
  2. Directs response to LBLOCA per E-1:
    - a. Determines SI cannot be terminated
    - b. Transitions to appropriate procedure or FRP if required by red/orange path CSFST:
      - 1) FR-Z.1 if CNMT pressure > 60 psia
      - 2) ES-1.3 if RWST level < 23%
      - 3) ECA-1.1 for loss of both LHSI pumps
  3. If applicable, directs response to LBLOCA per ES-1.3 but determines no LHSI pumps operable and transition required to ECA-1.1
  4. Directs response to LBLOCA per ECA-1.1:
    - a. Directs addition of makeup to the RWST
    - b. Directs RCS cooldown
    - c. If RWST level >3%:
      - 1) Reduces containment spray to minimum
      - 2) Verifies no backflow from RWST to sump & determines RCP could not be started
      - 3) Determines minimum SI flow (figure 1) & directs action accordingly
    - d. If RWST level < 3%, directs all charging and QS pumps to be stopped
  5. Classifies event as a \_\_\_\_\_ per EPIP-1.01, Tab(s) \_\_\_\_\_
  6. Informs SS of status of unit

NRC 2

**SIMULATOR INSTRUCTOR FACILITY OPERATING INSTRUCTIONS****I. SETUP**

- A. Recall IC #
- B. Verify channel IV SF/FF/1<sup>st</sup> stage pressure selected for SGWLC
- C. Verify analog trend pens set up for Tave, Tref, CTMT temperature & VCT level
- D. Verify the following malfunctions are preloaded:

**II. CONDUCTING THE EXAMINATION:**

- A. Unfreeze the simulator and begin the exam.
- B. Perform 1-PT-60.2, Reactor Containment Average Air Temperature
  - 1. Initiation: Crew should begin in response to shift turnover.
  - 2. Response:
- C. Power Increase from 50% (event 1).
  - 1. Initiation: Crew should begin in response to shift turnover. If slow to begin, call as System Dispatcher and prompt commencement of load increase.
  - 2. Response: Acknowledge load dispatcher/plant management notifications of the load increase. Respond as field operator in response to notification of starting/stopping plant equipment.
- D. FT-475 fails low (A S/G FRV closes) (event 2).
  - 1. Initiation: MMS0102; TD = 10 sec; ramp = 60 sec; start deg = 50; stop deg = 0; trigger = N/A
  - 2. Response: As SS state that a work request will be generated and I&C will be notified of the failure. As I&C, reply that a planner will initiate a work package for troubleshooting & repair.
- E. TM-408F fails low (event 3).
  - 1. Initiation: MRD07 (continuous rod insertion in AUTO); TD = 20 sec; trigger = N/A  
Meter override: TM-408B (Tref)
  - 2. Response: Respond as SS/I&C to notification of TM-408B failure. As SS state that a work request will be generated and I&C will be notified. As I&C, reply that a planner will initiate a work package for troubleshooting/repair.

NRC 2

**SIMULATOR INSTRUCTOR FACILITY OPERATING INSTRUCTIONS (cont'd)**

- F. Loss of Vital bus 1-IV**
1. Initiation: MEL1304; TD = 30 sec; trigger = N/A
  2. Response: Report as safeguards watchstander that the 1-IV inverter appears to have smoked, the outside is charred. Report as the electricians that the inverter is damaged and cannot be re-energized. Also report that the 1-IV vital bus has been checked and has been given the "OK" to re-energize.
- G. B RCP TBHX failure / CCTV-11A auto close failure (event 4).**
1. Initiation:
  2. Response: Acknowledge direction to auxiliary building watchstander for verification of RCP seal injection flows. Acknowledge direction as Chemistry to sample CCW for activity (RCS inleakage). After 10-15 minutes, report CCW activity with counting in progress. As HP, direction may be received to survey CCW piping for increased radiation levels. After 8-10 minutes, report radiation above background exists on CCW piping. Request plant announcements be made for personnel to stand clear of CCW piping (if not made already).
- H. Large break loss of coolant accident (event 5)**
1. Initiation: When the B RCP is tripped in response to event 4, actuate the large break LOCA using parameter controller direct trigger.
  2. Response: Respond as HP if directed to survey the main steam lines and outside containment. After 10-15 minutes, report elevated general area radiation in all areas near containment.
- I. Loss of offsite power (loss of B 4kV bus) (event 6)**
1. Initiation: MEL01; TD =
  2. Response:
- J. A RHR pump trip (loss of emergency coolant recirc) (event 7).**
1. Initiation: Immediately after transition from FR-P.1 to either FR-Z.1 or back to E-1, actuate increasing bearing wear on A RHR pump using \_\_\_\_ to cause the pump to trip on overcurrent.

NRC 2

**SIMULATOR INSTRUCTOR FACILITY OPERATING INSTRUCTIONS (cont'd)**

2. Response: When directed as safeguards watchstander to check out the A LHSI pump, wait 1-3 minutes and report as follows:

- If the pump is still running, state that the pump is much noisier than usual and getting worse.
- If the pump has tripped, state that top of the motor casing is very hot with burnt insulation smell in the room. The pump shaft will not rotate (seized) by hand.

If asked as mechanical maintenance about J EDG, state that the governor is disassembled and awaiting parts arriving tomorrow. Respond as HP as in event 5. Surveys may now include areas around containment. Acknowledge requests as Chemistry to take periodic S/G activity samples (no activity).

**III. TERMINATION CRITERIA:**

- A. Upon reduction of SI flow to minimum or trip of all pumps with RWST suction (step 17 or 30 of ECA-1.1),

**OR**

- B. At the discretion of the evaluator.

