Form 3.3-1 Scenario Outline

| | | | |
|---|---|---|---|
| Facility: | Salem | Scenario #: | 4 |
| Scenario Source: | 20-01 ESG-4 | Op. Test #: | 21-01 |
| Examiners: | | Applicants/ Operators: | |

Initial Conditions: Salem Unit 2 is at 2% power BOL; 21 SGFP in service

Turnover: The crew is directed to continue power ascension to 10% reactor power IAW S2.OP-IO.ZZ-0003 using control rods, steam dumps, and turbine load control.

Critical Tasks:

1. Establish 220,000 lbm/hr AFW flow before steam generator dryout occurs (WR ≤ 11%) during SBO
2. Depressurize the intact SG(s) such that a maximum of 100°F per hour cooldown rate is established and SG pressure(s) does not go below 310 psig

| Event No. | Malf. No. | Event Type* | Event Description |
|---|---|---|---|
| 1 | N/A | ATC(R)<br>BOP(R)<br>CRS(N) | Continue power ascension to 10% IAW IOP-3 and enter MODE 1. |
| 2 | VC0311A | ATC (I)<br>CRS (I,TS) | Containment pressure channel fails high |
| 3 | CV0035 | ATC(C,MC)<br>CRS(C) | Charging Master flow controller fails low |
| 4 | SW0216A | BOP(C)<br>CRS(I,TS) | # 2 SW bay leak |
| 5 | EL0134 | All(M) | Loss of offsite power |
| 6 | EL0144<br>EL0145<br>EL0163 | ATC(C)<br>BOP(C)<br>CRS(C) | Loss of all AC power**(CT-2)** |
| 7 | AF0353C | BOP(I,MC)<br>CRS(I) | 23 AFW pump fails to start**(CT-1)** |
| | | | |
| | | | |
| | | ABs | IOP-3 → ARP → AB.CVC-1 → AB.SW-2 |
| | | EOPs | LOPA-1 |
| | | | |
| | | | |

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor, (TS)Tech Spec, (MC)Manual Control

## I. OBJECTIVES

1. Given the order, perform actions to raise reactor power IAW S2.OP-IO.ZZ-0003, Hot Standby to Minimum Load.
2. Given the order or indications of a Containment Pressure Channel malfunction, perform actions as the nuclear control operator to RESPOND to the malfunction in accordance with the approved station procedures.
3. Given the order or indications of a charging system malfunction, perform actions as the nuclear control operator to RESPOND to the malfunction in accordance with the approved station procedures.
4. Given the order or indications of a charging system malfunction, DIRECT the response to the malfunction in accordance with the approved station procedures.
5. Given the unit at power and a leak of a Service Water Bay, take corrective action IAW AB.SW-0003.
6. Given the order or indications of a SW Bay leak, perform actions as the nuclear control operator to RESPOND to the malfunction, IAW approved station procedures.
7. Given the order or indications of a SW Bay leak, DIRECT the response to the malfunction IAW approved station procedures.
8. Given the order or indications of a reactor trip, perform actions as the nuclear control operator to RESPOND to the reactor trip in accordance with the approved station procedures.
9. Given indication of a reactor trip, DIRECT the response to the reactor trip in accordance with the approved station procedures.
10. Given the order or indications of a loss of all AC power, complete actions as the nuclear control operator to PERFORM the immediate response in accordance with the approved station procedures.
11. Given the order with the immediate response to a loss of all AC accident completed and no safety injection actuated or required, perform actions as the nuclear control operator to RECOVER from the loss of AC in accordance with the approved station procedures.
12. Given indication of a loss of all AC power, DIRECT the immediate response in accordance with the approved station procedures.
13. Given the plant with the immediate response completed for a loss of all AC power which did not result in a required safety injection, DIRECT the recovery of the loss of AC in accordance with the approved station procedures.

## II. MAJOR EVENTS

1. Power Ascension
2. Containment pressure channel 1 fails high
3. Charging master flow controller failure requiring manual control of charging
4. #2 SW bay leak
5. Loss of Offsite power
6. Loss of all AC Power
7. Failure of 23 AFW pump to auto start

## III. SCENARIO SUMMARY

1. The crew will take the watch with the unit stable at 3% reactor power during a plant startup, BOL. 21 SGFP is in service and 22 SGFP is not in service. Steam dumps are in Main Steam Pressure Control, Automatic, set at 1000 psig. The crew will be instructed to raise power to 10% and enter Mode 1.
2. The crew will initiate power ascension to 10%, and enter Mode 1, using Main Steam Dumps and control rods IAW **S2.OP-IO.ZZ-0003**, Hot Standby to Minimum Load and S2.OP-SO.MS-0002, Steam Dump System Operation, Attachments 3 or 4.
3. Containment pressure channel 1 will fail high. Operators will respond IAW S2.OP-AR.ZZ-0003, Overhead annunciator window C alarm response procedure. CRS will evaluate TS and Enter TS 3.3.2.1 Act b 16. After Tech Specs has been evaluated, Event #3 will be entered.
4. After the containment Pressure channel is addressed, The Charging Master flow controller fails LOW. The crew will enter S2.OP-AB.CVC-0001, Loss of Charging, the crew will take actions place the master flow controller in manual and adjust flow. The CRS will establish band for operation of the Charging Master flow controller. The crew will hold a brief after band established and AB actions completed, upon completion of the brief or update event #4 will be entered.
5. After the Master flow controller failure is addressed, the number 2 Service water bay will experience a leak and require isolation IAW S2.OP-AB.SW-0003, Service Water bay leak. The crew will start all bay 4 pumps and shutdown all bay 2 pumps, as well as performing isolation of the bay utilizing MOV's operated from the control room. The CRS will evaluate Tech Specs with the Service Water bay isolated and enter TS 3.7.4. The crew will direct removal of a CCHX from service and removal of control power from all bay 2 pumps. After Tech Specs is evaluated, Event #5 can be entered.
6. A loss of offsite power will occur. The crew will experience an automatic trip of the unit 2 reactor when all offsite power is lost. The crew will enter EOP-TRIP -1, Reactor Trip response, and transition to EOP-LOPA-1, Loss of all AC power, when it is recognized that no vital buses have power. In LOPA-1 the crew will take actions to check plant conditions, restore AC power, maintain conditions for optimal recovery, Determine if ELAP declaration is required, Commence cooldown when AC power is not yet available. **(CT-2)**

