

Simulation Facility: Byron

Scenario No.: Operating Test No. **2016 Byron NRC N16-1**

Examiners:

Applicant:

SRO

RO

BOP

Initial Conditions: IC-16

Turnover: Unit 1 is operating at 54.0% power due to grid demand, steady state, equilibrium xenon, Boron concentration is 998 ppm. The fuel is preconditioned to 100% power. Online risk is green.

| Event No. | Malf. No. | Event Type* | Event Description |
|-----------|---------------------------------|------------------------------|---|
| 1 | None | N (BOP, SRO) | Swap stator cooling pumps |
| 2 | MF NI09D | I (RO, BOP, SRO) TS (SRO) | N44 failure high |
| 3 | None | R (RO, SRO) | Raise power at 0.4 Mw/Min |
| 4 | MF CC01B | C (BOP, SRO) TS (SRO) | 1A CC pump trip with 1B CC pump autostart failure |
| 5 | MF CV08 0 5 | C (RO, SRO) | Letdown line pressure detector 1PT-CV131 fails low |
| 6 | MF RX02D | C (BOP, SRO) | 1D FWRV oscillates in auto |
| 7 | MF FW09D | C (SRO) | 1D FWRV fails closed resulting in a reactor trip |
| 8 | MF TH06C | M (all) | LOCA |
| 9 | MF SI01A RF RP84 MF RP15D | C (BOP, SRO) | 1A SI pump failure to start & ESF relay failure of 1B SI pump – manual start required |

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

SCENARIO OVERVIEW

Unit 1 is operating at 54.0% power due to grid demand, 606 MWe, steady state, equilibrium xenon, Boron concentration is 998 ppm, CBD at 150 steps. The fuel is preconditioned to 100% power. Online risk is green. Following completion of turnover, the shift manager requests the BOP to swap GC pumps in preparation for an OOS on 1GC01PA next shift.

After completing shift turnover and relief, the BOP will swap stator cooling pumps per BOP GC-5.

After swapping stator cooling pumps, N-44 fails high, causing CB D to step in. The RO will place rod control to MANUAL after verifying no turbine load shedding is in progress or upon seeing the PRNI failure. 1BOA Inst-1 will be entered, and Tech Spec 3.3.1 will be entered.

After the N-44 failure is addressed, the crew will ramp the unit up at 0.4 MW/minute to 88% power, using 1BGP 100-3, Power Ascension.

After a measurable change in power is observed, the 1A CC pump will trip and the 1B CC pump will fail to automatically start. The BOP should start the 1B CC pump manually. 1BOA Pri-6 may be entered, and Tech Spec 3.7.7 will be entered.

After the 1B CC pump has been started and the failure has been addressed, letdown pressure transmitter 1PT-131 will fail low. The letdown PCV will close and letdown pressure will rise lifting the letdown line relief valve. The RO will take manual control of letdown pressure controller and restore letdown pressure. The crew may isolate letdown due to the lifting letdown relief valve. If letdown is isolated, it will be restored per 1BOA ESP-2 or BOP CV-17. On-line risk remains yellow.

After the 1PT-131 failure is addressed, 1FW-540, 1D FWRV will begin oscillating in AUTOMATIC. The BOP will take manual control and restore normal feedwater flow. AUTOMATIC operation of 1FW-540 will not be available for the remainder of the scenario.

After normal feedwater flow is restored and the plant stabilized, 1D FWRV will fail fully closed, causing a loss of feedwater to the 1D SG. The reactor will trip or be tripped, and the crew will enter 1BEP-0, and transition to 1BEP ES-0.1 at step 4 of 1BEP-0.

After 1BEP ES-0.1 has been entered, and performed to Step 4, a 5000 gpm leak develops in the 1C cold leg. The crew will manually initiate Safety Injection and re-enter 1BEP-0. BST's will be monitored at this time. 1A SI pump failed to start and will not start if a manual start is attempted. An ESF relay failure will prevent 1B SI pump from starting on the SI signal, but it can be manually started from the MCR. RCP trip criteria will be met, requiring the RCPs to be tripped.

Completion criteria is selection of and transition to 1BEP ES-1.2, Post-LOCA Cooldown.

Critical Tasks

1. Establish flow from at least one high-head SI pump before transition out of E-0.
(ERG Critical Task number – CT-7) (K/A: 006000A4.07; importance - 4.4./4.4)
2. Trip all RCPs before exiting 1BEP-0 Attachment B.
(ERG Critical Task number – CT-16) (K/A: 000009EA1.09; importance - 3.6/3.6)

References

| | |
|--------------|-------------|
| BOP GC-5 | 1BOA ESP-2 |
| BOP CV-5 | 1BEP 0 |
| 1BGP 100-3, | 1BEP ES-0.1 |
| 1BGP 100-3T5 | 1BEP 1 |
| 1BOA Inst-1 | 1BEP ES-1.2 |
| 1BOA Pri-6 | BOP CX-14 |

SIMULATOR SETUP GUIDE:

- Verify/perform TQ-BY-201-0113, BYRON TRAINING DEPARTMENT SIMULATOR EXAMINATION SECURITY ACTIONS CHECKLIST.
- Establish the conditions of IC 16, 54% power, steady state, equilibrium xenon.
- Verify/remove any Equipment Status Tags and Danger Tags not applicable to the scenario.
- **Ensure rod control is in AUTO.**
- Place simulator in RUN (allow simulator to run during board walk down and turnover).
- Verify Simulator Readiness Checklist is completed.
- Provide students with turnover sheets and rema.
- Run **caep N16-1** from thumb drive and verify the following actions load in the CAEP:

Byron 2016 ILT NRC scenario 16-1|00:00:00|1

Event 1: Swap GC pumps - reset panel alarm|00:00:00|3

mrf tp15 ackn|08:00:00|4

Event 2: PRNI N-44 fails high|00:00:00|6

imf ni09d 200 30|08:00:00|7

Event 4: 1A CC pump trip|00:00:00|9

imf cc01b|08:00:00|10

Reset CNMT pen clg alm|00:00:00|11

mrf cc50 reset|08:00:00|12

Event 5: 1PT-CV131 fails low|00:00:00|14

imf cv08 0 5|08:00:00|15

Realigning XS LD if requested|00:00:00|16

mrf cv26remf 100|08:00:00|17

mrf cv27 0|08:00:00|18

Event 6: 1FW-540 oscillation|00:00:00|20

imf rx02d 1|08:00:00|21

dmf rx02d|08:00:00|22

Event 7: 1FW-540 fails closed|00:00:00|24

imf fw09d 0|08:00:00|25

Event 8: LOCA|00:00:00|27

imf th06c 5000|08:00:00|28

preloads are on next page|00:00:00|29

1B cc pump fail to autostart|00:00:00|31

imf cc02b 200|00:00:02|32

SI pump failures|00:00:00|34

imf si01a|00:00:03|35

mrf rp84 open|00:00:04|36

imf rp15d|00:00:05|37

Event 1: Swap stator cooling pumps.

If dispatched as EO to observe stator cooling pump swap, report 1A stator cooling pump is ready for start. Once started, **AS EO**, report the 1A GC pump is operating normally. If asked, discharge pressure is 28 psid at 1PDICG15.

If dispatched as EO to acknowledge stator panel alarm, insert the following:

- **MRF TP15 ACKN** to acknowledge 1PL01J.

If alarm 1-18-D13 does NOT come in and crew questions why not, as EO report there is a tag on the panel stating IR written for unreliable alarm.

Acknowledge as SM commencement and completion of procedure.

Event 2: Power range N-44 fails high.

NOTE: Ensure control rods are in AUTO before inserting this MF.

IMF NI09D 200 30

SM Acknowledge entry into TS, and request to bypass bistables.

SM Acknowledge request for writing IR, performing risk assessment and making appropriate notifications.

Event 3: Raise power at 0.4 MW/min

As Generation Dispatch, contact the MCR by phone and request Unit 1 raise power to 880MW at 0.4 MW/min due to grid demand.

Acknowledge as chemistry/rad protection requests for RCS samples (if required).

Acknowledge as Generation Dispatch initiation of ramp.

Event 4: 1A CC pump trip with 1B CC pump failure to autostart; 1B CC pump manual start available

IMF (In Preload) CC02B 200 and IMF CC01B to trip the running 1A CC pump and prevent the 1B CC pump from automatically starting on low pressure.

EO, If requested to check the breaker for the 1A CC pump, **REPORT** a target up on the overcurrent relay on the breaker

To reset the CC to CNMT Penetration Cooling alarm, **MRF CC50 to RESET**

SM acknowledge the failure, TS entry, on line risk assessment, request for maintenance support, and IR requests.

Event 5: Letdown line pressure detector 1PT-CV131 fails low.

Insert **IMF CV08 0 5** for 1PT-131 failed low.

If dispatched as EO to investigate 1PT-131, wait three minutes and report no visible damage to 1PT-131.

If dispatched as EO to align excess letdown to the top of the VCT, insert the following:

- **MRF CV26remf 100** to open 1CV8482
- **MRF CV27 0** to close 1CV8484

Acknowledge as SM 1PT-131 failure, on line risk assessment, requests for maintenance support, and IR requests

Event 6: 1FW-540 oscillates in auto

IMF RX02D 1

If dispatched as EO to investigate 1FW-540, report valve is responding normally (after MCR puts valve in MANUAL). SM acknowledge failure, online risk evaluation and IR initiation

AFTER THE OPERATOR PLACES THE VALVE CONTROLLER IN MANUAL, DELETE THE MALFUNCTION TO PREVENT THE ALARMS FROM TOGGLING IN AND OUT.

Event 7: 1FW-540 failed closed resulting in a reactor trip

IMF FW09D 0 to cause 1FW-540 to go fully shut.

SM acknowledge procedure entry and E Plan evaluations.

Event 8: LOCA

AFTER TRANSITION to 1BEP ES 0.1 and performed to step 4 (Check Pzr Pressure Control), IMF TH06C 5000 to insert a 5000 1C cold leg break

SM acknowledge procedure entry and E Plan evaluations, and STA request.

After STA requested, as STA report CSF status.

If dispatched as EO to investigate 1A SI pump, report ground overcurrent flag at breaker cubicle.

Event 9: 1A SI pump trip

(In Preload) IMF SI01A to prevent start of 1A SI pump.

1B SI pump relay failure requiring manual start

(In Preload) MRF RP84 OPEN and IMF RP15D to prevent SI auto start of 1B SI pump.

AT THE CONCLUSION OF THE SCENARIO,

- **ENSURE THE FOLLOWING COMPUTER POINTS ARE TAKEN OUT OF TEST AND RETURNED TO SCAN: N0047, N0048, U1143, N0052A, U0921, U0923**

| Scenario No: | NRC 16-1 | Event No. | 1 |
|---|---------------------------|---|---|
| Event Description: | Swap stator cooling pumps | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | From turnover, swap stator cooling pumps per BOP GC-5, SWITCHING STANDBY AND OPERATING GC PUMPS. | |
| | SRO | Directs BOP to perform BOP GC-5. | |
| | BOP | <ul style="list-style-type: none"> • Refer to BOP GC-5. • Start 1A stator water pump at 1PM02J. <ul style="list-style-type: none"> ○ Allow both pumps to run in parallel for ≥ 5 minutes (per step D.1). ○ Notify EO to perform leak check at skid. • Shutdown 1A GC pump when high amps are seen, or when EO reports 1A GC pump is very noisy. <ul style="list-style-type: none"> ○ Notify EO to reset Hy/GC panel alarm, if received. ○ Inform SRO to write IR about 1A GC pump. | |
| | RO | <ul style="list-style-type: none"> • Monitor primary and secondary panels while BOP performing BOP GC-5. • Provide support as requested to BOP. | |
| | SRO | <ul style="list-style-type: none"> • Acknowledge report. • Notify SM/WEC to write IR for 1A GC pump. | |
| <p>EVALUATOR NOTE: After 1A GC pump is shutdown and with lead examiners concurrence, enter next event.</p> | | | |

| Scenario NRC 16-1 | | Event 2 |
|---|------------|--|
| No: | | No. |
| Event Description: Power range N-44 fails high. | | |
| Time | Position | Applicant's Actions or Behavior |
| | CUE | <ul style="list-style-type: none"> • Annunciator PWR RNG FLUX RATE RX TRIP ALERT (1-10-C3) • Annunciator PWR RNG CHANNEL DEV (1-10-C4) • Annunciator PWR RNG FLUX HIGH ROD STOP (1-10-B5) • Annunciator PWR RNG HIGH STPT RX TRIP ALERT (1-10-A3) ○ Control rod inward motion |
| | RO/ BOP | <ul style="list-style-type: none"> • Implement BHC for Uncontrolled Rod Motion. • Ensure turbine power is stable • Place control rods in MANUAL. ○ Reference BARs as time permits |
| | SRO | <ul style="list-style-type: none"> ○ Implement 1BOA ROD-1, "Uncontrolled Rod Motion" • Identify PR N-44 failure • Notify SM to evaluate for E-plan • Implement 1BOA INST-1, "NUCLEAR INSTRUMENTATION MALFUNCTION", Attachment A "PR CHANNEL FAILURE" and direct operator action • Notify SM of PR N-44 failure • Notify SM to evaluate for E-plan ○ Evaluate DNB TS 3.2.5 if pressure <22090 PSIG. |
| | RO/ BOP | <ul style="list-style-type: none"> • Check rod control status <ul style="list-style-type: none"> • Rod bank select switch in manual • Check for rod stop <ul style="list-style-type: none"> • Annunciator PWR RNG FLUX HIGH ROD STOP (1-10-B5) – LIT • Place rod stop bypass switch to N-44 at 1PM07J |
| | RO | <ul style="list-style-type: none"> • Verify/restore $T_{AVE} - T_{REF}$ to within 1°F <ul style="list-style-type: none"> ○ Withdraw control rods ○ Adjust RCS boron concentration ○ Adjust turbine load |
| | BOP | <ul style="list-style-type: none"> • Check SG levels normal and stable |
| | BOP | <ul style="list-style-type: none"> • Bypass/defeat PR channel functions at 1PM07J <ul style="list-style-type: none"> • N-44 upper current comparator • N-44 lower current comparator • N-44 power mismatch bypass ○ N-44 rod stop bypass • N-44 channel current comparator |
| | BOP | <ul style="list-style-type: none"> • Reset PR Flux Rate Rx Trip Alert |
| | RO/ BOP | <ul style="list-style-type: none"> • Place computer points in test <ul style="list-style-type: none"> • N0047 • N0048 • U1143 (continued) • Place computer point in removed from scan – may use BOP CX-14 <ul style="list-style-type: none"> • N0052A • Place NIS input to DEH – IN TEST (Graphic 5515) |