NRC 2

**EVALUATION SCENARIO CONTENT SUMMARY**

1.	Total Number of Malfunctions:	8
2.	Malfunctions Occurring During EOP Performance:	1
	a. A RHR pump trip /	
	2. loss of emergency coolant recirc	
3.	Abnormal Events:	5
	a. FT-475 fails low	
	b. TM-408 fails low	
	c. Loss of Vital bus 1-IV	
	d. RCP thermal barrier failure	
	e. CC-TV-116B auto close failure	
4.	Major Transients:	2
	a. Large break loss of coolant accident	
	b. Loss of offsite power	
5.	EOPs Used:	2
6.	EOP Contingencies Entered:	1
7.	Simulator Run Time:	90 minutes
8.	EOP Run Time:	45 minutes
9.	Crew Critical Tasks:	3

## Lessons-Learned

### Examiner Note 2000-03

The Chief Examiners met on August 2, 2000 to discuss experiences from their most recent examinations in order to identify common issues, resolution of these issues, good practices and lessons-learned. This note documents the results of this meeting. It is intended to periodically conduct similar meetings in the future and to share the results with all examiners to improve efficiency and effectiveness.

1. During JPM validation on prep week, examiners must ensure they understand the intention behind all initial conditions, initiating cues, all cues/prompts to be given, the task's procedural steps, the basis behind each critical step and the alternative actions that may arise due to incorrect performance by the applicant. Many mistakes are being observed during exam administration and appear to be due to inadequate examiner preparation. This leads to possible compromise of the JPM's validity, causes applicant confusion and anxiety, and could lead to incorrect grading. It has been suggested that a simplified one-line diagram for the system in question be attached to the JPM as an examiner reference to better understand the equipment alignment and the applicant's actions.
2. Administration of control room system JPMs (Part B.1 of the operating test) in the control room is difficult at best. If the number of applicants and exam scheduling allows, examiners should perform as many of these JPMs as possible on a "live" simulator. In particular, alternate-path JPMs should be performed on the simulator in most instances. Verbal cuing of difficult and abnormal plant configurations using control room panels showing a 100% power lineup may result in poor applicant performance that has nothing to do with a lack of knowledge, skill or ability. Our test items must be able to discriminate whether an applicant is safe or unsafe to operate the plant. They must not yield unsatisfactory results based on improper test conditions or inadequate measurement tools.
3. It is important that examinations developed by our staff follow and meet the requirements of NUREG-1021. We must be as critical of our own test items and examinations as we would be of the licensee's. A key element to accomplish this goal is a thorough and independent review of all material by another examiner. Specifically, this should not be the Chief Examiner (he performs a different, higher level review.) Currently, personnel resources limit our ability to achieve this goal. Chief Examiners must balance the desire for a high quality, discriminating examination with available resources. In all cases, examinations must meet at least the minimum requirements of NUREG-1021 to authorize administration. However, the quality of these examinations may be lower

(more minor errors, small oversights) than normally generated by this staff. As more examiners are added to the branch, these resources will be scheduled to support the guidelines of NUREG-1021 to a greater extent. It is expected we will see some relief in this area beginning the second quarter of CY 2001.

4. In the past, the long term schedule has not properly aligned staff resources with the scope of effort defined by the agreement with the licensees in many instances. To better define the scope of effort and schedule adequate staff resources, a quarterly meeting of the Chief Examiners will be held addressing the management of exams 12-18 months in the future. In particular, the Chief Examiners will be asked to assess the number and timing of examiner resources needed to accomplish the scope of their examination. A special meeting will also be held each FY to discuss the exam requests from each licensee before committing to a specific date of exam and scope of effort. This meeting will coordinate, to the extent possible, staff resources with all known commitments including training, mandatory meetings (e.g., DRS/DRP inspector counterpart meetings, Examiner Conferences), holidays, vacation schedules, etc. Project management software to administer and track these needs and commitments will be purchased once adequate software is identified.
5. An issue related to scheduling is identifying typing, reproduction, ADAMS scanning, shipping, etc. needs for each examination and arranging for those resources (including those from outside this branch) sufficiently in advance to avoid last minute crises. This may require shifting of examination deliverable due dates outside of those listed in NUREG-1021. Again this should be considered by each Chief Examiner during the quarterly meeting discussed above. However, we also need to be creative in finding ways around these and other similar issues. There must be alternatives to generating a ton of paper for each applicant (most of which is eventually thrown away) and transporting it to the site for each exam. One suggestion was to evaluate the possibility of loading all the examination material onto a palm-held, electronic device (PDA or equivalent) and using it to administer the examination to each applicant and to document their performance. As envisioned, each examiner would have their own palm-held computer assigned for this purpose. If anyone has other ideas, concerns, suggestions, or experience to address this issue, please provide them to Charlie.
6. It was suggested that peer level training of examiners would be useful in certain areas so that examination development expectations would be more consistent between Chief Examiners. For example, what types of questions or JPMs are appropriate for testing under the Admin part of the operating test? What characterizes a written exam question as at the "SRO level?" When is a question a "direct look up?" What is a "critical step?" When these types of questions arise, each examiner should attempt to research the issue, to develop a proposed resolution, to obtain a consensus on the resolution, to conduct training on the issue, and finally to document (and distribute to every examiner) the issue/resolution as an Examiner Note. When this is not possible, the issue should be brought to the Branch Chief who will assign someone to perform the above actions.



Reference: Chief Examiner meeting (Aiello,Baldwin,Ernstes,Hopper,Payne,Casto), dtd 8/2/00