7. While in the EOP network the 23 AFW pump will fail to start. The 23 AFW pump should automatically start with the Loss of offsite power. The crew will take the actions to start the 23 AFW pump to maintain a source of inventory control for the Steam generators. **(CT-1)**
8. The scenario may be terminated when cooldown has been commenced and CT 2 evaluated or by direction from the Lead Examiner.

## IV. INITIAL CONDITIONS

____ IC-239

**PREP FOR TRAINING (i.e. computer setpoints, procedures, bezel covers ,tagged equipment)**

| *Initial* | Description |
|---|---|
| ____ 1 | VC1and VC4 C/T |
| ____ 2 | RCPs (SELF CHECK) |
| ____ 3 | RTBs (SELF CHECK) |
| ____ 4 | MS167s (SELF CHECK) |
| ____ 5 | 500 KV SWYD (SELF CHECK) |
| ____ 6 | SGFP Trip (SELF CHECK) |
| ____ 7 | 23 CV PP (SELF CHECK) |
| ____ 8 | **21 SGFP is in service** |
| ____ 9 | **IOP-3 open and complete up to step 4.3.16, Power Operation. Attachment 4 is marked up.** |
| ___ 10 | **Steam Dumps are in MS Pressure Mode and Auto, and S2.OP-SO.MS-0002 is open and marked up to step 4.4.1** |
| ___ 11 | **Rod control in manual.** |
| ___ 12 | Complete Attachment 2 “Simulator Ready-for-Training/Examination Checklist.” |

Note: Tables with blue headings may be populated by external program, do not change column name without consulting Simulator Support group

## EVENT TRIGGERS:

| Initial | ET # | Description | |
|---|---|---|---|
| | 1 | EVENT ACTION:<br>COMMAND:<br>PURPOSE: | kb423dmj //CHARGING FLOW DEM-MANUAL (MAST<br>DMF CV0035<br><update as needed> |
| | 2 | EVENT ACTION:<br>COMMAND:<br>PURPOSE: | MONP254 < 10. //CONT ROD BANK C < 10 ( RX TRIP )<br><br><update as needed> |

## MALFUNCTIONS:

| *SELF-CHECK* | Description | Delay Time | Initial Value | Ramp Time | Trigger | Severity |
|---|---|---|---|---|---|---|
| _____ 01 | VC0311A Containment Presssure CH I (PT948D) FAILS (NR only) | N/A | N/A | N/A | RT-1 | 55 |
| _____ 02 | CV0035 CHRG MASTER FLO CNTRLR FAILS H/L | N/A | 37 | 00:05:00 | RT-2 | 0 |
| _____ 03 | SW0216A 21 SW HDR LEAK IN SW STRUCTURE | N/A | 500 | 00:03:00 | RT-3 | 8000 |
| _____ 04 | EL0134 LOSS OF ALL 500KV OFF-SITE POWE | N/A | N/A | N/A | RT-4 | |
| _____ 05 | AF0353C 23 AFP FAILURE TO AUTO START ON ANY (ALL) SIGNALS | N/A | N/A | N/A | N/A | |
| _____ 06 | EL0144 LOSS OF 2A 4160V VITAL BUS | N/A | N/A | N/A | ET-2 | |
| _____ 07 | EL0145 LOSS OF 2B 4160V VITAL BUS | N/A | N/A | N/A | ET-2 | |
| _____ 08 | EL0163 2C EMERG DIESEL GENERATOR TRIP | 00:00:20 | N/A | N/A | ET-2 | |
| _____ 09 | VL0045 2CV116 Fails to Position ( 0-100% ) | N/A | N/A | N/A | RT-13 | 0 |
| _____ 10 | VL0087 2CC131 Fails to Position ( 0-100% ) | N/A | N/A | N/A | RT-13 | 0 |

## REMOTES:

| *SELF-CHECK* | Description | Delay Time | Initial Value | Ramp Time | Trigger | Condition |
|---|---|---|---|---|---|---|
| _____ 01 | SW23D 21 SW PUMP BKR CONTROL POWER | 00:00:30 | N/A | N/A | RT-10 | OFF |
| _____ 02 | SW27D 22 SW PUMP BKR CONTROL POWER | 00:01:00 | N/A | N/A | RT-10 | OFF |
| _____ 03 | SW32D 23 SW PUMP BKR CONTROL POWER | 00:01:30 | N/A | N/A | RT-10 | OFF |
| _____ 04 | DG01D DEENERGIZE "A" SEC CABINET | N/A | N/A | N/A | RT-9 | YES |
| _____ 05 | DG02D DEENERGIZE "B" SEC CABINET | 00:00:30 | N/A | N/A | RT-9 | YES |
| _____ 06 | DG03D DEENERGIZE "C" SEC CABINET | 00:01:00 | N/A | N/A | RT-9 | YES |
| _____ 07 | AF20D 21 AFW PUMP BKR CONTROL POWER | N/A | N/A | N/A | RT-12 | OFF |
| _____ 08 | AF25D 22 AFW PUMP BKR CONTROL POWER | N/A | N/A | N/A | RT-12 | OFF |
| _____ 09 | AF28D 22 AFW PUMP BKR LOCAL TRIP | N/A | N/A | N/A | RT-12 | TRIP |
| _____ 10 | AF23D 21 AFW PUMP BKR LOCAL TRIP | N/A | N/A | N/A | RT-12 | TRIP |
| _____ 11 | CV28A 21CV98 RCP SEAL INJ MAN ISOL | N/A | N/A | N/A | RT-11 | 0 |
| _____ 12 | CV29A 22CV98 RCP SEAL INJ MAN ISOL | N/A | N/A | N/A | RT-11 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| _____ 13 | CV30A 23CV98 RCP SEAL INJ MAN ISOL | N/A | N/A | N/A | RT-11 | 0 |
| _____ 14 | CV31A 24CV98 RCP SEAL INJ MAN ISOL | N/A | N/A | N/A | RT-11 | 0 |
| _____ 15 | ANCGA289 CGA HW&CNDS-CPD COND HI ALARM | N/A | N/A | N/A | N/A | OVRD OFF |
| _____ 16 | MT02D MAIN TURB TURNING GEAR ENGAGE | N/A | N/A | N/A | N/A | ENGAGE |