| Scenario No: | NRC 16-1 | Event No. | 2 |
|--|-----------------|---|----------|
| Event Description: Power range N-44 fails high. | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | SRO | <ul style="list-style-type: none"> • Contact SM/WEC to have bistables BYPASSED • Direct Loop ΔT recorder selected to operable channel | |
| | RO | <ul style="list-style-type: none"> • Check if rod control can be placed in auto <ul style="list-style-type: none"> • C-5 (1-BP-5.7) NOT LIT • $T_{AVE} - T_{REF}$ within 1°F • Place control rods in auto | |
| | SRO | <ul style="list-style-type: none"> • Determines TS 3.3.1 conditions A, D, and E are applicable. <ul style="list-style-type: none"> ○ Enter degraded equipment log for P-10 & P-8 • Contact SM to perform risk assessment, initiate IR, evaluate reactivity screening, make notifications and contact appropriate personnel to investigate/correct instrument failure. | |
| <p>EVALUATOR NOTE: After the actions for N-44 are complete and Tave-Tref are within 1°F, (bypassing the bistables only need to be requested, not completed) and with lead examiner concurrence, enter next event.</p> | | | |

| Scenario No: | NRC 16-1 | Event No: | 3 |
|--|-----------------|--|---|
| Event Description: Raise power at 0.4 MW/min | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> ○ Call from Generation Dispatch to raise power to 880 MW at 0.4 Mw/min. | |
| | SRO | <ul style="list-style-type: none"> ● Acknowledge request to raise power to 880 MW at 0.4 Mw/min. ● Implement actions of 1BGP 100-3. ● Perform pre-job brief for load ramp. ● Direct raising load to 880MW at 0.4 MW/min. ● Initiate load swing instruction sheet, 1BGP 100-3T5. | |
| | CREW | <ul style="list-style-type: none"> ● Review applicable Precautions, and Limitations and Actions. | |
| | RO | <ul style="list-style-type: none"> ● Verify rod position and boron concentration. ● Initiate dilution as required (BOP CV-5). ● Determine required PW volume: (approximate band: 2500 gal – 3000 gal). <ul style="list-style-type: none"> ○ Effects of previously performed dilutions. ○ Byron Boration Dilution Tables. ● Determine required PW flow rate. ● Perform the following at 1PM05J: <ul style="list-style-type: none"> ● Set 1FK-111 PW/Total Flow Cont POT to the desired PW flow rate. ● Set 1FY-0111 PW Control Predet Counter to desired PW volume. ● Place MAKE-UP CONT SWITCH to STOP position. ● Set MODE SELECT to DIL/ALT DIL position. ● Place MAKE-UP CONT Switch to START. ○ Verify proper operation of valves and PW makeup pump (1CV111B open, 1CV111A throttled, 1CV110B open (ALT DIL only), PW pump running, PW flow on recorder). ○ Turn on PZR backup heaters. | |
| | BOP | <ul style="list-style-type: none"> ● Raise turbine load at 1PM02J or OWS drop 210 by performing the following: <ul style="list-style-type: none"> ● Select SETPOINT. ● Enter 0.4 MW/min into the RATE window. ● Select ENTER. ● Enter 880 MW into REF DEMAND window. ● Select ENTER. ● Select EXIT. ○ Notify SRO and RO of pending ramp. ● Select GO/HOLD. ● Verify GO/HOLD button illuminates. ● Verify HOLD illuminated RED. ● Select GO. ● Verify GO illuminates RED. ● Verify main turbine load begins to rise. | |
| | RO/ BOP | <ul style="list-style-type: none"> ● Monitor reactor power and load ascension: <ul style="list-style-type: none"> ● Monitor NI's, Tave, ΔI, Pzr press/level at 1PM05J. ● Monitor MW and DEHC system response at 1PM02J or OWS drop 210. ● During dilution, monitor the following at 1PM05J and HMI: <ul style="list-style-type: none"> ● VCT level. ● RCS Tave rising/RCS boron concentration lowering. ● PW/Total flow predet counter responding correctly. ● Verify dilution auto stops at preset value. ● Return Reactor Makeup System to automatic. | |

| | | | |
|---|---------------------------|---------------------------------|---|
| Scenario No: | NRC 16-1 | Event No. | 3 |
| Event Description: | Raise power at 0.4 MW/min | | |
| Time | Position | Applicant's Actions or Behavior | |
| | | | |
| <p>EVALUATOR NOTE: After measurable change in power and lead examiner approves, initiate the next event.</p> | | | |

| | | | |
|---|---|--|---|
| Scenario No: | NRC 16-1 | Event No: | 4 |
| Event Description: | 1A CC pump trip with failure of 1B CC pump to automatically start | | |
| Time | Position | Applicant's Actions or Behavior | |
| EVALUATOR NOTE: Crew MAY enter 1BOA Pri-6, but per BAR 1-2-A4, entry into 1BOA Pri-6 is NOT required if CC flow is restored. | | | |
| | CUE | <ul style="list-style-type: none"> • Annunciator 1-02-A4, CC Pump Trip Alarm LIT • 1A CC pump control switch AMBER light LIT • 1B CC pump does NOT automatically start | |
| | BOP | <ul style="list-style-type: none"> ○ Check BAR 1-2-A4 | |
| | SRO | <ul style="list-style-type: none"> ○ Direct actions to restore CC flow IAW BAR 1-2-A4 ○ Enter 1BOA Pri-6, CC System Malfunction and direct the actions of: <ul style="list-style-type: none"> ○ Step 1: Check CC surge tank level ○ Step 2: Check system status – Start 1 CC pump ○ Step 3: Check system temperature ○ Step 4: Check RCP temperature ○ Step 5: Check Letdown temperature ○ Step 6: Check CC system status | |
| | BOP | <ul style="list-style-type: none"> • Start 1B CC Pump ○ Place 1A CC Pump to PTL | |
| | BOP/RO | <ul style="list-style-type: none"> ○ Dispatch EO to check 1A CC Pump for cause of failure ○ Dispatch EO to check 1B CC Pump for proper operation | |
| | RO | <ul style="list-style-type: none"> ○ Review BARs ○ Monitor primary and secondary panels as BOP responds to CC malfunction | |
| | SRO | <ul style="list-style-type: none"> • Evaluate TS 3.7.7, Condition B ○ Direct U0 CC Pump to be aligned to replace 1A CC Pump <ul style="list-style-type: none"> ○ Exit TS 3.7.7 Condition B ○ Evaluate 1B CC pump as degraded | |
| Evaluator note: TS 3.7.7 LCO is met if U-0 CC pump is aligned to replace the tripped 1A CC pump and LCOAR condition B may be exited. | | | |
| | SRO | <ul style="list-style-type: none"> • Notify SM of malfunction, TS evaluation, request IR and E plan evaluation | |
| EVALUATOR NOTE: After the actions for the CC malfunction are complete and with lead examiners concurrence, insert the next event. | | | |

| Scenario No: | NRC 16-1 | Event No. | 5 |
|--|-----------------|--|---|
| Event Description: 1PT-CV131 fails low | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> ○ Annunciator LP LTDWN RLF TEMP HIGH (1-9-B1) ● 1FI-132, letdown line flow, lowering. ● 1PI-131, letdown line pressure, lowering. | |
| | CREW | <ul style="list-style-type: none"> ● Refer to BARs ● Recognize 1PT-131 failed low. | |
| | SRO | <ul style="list-style-type: none"> ● Implement BHC for Letdown Malfunction ● Direct/Ensure RO takes manual control of 1PK-131 and returns letdown pressure to normal. ● Inform SM of 1PT-131 failure. <ul style="list-style-type: none"> ○ Direct BOP/RO to stop load ramp/dilution. ○ Direct RO to isolate letdown. | |
| | RO | <ul style="list-style-type: none"> ● Implement BHC for Letdown Malfunctions. ● Perform the following at 1PM05J: <ul style="list-style-type: none"> ● Place 1PK-131, letdown line pressure control valve, in manual. ● Raise demand on 1PK-131. ● Lower letdown line pressure sufficiently to close letdown line relief valve and restore letdown flow to normal. ● Maintain letdown flow and pressure by operating 1PK-131 in manual. | |
| | BOP | <ul style="list-style-type: none"> ● Refer to BAR's ● Support RO by monitoring panels and providing assistance as requested. | |
| | SRO | <ul style="list-style-type: none"> ● Contact SM to perform risk assessment, initiate IR, and contact maintenance to investigate/correct instrument failure. | |
| <p>EVALUATOR NOTE: The crew may elect to <u>isolate letdown</u> based on letdown relief valve lifting or loss of letdown pressure indication. The steps for isolating letdown and restoring normal letdown are in italics on the next page.</p> | | | |
| <p>EVALUATOR NOTE: The crew may elect to <u>place excess letdown on line</u> due to the loss of letdown pressure indication. The steps for placing excess letdown on line are in italics on the next page.</p> | | | |

| Scenario No: | NRC 16-1 | Event No. | 5 |
|---|-----------------|--|---|
| Event Description: 1PT-CV131 fails low | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | RO/ BOP | <ul style="list-style-type: none"> ○ <i>Isolate letdown</i> <ul style="list-style-type: none"> ○ <i>Close 1CV8149A, B, & C</i> ○ <i>Close 1CV459 & 1CV460</i> ○ <i>Place 1CV121 in manual and control RCP seal injection 8-13 gpm per RCP</i> ○ <i>Close 1CV8105/8106</i> ○ <i>Monitor RMCS during automatic VCT makeup</i> <ul style="list-style-type: none"> ○ <i>Proper flow indicated on PW/Total Flow (1FT-0111) and Boric Acid Flow (1FT-0110).</i> ○ <i>Establish normal letdown per 1BOA ESP-2 (or BOP CV-17)</i> <ul style="list-style-type: none"> ○ <i>Verify/close 1CV8149A/B/C and 1CV459 and 1CV460</i> ○ <i>Verify/open 1CV8401A/B, 1CV8324A/B and 1CV8389A/B</i> ○ <i>Verify/open 1CV8152/8160</i> ○ <i>Check BTRS MODE SELECTOR switch is OFF</i> ○ <i>Place 1CV131 manual at 40% demand</i> ○ <i>Place 1CC130 in manual at 60% demand</i> ○ <i>Verify/open 1CV8105/8106</i> ○ <i>Adjust charging flow to approx. 100 gpm w/seal injection 8-10 gpm per RCP</i> ○ <i>Open 1CV459/460</i> ○ <i>Open 1CV8149A/B/C and control 1CV131 to maintain letdown pressure 360-380 psig</i> ○ <i>Control 1CC130 to maintain letdown temperature 90-115°F</i> ○ <i>Place controllers in auto</i> ○ <i>Verify 1PR06J in service</i> ○ <i>Establish excess letdown per BOP CV-15</i> <ul style="list-style-type: none"> ○ <i>Verify open 1CV8100 and 1CV8112.</i> ○ <i>Open 1CC9437A & B.</i> ○ <i>Verify close 1HCV-CV123.</i> ○ <i>Place 1CV8143 to VCT</i> ○ <i>Direct EOs to open 1CV8482 and close 1CV8484.</i> ○ <i>Open 1RC8037A, B, C, & D.</i> ○ <i>Open 1CV8153A & B.</i> ○ <i>Open 1HCV-CV123 and maintain excess letdown outlet temperature < 165°F.</i> | |
| | RO | <ul style="list-style-type: none"> ○ <i>Verify proper operation of RMCS during VCT makeup</i> <ul style="list-style-type: none"> ○ <i>Proper flow indicated on PW/Total Flow (1FT-0111) and Boric Acid Flow (1FT-0110).</i> ○ <i>Restore PZR level to program</i> | |
| EVALUATOR NOTE: Initiate the next event when the lead examiner approves. | | | |

| Scenario No: | NRC 16-1 | Event No. | 6 |
|--|-----------------|--|---|
| Event Description: 1FW540 oscillating | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciator 1-15-D4, S/G 1D FLOW MISMATCH STM FLOW LOW • Annunciator 1-15-D9, S/G 1D LEVEL DEVIATION HIGH LOW • 1D SG level OSCILLATING | |
| | BOP | <ul style="list-style-type: none"> • Implement BHC for Steam Generator Level. • Place 1FW540 in MANUAL • Control feedwater flow • Balance feedwater flow with steam flow to restore and stabilize SG level | |
| | SRO | <ul style="list-style-type: none"> • Direct BOP to manually control 1D SG level • Notify SM for IR | |
| | RO | <ul style="list-style-type: none"> ○ Monitor primary plant for reactivity effects ○ Review BARs | |
| <p>EVALUATOR NOTE: After the actions to control feedwater flow are complete and with lead examiners concurrence, insert the next event.</p> | | | |

| Scenario No: NRC 16-1 | | Event No: 7 |
|--|----------|--|
| Event Description: 1FW540 Failed Closed/Unit 1 Reactor Trip | | |
| Time | Position | Applicant's Actions or Behavior |
| | CUE | <ul style="list-style-type: none"> Annunciator 1-15-D4, SG 1D Flow Mismatch FW Flow Low Alarm LIT 1FW540 TSLB light LIT 1D SG level lowering |
| | CREW | <ul style="list-style-type: none"> Identify entry conditions for 1BEP-0, "REACTOR TRIP OR SAFETY INJECTION" |
| | SRO | <ul style="list-style-type: none"> Order U-1 Reactor trip Notify SM of plant status and procedure entry Request evaluation of Emergency Plan conditions Enter/Implement 1BEP-0 and direct operator actions of 1BEP-0 |
| | RO | <p>Perform immediate operator actions of 1BEP-0:</p> <ul style="list-style-type: none"> Step 1: Verify reactor trip <ul style="list-style-type: none"> Rod bottom lights - ALL LIT Reactor trip & Bypass breakers - OPEN Neutron flux – DROPPING |
| | BOP | <p>Perform immediate operator actions of 1BEP-0:</p> <ul style="list-style-type: none"> Step 2: Verify Turbine Trip <ul style="list-style-type: none"> All Turbine throttle valves - CLOSED All Turbine governor valves - CLOSED Step 3: Verify power to 4KV busses <ul style="list-style-type: none"> ESF Buses – BOTH ENERGIZED (141 & 142) |
| | CREW | <ul style="list-style-type: none"> Step 4: Check SI Status <ul style="list-style-type: none"> SI First OUT annunciator – NOT LIT SI ACTUATED Permissive Light – NOT LIT SI Equipment – NOT ACTUATED <ul style="list-style-type: none"> Either SI pump – NOT RUNNING Either CV pump to cold leg isolation valve – NOT OPEN – 1SI8801A/B Recognize SI NOT Actuated Check if SI Required <ul style="list-style-type: none"> Pzr Pressure – NOT < 1829 # Steamline Pressure – NOT < 640# CNMT Pressure – NOT > 3.4# Recognize SI is NOT required |
| | SRO | <ul style="list-style-type: none"> Transition to 1BEP ES-0.1, Reactor Trip Response Direct STA to monitor BST Notify SM of procedure entry Request evaluation of Emergency Plan conditions |

| Scenario No: | NRC 16-1 | Event No. | 8 & 9 |
|---|------------------------|--|------------------|
| Event Description: LOCA / SI pump failure | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | SRO | <ul style="list-style-type: none"> Direct the actions of 1BEP ES-0.1 | |
| | RO | <ul style="list-style-type: none"> Step 1: Check RCS temperatures Maintain RCS temperature at 557°F | |
| | BOP | <ul style="list-style-type: none"> Control feed flow >500 gpm until ≥ 1 SG level is > 10% | |
| | RO | <ul style="list-style-type: none"> Step 2: Check Shutdown Reactivity <ul style="list-style-type: none"> All rod bottom lights LIT Step 3: Control charging to control Pzr Level at normal level Step 4: Check Pzr pressure trending to normal pressure | |
| EVALUATOR NOTE: The next malfunction (LOCA) may now be inserted. | | | |
| | CUE | <ul style="list-style-type: none"> Pzr pressure and level – LOWERING CNMT pressure – RISING | |
| EVALUATOR NOTE: The next step may still be in progress before the LOCA is recognized. | | | |
| | BOP | <ul style="list-style-type: none"> Step 5: Check FW status If RCS < 564°F, verify FW isolation complete and trip running MF pumps | |
| | SRO | <ul style="list-style-type: none"> Transition back to 1BEP-0 Notify SM of procedure entry Request evaluation of Emergency Plan conditions <ul style="list-style-type: none"> Request STA to monitor BST (if not requested earlier) Direct crew to reperform Steps 1 – 3 of 1BEP-0 <ul style="list-style-type: none"> Verify Reactor Trip Verify Turbine Trip Verify 4KV busses energized | |
| | CREW | <ul style="list-style-type: none"> Step 4: Check SI Status <ul style="list-style-type: none"> SI First OUT annunciator - LIT SI ACTUATED Permissive Light - LIT SI Equipment – AUTOMATICALLY ACTUATED <ul style="list-style-type: none"> Either SI pumps - RUNNING Either CV pump to cold leg isolation valve OPEN – 1SI8801A/B Recognize SI Actuated Manually actuate SI from 1PM05J and 1PM06J | |
| | CREW [CT-16] | <ul style="list-style-type: none"> Determine RCP trip required <ul style="list-style-type: none"> RCS pressure < 1425 psig & High head SI flow (1FI-917) > 100 gpm TRIP ALL RCPs | |
| | SRO | <ul style="list-style-type: none"> Step 5: Direct BOP to perform Attachment B of 1BEP-0 | |
| EVALUATOR NOTE: SRO and RO will continue in 1BEP-0 while BOP is performing Attachment B, SI Verification. 1BEP-0 steps continue and the Att B steps are listed at the end of the guide on page 20. | | | |

| Scenario No: NRC 16-1 | | Event No: 8 & 9 |
|--|----------|---|
| Event Description: LOCA / SI pump failure | | |
| Time | Position | Applicant's Actions or Behavior |
| | RO | <ul style="list-style-type: none"> • Step 6: Verify AF system: <ul style="list-style-type: none"> • AF pumps – BOTH AF pumps RUNNING. • AF isolation valves – 1AF13A-H OPEN. • AF flow control valves – 1AF005A-H THROTTLED. • AF flow - >500 GPM • Check SG tubes - INTACT and SG NR levels – NOT RISING UNCONTROLLED • Step 7: Check PZR PORVs and SPRAY VALVES at 1PM05J: <ul style="list-style-type: none"> • 1RY455 & 1RY456 CLOSED • PORV isol valves – 1RY8000A & 1RY8000B BOTH ENERGIZED • PORV relief path – Both PORVs in AUTO, Both isolation valves – OPEN. • Normal PZR Spray Valves CLOSED • Step 8: Maintain RCS temperature control at 1PM05J: <Cont Action Step> <ul style="list-style-type: none"> • Verify RCS average temperature stable at or trending to 557°F. • Throttle AF maintaining >500 GPM until SG minimum level is met <ul style="list-style-type: none"> ○ MSIVs closed • Step 9: Check status of RCPs at 1PM05J: <ul style="list-style-type: none"> ○ All RCP's – NONE RUNNING. ○ Any RCPs still running – TRIP All RCPs • Step 10: Check if SG secondary pressure boundaries are intact at 1PM04J: <ul style="list-style-type: none"> • Check pressure in all SGs: <ul style="list-style-type: none"> • None dropping in an uncontrolled manner. • None completely depressurized. • Step 11: Check S/G tubes are intact at RM-11 console: <ul style="list-style-type: none"> • 1PR08J SG Blowdown. • 1PR27J SJAE/GS. • 1AR22/23A-D Main steam Lines. |
| | CREW | <ul style="list-style-type: none"> • Step 12: Determine RCS is NOT intact: <ul style="list-style-type: none"> ○ CNMT area rad monitors > alert alarm setpoint at RM-11 console. ○ CNMT pressure > 3.4 psig (1PI-CS 934-937) at 1PM06J. ○ CNMT floor drain sump level > 46 inches (1LI-PC002/003) at 1PM06J. |
| | CREW | Transition to 1BEP-1, 'LOSS OF REACTOR OR SECONDARY COOLANT' |
| | SRO | <ul style="list-style-type: none"> • Notify SM of plant status and procedure entry • Request evaluation of Emergency Plan conditions • Enter/Implement 1BEP-1 and direct operator actions of 1BEP-1 |
| | RO | <ul style="list-style-type: none"> • Step 1: Check Status of RCPs: <ul style="list-style-type: none"> • RCPs – NONE RUNNING |
| | RO/ BOP | <ul style="list-style-type: none"> • Step 2: Check if SG secondary pressure boundaries are intact: <ul style="list-style-type: none"> • Check pressure in all SGs: <ul style="list-style-type: none"> • None dropping in an uncontrolled manner • None completely depressurized • Step 3: Check intact SG levels <ul style="list-style-type: none"> • SG levels maintained between 10% (31%) and 50% • SG NR levels – NOT rising in an uncontrolled manner • Step 4: Check secondary radiation normal. <ul style="list-style-type: none"> • Reset Phase A <ul style="list-style-type: none"> • Depress BOTH Phase A Reset Pushbuttons at 1PM06J • OPEN 1SD005A-D at 1PM11J • At RM-11 or HMI Check secondary rad trends on : |

| Scenario No: NRC 16-1 | | Event No: 8 & 9 |
|--|----------|---|
| Event Description: LOCA / SI pump failure | | |
| Time | Position | Applicant's Actions or Behavior |
| | | <ul style="list-style-type: none"> • 1PR08J SG Blowdown • 1PR27J SJAE/GS • 1AR22/23A-D Main steam line |
| | RO | <ul style="list-style-type: none"> • Step 5: Check at least ONE PZR PORV relief path available: <ul style="list-style-type: none"> • PORV isol valves – BOTH ENERGIZED • PORV relief path – BOTH PORVs in AUTO, 1RY8000A & B – OPEN |
| | CREW | <ul style="list-style-type: none"> • Step 6: Check if ECCS flow should be reduced <ul style="list-style-type: none"> • RCS subcooling – NOT acceptable • Step 7: Check if CS should be stopped <ul style="list-style-type: none"> • Both CS pumps – NEITHER is RUNNING • Step 8: Check if RH pumps should be stopped <ul style="list-style-type: none"> • Reset SI <ul style="list-style-type: none"> • Depress BOTH SI Reset Pushbuttons at 1PM06J • Verify SI ACTUATED BP light NOT lit at 1PM05J • Verify AUTO SI BLOCKED BP light NOT lit at 1PM05J • RCS pressure > 325 psig & stable <ul style="list-style-type: none"> • Stop both RH pumps and place in standby • Step 9: Check for faulted SG <ul style="list-style-type: none"> • Pressure in all SG stable or rising • RCS pressure stable or dropping • Step 10: Check if DGs should be stopped <ul style="list-style-type: none"> • Stop DGs and place in standby • Step 11: Initiate evaluation of plant status <ul style="list-style-type: none"> • Check cold leg recirc capability – BOTH trains available • Check AB rad trends normal • Obtain samples • Evaluate equipment for long term recovery • Shutdown chiller on non-operating VC trains • Start additional plant equipment as required • Step 12: Check if RCS cooldown and depressurization is required <ul style="list-style-type: none"> • RCS pressure – Greater than 325# • Go to 1BEP ES-1.2, Post LOCA Cooldown and Depressurization |
| | CREW | Transition to 1BEP ES-1.2, 'POST LOCA COOLDOWN AND DEPRESSURIZATION' |
| | SRO | <ul style="list-style-type: none"> • Notify SM of plant status and procedure entry • Request evaluation of Emergency Plan conditions • Enter/Implement 1BEP ES-1.2 and direct operator actions |
| | CREW | <ul style="list-style-type: none"> • Reset SI if necessary – SI has been reset • Reset Phase A isolation <ul style="list-style-type: none"> • Depress Phase A isolation RESET PB • Phase A Isolation Alarm - CLEAR • Reset Phase B isolation – NOT actuated |
| | BOP | <ul style="list-style-type: none"> • Establish IA to containment <ul style="list-style-type: none"> • Check SACs- any running • Open 1IA065 and 1IA066 • Verify ALL AC busses energized by offsite power – ALL busses are powered from offsite |
| | RO | <ul style="list-style-type: none"> • Deenergize PZR heaters <ul style="list-style-type: none"> • BU heaters in OFF |

| | | | |
|---|-----------------|--|-------|
| Scenario No: | NRC 16-1 | Event No. | 8 & 9 |
| Event Description: LOCA / SI pump failure | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | | <ul style="list-style-type: none"> • Variable heaters (Group C) in AFTER TRIP | |
| | SRO | <ul style="list-style-type: none"> • Contact SM or WEC to consult TSC to recommend Pzr water level | |
| | CREW | <ul style="list-style-type: none"> • Check if RH pumps should be stopped <ul style="list-style-type: none"> • Any RH pump running and aligned to RWST • RCS pressure >325# • Stop both RH pumps | |
| | BOP | <ul style="list-style-type: none"> • Check intact SG levels > 10% • Control FF to maintain NR levels 30 – 50% | |
| | CREW | <ul style="list-style-type: none"> • Initiate RCS cooldown to 200°F. <ul style="list-style-type: none"> ○ Use RH if in SD Cooling mode – NOT in SD cooling • Check RCS pressure < 1930 PSIG – P-11 IS LIT <ul style="list-style-type: none"> • Block STEAMLINe SI - Block switches actuated ○ Dump steam to condenser from intact SGs – steam dumps NOT available • Dump steam from all intact SGs using SG PORVs • Place SG PORV controllers in manual and adjust demand to establish cooldown of $\leq 100^\circ$ per hour. | |
| EVALUATOR NOTE: When the Crew begins RCS cooldown in 1BEP ES-1.2, conclude the scenario. | | | |

EVALUATOR NOTE: 1BEP 0, ATTACHMENT B steps are listed here.

| | |
|----------------------|--|
| RO/ BOP [CT-7] | <ul style="list-style-type: none"> • Att B, Step 1: Verify ECCS pumps running <ul style="list-style-type: none"> • Both CV pumps – RUNNING • Both RH pumps – RUNNING • Neither SI pump – RUNNING <ul style="list-style-type: none"> • Manually start 1B SI pump prior to completion of step 6 of 1BEP-0 (CT-7). <ul style="list-style-type: none"> ○ Place 1A SI pump in pull out |
| BOP | <ul style="list-style-type: none"> • Att B, Step 2: Verify ECCS valve alignment <ul style="list-style-type: none"> • Determine Group 2 Cold Leg Injection monitor lights required for injection - All lit • Att B, Step 3: Verify ECCS flow <ul style="list-style-type: none"> • High Head SI flow >100 gpm (1FI-917) • RCS pressure < 1700 psig <ul style="list-style-type: none"> • 1B SI pump discharge flow > 200 gpm • RCS pressure > 325 psig • Perform the following at 1PM06J: <ul style="list-style-type: none"> • Att B, Step 4: Verify RCFCs running in Accident Mode: <ul style="list-style-type: none"> • Group 2 RCFC Accident Mode lights – 2 LIT. • Att B, Step 5: Verify Phase A isolation: <ul style="list-style-type: none"> • Group 3 Cnmt Isol monitor lights – ALL LIT. • Att B, Step 6: Verify Cnmt Vent isolation: <ul style="list-style-type: none"> • Group 6 Cnmt Vent Isol monitor lights – ALL LIT. ○ Verify MSIV and Bypass Valves – CLOSED • Att B, Step 7: Verify CC pumps – BOTH RUNNING. • Att B, Step 8: Verify SX pumps – BOTH RUNNING. • Att B, Step 9: Check if Main Steamline Isolation –required: <ul style="list-style-type: none"> ○ All S/G pressures > 640 psig (at 1PM04J). • CNMT pressure > 8.2 psig. • MSIVs and bypass valves – CLOSED |
| CREW | <ul style="list-style-type: none"> ○ MAY actuate MSLI in anticipation of reaching MSLI setpoint of 8.2 psig. • Recognize and announce ADVERSE CNMT |

| | |
|-----|---|
| BOP | <ul style="list-style-type: none"> • Att B, Step 10: Check if CS is required <Cont Action Step> <ul style="list-style-type: none"> • CNMT pressure has NOT risen > 20 psig. • Att B, Step 11: Verify FW isolated at 1PM04J: <ul style="list-style-type: none"> • FW pumps – TRIPPED. • Isolation monitor lights – LIT. • FW pumps discharge valves - CLOSED (or going closed) 1FW002A-C. • Trip all running HD pumps. • Att B, Step 12: Verify DGs running at 1PM01J: <ul style="list-style-type: none"> • DGs – BOTH DG running • 1SX169A/B OPEN. • Dispatch operator locally to check operation • Att B, Step 13: Verify Generator Trip at 1PM01J: <ul style="list-style-type: none"> • OCB 1-8 and 7-8 open. • PMG output breaker open. • Att B, Step 14: Verify Control Room ventilation aligned for emergency operations at 0PM02J: <ul style="list-style-type: none"> • VC Rad Monitors – LESS THAN HIGH ALARM SETPOINT. • Operating VC train equipment – RUNNING. <ul style="list-style-type: none"> • 0B Supply fan • 0B Return fan • 0B M/U fan • 0B Chilled water pump • 0B Chiller • Operating VC train dampers – ALIGNED. <ul style="list-style-type: none"> • M/U fan outlet damper – 0VC08Y NOT FULLY CLOSED. • 0B VC train M/U filter light – LIT. • 0VC09Y - OPEN • 0VC313Y – CLOSED • Operating VC train Charcoal Absorber aligned for train B. <ul style="list-style-type: none"> • 0VC44Y - CLOSED • 0VC05Y - OPEN • 0VC06Y – OPEN • Control Room pressure greater than +0.125 inches water on 0PDI-VC038. |
| BOP | <ul style="list-style-type: none"> • Att B, Step 15: Verify Auxiliary Building ventilation aligned at 0PM02J: <ul style="list-style-type: none"> • Two inaccessible filter plenums aligned. <ul style="list-style-type: none"> • Plenum A: <ul style="list-style-type: none"> • 0VA03CB - RUNNING • 0VA023Y - OPEN • 0VA436Y – CLOSED • Plenum C: <ul style="list-style-type: none"> • 0VA03CF - RUNNING • 0VA072Y – OPEN • 0VA438Y – CLOSE • Att B, Step 16: Verify FHB ventilation aligned at 0PM02J: <ul style="list-style-type: none"> • 0VA04CB - RUNNING • 0VA055Y - OPEN • 0VA062Y - OPEN • 0VA435Y – CLOSED |
| BOP | <ul style="list-style-type: none"> • Att B, Step 17: Maintain UHS Basin Level - >80% <Cont Action Step> • Att B, Step 18: Initiate periodic checking of Spent Fuel Cooling <ul style="list-style-type: none"> • Notify EO to verify SFP level and temperature • Notify STA of SFP cooling status |

| | | |
|--|--|--|
| | | <ul style="list-style-type: none">• Att B, Step 19: Notify US of actions taken, equipment status, CAS ownership and that Attachment B is completed○ Att B, Step 20: Shutdown unnecessary equipment per 1BGP 100-1T4 and 100-5 - May notify WEC of this step |
|--|--|--|