## OVERRIDES:

| ***SELF-CHECK*** | **Description** | **Delay Time** | **Initial Value** | **Ramp Time** | **Trigger** | **Condition/ Severity** |
|---|---|---|---|---|---|---|
| | | | | | | |

## OTHER CONDITIONS:

| | Description |
|---|---|

____ 1. None

## V. SEQUENCE OF EVENTS

1. State shift job assignments.
2. Hold a shift briefing, detailing instruction to the shift: (provide crew members a copy of the shift turnover sheet).
3. Inform the crew “The simulator is running. You may commence panel walkdowns at this time. CRS please inform me when your crew is ready to assume the shift”.
4. Allow sufficient time for panel walk-downs. When informed by the CRS that the crew is ready to assume the shift, ensure the simulator is cleared of unauthorized personnel.

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **1. Power Ascension** | | | |
| | | | |
| **Examiner's Note:** The crew will be using S2.OP-IO.ZZ-0003, Hot Standby to Minimum Load, to perform the power ascension.<br><br>Step 4.3.16 provides guidance on raising reactor power using Steam Dumps IAW S2.OP-SO.MS-0002. The crew can use Attachments 3 or 4 of S2.OP-SO.MS-0002 to operate Steam Dumps.<br><br>The intent is for the crew to enter Mode 1, ≈ 6% Rx power, THEN; proceed to next event. | | | |
| | | | |
| **Examiner's Note:** IF console alarm **RC LOOPS Tavg – Tref DEVIATION** is in at the time the crew takes the watch, the crew will be provided instructions during turnover that verification of Tavg is 541 F once per 30 minutes until alarm is reset in Control Room Narrative Log is being performed by the extra NCO.<br><br>This alarm will clear during the power ascension into Mode 1. | | | |
| | **CRS directs power ascension** using Main Steam Dumps in MS Pressure Control and control rods. | | |
| **Examiner's Note:** The CRS will direct the crew in the order in which to raise Rx power by withdrawing control rods or raising steam dump demand first. | | | |
| | | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **Crew will most likely make steam dump adjustments in Manual due to Caution: "**Small adjustments on the Steam Dump controller while in automatic may not produce the expected results." | **PO raises steam dump demand IAW S2.OP-SO.MS-0002, section 5.4 using Attachments 3 or 4.**<br>Slowly **ADJUST** STM DUMP PRESSURE SETPOINT to maintain less than 1000 psig IAW Attachment 3, MS PRESS CONTROL MODE in AUTO:<br>• **SELECT** PRESSURE MODE - MANUAL.<br>• Slowly **ADJUST** VALVE DEMAND until desired setpoint is reached.<br>• **SELECT** PRESSURE MODE - AUTO.<br>**OR**<br><br>**ADJUST** Steam Dumps to raise Reactor Power Demand IAW Attachment 4, MS PRESS CONTROL MODE in MANUAL:<br>• Slowly **ADJUST** VALVE DEMAND until desired setpoint is reached. | | |
| | | | |
| | **RO withdraws control rods at the specified increments to maintain Tave on program.** | | |
| | | | |
| **Examiner's Note:** Program Tavg at 10% Rx power is about 549 F.<br><br>During simulator runs, Steam Dump pressure setting was about 982 psig for a Rx Power of 5.4%. | | | |
| | | | |
| | **RO announces when NIS indicates 5% Reactor Power and RECORDs time of Mode 1 entry in Control Room Narrative Log.** | | |
| | | | |
| Proceed on to next event when Reactor Power is 6% or by direction from Lead Examiner. | | | |
| | | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **2. Containment pressure channel fails high:** | | | |
| | | | |
| **Simulator Operator:** Insert **RT-1** on direction from Lead Examiner.<br><br>**VC0311**<br>**A, Containment press channel 1**<br>**Value = 55** | | | |
| | | | |
| | RO announces unexpected OHA alarm for CNTMT PRESS HI-HI OHA C-6. | | |
| | | | |
| | CRS places power ascension on hold. | | |
| | | | |
| | RO reports actual containment pressure is normal and appears the channel is failed. | | |
| | | | |
| | PO reviews S2.OP-AR-ZZ-0003, and determines notification must be written and TS evaluation performed | | |
| | | | |
| **TS evaluation #1:** | | | |
| | | | |
| | **CRS enters:**<br>• **TS 3.3.2.1 Act b 16** | | |
| | | | |
| Proceed to next event after CRS evaluates Tech Specs or by direction from Lead Examiner. | | | |
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| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **3. Charging Master Flow Controller fails low** | | | |
| | | | |
| **Simulator Operator**: Insert **RT-2** on direction from Lead Evaluator.<br><br>**MALF: CV0035 CHRG MASTER FLO CNTRLR FAILS H/L**<br>**Starting Value: 37**<br>**Final Value: 0**<br>**Ramp: 5 minutes** | | | |
| | | | |
| | RO reports lowering charging flow and/or low RCP seal injection flow. | | |
| | | | |
| | RO diagnoses Master Flow Controller (MFC) output lowering with PZR level on (or below) program. | | |
| | | | |
| | **CRS directs RO to place Master Flow Controller in manual and restore charging flow**. | | |
| | | | |
| **Simulator Operator:** Ensure **ET-2** is true when MFC is placed in manual this will delete MALF CV0035 | | | |
| | | | |
| | **RO places MFC in manual, and adjusts demand to required flow.** | | |
| | | | |
| | **CRS enters S2.OP-AB.CVC-0001, Loss of Charging, based on the reduction of charging flow.** | | |
| | | | |
| | CRS directs initiation of Attachment 1 CAS. | | |
| | | | |
| | RO reports 23 charging pump in service with no indication of cavitation. | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| | RO reports NO PZR level channel failure. | | |
| | | | |
| | RO reports VCT level channel has NOT failed. | | |
| | | | |
| | RO reports NO indication of charging header leak. | | |
| | | | |
| | RO reports charging MFC failed. | | |
| | | | |
| | RO reports manual control of 23 charging pump has been established, and reports PZR level can be maintained stable or rising. | | |
| | | | |
| | CRS assigns responsibility and band for manual PZR level control. | | |
| | | | |
| Proceed to next event at Lead Evaluators direction. | | | |