(final)

| | | | | |
|---------------------|--|-----------------|---------------------|-----------------------|
| Simulation Facility | <u>Byron</u> | Scenario No.: | Operating Test No.: | 2016 Byron NRC |
| Examiners: | _____ | NRC 16-3 | Applicant: | _____ |
| | _____ | | | SRO |
| | _____ | | | RO |
| | _____ | | | BOP |
| Initial Conditions: | IC-14 | | | |
| Turnover: | Unit 1 is at 12% power, BOL, ready to synchronize Main Generator. Online risk is green. CBD @ 132 steps, and boron concentration is 1285 ppm. 1BGP 100-3, step F.27 is the next step to perform. Steam dump demand must be raised to 35% to 45% as directed by step 23.p. The offgoing shift has just diluted 150 gallons. | | | |

| Event No. | Malf. No. | Event Type* | Event Description |
|-----------|--|-------------------------|---|
| Preload | IMF RP15A MRF RP83 OPEN trgset 2 "zlobyan14 > 0" trg 2 "IMF CV01b" IMF MS01A 100 | | 1A CV pump auto start failure 1B CV pump trip 1A MSIV failed open |
| 1 | | R (RO, SRO) | Power ascension |
| 2 | | N (BOP, SRO) | Synchronize Main Generator to grid |
| 3 | IMF RX13A 0 15 | I (RO, SRO) TS (SRO) | Pressurizer level channel 1LT-459 fails low (Tech Spec) |
| 4 | IMF RX30A 65 60 40 | I (BOP, SRO) | 1FW510A, 1A SG FWRV Bypass valve controller failure |
| 5 | MRF ED052A OPEN | TS (SRO) | Loss of power to Pzr Heater Groups B and C (Tech Spec) |
| 6 | MRF SW38 OPEN IMF SW06B | C (BOP, SRO) | 0B WS pump trip with 0A WS pump auto start failure |
| 7 | IMF MS08A 4 120 | M (ALL) | Faulted 1A SG with 1A MSIV failed open |
| 8 | Preload | C (RO, BOP, SRO) | 1B CV pump trips/1A CV pump fails to auto start. |

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

SCENARIO OVERVIEW

Unit 1 is at 12% power, BOL, ready to synchronize Main Generator. Online risk is green. CBD @ 132 steps, and boron concentration is 1285 ppm. 1BGP 100-3, step F.27 is the next step to perform. Steam dump demand must be raised to 35% to 45% as directed by step 23.p. The offgoing shift has just diluted 100 gallons.

After completing shift turnover and relief, the crew will continue 1BGP 100-3, step F.27 to synchronize the main generator to the grid. The RO will dilute or withdraw control rods to raise steam dump demand from current demand to 35% to 45% IAW 1BGP 100-3.

After power has been raised and the synchronization is complete, the controlling pressurizer level channel will fail low. Letdown will automatically isolate and the RO will take manual control of charging flow. 1BOA INST 2, OPERATION WITH A FAILED INSTRUMENT CHANNEL, Attachment C, will be implemented. The RO will restore pressurizer level control to automatic after letdown is reestablished and pressurizer level is restored to normal. Technical specification 3.3.1 conditions A and K will be entered. On line risk remains green.

After the pressurizer level channel failure has been addressed, the Feedwater Bypass valve controller on the 1A SG fails high. The BOP will take manual control of feedwater flow. The BOP will maintain feedwater flow control in manual. On line risk remains green.

After the feedwater controller failure has been addressed, the supply breaker to Groups B and C Pressurizer Heaters will trip and will not reset. The crew must enter TS 3.4.9, and energize a set of backup heaters to maintain RCS pressure in the normal band.

After the trip of the Pressurizer Heaters has been addressed, the 0B WS pump will trip, and the 0A WS pump will fail to automatically start on low WS header pressure, so the crew will manually start the 0A WS pump. Crew will enter 0/1BOA SEC-5 for the failure.

After the WS Pump trip has been addressed, the 1A SG steam line will fault outside containment, and the 1A MSIV will fail to close, automatically or manually. The crew will implement 1BEP-0, REACTOR TRIP OR SAFETY INJECTION. When safety injection is actuated, the 1B CV pump will trip. The 1A CV pump must be manually started to establish high head ECCS flow.

After determining 1A SG secondary pressure boundary is not intact the crew will transition to 1BEP-2, FAULTED STEAM GENERATOR ISOLATION.

The crew will complete isolation of 1A SG and transition to 1BEP-1, LOSS OF REACTOR OR SECONDARY COOLANT.

After the steam generator has blown dry, the crew will transition to 1BEP ES-1.1, SI TERMINATION.

The scenario is complete when the crew has stopped the RH pumps in step 10 of 1BEP ES-1.1.

Critical Tasks

1. Manually start the 1B CV pump prior to completion of Attachment B of 1BEP-0.
(ERG Critical Task number – CT-6) (K/A number - 013000A4.01 importance – 4.5/4.8)
2. Isolate 1A Steam Generator prior to exiting 1BEP-2.
(ERG Critical Task number – CT-17) (K/A number - APE040AA1.10 importance - 4.1/4.1)

References

| | |
|-------------|-------------|
| 1BGP 100-3 | 1BEP-0 |
| 1BOA INST-2 | 1BEP-2 |
| 1BOA ESP-2 | 1BEP-1 |
| 1BOA SEC-5 | 1BEP ES-1.1 |
| 0BOA SEC-5 | |

SIMULATOR SETUP GUIDE:

- Verify/perform TQ-BY-201-0113, BYRON TRAINING DEPARTMENT SIMULATOR EXAMINATION SECURITY ACTIONS CHECKLIST.
- Establish the conditions of IC 14, 12% power, BOL, ready to synchronize Main Generator.
- Verify/remove any Equipment Status Tags and Danger Tags not applicable to the scenario.
- Place simulator in RUN (allow simulator to run during board walk down and turnover).
- Verify Simulator Readiness Checklist is completed.
- **Start 0B WS pump and place 0A WS pump in standby.**
- **Verify 1B CV pump is running and 1A CV pump is in standby.**
- Set main generator VPL to 25% on Graphic 5501.
- Adjust incoming voltage about **1 to 4 volts < running voltage.**
- Adjust generator speed so that synchroscope is running slowly in the **SLOW** direction.
- Dilute 150 Gallons. Provide a boration/dilution log with 150 Gallons Dilution for Temperature Control to the oncoming crew. Provide 1BGP 100-3T1 initialed up to step 27. Leave RMCS setup for dilution.
- Adjust MFWP DP to maintain SG levels as power rises.
- Put Plant Display 13, AFD Summary, on 1PM05J right CRT.
- Start a second CW Makeup Pump.
- Run **caep N16-3** from thumb drive and verify the following actions load in the caep:

Byron ILT NRC 16-3|00:00:00|0
Event 3: 1LT459 failed low|00:00:00|2
IMF RX13A 0 15|08:00:00|3
Event 4: 1FW510A controller failure|00:00:00|5
IMF RX30A 65 60 40|08:00:00|6
Event 5: Loss of power to Pzr heaters|00:00:00|8
mrf ed052a open|08:00:00|9
Event 6: WS pump trip|00:00:00|11
imf sw06b|08:00:00|12
Event 7: 1A SG fault|00:00:00|14
imf ms08a 4 120|08:00:00|15
Setup file|00:00:00|20
IMF RP15A|00:00:01|21
MRF RP83 OPEN|00:00:02|22
trgset 2 "zlobyan14 > 0"|00:00:03|23
trg 2 "IMF CV01b"|00:00:04|24
IMF MS01A 100|00:00:05|25
mrf sw38 open|00:00:06|26

Event 1: Power ascension

As **EO**, perform the local actions of 1BGP 100-3 as directed by the crew.

Event 2: Synchronize Main Generator to grid

As **EO**, perform the local actions of 1BGP 100-3 as directed by the crew.

Event 3: Pressurizer level channel 1LT-459 failed low.

Insert **IMF RX13A 0 15** to fail 1LT-459 low over a 15 second period.

If lead examiner desires the bistables tripped, participate in brief and perform the following:

- As assist NSO contact Unit 1 (X-2208)
- Insert the following:
 - **MRF RP20 OPEN** (open protection cabinet #1 door)
 - **MRF RX029 TRIP** (trip PZR hi water level Rx trip bistable LB459A)
 - **MRF RP20 CLOSE** (close protection cabinet #1 door)

As SM acknowledge the failure, LCOs 3.3.1, conditions A and K entry, on line risk assessment, request for maintenance support, and IR requests.

Event 4: 1FW510A, 1A SG Feed Bypass Controller failure

Insert **IMF RX30A 65 60 40** to fail 1FW510A controller over a 60 second period. (note: "final value, ramp time, initial value")

As SM acknowledge the failure, on line risk assessment, request for maintenance support, and IR requests.

Event 5: Loss of power to Pzr Heater Groups B and C

Modify **MRF ED052A OPEN** to open the feed breaker to Pzr Heater Groups B and C.

Acknowledge as SM the 1A HD pump trip, request for E Plan evaluation, and requests for on line risk assessment, maintenance support, and IR initiation. Acknowledge LCO 3.4. entry.

If dispatched as EO, report breaker 144 Cubicle 3 is TRIPPED on ground overcurrent.

Event 6: 0B WS pump trip with 0A WS pump auto start failure

Ensure **MRF SW38 OPEN** is active (in preload) to prevent 0A WS pump auto start.
Insert **IMF SW06B** to trip the 0B WS pump.

If dispatched as EO, report 0B WS pump breaker is tripped on phase overcurrent, bus 144, cubicle 7.

EO reports the 0B WS pump is NOT rotating backwards.

As SM, acknowledge the failure, BOA entry, and requests for E Plan evaluations, on line risk assessment, maintenance support, and IR initiation.

Event 7: Faulted 1A SG with 1A MSIV failed open

Ensure **MF MS01A (in preload)** is active at 100 so the 1A MSIV is failed open.

Insert **IMF MS08A 4 120** to fault the 1A SG steam line outside containment.

TR EO reports steam is coming from the East valve room.

Acknowledge as SM procedure changes, E Plan evaluations, and STA request.

After STA requested, as STA report CSF status:

If requested as WEC or MM FLS, report the crew is unable to close the 1A MSIV.

Event 8: 1B CV pump trips/1A CV pump fails to auto start (preload)

If dispatched as EO to investigate 1B CV pump, report ground overcurrent flag at breaker cubicle.

| Scenario No: | NRC 16-3 | Event No. | 1 |
|------------------------------------|-----------------|--|---|
| Event Description: Power Ascension | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | SRO | <ul style="list-style-type: none"> • Direct power ascension per 1BGP 100-3 • Approve reactivity changes for RO | |
| | RO | <ul style="list-style-type: none"> • Raise reactor power appropriately to raise steam dump demand to 35% to 45% to support generator synchronization. <ul style="list-style-type: none"> ○ Dilute as necessary <ul style="list-style-type: none"> • Turn OFF RMCS Makeup CS • Select DILUTE on the RMCS Mode Select Switch • Enter the desired dilution amount in the PW Flow Totalizer • Turn ON RMCS Makeup CS <ul style="list-style-type: none"> ○ Turn on Pzr Backup heaters as needed ○ Withdraw control rods as necessary <ul style="list-style-type: none"> • Select MANUAL • Withdraw control rods to desired height | |
| | BOP | <ul style="list-style-type: none"> • When steam dumps are closed (after generator synchronization), transfer control to Tave Mode • Place 1PK-507 to MANUAL and adjust to 0% • Place Mode switch to RESET then to Tave • Ensure C-7 is OFF • Place 1PK-507 in AUTO | |

| Scenario No: | NRC 16-3 | Event No. | 2 |
|---|-----------------|---|---|
| Event Description: Synchronize Main Generator to the Grid | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> ○ From turnover, synchronize the Main Generator to the grid and continue with 1BGP 100-3 at Step 27. | |
| | SRO | <ul style="list-style-type: none"> ● Direct BOP and RO to perform 1BGP 100-3 ● Hold a reactivity and pre-job brief before beginning the synchronization | |
| | BOP | <ul style="list-style-type: none"> ● Refer to BOP 1BGP 100-3, step 27 ○ Turn on 1 synch switch for either BT 3-4 or 4-5 ● Adjust Generator voltage < 4 volts > grid voltage ● Adjust Generator speed to obtain synch rotation slowly in the FAST direction ● Close selected output breaker ● Raise turbine power as necessary using graphic 5501 ● Adjust MVARS to about 100 MVAR OUT ● Turn off Synch switch ● Turn on remaining Synch switch ● Close remaining output breaker ● Turn off Synch switch ● Match CS targets for OPM03J BT breakers | |
| | BOP | <ul style="list-style-type: none"> ○ Adjust Feedwater Flow as needed ● Verify TGTMS graphics are displayed ● Set VPL to 120% <ul style="list-style-type: none"> ● Select LIMITERS ● Select VPL up arrow until 120% is reached ● Select EXIT | |
| | RO | <ul style="list-style-type: none"> ● Monitor primary and secondary panels while BOP is synchronizing the generator ● Provide support as requested to BOP. ● Control rod position and dilute as required to maintain temperature and power. | |
| | BOP | <ul style="list-style-type: none"> ● Continue with 1BGP 100-3 ● Initial flowchart | |
| | SRO | <ul style="list-style-type: none"> ● Acknowledge reports ● Placekeep procedure steps appropriately | |
| <p>EVALUATOR NOTE: After the actions to synchronize the Main Generator are complete and with lead examiners concurrence, insert the next event. Insert next failure when Generator is at 100 MW.</p> | | | |