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| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **4. #2 SW Bay Leak** | | | |
| | | | |
| **Simulator Operator**: Insert **RT-3** on direction from Lead Evaluator.<br><br>**MALF: SW0216A, 21 SW LEAK IN SW STRUCTURE**<br>**Ramp = 3 min**<br>**Final Value = 8000** | | | |
| | | | |
| **Evaluator's Note:** The first OHA will annunciate ~1 minute after the leak is inserted. | | | |
| | | | |
| | RO reports unexpected OHA alarm B-29, followed shortly by B-13 and B-14. | | |
| | | | |
| | ARP for OHA B29, 21-23 SW PMP SUMP AREA LVL HI, directs entry into S2.OP-AB.SW-0003 if alarm is concurrent with OHA B-13, 21 SW HDR PRESS LO. | | |
| | | | |
| | RO either starts a SW pump based on lowering SW header pressure, or announces the auto start of 25 SW pump when it occurs, and the clearing of the low SW header pressures alarms. | | |
| | | | |
| **Evaluator's Note:** OHA B-29 also directs entry into S2.OP-AB.ZZ-002, Flooding. | | | |
| | | | |
| | **CRS enters S2.OP-AB.SW-0003 SW Bay Leak per ARP direction or enters S2.OP-AB.SW-001, Loss of SW Header Pressure, then transitions to S2.OP-AB.SW-0003, and initiates CAS.** | | |
| | | | |
| | RO reports both SW Bays are in service and dispatches NEO to investigate 2 Bay alarms. | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| | PO monitors Main Turbine / SGFP temps on SPDS and Plant Computer per CAS. | | |
| | | | |
| **Role Play:** 2 minutes after being contacted, report as NEO that ***there is a large leak in the back of #2 SW bay. The water level is approx. 2.5 feet above the pump pedestal and rising.*** (Bay is considered disabled at 2 ft.) | | | |
| | | | |
| | **PO opens 21 and 22 SW23's.** | | |
| | | | |
| | **PO closes 21 and 22 SW17's.** | | |
| | | | |
| | **PO starts all Bay 4 SW pumps.** | | |
| | | | |
| | PO reports all Bay 4 SW pumps are running. | | |
| | | | |
| | **PO stops all Bay 2 SW pumps.** | | |
| | | | |
| | **Crew dispatches NEO to open control power bkrs for 21-23 SW pumps.** | | |
| | | | |
| **Simulator Operator:** Call for First Check (IF directed), **THEN** insert **RT-10** to open control power.<br><br>**SW23D, 21 SW pump control power**<br>**SW27D, 22 SW pump control power**<br>**SW32D, 23 SW pump control power**<br><br>NOTIFY control room after last remote is active and report control power breakers have been opened for 21, 22 and 23 SW pumps. | | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| | **PO closes 21SW22 and 21SW20.** | | |
| | | | |
| **Role Play**: Once 2 SW Bay is isolated, ***NEO reports that the leak has stopped. IF ask about the water level, state the water level is up to the bottom of the motor housing.*** | | | |
| | | | |
| | PO reports the leak is isolated. | | |
| | | | |
| | PO reports SW remains available to the EDGs. | | |
| | | | |
| | PO reports SW is being supplied to the Turbine Building through 23SW20. | | |
| | | | |
| | PO monitors Main Turbine parameters on SPDS and the Plant Computer. | | |
| | | | |
| | PO initiates action to remove one CCHX from service IAW CAS item 4.0. | | |
| | | | |
| **TS evaluation #2:** | | | |
| | | | |
| | **CRS enters LCO 3.7.4 (72 hours) due to having only one operable SW loop.** | | |
| | | | |
| | CRS may enters S2.OP-AB.ZZ-002, Flooding, due to flooding in 2 Bay. | | |
| | | | |
| Proceed to next event after Tech Spec and ECG classification has been identified or at Lead Evaluators direction. | | | |
| | | | |
| | | | |
| | | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **5. Manual Rx Trip AND Loss of All AC Power (LOPA)** | | | |
| | | | |
| **Simulator Operator:** Insert **RT-4** at the direction of the lead examiner this will cause the Loss of Offsite power and automatic Reactor trip. | | | |
| | | | |
| | **CRS directs RO to trip the Rx** and perform immediate actions of **EOP-TRIP-1**, Reactor Trip or Safety Injection. | | |
| | | | |
| | **RO turns reactor trip switch to backup the automatic Rx Trip.** | | |
| | | | |
| **Simulator Operator**: Ensure **ET-2** is TRUE following the Rx trip.<br><br>This Inserts the following malfunctions:<br><br>**EL0144: Loss of 2A 4KV bus**<br>**EL0145: Loss of 2B 4KV bus**<br>**EL0163: 2C EDG trip** | | | |
| | **RO performs Immediate Actions for EOP-TRIP-1:**<br>▪ **Confirms the reactor tripped**<br>▪ **Trips the main turbine** | | |
| | | | |
| | PO reports NO Vital Busses are Energized and entry into EOP-LOPA-1 required | | |
| | | | |
| | CRS and RO verify performance of immediate actions. | | |
| | | | |
| | **CRS transitions to EOP-LOPA-1, Loss of All AC Power.** | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| | **RO performs immediate actions of LOPA-1:**<br>▪ **Trip the Reactor**<br>▪ **Trip the Turbine** | | |
| | | | |
| | CRS and RO verify performance of immediate actions. | | |
| | | | |
| | RO may close 2CV2 and 2CV277 | | |
| | | | |
| | RO reports both PORVs closed | | |
| | | | |
| | RO reports Excess letdown is isolated | | |
| | | | |
| | PO reports that 23 AFW pump failed to Auto start. | | |
| | | | |
| **CT-1 (CT-23)**<br><br>**Critical Task**<br>Establish 22E4 lbm/hr AFW flow before steam generator dryout occurs (WR ≤ 11%)<br><br>**SAT_____ UNSAT_____** | | | |
| | | | |
| | **PO manually starts 23 AFW pump. CT #1** | | |
| | | | |
| | **PO throttles AFW flow to no less than 22E4 lbm/hr. CT #1** | | |
| | | | |
| | CRS assigns CAS for loss of 23 AFW pump | | |
| | | | |
| | | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **Evaluator's Note:** 2A & 2B 4KV vital buses are deenergized with a bus differential. 2C EDG tripped on overspeed. Crew should determine that 2A and B EDG need to be stopped. | | | |
| | | | |
| | PO reports 2A and B EDG running with breaker open and 2C EDG tripped. | | |
| | | | |
| | PO reports no vital buses energized. | | |
| | | | |
| **Role Play (2C EDG)**: IF dispatched, report that ***2C EDG tripped on overspeed and the linkage looks bent***.<br><br>**Role Play (Maintenance on 2A and B 4KV Bus)**: When contacted about status ***state that you will go to the field to get a status***. | | | |
| | RO reports SI has not been actuated. | | |
| | | | |
| | **RO actuates SI.** | | |
| | | | |
| | CRS assigns CAS for SI reset and AB.SSP-1 action if required. | | |
| | | | |
| **Evaluator's Note:** Around this point the crew should be discussing strategy to recover a vital bus. 2C EDG tripped on overspeed and will take some time to troubleshoot. 2A and 2B vital bus is deenergized on Bus Differential protection and therefore not expected back soon. Crew should determine that success path is to restore 2C EDG with maintenance assistance. | | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| | **After 74 seconds a crew member performs reset of SI.** | | |
| | | | |
| | PO reports no vital buses energized | | |
| | | | |
| | CRS assigns CAS to stop EDG's without SW once SEC's deenergized. | | |
| | | | |
| | CRS reads Continuous Caution C6-1 When power is restored to any 4KV vital bus. Recovery actions should continue starting with Step 26. | | |
| | | | |
| | **CRS dispatches operator to deenergize all SECs.** | | |
| | | | |
| **Deenergize SECs:** | | | |
| | | | |
| **Simulator Operator**: After being contacted, Insert **RT-9** to deenergize all SECs with a time delay.<br><br>**REMOTES:**<br>**DG01D** Deenergize A SEC<br>**DG02D** Deenergize B SEC<br>**DG03D** Deenergize C SEC<br><br>**NOTIFY** CRS when complete. | | | |
| | | | |
| | **CRS directs performance of S2.OP-AB.LOOP-1** | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **Role Play for AB.LOOP-1 (Attachment 2 Part A):**<br>If called by a crew member<br><br>Section1.A (Field Operator) - After **10-15 minutes** report back as field operator that Steps 1.A.1 thru 1.A.4 are complete.<br><br>Section 1.B steps are performed by the NCO in the control room if resources available. CRS may direct WCC to do this, if so then report back after 20 minutes that Section 1.A and 1.B are complete (simulate that panels and doors are open) | | | |
| | | | |
| | **CRS directs WCC to ensure 21 and 22 AFW pump breakers open and remove control power for 21 and 22 AFW pumps.** | | |
| | | | |
| **Simulator Operator**: Insert **RT-12** to open 21 and 22 AFW pump breakers and remove control power to 21 and 22 AFW pumps.<br><br>**Remote:**<br>**AF20D and AF23D – 21 AFW**<br>**AF25D and AF28D – 22 AFW** | | | |
| | | | |
| | Crew waits until all SECs are deenergized. | | |
| | | | |
| | CRS receives report that all SECs are deenergized. | | |
| **Stop running EDGs:** | | | |
| | | | |
| | **PO stops 2A and 2B EDG based on no service water pump running IAW CAS of LOPA-1.** | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| | **RO depresses stop pushbutton for all loads in Table A of LOPA-1.** | | |
| | | | |
| | Crew waits until report from WCC that 21 and 22 AFW pump breakers are open and control power removed | | |
| | | | |
| **Simulator Operator**: Notify crew when **RT-12** has been completed to open 21 and 22 AFW pump breakers and remove control power from 21 and 22 AFW pumps. | | | |
| | | | |
| | PO reports status of 4 KV Vital Busses and priority should be placed on restoring 2C EDG with help from maintenance. | | |
| | | | |
| | PO reports that no EDG's are available and no EDG's running | | |
| | | | |
| | **CRS dispatch operator** for local start when EDG becomes available. | | |
| | | | |
| | CRS assigns CAS to PO for vital bus energization, SW pump start, and turbine header isolation. | | |
| **Evaluator's Note**: There will be no console indications to verify valve positions during LOPA-1 only field reports. | | | |
| | | | |
| | PO reports 23 and 24 SPT are deenergized | | |
| | | | |
| | CRS has SM contact ESO for power availability | | |
| | | | |
| | **CRS directs crew to restore power IAW S2.OP-AB.LOOP-0001, Loss of Offsite Power, while continuing with LOPA-1.** | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| | SM discusses with TSC additional power source availability/strategy. | | |
| | | | |
| | **CRS dispatches operator for Seal injection isolation and seal return and CCW thermal barrier isolation.** | | |
| | | | |
| **Simulator Operator**: Insert **RT-11** to close 21-24 CV98. This will simulate closure for 2CV83, 2CV89 and 2CV95 to isolate seal injection filters.<br><br>**Remotes:**<br>**CV28A – 21CV98 fails to position**<br>**CV29A – 22CV98 fails to position**<br>**CV30A – 23CV98 fails to position**<br>**CV31A – 24CV98 fails to position**<br>**Final = 0**<br>**Ramp: 1 min**<br>**Delay = 0-3 mins** | | | |
| | | | |
| **Simulator Operator**: Insert **RT-13** to close 2CC131 and 2CV116 valves.<br>**VL0045 2CV116 fails to position**<br>**Final = 0**<br>**Ramp = 1 min**<br><br>**VL0087 2CC131 fails to position**<br>**Final = 0**<br>**Ramp: 01:00 min** | | | |
| | | | |
| | Crew contacts WCC/SM/DSM for status of 2C EDG and 2A and 2B Vital buses. | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| **Simulator Operator:** Notify crew that maintenance has investigated the 2C EDG trip mechanism and believe they can restore it in 2 hours. | | | |
| | | | |
| | | | |
| | **PO reports valves in Table B are closed except 21-24 MS167 crew closes 21-24 MS167** | | |
| | | | |
| | **PO places 21-24 BF19 and 40s in manual and closed** | | |
| | | | |
| | RO states 21-24 SS94 closed | | |
| | | | |
| | PO states 21-24 GB4s closed | | |
| | | | |
| | PO states NO SG pressures are dropping in an uncontrolled manner or completely depressurized | | |
| | | | |
| | PO gives AFW status to CRS and current SG levels, if less than 9% will feed at max rate to allow cooldown to establish greater than 9% for cooldown later | | |
| | | | |
| | PO reports secondary rad monitors normal | | |
| | | | |
| | **CRS dispatches personnel to perform checkoff sheet 3** | | |
| | | | |
| | PO reports AFWST greater than 21% | | |
| | | | |
| | | | |
| | PO reports SG levels greater than 9% | | |