| Scenario No: NRC 16-3 | | Event No: 3 |
|--|----------|--|
| Event Description: Pressurizer level channel 1LT-459 fails low | | |
| Time | Position | Applicant's Actions or Behavior |
| | CUE | <ul style="list-style-type: none"> • Annunciator PZR LVL LOW HTRS OFF LTDWN SECURED (1-12-A4) • Annunciator PZR HTR TRIP (1-12-A5) • Annunciator PZR LEVEL CONT DEV LOW (1-12-B4) • PZR level indicators 1LI-460 and 461 rising. |
| | RO | <ul style="list-style-type: none"> ○ Implement BHC for Letdown Malfunction. • Identify 1LT-459 is failing low. • Identify letdown is isolated. • Report failure to SRO. ○ |
| | CREW | <ul style="list-style-type: none"> ○ Refer to BARs. • Identify entry conditions for 1BOA INST-2, "OPERATION WITH A FAILED INSTRUMENT CHANNEL". |
| | SRO | <ul style="list-style-type: none"> • Notify SM of plant status and procedure entry. • Request evaluation of Emergency Plan conditions. • Implement 1BOA INST-2 "OPERATION WITH A FAILED INSTRUMENT CHANNEL", Attachment C "PRESSURIZER LEVEL CHANNEL FAILURE" and direct operator actions of 1BOA INST -2 to establish the following conditions: |
| | RO | <ul style="list-style-type: none"> • Perform the following at 1PM05J: <ul style="list-style-type: none"> • Place 1FK-121, CV pumps flow control valve <u>OR</u> 1LK-459, PZR master level controller, in manual. • Lower demand on 1FK-121 <u>OR</u> 1LK-459 in conjunction with lowering demand on 1CV182 to lower charging flow to the minimum required for RCP seal injection. • Operate 1FK-121 <u>OR</u> 1LK-459 in manual to minimize PZR level rise and maintain 8-13 gpm RCP seal injection flow. • Select operable PZR level control channel: <ul style="list-style-type: none"> • Place PZR level control select C/S to CH-461/CH-460. • Select operable recorder at 1PM05J: <ul style="list-style-type: none"> • Place PZR level select switch to CH-460 or CH-461. • Restore PZR heaters to normal. <ul style="list-style-type: none"> • Verify PZR backup heaters in auto • Cycle PZR variable heater control switch to restore to auto. |
| <p>EVALUATOR NOTE: The unit supervisor may elect to continue on in 1BOA INST-2 while the BOP reestablishes CV letdown per 1BOA ESP-2.</p> | | |
| | BOP | <ul style="list-style-type: none"> • Restore normal letdown flow per 1BOA ESP-2, REESTABLISHING CV LETDOWN DURING ABNORMAL CONDITIONS. • Perform the following at 1PM05J: <ul style="list-style-type: none"> • Check Letdown Isolated: <ul style="list-style-type: none"> • Verify 1CV8149A, B, & C closed. • Verify 1CV459 & 1CV460 closed. <ul style="list-style-type: none"> ○ Manually close 1CV460 • Check letdown flow path: <ul style="list-style-type: none"> • Verify 1CV8401A, 1CV8324A, 1CV8389A, 1CV8152, and 1CV8160 open. • Verify BTRS mode select switch OFF. • Align letdown controllers: <ul style="list-style-type: none"> • Place 1CV-131 in MANUAL and raise demand to 40%. • Place 1CV-130 in MANUAL and raise demand to 60%. |

| Scenario No: | NRC 16-3 | Event No: | 3 |
|---|---|--|----------|
| Event Description: | Pressurizer level channel 1LT-459 fails low | | |
| Time | Position | Applicant's Actions or Behavior | |
| | | <ul style="list-style-type: none"> • Verify charging flow established: <ul style="list-style-type: none"> • Verify 1CV8105 & 1CV8106 open. • Throttle 1CV182 and 1CV121 to establish 8-13 gpm seal inj and 100 gpm charging flows. • Establish letdown flow: <ul style="list-style-type: none"> • Open 1CV459 and 1CV460. • Open 1CV8149A/B/C to establish 120 gpm letdown. • Adjust 1CV131 controller to 360 psig and place in AUTO • Adjust 1CC130A/B controller to 90° to 115°F and place in AUTO • Verify 1PR06J in service at RM-11 console. | |
| | RO/ BOP | <ul style="list-style-type: none"> • Check PZR level control in auto: <ul style="list-style-type: none"> • Place 1CV-121 and 1CV-459 in automatic when PZR level is restored to normal. | |
| | SRO | <ul style="list-style-type: none"> • Determine TS 3.3.1 conditions A and K are applicable. • Determine TS 3.3.3 and 3.3.4 are MET– minimum channels operable requirement is met. <ul style="list-style-type: none"> ○ Determine by use of 1BOSR 3.3.1-1 and 3.4.1-1 tables • Contact SM/WEC for bistable to be BYPASSED • Contact SM to perform risk assessment, initiate IR, and contact maintenance to investigate/correct instrument failure. | |
| EVALUATOR NOTE: After the actions for the pressurizer level channel failure are complete and with lead examiners concurrence, insert the next event. | | | |

| Scenario No: | NRC 16-3 | Event No: | 4 |
|--|--|---|---|
| Event Description: | Feedwater flow controller for 1FW510A fails high | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> ○ Annunciator S/G 1A Level Deviation High Low (1-15-A9) ○ 1A SG FW flow indicators rising ○ FWRV Bypass Valve 1FW-510A opening ○ 1A SG level indicators rising | |
| | BOP | <ul style="list-style-type: none"> • Identify 1FW-510A controller output failing high • Refer to BARs • Report failure to SRO • Perform the following at 1PM04J <ul style="list-style-type: none"> • Place 1FW-510A in MANUAL • Lower FW flow to match or slightly lower than steam flow • Monitor 1A SG level and control 1FW-510A in MANUAL | |
| | RO | <ul style="list-style-type: none"> • Assist BOP as requested • Monitor reactor panel for reactivity changes | |
| | CREW | <ul style="list-style-type: none"> ○ Refer to BARs | |
| | SRO | <ul style="list-style-type: none"> • Notify SM of plant status and procedure entry. • Request evaluation of Emergency Plan conditions. | |
| | BOP | <ul style="list-style-type: none"> • Maintain 1FW-510A in Manual and maintain 1A SG level at normal level | |
| <p>EVALUATOR NOTE: After the actions for the feedwater flow controller failure are complete and with lead examiners concurrence, insert the next event.</p> | | | |

| Scenario No: | NRC 16-3 | Event No. | 5 |
|--|--|--|---|
| Event Description: | Loss of power to Pzr Heater Groups B and C | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciator 1-12-A5 Pzr Heater Trip • Annunciator 1-12-C5 Phase Loss or Reversal • Annunciator 1-12-D5 Pzr Htr SCR Clg Fan Failure • Loss of power to B and C Pzr Heater contactors • ACB 1445 Disagreement/trip light • Slowly lowering RCS pressure | |
| | RO | <ul style="list-style-type: none"> • Recognizes supply to Pzr heater contactors B and C is tripped. <ul style="list-style-type: none"> ○ Refer to BAR(s) for alarms listed above • Reports failure to SRO. • Places/verifies ≥ 1 backup heater group in service as required <ul style="list-style-type: none"> ○ Dispatches EO to bus 144 to check breaker 1445 | |
| | SRO | <ul style="list-style-type: none"> • Contact SM to perform risk assessment, initiate IR, and contact maintenance to investigate/correct failure. • Enters TS 3.4.9, Condition B because only the remaining Pzr heaters are available to be powered from only 1 ESF source. The LCO requires 2 groups from separate sources. | |
| <p>EVALUATOR NOTE: After the actions for the Pzr Heater trip are complete and with lead examiners concurrence, insert the next event.</p> | | | |

| Scenario No: | NRC 16-3 | Event No. | 6 |
|---|-----------------|--|---|
| Event Description: 0B WS pump trip with 0A WS pump auto start failure | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciator WS PUMP TRIP OR AUTO START (0-38-A10) • Annunciator WS HDR PRESS LOW (0-38-B10) • Trip/yellow disagreement light on 0B WS Pump | |
| | BOP | <ul style="list-style-type: none"> • Identify/report trip of 0B WS pump <ul style="list-style-type: none"> ○ Refer to BAR(s) 0-38-A10/B10 • Manually start 0A WS pump • Dispatch operator to 0B WS pump and breaker | |
| | SRO | <ul style="list-style-type: none"> • Direct operators to start 0A WS pump • Notify SM of 0B WS pump trip. <ul style="list-style-type: none"> ○ Enter 0BOA SEC-5 / 1BOA SEC-5 for WS SYSTEM MALFUNCTION ○ Dispatch EO to check 0B WS pump – NOT ROTATING | |
| <p>EVALUATOR NOTE: After the actions for the WS pump trip are complete and with lead examiners concurrence, insert the next event.</p> | | | |

| Scenario No: | | NRC 16-3 | Event No: | 7 & 8 |
|--|----------|--|-----------|-------|
| Event Description: | | | | |
| 1A SG fault, 1B CV pump trips/1A CV pump fails to auto start, 1A MSIV failed open | | | | |
| Time | Position | Applicant's Actions or Behavior | | |
| | CUE | <ul style="list-style-type: none"> Annunciator UNIT 1 AREA FIRE (1-37-A4). RM-11 Rad Monitor ALERT/HI RAD Alarms. <ul style="list-style-type: none"> 1AR 22/23A & 1AR22/23D, 1A & 1D Main steam line. Steam flow rising on all SGs FIRE ALARM 1D-15 E VALVE ROOM | | |
| | RO | <ul style="list-style-type: none"> Initiate a manual reactor trip and transition to 1BEP-0. <ul style="list-style-type: none"> Initiate a manual SI. Initiate a main steam line isolation | | |
| | SRO | <ul style="list-style-type: none"> Notify SM of plant status and procedure entry. Request evaluation of Emergency Plan conditions. Enter/Implement 1BEP-0 and direct operator actions of 1BEP-0. | | |
| | RO | Perform immediate operator actions of 1BEP-0 at 1PM05J: <ul style="list-style-type: none"> Verify reactor trip. <ul style="list-style-type: none"> Rod bottom lights - ALL LIT. Reactor trip & Bypass breakers – OPEN. Neutron flux – DROPPING. | | |
| | BOP | Perform immediate operator actions of 1BEP-0 at 1PM02J or OWS drop 210: <ul style="list-style-type: none"> Verify Turbine Trip. <ul style="list-style-type: none"> All Turbine throttle valves – CLOSED. All Turbine governor valves – CLOSED. | | |
| | BOP | Perform immediate operator actions of 1BEP-0 at 1PM01J: <ul style="list-style-type: none"> Verify power to 4KV busses. <ul style="list-style-type: none"> ESF Buses – BOTH ENERGIZED (141 & 142). | | |
| | CREW | <ul style="list-style-type: none"> PZR pressure cannot be maintained > 1829 psig. <ul style="list-style-type: none"> Manually actuate SI. Recognize SI Actuated Manually actuate SI from 1PM05J and 1PM06J Manually actuate main steamline isolation (if not done earlier) | | |
| | SRO | <ul style="list-style-type: none"> Step 5: Direct BOP to perform Attachment B of 1BEP-0 | | |
| <p>EVALUATOR NOTE: SRO and RO will continue in 1BEP-0 while BOP is performing Attachment B, SI Verification. 1BEP-0 steps continue and the Att B steps are listed at the end of the guide on page 17.</p> | | | | |
| | RO | <ul style="list-style-type: none"> Step 6: Verify AF system: <ul style="list-style-type: none"> AF pumps – BOTH AF pumps RUNNING. AF isolation valves – 1AF13A-H OPEN. AF flow control valves – 1AF005A-H THROTTLED. AF flow - >500 GPM Check SG tubes - INTACT and SG NR levels – NOT RISING UNCONTROLLED | | |
| | RO | <ul style="list-style-type: none"> Step 7: Check PZR PORVs and SPRAY VALVES at 1PM05J: <ul style="list-style-type: none"> 1RY455 & 1RY456 CLOSED PORV isol valves – 1RY8000A & 1RY8000B BOTH ENERGIZED PORV relief path – Both PORVs in AUTO, Both isolation valves – OPEN. Normal PZR Spray Valves CLOSED | | |

| Scenario No: | NRC 16-3 | Event No: | 7 & 8 |
|--------------------|---|---|-------|
| Event Description: | 1A SG fault, 1B CV pump trips/1A CV pump fails to auto start, 1A MSIV failed open | | |
| Time | Position | Applicant's Actions or Behavior | |
| | RO | <ul style="list-style-type: none"> Step 8: Maintain RCS temperature control at 1PM05J: <Cont Action Step> <ul style="list-style-type: none"> Verify RCS average temperature stable at or trending to 557°F. Throttle AF maintaining >500 GPM until SG minimum level is met Verify MSIVs closed – 1A MSIV is OPEN <ul style="list-style-type: none"> Crew may isolate 1AF013A & E with SM permission | |
| | RO | <ul style="list-style-type: none"> Step 9: Check status of RCPs at 1PM05J: Determine RCP trip required <ul style="list-style-type: none"> RCS pressure < 1425 psig & High head SI flow (1FI-917) > 100 gpm Trip ALL RCPs | |
| | RO/ SRO | <ul style="list-style-type: none"> Step 10: Check if SG secondary pressure boundaries are intact at 1PM04J: <ul style="list-style-type: none"> Check pressure in all SGs: <ul style="list-style-type: none"> 1A SG pressure lowering in an uncontrolled manner. Transition to 1BEP-2, "Faulted Steam Generator Isolation" (1BEP-2 follows the Attachment B steps that are listed below) | |
| | CREW | <ul style="list-style-type: none"> Transition to 1BEP-2, "FAULTED STEAM GENERATOR ISOLATION" | |
| | SRO | <ul style="list-style-type: none"> Notify SM of plant status and procedure entry. Request evaluation of Emergency Plan conditions. Request STA evaluation of status trees. Enter/Implement 1BEP-2 and direct operator actions of 1BEP-2 to establish the following conditions. | |
| | RO/ BOP | <ul style="list-style-type: none"> Check MS isolation at 1PM06J: <ul style="list-style-type: none"> All MSIVs and bypass valves – OPEN. Attempt to close ALL MSIVs Identify 1A MSIV failed to close | |
| | BOP | <ul style="list-style-type: none"> Check if any SG secondary pressure boundary is intact at 1PM04J: <ul style="list-style-type: none"> 1B, 1C, & 1D SG pressures stable. | |
| | CREW | <ul style="list-style-type: none"> Identify faulted SG at 1PM04J: <ul style="list-style-type: none"> 1A SG pressure decreasing in an uncontrolled manner. 1A SG indicates steam flow with 1A MSIV open | |
| | RO/ BOP [CT-7] | <ul style="list-style-type: none"> Isolate 1A Steam Generator at completion of step 2 of 1BEP-2: <ul style="list-style-type: none"> Verify/close 1AF013A & E at 1PM06J (CT-7) Top row of FW isolation monitor lights – lit. 1MS018A closed. 1SD002A & B closed. 1SD005A closed. | |
| | BOP | <ul style="list-style-type: none"> Monitor AF pump suction pressure. Annunciator AF PUMP SX SUCTION VLVS ARMED (1-3-E7) – NOT LIT. | |
| | CREW | <ul style="list-style-type: none"> Determine 1A S/G tubes are intact: <ul style="list-style-type: none"> No RM-11 or HMI Rad Monitor ALERT/HI RAD Alarms. <ul style="list-style-type: none"> 1PR08J SG Blowdown. 1PR27J SJAE/GS. 1AR 22/23A 1A Main steam Line. | |
| | CREW | <ul style="list-style-type: none"> Check if ECCS flow should be reduced | |

| Scenario No: | NRC 16-3 | Event No. | 7 & 8 |
|--|---|---|-------|
| Event Description: | 1A SG fault, 1B CV pump trips/1A CV pump fails to auto start, 1A MSIV failed open | | |
| Time | Position | Applicant's Actions or Behavior | |
| | | <ul style="list-style-type: none"> RCS subcooling –ACCEPTABLE Secondary heat sink-total feed flow to INTACT SGs > 500 GPM or NR level in at least 1 SG > 10% RCS pressure – stable or rising Pzr level - > 12% | |
| | CREW | <ul style="list-style-type: none"> Determine transition to 1BEP ES-1.1, SI TERMINATION Transition to 1BEP ES-1.1, SI TERMINATION | |
| | SRO | <ul style="list-style-type: none"> Notify SM of plant status and procedure entry. Request evaluation of Emergency Plan conditions. Enter/Implement 1BEP ES-1.1 and direct operator actions of 1BEP ES-1.1 | |
| | RO/BOP | <ul style="list-style-type: none"> Reset SI <ul style="list-style-type: none"> Depress both SI reset PB Verify SI Actuated light – NOT LIT Very Auto SI Blocked light – LIT | |
| | RO/BOP | <ul style="list-style-type: none"> Reset Cnmt Isolation <ul style="list-style-type: none"> Reset Phase A | |
| | BOP | <ul style="list-style-type: none"> Establish IA to CNMT <ul style="list-style-type: none"> Check SACs – ANY Running Open 1IA065 and 1IA066 | |
| | RO/BOP | <ul style="list-style-type: none"> Realign CV Pump <ul style="list-style-type: none"> Do NOT stop the single running CV pump | |
| | CREW | <ul style="list-style-type: none"> Check RCS pressure – Stable or rising | |
| | RO/BOP | <ul style="list-style-type: none"> Terminate High-head SI <ul style="list-style-type: none"> Reset SI recirc sump isolation valves – 1SI8811A & B and 1CV8110 & 1CV8111 Reset CV pump miniflow valves – 1CV8114 and 1CV8116 Verify CV pump miniflow valves – OPEN Close CV injection valves – 1SI8801A & B Establish Charging Flow <ul style="list-style-type: none"> Place 1CV182 controller at 0% demand Open 1CV8105 and 1CV8106 Establish desired charging flow using 1CV121 and 1CV182, maintaining RCP seal injection flow 8 – 13 GPM per RCP Control Charging flow to maintain Pzr level stable Check if SI pumps should be stopped <ul style="list-style-type: none"> RCS Pressure - stable or rising and Pressure > 1700 PSIG Stop SI pumps | |
| EVALUATOR NOTE: The scenario can be terminated at lead examiner's discretion. | | | |

EVALUATOR NOTE: 1BEP 0, ATTACHMENT B steps are listed here.

| | |
|-----------------------|---|
| <p>BOP [CT-6]</p> | <ul style="list-style-type: none"> • Att B, Step 1: Verify ECCS pumps running <ul style="list-style-type: none"> • CV pumps - NONE RUNNING. <ul style="list-style-type: none"> • Manually start the 1A CV pump prior completion of Attachment B of 1BEP-0. (CT-6) • Both RH pumps – RUNNING • Both SI pumps – RUNNING • Att B, Step 2: Verify ECCS valve alignment <ul style="list-style-type: none"> • Determine Group 2 Cold Leg Injection monitor lights required for injection - All lit • Att B, Step 3: Verify ECCS flow <ul style="list-style-type: none"> • High Head SI flow >100 gpm (1FI-917) <ul style="list-style-type: none"> ○ RCS pressure > 1700 psig OR ○ RCS pressure < 1700 psig <ul style="list-style-type: none"> • 1B SI pump discharge flow > 200 gpm ○ RCS pressure > 325 psig |
| | <ul style="list-style-type: none"> • Att B, Step 4: Verify RCFCs running in Accident Mode: <ul style="list-style-type: none"> • Group 2 RCFC Accident Mode lights – 4 LIT. • Att B, Step 5: Verify Phase A isolation: <ul style="list-style-type: none"> • Group 3 Cnmt Isol monitor lights – ALL LIT. • Att B, Step 6: Verify Cnmt Vent isolation: <ul style="list-style-type: none"> • Group 6 Cnmt Vent Isol monitor lights – ALL LIT. • Att B, Step 7: Verify CC pumps – BOTH RUNNING. • Att B, Step 8: Verify SX pumps – BOTH RUNNING. • Att B, Step 9: Check if Main Steamline Isolation – REQUIRED: <ul style="list-style-type: none"> ○ SG pressures > 640 psig – continue on in 1BEP-0 ○ 1A S/G pressure < 640 psig <ul style="list-style-type: none"> • Check MSIVs and bypass valves - CLOSED <ul style="list-style-type: none"> • 1A MSIV – OPEN • Attempt to close 1A MSIV with BOTH MSLI switches and 1A MSIV switch • Att B, Step 10: Check if CS is required <Cont Action Step> <ul style="list-style-type: none"> • CNMT pressure has NOT risen > 20 psig. • Att B, Step 11: Verify FW isolated at 1PM04J: <ul style="list-style-type: none"> • FW pumps – TRIPPED. • Isolation monitor lights – LIT. • FW pumps discharge valves - CLOSED (or going closed) 1FW002A-C. • Trip all running HD pumps. • Att B, Step 12: Verify DGs running at 1PM01J: <ul style="list-style-type: none"> • DGs – BOTH DG running • 1SX169A/B OPEN. • Dispatch operator locally to check operation • Att B, Step 13: Verify Generator Trip at 1PM01J: <ul style="list-style-type: none"> • OCB 1-8 and 7-8 open. • PMG output breaker open. |

| | |
|--|---|
| | <ul style="list-style-type: none"> • Att B, Step 14: Verify Control Room ventilation aligned for emergency operations at 0PM02J: <ul style="list-style-type: none"> • VC Rad Monitors – LESS THAN HIGH ALARM SETPOINT. • Operating VC train equipment – RUNNING. <ul style="list-style-type: none"> • 0B Supply fan • 0B Return fan • 0B M/U fan • 0B Chilled water pump • 0B Chiller • Operating VC train dampers – ALIGNED. <ul style="list-style-type: none"> • M/U fan outlet damper – 0VC08Y NOT FULLY CLOSED. • 0B VC train M/U filter light – LIT. • 0VC09Y - OPEN • 0VC313Y – CLOSED • Operating VC train Charcoal Absorber aligned for train B. <ul style="list-style-type: none"> • 0VC44Y - CLOSED • 0VC05Y - OPEN • 0VC06Y – OPEN • Control Room pressure greater than +0.125 inches water on 0PDI-VC038. |
| | <ul style="list-style-type: none"> • Att B, Step 15: Verify Auxiliary Building ventilation aligned at 0PM02J: <ul style="list-style-type: none"> • Two inaccessible filter plenums aligned. <ul style="list-style-type: none"> • Plenum A: <ul style="list-style-type: none"> • 0VA03CB - RUNNING • 0VA023Y - OPEN • 0VA436Y – CLOSED • Plenum C: <ul style="list-style-type: none"> • 0VA03CF - RUNNING • 0VA072Y – OPEN • 0VA438Y – CLOSE • Att B, Step 16: Verify FHB ventilation aligned at 0PM02J: <ul style="list-style-type: none"> • 0VA04CB - RUNNING • 0VA055Y - OPEN • 0VA062Y - OPEN • 0VA435Y – CLOSED |
| | <ul style="list-style-type: none"> • Att B, Step 17: Maintain UHS Basin Level - >80% <Cont Action Step> • Att B, Step 18: Initiate periodic checking of Spent Fuel Cooling <ul style="list-style-type: none"> • Notify EO to verify SFP level and temperature • Notify STA of SFP cooling status • Att B, Step 19: Notify US of actions taken, equipment status, CAS ownership and that Attachment B is completed • Att B, Step 20: Shutdown unnecessary equipment per 1BGP 100-1T4 and 100-5 - May notify WEC of this step |

| | | | |
|---------------------|--------------|---------------|--|
| Simulation Facility | <u>Byron</u> | Scenario No.: | Operating Test No. 2016 Byron NRC N16-4 |
| Examiners: | _____ | Applicant: | SRO |
| | _____ | | RO |
| | _____ | | BOP |

Initial Conditions: IC-18, 75% power, steady state, MOL

Turnover: Unit 1 is at 76% power, steady state, MOL, CB D is @ 180 steps and boron concentration is 998 ppm. Online risk is green. Crew is to raise power to 100% for grid demand @ 0.5 MW/min. Crew is to switch Bus 156 from SAT to UAT following ACB 1561 maintenance. 0G and 0C SX tower fans are OOS for oil changes.

| Event No. | Malf. No. | Event Type* | Event Description |
|-----------|---|----------------------------|---|
| Preload | RP02A RP02B TC03 ZDIHSTG010 NORM | | Turbine fails to AUTO trip from Rx trip Manual Turbine trip PB fails to trip turbine |
| 1 | None | N (BOP,SRO) | Switch Bus 156 Electrical Lineup |
| 2 | None | R (RO, SRO) | Raise power to full power |
| 3 | None | TS (SRO) | Notified that 1B AF pump failed ASME surveillance |
| 4 | PA0154 ON PA0152 ON zao0iisx032 95 | C (BOP,SRO) TS (SRO) | SX Fan high vibration requiring fan swap |
| 5 | RX18A 630 | I (RO, SRO) TS (SRO) | 1A TCOLD RTD Fail High |
| 6 | RX04D 0 30 | I (BOP,SRO) | Feedwater flow channel 1FT-521 fails Low |
| 7 | CV16 0 | I (RO, SRO) | VCT Level Channel 1LT-112 Fail Low |
| 8 | TH16C | M (ALL) | ATWS 1C RCP Trip with Rx Trip Breakers Fail To Open |
| 9 | Pre-load | C (ALL) | Failure of Main Turbine to Trip on auto signal or manual push button |

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

SCENARIO OVERVIEW

Unit 1 is at 76% power, steady state, MOL, CB D is @ 180 steps and boron concentration is 998 ppm. Online risk is green. Crew is to switch Bus 156 from SAT to UAT following ACB 1561 maintenance. . 0G and 0C SX tower fans are OOS for oil changes.

After completing shift turnover and relief, the crew is directed to switch Bus 156 from SAT to UAT following ACB 1561 maintenance using BOP AP-200.

After the Bus power supply swap, the crew will begin a ramp to full power at 0.5 MW/minute.

After the ramp has begun, the Unit Supervisor will be called by Engineering stating that after reviewing the previously run ASME surveillance the 1B AF pump has failed the acceptance criteria.

After the SRO has addressed the SI pump issue, 0B SX MDCT Fan High Vibration will alarm and amps will go high, requiring the 0B SX fan be tripped IAW BAR 0-37-E6 directions. The crew will evaluate SX temperature and decide which fan(s) to start. If sent to the SX Tower for a local inspection, the EO will report the fan gearbox is leaking oil. The US will refer to TS 3.7.9 and determine the LCO is satisfied if 7 fans are running in High Speed.

After the SX fan vibration has been addressed, 1A Tcold RTD fails high, requiring entry to 1BOA Inst-2, Operation with a Failed Instrument Channel. This will require entry into Tech Specs by the SRO.

After 1BOA Inst-2 is exited, the controlling feedwater flow channel on the 1B SG fails low. The BOP will take manual control of feedwater flow. 1BOA INST 2, OPERATION WITH A FAILED INSTRUMENT CHANNEL, Attachment G, will be implemented. The BOP will restore feedwater flow control to automatic when SG level is restored to normal. On line risk remains green.

After the FW flow failure has been corrected, VCT Level channel 1LT-112 fails low. RMCS auto makeup will start, and the crew will have to place the Makeup Mode Select switch to Off. Any required makeup will have to be done in Manual.

After the VCT level channel failure has been addressed, the 1C RCP trips. When the crew attempts to trip the reactor, the trip breakers will fail to open. The crew will enter 1BFR S.1, ATWS. At step 16, the crew will be directed to return to 1BEP-0, Reactor Trip or Safety Injection.

After the crew enters 1BFR S.1, the auto turbine trip from a reactor trip signal will not function. The manual Turbine trip P.B. will also malfunction. The turbine GVs must be closed manually, or MSLI actuated.

Completion criterion is transition to 1BEP-0, Reactor Trip or Safety Injection. The lead evaluator may end the scenario at the transition.

Critical Tasks

1. Isolate the main turbine from the SGs (so that RCS pressure does not exceed 3200 psig (UFSAR 15.8). (ERG Critical Task Number – CT-50) (K/A number – EPE029EA1.13 importance – 4.1/3.9)
2. Insert negative reactivity into the core by at least one of the following methods (prior to procedural step to dispatch operators to locally trip the reactor.):
 - Insert the control rods
 - Establish emergency boration flow to the RCS(ERG Critical Task Number – CT-52) (K/A number – EPE029EA1.14 importance – 4.2/3.9) or (K/A number – EPE029EK3.11 importance – 4.2/4.3)

References:

| | |
|-------------|----------|
| BOP AP-200 | 1BFR-S.1 |
| BAR 0-37-E6 | 1BEP-0 |
| 1BOA INST-2 | |

SIMULATOR SETUP GUIDE:

- Verify/perform TQ-BY-201-0113, BYRON TRAINING DEPARTMENT SIMULATOR EXAMINATION SECURITY ACTIONS CHECKLIST.
- Establish the conditions of IC 18, 76% power, BOL, steady state.
- Verify/remove any Equipment Status Tags and Danger Tags not applicable to the scenario.
- Place simulator in RUN (allow simulator to run during board walk down and turnover).
- Place Bus 156 on SAT.
- Place 0G and 0C SX tower fans high and low speed control switches in PTL with C/O tags on them. Align riser valves to match.
- Ensure 1B SG FW Flow Channel is selected to F-521
- Divert 1CV112A to get to approximately 39% VCT level.
- Verify Simulator Readiness Checklist is completed.
- Provide students with turnover sheets and rema.
- Run **caep N16-4** from thumb drive and verify the following actions load in the CAEP:

Byron 2016 ILT NRC scenario 16-4|00:00:01|0

Event 4: 0B MDCT fan high vibration alarm|00:00:02|2

IMF pa0152 on|10:00:00|3

IMF PA0154 ON|10:00:00|4

IOR zao0iisx032 95|10:00:00|5

Event 5: 1A Tc RTD fails low|00:00:03|7

IMF RX18A 630|10:00:00|8

Event 6: 1FT-521 fails low|00:00:04|10

IMF RX04D 0 30|10:00:00|11

Event 7: 1LT-112 fails low|00:00:05|13

IMF CV16 0|10:00:00|14

Event 8: 1C RCP trip|00:00:06|16

IMF TH16C|10:00:00|17

Preload: |00:00:07|19

RTB fail to open|00:00:08|20

IMF RP02A|00:00:09|21

IMF RP02B|00:00:10|22

Turbine trip failure|00:00:11|23

IMF TC03|00:00:12|24

IOR ZDI1HSTG010 NORM|00:00:13|25

trgset 10 "zlo0sx03cbhi(1).gt.0"|00:00:14|30

trgset 11 "zlo0sx03cbhi(1).gt.0"|00:00:15|31

trgset 12 "zlo0sx03cbhi(1).gt.0"|00:00:16|32

trg 10 "dor zao0iisx032"|00:00:17|33

trg 11 "dmf pa0152"|00:00:18|34

trg 12 "dmf pa0154"|00:00:19|35

INSTRUCTOR/SIMULATOR RUN AID GUIDE

Event 1: Switch Bus 156 Electrical Lineup

Event 2: Ramp unit to full power (1240 MW) at 0.5 MW per minute.

Event 3: Unit Supervisor is notified that 1B AF pump has failed ASME acceptance criteria

As Engineering, call the US and notify him that after reviewing pump data from a surveillance run 12 hours ago, the discharge pressure at full recirc flow is 50 GPM below acceptance criteria.