| Evaluator/Instructor Activity | Expected Plant/Student Response | SBT LOG | Comment |
|---|---|---|---|
| | | | |
| **CT-2 (CT-26)**<br>Depressurize the intact SG(s) such that all the following limiting conditions are met:<br>• The cooldown rate in all RCS cold legs is maintained less than 100°F per hour<br>• SG depressurization is not initiated until narrow-range level in at least one intact SG is greater than 9%(15% for adverse containment)<br>• If narrow-range level cannot be maintained greater than 9%(15% for adverse containment) in at least one intact SG (after depressurization is commenced), then SG depressurization is stopped until narrow-range level is restored to greater than 9%(15% for adverse containment) in at least one intact SG<br><br>**SAT_____ UNSAT_____** | | | |
| | **PO opens 21-24MS10s and begins cooldown at less than 100 degrees per hour. CT #2** | | |
| | | | |
| | PO monitors SGWL and stops if required and maintains achievable cooldown rate. | | |
| **The scenario maybe terminated when CT # 2 has been evaluated or as directed by the Lead Examiner.** | | | |

## VI. SCENARIO REFERENCES

1. Alarm Response Procedures (Various)
2. Technical Specifications
3. Emergency Plan (ECG)
4. OP-AA-101-111-1003, Use of Procedures
5. S2.OP-IO.ZZ-0003, Hot Standby to Minimum Load
6. S2.OP-AB.CVC-0001, Loss of Charging
7. S2.OP-SO.MS-0002, Steam Dump System Operation
8. S2.OP-AB.SW-0003, Service Water Bay Leak
9. 2-EOP-TRIP-1, Reactor Trip or Safety Injection
10. 2-EOP-LOPA-1, Loss of All AC Power

MODE: 2 POWER: 3% RCS BORON: 1311 MWe 0

SHUTDOWN SAFETY SYSTEM STATUS (5, 6 & DEFUELED):

N/A

REACTIVITY PARAMETERS

- Control Bank D at 130 steps.
- Reactor Engineering directs use of control rods and steam dumps to raise power to 10%. No Fuel Conditioning Limits are imposed until 50%.