SM acknowledge T/S 3.7.5 entry conditions

Event 4: 0B SX MDCT Fan High Vibration

IMF PA0154 ON
IOR zao0iisx032 95

As EO, report 0B SX fan is vibrating excessively, and the fan gearbox is leaking.

As SM Acknowledge request for writing IR, performing risk assessment and making appropriate notifications.

As SM, direct the crew to start the 0D SX fan if the crew does not decide to start it.

Event 5: 1A Tcold RTD Failed High

IMF RX18A 630

As SM Acknowledge procedure entry and request for Emergency Plan evaluations.

As SM Acknowledge entry into TS 3.3.1

As SM Acknowledge request for writing IR, performing risk assessment and making appropriate notifications.

As WEC or Extra NSO, acknowledge request to bypass or trip bistables.

Event 6: Feedwater flow channel 1FT-521 fails low

Insert **IMF RX04D 0 30** to fail 1FT-521 low over a 30 second period.

As SM acknowledge the failure, on line risk assessment, request for maintenance support, and IR requests.

Event 7: VCT Level Channel 1LT-112 Failed Low

IMF CV16 0

As SM Acknowledge request for writing IR, performing risk assessment and making appropriate notifications.

Event 8: ATWS – 1C RCP trip with Rx Trip Breakers Fail to Open

IMF RP02A and RP02B (in preload)

IMF TH16C to trip 1C RCP

As SM Acknowledge procedure entry and request for Emergency Plan evaluations.
After transition to 1BFR-S.1, Acknowledge request for STA and begin monitoring BSTs.

As EO, acknowledge request for local trip of Reactor Trip Breakers. After crew has gone past step 6 of 1BFR S.1,
DMF RP02A and RP02B, and **MRF RP01REMF and RP02 OPEN**

Event 9: Main Turbine Fails to trip on auto signal or manual push button

IMF TC03

IOR ZDIHSTG010 NORM

| Scenario No: | NRC 16-4 | Event No. | 1 |
|---|-----------------|--|---|
| Event Description: Switch Bus 156 Electrical Lineup | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> (From Turnover) Realign Bus 156 to UAT following maintenance on ACB 1561 | |
| | US | <ul style="list-style-type: none"> Refer to BOP AP-200, step F.1 <ul style="list-style-type: none"> Direct BOP to switch Bus 156 to the UAT per step F.1 | |
| | BOP | <ul style="list-style-type: none"> Switch Bus 156 Electrical Lineup <ul style="list-style-type: none"> Turn on synchroscope for Bus 156 Close 1561 Open 1562 Turn off synchroscope | |
| | RO | <ul style="list-style-type: none"> Monitor primary and secondary panels | |
| EVALUATOR NOTE: When electrical swap is complete, insert the next event. | | | |

| Scenario No: | NRC 16-4 | Event No: | 2 |
|--|-----------------|--|----------|
| Event Description: Raise power at 0.5 MW/min | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> ○ Direction from Power Team to raise power to 1240 MW at 0.5 Mw/min. | |
| | US | <ul style="list-style-type: none"> ● Acknowledge request to raise power to 1240 MW at 0.5 Mw/min. ● Implement actions of 1BGP 100-3. ○ Perform pre-job brief per HU-AA-1211 "PRE-JOB, HEIGHTENED LEVEL OF AWARENESS, INFREQUENT PLANT ACTIVITY, AND POST JOB BRIEFINGS" for load ramp. | |
| | US | <ul style="list-style-type: none"> ● Direct raising load to 1240 MW at 0.5 MW/min. <ul style="list-style-type: none"> ● Initiate load swing instruction sheet, 1BGP 100-3T5. | |
| | CREW | <ul style="list-style-type: none"> ● Review applicable Precautions, and Limitations and Actions. | |
| | RO | <ul style="list-style-type: none"> ● Verify rod position and boron concentration. <ul style="list-style-type: none"> ○ Perform dilution boundary calculation per 1BGP 100-3T5. ● Determine required PW volume: (approximate band: 1200 gal – 1500 gal). <ul style="list-style-type: none"> ○ Rema ● Determine required PW flow rate. ● Initiate dilution as required (BOP CV-5). ● Perform the following at 1PM05J: <ul style="list-style-type: none"> ● Set 1FK-111 PW/Total Flow Cont POT to the desired PW flow rate. ● Set 1FY-0111 PW Control Predet Counter to desired PW volume. ● Place MAKE-UP CONT SWITCH to STOP position. ● Set MODE SELECT to DIL/ALT DIL position. ● Place MAKE-UP CONT Switch to START. ○ Verify proper operation of valves and PW makeup pump (1CV111B open, 1CV111A throttled, 1CV110B open (ALT DIL only), PW pump running, PW flow on recorder). ○ Turn on PZR backup heaters. | |
| | BOP | <ul style="list-style-type: none"> ● Raise turbine load at 1PM02J or OWS drop 210 by performing the following: <ul style="list-style-type: none"> ● Select SETPOINT. ● Enter 0.5 MW/min into the RATE window. ● Select ENTER. ● Enter 1240 MW into REF DEMAND window. ● Select ENTER. ● Select EXIT. ○ Notify US and RO of pending ramp. ● Select GO/HOLD. ● Verify GO/HOLD button illuminates. ● Verify HOLD illuminated RED. ● Select GO. ● Verify GO illuminates RED. ● Verify main turbine load begins to rise. | |
| | RO/BOP | <ul style="list-style-type: none"> ● Monitor reactor power and load ascension: <ul style="list-style-type: none"> ● Monitor NI's, Tave, ΔI, Pzr press/level at 1PM05J. ● Monitor MW and DEHC system response at 1PM02J or OWS drop 210. ● During dilution, monitor the following at 1PM05J and HMI: <ul style="list-style-type: none"> ● VCT level. ● RCS Tave rising/RCS boron concentration lowering. | |

| Scenario No: | NRC 16-4 | Event No. | 2 |
|--|-----------------|---|---|
| Event Description: Raise power at 0.5 MW/min | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | | <ul style="list-style-type: none"> • PW/Total flow predet counter responding correctly. • Verify dilution auto stops at preset value. • Return Reactor Makeup System to automatic. | |
| | | <p>EVALUATOR NOTE: After ramp has begun, and crew has demonstrated ability to control T_{ave} and ΔI within station guidelines, continue with next event, or at lead evaluator's discretion.</p> | |

| | | | |
|---|-----------------|---|---|
| Scenario No: | NRC 16-4 | Event No: | 3 |
| Event Description: Unit Supervisor notified of 1B AF pump ASME surveillance failure | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> US called by Engineering that 1B AF pump ASME surveillance acceptance criteria has NOT been met, because developed discharge pressure spec not met. | |
| | US | <ul style="list-style-type: none"> Refers to TS 3.7.5 determines that <u>Condition A</u> applies: <u>Restore pump to operable w/i 72 hours</u> Calls SM and informs same of condition. Requests, evaluation for on-line risk, IR initiation and maintenance informed. | |
| | | EVALUATOR NOTE: After the Tech. Spec. condition has been determined and with lead examiners concurrence, insert the next event. | |

| Scenario No: | NRC 16-4 | Event No. | 4 |
|--------------------|--|--|---|
| Event Description: | 0B SX MDCT Fan High Vibration requiring a Fan Trip | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciator SX CLG TWR FAN VIBRATION HIGH (0-37-E6) is LIT • 0B SX High Speed Fan Amps indicate High in Red Band | |
| | BOP | <ul style="list-style-type: none"> • Refer to BAR 0-37-E6 • Monitor amps NOT normal • Manually trip 0B SX Fan • Start 0D SX fan in high speed | |
| | US | <ul style="list-style-type: none"> • Evaluate TS 3.7.9; <6 fans are OPERABLE, so Condition B is entered to verify within 1 hour the operable fans are capable of being powered from emergency power source (yes, both EDG are operable) and initiate action to restore ≥ 1 more SX fan within 72 hours. • Notify SM to evaluate online risk and create IR | |
| | RO | <ul style="list-style-type: none"> • Monitor primary and secondary panels <ul style="list-style-type: none"> ○ Assist with notifications | |
| | | EVALUATOR NOTE: After the actions for the fan trip are complete and with lead examiners concurrence, insert the next event. | |

| Scenario No: | NRC 16-4 | Event No: | 5 |
|---|-----------------|---|---|
| Event Description: 1A Tcold RTD Failed High | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciator TAVE CONT DEV HIGH (1-14-D1) is LIT • Annunciator AUCT TAVE HIGH (1-14-E2) is LIT • Annunciator PZR LEVEL CONT DEV LOW (1-12-B4) is LIT | |
| | CREW | <ul style="list-style-type: none"> • Identify instrument failure | |
| | US | <ul style="list-style-type: none"> • Enter 1BOA Inst-2, Operation with a Failed Instrument Channel, Attachment A. • Notify SM of procedure entry, request EAL evaluation and IR <ul style="list-style-type: none"> ○ Order ramp in HOLD | |
| | RO | <ul style="list-style-type: none"> ○ Verify/Place Rod Bank Select Switch in MANUAL • Manually defeat 1A Tave channel • Manually defeat 1A ΔT channel • Select operable RTD for the ΔT recorder • Check if Rod Control can be placed in AUTO <ul style="list-style-type: none"> • Check C-5 NOT LIT <ul style="list-style-type: none"> ○ May place rods in AUTO if Tave within 1° of Tref • Check Pzr level trending to normal <ul style="list-style-type: none"> ○ May take manual control of Master Pzr level controller or 1CV121 | |
| | BOP | <ul style="list-style-type: none"> • Assist RO with BAR response <ul style="list-style-type: none"> ○ Place ramp in HOLD | |
| | US | <ul style="list-style-type: none"> ○ Contact the WEC to brief, or personally brief an extra NSO to bypass bistables ○ Direct the crew to coordinate bistable bypassing with extra NSO | |
| | US | <ul style="list-style-type: none"> • Determines TS 3.3.1 condition A & E is applicable <ul style="list-style-type: none"> ○ Evaluates DNB TS 3.5.2 for RCS < 2209 PSIG ○ Enter DEL 3.3.2 for P-12 | |
| | | EVALUATOR NOTE: After the actions for the instrument failure are complete and with lead examiners concurrence, insert the next event. | |

| Scenario No.: | NRC 16-4 | Event No.: | 6 |
|--|-----------------|--|---|
| Event Description: Feedwater flow channel 1FT-521 fails low | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUES: | <ul style="list-style-type: none"> ○ Annunciator 1B SG FW FLOW MISMATCH (1-15-B4) ○ FW flow indicator 1FI-521A lowering ○ FW flow indicator 1FI-520A rising ○ FWRV 1FW-520 opening ○ SG level indicators 1LI-527, 528, 529, 557 rising | |
| | BOP | <ul style="list-style-type: none"> ● Identify 1FT-521 failed low ● Report failure to US ● Implement BHC for SG Level failure ● Perform the following at 1PM04J <ul style="list-style-type: none"> ● Place 1FW-520 in MANUAL ● Lower FW flow to match or slightly lower than steam flow ● Monitor 1B SG level and control 1FW-520 in MANUAL ● Select operable SG level channel F-520 on 1FS-520C ● Check 1B SG level – normal on 1LI-527, 528, 529, 557 ● Place 1FW-520 in AUTOMATIC ○ Place ramp on hold | |
| | US | <ul style="list-style-type: none"> ● Enter/Implement "1BOA INST-2, "OPERATION WITH A FAILED INSTRUMENT CHANNEL", Attachment G. ● Notify SM of plant status and procedure entry. ● Request evaluation of Emergency Plan conditions. ● | |
| | RO | <ul style="list-style-type: none"> ● Assist BOP as requested ● Monitor reactor panel for reactivity changes | |
| EVALUATOR NOTE: After the actions for the feedwater flow channel failure are complete and with lead examiners concurrence, insert the next event. | | | |

| Scenario No: | NRC 16-4 | Event No. | 7 |
|---|-----------------|--|---|
| Event Description: VCT Level Channel 1LT-112 Failed Low | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciator VCT LEVEL HIGH-HIGH LOW is LIT • VCT Level 1LI-112 indicates ZERO • Automatic RMCS makeup in operation | |
| | CREW | <ul style="list-style-type: none"> • Refer to BAR 1-9-A2 • Determine 1LT-112 is failed LOW by comparing to 1LT-185 and sudden change in 1LT-112 level with no change in charging or letdown. | |
| | RO | <ul style="list-style-type: none"> • Place RMCS makeup switch in OFF • Monitor VCT level <ul style="list-style-type: none"> ○ Makeup to VCT in MANUAL if required | |
| | US | <ul style="list-style-type: none"> • Notify SM of failure, request IR ○ Enter DEL 3.3.9 | |
| | BOP | <ul style="list-style-type: none"> • Monitor primary and secondary panels • Assist with BAR response | |
| | | <p>EVALUATOR NOTE: After the actions for the VCT level failure are complete and with lead examiners concurrence, insert the next event.</p> | |

| Scenario No: | NRC 16-4 | Event No. | 8 & 9 |
|---|------------------------|--|-------|
| Event Description: 1C RCP Trip with ATWS | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> The following annunciators are LIT: <ul style="list-style-type: none"> RCP TRIP (1-13-E3) RCP LOW FLOW ABOVE P8 RX TRIP (1-11-C5) RCP 1C BRKR OPEN OR FLOW LOW ALERT (1-13-C3) | |
| | CREW | <ul style="list-style-type: none"> Identify entry conditions for 1BEP-0, "REACTOR TRIP OR SAFETY INJECTION" | |
| EVALUATOR NOTE: The crew may dispatch an operator to open the reactor trip breakers before reaching step 6. | | | |
| | US | <ul style="list-style-type: none"> Enters 1BEP-0, "REACTOR TRIP OR SAFETY INJECTION" Transition to 1BFR S.1, "ATWS" Notify SM of procedure entry Request EAL evaluation and STA to monitor BSTs | |
| | RO | <ul style="list-style-type: none"> Rod Bottom lights -NOT LIT Rx Trip and Bypass Bkrs- NOT ALL OPEN Manually TRIP the Reactor from BOTH locations Allow rods to insert automatically until rod speed less than 48 SPM, then manually insert rods | |
| | CREW CT-50 | <ul style="list-style-type: none"> Manually trip the Turbine <ul style="list-style-type: none"> All Turbine throttle valves – CLOSED. All Turbine governor valves – CLOSED. Recognizes the Turbine did not auto trip from Reactor trip Manually trip the turbine <ul style="list-style-type: none"> Actuate manual trip P.B. Operate the manual trip soft key on the OWS G-5512 panel Select turbine manual on G-5501 panel Select RAPID Select and hold GV lower arrow OR Manually actuate Mainsteam Line Isolation | |
| | CREW | <ul style="list-style-type: none"> Manually start both AF pumps | |
| | RO/BOP CT-52 | <ul style="list-style-type: none"> Verify/ensure Control Rods inserting in Manual or Auto at least 48 steps per minute Check at least 1 CV pump running Initiate emergency boration by <ul style="list-style-type: none"> Open 1CV8104 Start boric acid transfer pump Check emergency boration and charging flows > 30 GPM | |
| | RO/BOP | <ul style="list-style-type: none"> Check Pzr pressure < 2335 PSIG Verify Group 6 CVI monitor lights LIT | |
| | CREW | <ul style="list-style-type: none"> Check if Reactor Trip has occurred <ul style="list-style-type: none"> Dispatch EO to locally open Rx Trip Breakers Check Turbine Trip occurred | |
| EVALUATOR NOTE: Depending on timeframe, the crew may go to either step 8 or step 16 at this point. Steps 8-15 are in <i>italics</i>. | | | |