MOST LIMITING LCO AND DATE/TIME OF EXPIRATION:

None

EVOLUTIONS/PROCEDURES/SURVEILLANCES IN PROGRESS:

- S2.OP-IO.ZZ-0003, Hot Standby to Minimum Load complete up to Section 4.3, step 4.3.18 and S2.OP-SO.MS-0002, Steam Dump System Operation is open at (4.4.1)
- IF RC Loop Tavg – Tref Deviation console alarm is in, then extra NCO will log Tavg > 541 F once per 30 minutes.
- Crew to continue Power ascension to 10% using control rods and steam dumps, and enter Mode 1.
- Reactor Engineering is standing by to support power ascension.
- Mode 1 entry is authorized.

ABNORMAL PLANT CONFIGURATIONS:

CONTROL ROOM:

Unit 1 and Hope Creek at 100% power.

PRIMARY:

SECONDARY:

- On main feedwater using 21 SGFP; 22 SGFP is Out of Service

RADWASTE:

No discharges in progress

CIRCULATING WATER/SERVICE WATER:

____ 1. Verify simulator is in “TRAIN” Load
____ 2. Simulator is in RUN
____ 3. Overhead Annunciator Horns ON
____ 4. All required computer terminals in operation
____ 5. Simulator clocks synchronized
____ 6. All tagged equipment properly secured and documented
____ 7. TSAS Status Board up-to-date
____ 8. Shift manning sheet available
____ 9. Procedures in progress open and signed-off to proper step
____ 10. All OHA lamps operating (OHA Test) and burned out lamps replaced
____ 11. Required chart recorders advanced and ON (proper paper installed)
____ 12. All printers have adequate paper AND functional ribbon
____ 13. Required procedures clean
____ 14. Multiple color procedure pens available
____ 15. Required keys available
____ 16. Simulator cleared of unauthorized material/personnel
____ 17. All charts advanced to clean traces and chart recorders are on.
____ 18. Rod step counters correct (channel check) and reset as necessary
____ 19. Exam security set for simulator
____ 20. Ensure a current RCS Leak Rate Worksheet is placed by Aux Alarm Typewriter with Baseline Data filled out
____ 21. Shift logs available if required
____ 22. Recording Media available (if applicable)
____ 23. Ensure ECG classification is correct
____ 24. Reference verification performed with required documents available
____ 25. Verify phones disconnected from plant after drill.
____ 26. Verify EGC paperwork is marked “Training Use Only” and is current revision.
____ 27. Ensure sufficient copies of ECG paperwork are available.

In reviewing each proposed CT, the examination team assesses the task to ensure, that it is essential to safety. A task is essential to safety if, in the judgment of the examination team, the improper performance or omission of this task by a licensee will result in direct adverse consequences or in significant degradation in the mitigative capability of the plant.
The examination team determines if an automatically actuated plant system would have been required to mitigate the consequences of an individual's incorrect performance. If incorrect performance of a task by an individual necessitates the crew taking compensatory action that would complicate the event mitigation strategy, the task is safety significant.

I. Examples of CTs involving essential safety actions include those for which operation or correct performance prevents...

- degradation of any barrier to fission product release
- degraded emergency core cooling system (ECCS) or emergency power capacity
- a violation of a safety limit
- a violation of the facility license condition
- incorrect reactivity control (such as failure to initiate Emergency Boration or Standby Liquid Control, or manually insert control rods)
- a significant reduction of safety margin beyond that irreparably introduced by the scenario

II. Examples of CTs involving essential safety actions include those for which a crew demonstrates the ability to...

- effectively direct or manipulate engineered safety feature (ESF) controls that would prevent any condition described in the previous paragraph.
- recognize a failure or an incorrect automatic actuation of an ESF system or component.
- take one or more actions that would prevent a challenge to plant safety.
- prevent inappropriate actions that create a challenge to plant safety (such as an unintentional Reactor Protection System (RPS) or ESF actuation.

**SCENARIO IDENTIFIER: 21-01 NRC Scenario #4 REVIEWER: K. Hantho**

| Initials | | Qualitative Attributes |
|---|---|---|
| KH | 1. | The scenario has clearly stated objectives in the scenario. |
| KH | 2. | The initial conditions are realistic, in that some equipment and/or instrumentation may be out of service, but it does not cue crew into expected events. |
| KH | 3. | The scenario consists mostly of related events. |
| KH | 4. | Each event description consists of:<br>• the point in the scenario when it is to be initiated<br>• the malfunction(s) that are entered to initiate the event<br>• the symptoms/cues that will be visible to the crew<br>• the expected operator actions (by shift position)<br>• the event termination point |
| KH | 5. | No more than one non-mechanistic failure (e.g., pipe break) is incorporated into the scenario without a credible preceding incident such as a seismic event. |
| KH | 6. | The events are valid with regard to physics and thermodynamics. |
| KH | 7. | Sequencing/timing of events is reasonable, and allows for the examination team to obtain complete evaluation results commensurate with the scenario objectives. |
| KH | 8. | The simulator modeling is not altered. |
| KH | 9. | All crew competencies can be evaluated. |
| KH | 10. | The scenario has been validated. |
| NA | 11. | If the sampling plan indicates that the scenario was used for training during the requalification cycle, evaluate the need to modify or replace the scenario. |
| KH | 12. | ESG-PSA Evaluation Form is completed for the scenario at the applicable facility. |

## 21-01 NRC Scenario #4

## Critical Tasks:

**CT-1 (CT-23)**

**Critical Task**
Establish 220,000 lbm/hr AFW flow before steam generator dryout occurs (WR ≤ 11%) during SBO

**Safety Significance**
Establishing the minimum required AFW flow rate, under the postulated plant conditions, constitutes a task that "is essential to safety," because "its improper performance or omission by an operator will result in direct adverse consequences or significant degradation in the mitigative capability of the plant."

Failure to establish minimum AFW flow (under the postulated conditions) is a violation of the basic objective of ECA-0.0 and of the assumptions of the analyses upon which ECA-0.0 is based. Both intend to mitigate deterioration of RCS conditions while ac emergency power is not available. Without AFW flow, the SGs could not support any significant plant cooldown. Thus, the crew would lose the ability to delay the adverse consequences of core uncovery. Also without AFW flow, decay heat would still open the SG safety valves and would rapidly deplete the SG inventory, leading to a loss of secondary heat sink, or SG dryout. Decay heat would then increase RCS temperature and pressure until the pressurizer PORVs open, imposing a larger LOCA than RCP seal leakage. Both of these examples violate the basic assumptions of the analyses on which ECA-0.0 is based, complicating the mitigation actions.

**Cues:**
- Indication and/or annunciation of station blackout

AND
- Indication and/or annunciation that insufficient AFW flow to SGs is present

**Measurable Performance Indicator**

Manipulation of controls in the control room as required to establish the minimum required AFW flow rate to the SGs
- Valve position indication

OR
- Pump speed increasing

**Feedback**

Indication that at least the minimum required AFW flow is being delivered to the SGs

**CT-2 (CT-26)**

**Critical Task**

Depressurize the intact SG(s) such that all the following limiting conditions are met:

- The cooldown rate in all RCS cold legs is maintained less than 100°F per hour
- SG depressurization is not initiated until narrow-range level in at least one intact SG is greater than 9%(15% for adverse containment)
- If narrow-range level cannot be maintained greater than 9%(15% for adverse containment) in at least one intact SG (after depressurization is commenced), then SG depressurization is stopped until narrow-range level is restored to greater than 9%(15% for adverse containment) in at least one intact SG
- SG pressure does not decrease to less than 310 psig
- RCS cold leg temperature does not decrease to less than 280 Degrees F
- If a positive SUR is indicated on either the source range or the intermediate range (after depressurization is commenced), then SG depressurization is stopped and the RCS is allowed to heat up

**Safety Significance**

Failure to depressurize the secondary and cool down the RCS, under the postulated plant conditions, results in a greater possibility for core damage. Depressurization and cooldown provide the following benefits, which extend the time to core uncovery and maximize the time available to restore ac power:

- Reduction in the rates of RCS inventory loss and RCP seal degradation
- Replenishment (temporary) of RCS inventory by injection of accumulator liquid

Failure to perform the critical task denies these benefits, reducing the time available to restore AC power before the core uncovers.

Failure to depressurize the secondary and cool down the RCS results in “adverse consequence(s)” and in a “significant degradation in the mitigative capability of the plant.” Such a failure constitutes misoperation or incorrect crew performance which leads to “degradation of {the RCS} barrier to fission product release” and to a “significant reduction of safety margin beyond that irreparably introduced by the scenario.”

**Cues:**

- Indication and/or annunciation that all ac emergency buses are de-energized
  - Bus-energized lamps extinguished
  - Circuit breaker position
  - Bus voltage
  - EDG status

AND

- Step 17 of ECA-0.0 is reached

**Measurable Performance Indicator**

Manipulation of controls as required to depressurize the intact SG(s) at the highest rate achievable within the 100°F per hour RCS cold leg cooldown limit

- Valve position indication that the PORV(s) on the intact SG(s) are open the maximum amount consistent with controllability and the 100°F per hour RCS cold leg cooldown limit
- Indication that the RCS cold leg cooldown rate remains less than 100°F per hour Indication that narrow-range level in at least one intact SG is greater than 9%(15% for adverse containment)
- Indication that SG pressure remains above 310 psig
- Indication that RCS cold leg temperature remains above 280 Degrees F
- Indication of a zero or a negative SUR on the source and intermediate ranges

**Feedback**

- Indication of decreasing pressure in the intact SG(s)
- Indication of decreasing RCS pressure and temperature
- Accumulators inject

## ATTACHMENT 6

## ESG-PRA RELATIONSHIP EVALUATION

### EVENTS LEADING TO CORE DAMAGE

| Y/N | Event | Y/N | Event |
|---|---|---|---|
| N | TRANSIENTS with PCS Unavailable | N | Loss of Service Water |
| N | Steam Generator Tube Rupture | N | Loss of CCW |
| N | Loss of Offsite Power | N | Loss of Control Air |
| N | Loss of Switchgear and Pen Area Ventilation | **Y** | Station Black Out |
| N | LOCA | | |

### COMPONENT/TRAIN/SYSTEM UNAVAILABILITY THAT INCREASES CORE DAMAGE FREQUENCY

| Y/N | COMPONENT, SYSTEM, OR TRAIN | Y/N | COMPONENT, SYSTEM, OR TRAIN |
|---|---|---|---|
| N | Containment Sump Strainers | N | Gas Turbine |
| N | SSWS Valves to Turbine Generator Area | **Y** | Any Diesel Generator |
| N | RHR Suction Line valves from Hot Leg | N | Auxiliary Feed Pump |
| N | CVCS Letdown line Control and Isolation Valves | N | SBO Air Compressor |

### OPERATOR ACTIONS IMPORTANT IN PREVENTING CORE DAMAGE

| Y/N | OPERATOR ACTION |
|---|---|
| N | Restore AC power during SBO |
| N | Connect to gas turbine |
| N | Trip Reactor and RCPs after loss of component cooling system |
| N | Re-align RHR system for re-circulation |
| N | Un-isolate the available CCW Heat Exchanger |
| N | Isolate the CVCS letdown path and transfer charging suction to RWST |
| Y | Cooldown the RCS and depressurize the system |
| N | Isolate the affected Steam Generator that has the tube rupture(s) |
| N | Early depressurize the RCS |
| N | Initiate feed and bleed |

Complete this evaluation form for each ESG