| Scenario No: | NRC 16-4 | Event No. | 8 & 9 |
|--|-----------------|--|-------|
| Event Description: 1C RCP Trip with ATWS | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CREW | <ul style="list-style-type: none"> • Check if Reactor is subcritical <ul style="list-style-type: none"> • PR channels <5% • IR channels – negative SUR | |
| | CREW | <ul style="list-style-type: none"> • Check SG NR levels ≥ 1 SG >10% • Control feed flow to maintain SG NR level 10% - 50% • Check 1SD002A-H closed • Check 1CV111A & B closed • Verify BTRS MODE SELECTOR SWITCH is OFF • Dispatch operator to verify dilution paths are isolated ○ Check for RCS temperature NOT dropping uncontrollably ○ Check for any SG pressure NOT dropping uncontrollably | |
| | | <ul style="list-style-type: none"> • EVALUATOR NOTE: If RCS is cooling down or SG are depressurizing, the crew will perform steps 11-13 | |
| | CREW | <ul style="list-style-type: none"> ○ Step 11: Check/close MSIVs and bypass valves closed ○ Step 12: Check SG pressure NOT dropping uncontrollably or depressurized ○ Step 13: Isolate Faulted SG | |
| | CREW | <ul style="list-style-type: none"> • Step 14: Check CETC < 1200°F • Step 15: Verify reactor subcritical <ul style="list-style-type: none"> • PR channels < 5% • IR channels – negative SUR | |
| | Crew | <ul style="list-style-type: none"> • Return to procedure and step in effect | |
| | US | <ul style="list-style-type: none"> • Announces transition to 1BEP-0, Reactor Trip or Safety Injection | |
| | RO | Perform immediate operator actions of 1BEP-0: <ul style="list-style-type: none"> • Step 1: Verify reactor trip <ul style="list-style-type: none"> • Rod bottom lights - ALL LIT • Reactor trip & Bypass breakers - OPEN • Neutron flux – DROPPING | |
| | BOP | Perform immediate operator actions of 1BEP-0: <ul style="list-style-type: none"> • Step 2: Verify Turbine Trip <ul style="list-style-type: none"> • All Turbine throttle valves – NOT CLOSED • All Turbine governor valves - CLOSED • Step 3: Verify power to 4KV busses <ul style="list-style-type: none"> • ESF Buses – BOTH ENERGIZED (141 & 142) | |
| | CREW | <ul style="list-style-type: none"> • Step 4: Check SI Status <ul style="list-style-type: none"> • SI First OUT annunciator – NOT LIT • SI ACTUATED Permissive Light – NOT LIT • SI Equipment – NOT ACTUATED <ul style="list-style-type: none"> • Either SI pump – NOT RUNNING • Either CV pump to cold leg isolation valve – NOT OPEN – 1SI8801A/B • Recognize SI NOT Actuated | |

| Scenario No: | NRC 16-4 | Event No. | 8 & 9 |
|--|-----------------|---|-------|
| Event Description: 1C RCP Trip with ATWS | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | | <ul style="list-style-type: none"> • Check if SI Required <ul style="list-style-type: none"> • Pzr Pressure – NOT < 1829 # • Steamline Pressure – NOT < 640# • CNMT Pressure – NOT > 3.4# • Recognize SI is NOT required | |
| | SRO | <ul style="list-style-type: none"> • Transition to 1BEP ES-0.1, Reactor Trip Response • Direct STA to monitor BST • Notify SM of procedure entry • Request evaluation of Emergency Plan conditions | |
| EVALUATOR NOTE: The scenario can be terminated after the transition to 1BEP ES-0.1 is announced or at Lead Examiner's discretion. | | | |

(FINAL)

Simulation Facility ByronScenario No.: Operating Test No.: **2016 Byron NRC
NRC 16-5**

Examiners:

Applicant:

SRO

RO

BOP

Initial Conditions: IC-22

Turnover: Unit 1 is at 100% power, steady state, equilibrium xenon, MOL. Online risk is green. CBD @ 221 steps, and boron concentration is 883 ppm. 1BOSR 5.5.8.AF-1c, Comprehensive IST Requirements for the Motor Driven Auxiliary Feedwater Pump 1AF01PA, Step F.2 is to be performed for an engineering request for data on the AF flow controllers. SED has recorders installed. The unit will be ramped to 97% power at 3MW/min for the flow test.

| Event No. | Malf. No. | Event Type* | Event Description |
|-----------|---|-------------------------|---|
| 1 | None | R (RO, SRO) | Ramp down for AF Flow Test |
| 2 | None | N (BOP, SRO) | AF Flow Test |
| 3 | MRF ED042H OPEN MRF ED042E OPEN MRF ED042D OPEN IOR ZLO1HSDG0201 OFF | TS (SRO) | Loss of DC to 1B DG (Tech Spec) Online Risk to Yellow |
| 4 | IMF RX10A 100 30 | I (RO, SRO) TS (SRO) | Turbine impulse pressure channel 1PT-505 fails high (Tech Spec) |
| 5 | IMF EG03 90 10 | C (BOP, SRO) | Generator voltage regulator failure |
| 6 | IMF CV10 | C (RO, SRO) | 1CV121 fails open |
| 7 | IMF RX05 1000 30 | I (BOP, SRO) | Steam line pressure detector 1PT-507 fails low |
| 8 | IMF ED15C IMF ED15G IMF EG08A | M (ALL) | Dual unit loss of all AC power |

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

SCENARIO OVERVIEW

Unit 1 is at 100% power, steady state, equilibrium xenon, MOL. Online risk is green. CBD @ 221 steps, and boron concentration is 883 ppm. 1BOSR 5.5.8.AF-1c, Comprehensive IST Requirements for the Motor Driven Auxiliary Feedwater Pump 1AF01PA, Step F.2 is to be performed for an engineering request for data on the AF flow controllers. SED has recorders installed. The unit will be ramped to 97% power at 3MW/min for the flow test.

After completing shift turnover and relief, the crew will ramp the unit to 97% power at 3MW/min (Rema supplied by QNE) and perform 1BOSR 5.5.8.AF-1c, Comprehensive IST Requirements for the Motor Driven Auxiliary Feedwater Pump 1AF01PA. This procedure has been signed off to step F.1.k.

After a the AF test is done, control power is lost to the 1B DG (both inputs). Tech Spec 3.8.1, condition B applies. The 1B DG will remain unavailable for the remainder of the scenario. (On-line risk is yellow.)

After the 1B DG failure is addressed and flow test is completed, turbine impulse pressure channel 1PT-505 will fail high over a 30 second period. Control rods will begin automatically withdrawing. After recognizing the instrument failure and checking turbine power stable, the RO will place rod control in manual to stop the outward rod motion. 1BOA INST-2, OPERATION WITH A FAILED INSTRUMENT CHANNEL, Attachment A, will be implemented. The crew will defeat the failed instrument and the RO will restore Tave – Tref deviation. Technical specification 3.3.1, conditions A and P apply.

After the 1PT-505 failure is addressed, the generator voltage regulator output will fail high, causing the main generator to be overexcited. The BOP will turn the voltage regulator off and manually lower main generator excitation using the base adjuster.

After the voltage regulator failure is addressed, 1CV 121 will slowly fail open in AUTOMATIC. The RO will take manual control and restore normal charging flow. AUTOMATIC operation of 1CV121 will not be available for the remainder of the scenario.

After normal charging flow is restored and the plant stabilized, steam line pressure detector 1PT-507 will fail low over a 30 second period. Both main feedwater pumps speed will lower, reducing feedwater flow and causing all steam generator levels to begin lowering. The crew will take actions to stabilize the plant by taking manual control of the main feedwater pumps. 1PT-507 will remain unavailable for the remainder of the scenario. On-line risk remains yellow.

After the 1PT-507 failure is addressed, a loss of all offsite power will occur for both Units. When the 1A DG engine attempts to start, the engine will seize, resulting in a loss of all AC power to Unit 1. Transition will be made to 1BCA-0.0, LOSS OF ALL AC POWER. A limited crosstie to Unit 2 will be required due to the failure of 2B DG to energize bus 142. The crew must restore power to Unit 1. After power is restored to Bus 141, SX will be cross-tied between units per 1BCA-0.0, Attachment C.

The scenario is complete when the crew has crosstied power from Unit 2 to Unit 1, and isolated RCP seal injection by closing seal injection filter inlet valve(s).

Critical Tasks

1. Restore power to Bus 141 (before exiting 1BCA-0.0).
(UFSAR 8.3.1.1.2.2) (K/A number – 000055EA2.03; importance 3.9/4.7)
2. Isolate RCP seal injection before a CV pump is started in 1BCA-0.0.
(ERG Critical Task number – CT-27) (K/A number - 003000A4.01; importance - 3.3/3.2)

References

1BOSR 5.5.8.AF-1c
1BOA INST-2
1BCA 0.0

SIMULATOR SETUP GUIDE:

- Verify/perform TQ-BY-201-0113, BYRON TRAINING DEPARTMENT SIMULATOR EXAMINATION SECURITY ACTIONS CHECKLIST.
- Establish the conditions of IC 22, 100% power, MOL, steady state, equilibrium xenon.
- Raise CST level to 90%.
- Lower hotwell level to 15" in preparation for AF surveillance. Monitor hotwell level on 1PM03J and use remote functions on FW14:
 - **MRF FW048 100** OR
 - **IMF FW37 48** and **MRF FW049 0 to 100** (Throttle open while monitoring level carefully, this lowers level quickly.)
- Verify/remove any Equipment Status Tags and Danger Tags not applicable to the scenario.
- Place simulator in RUN and allow simulator to run during board walk down and turnover.
- Verify Simulator Readiness Checklist is completed.
- Place Turnover and ReMa, 1BGP 100-4T3, Load Change Instruction Sheet, and marked up copy (signed off to step F.1.k, with steps F.3 and F.4 N/A) of 1BOSR 5.5.8.AF-1c, Comprehensive IST Requirements for the Motor Driven Auxiliary Feedwater Pump 1AF01PA on the Unit Desk.
- Run **caep N16-5** from thumb drive and verify the following actions load in the caep:

Byron 2016 ILT NRC scenario 16-5|00:00:00|1

Event 2: 1A AFP run - Start ALOP|00:00:00|3

mrf fw146 start|08:00:00|4

Event 3: Loss of DC to 1B DG|00:00:00|6

mrf ed042d open|08:00:00|7

mrf ed042e open|08:00:00|8

mrf ed042h open|08:00:00|9

ior zlo1hsdg0201 off|08:00:00|10

Event 4: 1PT-505 fails high|00:00:00|12

IMF RX10A 800 30|08:00:00|13

To trip bistables|00:00:00|14

MRF RP20 OPEN|08:00:00|15

MRF RX143 TRIP|08:00:00|16

MRF RP20 CLOSE|08:00:00|17

To trip AMS bistable|00:00:00|18

IOR PN0470 ON |08:00:00|19

MRF RX149 TRIP |08:00:00|20

Event 5: MG Voltage Reg failure|00:00:00|22

imf eg03 95 10|08:00:00|23

Event 6: 1CV-121 fails open|00:00:00|25

imf cv10 200 30 132|08:00:00|26

Events continue on next page|00:00:00|28

Event 7: 1PT-507 fails low|00:00:00|31

imf rx05 0 30|08:00:00|32

Event 8: Dual unit LOOP|00:00:00|34

imf ed15c|08:00:00|35

imf ed15e|08:00:00|36

imf eg08a|08:00:00|37

Emergency stop U1 DGs|00:00:00|39

mrf eg19 trip|08:00:00|40

mrf eg20 trip|08:00:00|41

Close 2414|00:00:00|43

mrf ed006 close|08:00:00|44

Throttle AF005 valves locally|00:00:00|46

Use RF FW 161-164|00:00:00|47

Isolate seal injection valves|00:00:00|49

mrf cv41 0|08:00:00|50

mrf cv42 0|08:00:00|51

Event 1: Ramp to 97% power

SM acknowledge start of ramp when notified.
TSO acknowledge start of ramp when notified.

When ramp is complete, If Rod Control is NOT in AUTOMATIC, as SM, notify the US that the QNE requests rod control be placed in AUTOMATIC for BEACON and PDMS calculations that are being performed by RE.

Event 2: Perform 1BOSR 5.5.8.AF-1c

EO provide information 1BOSR 5.5.8.AF-1c, Comprehensive IST Requirements for the Motor Driven Auxiliary Feedwater Pump 1AF01PA as requested.

EO report 1A AF pump recirc flow when requested. SMDG FW12, MP YCF2333

After the AFP is started, call as SED and report the desired data has been taken.

EO start 1A AF pump ALOP when requested. **MRF FW146 START** (Note the MCR ALOP Run Light won't start until the 1A AF pump is shut down.)

Events 3: Loss of DC to 1B DG.

Modify/insert and verify the following actuate:

- **MRF ED042D OPEN**
- **MRF ED042E OPEN**
- **MRF ED042H OPEN**
- **IOR ZLO1HSDG0201 OFF**

If dispatched as EO to 1B DG, report that all DC control power lights for the 1B DG are de-energized. Faint acrid smell exists in 1PL08J. The "Available for Emergency" light is out.

If dispatched as EO to DC bus 112, report no damage to the bus and both breakers for 1B DG control power are tripped (125 VDC Bus 112, Compt BF-1, ckt 16 and BR-1, ckt 13). If closure is attempted neither breaker will close.

If asked, report as Unit 2 that both U-2 DG's are operable.

Acknowledge as SM entry into TS 3.8.1, condition B entry, on line risk assessment (yellow), request for common cause failure analysis, request for maintenance support, and IR requests.

Once recognized that the Offsite AC Power Availability surveillance needs to be performed, report that an assist NSO will perform the surveillance.

Event 4: Turbine impulse pressure channel 1PT-505 fails high

Insert **IMF RX10A 800 30** to fail 1PT-505 high over a 30 second period.

If lead examiner desires the bistables tripped, participate in brief and perform the following:

- As extra NSO contact Unit 1 (X-2209)
- Insert the following:
 - **MRF RP20 OPEN** (open protection cabinet #1 door)
 - **MRF RX143 TRIP** (trip turbine power P-13 bistable PB505A)
 - **MRF RP20 CLOSE** (close protection cabinet #1 door)

If lead examiner desires the AMS bistables tripped, participate in brief and perform the following:

- As extra NSO contact Unit 1 (X-2209)
- Insert the following:
 - **IOR PN0470 ON** (place operating bypass switch 12 in TIP 1 position) (On annunciator tab of Action List)
 - **MRF RX149 TRIP** (place operating bypass input switch 11 to test-trip)

Acknowledge as Shift Manager the failure, LCOAR entry, on line risk assessment, EAL evaluation, request for maintenance support, and IR request.

Event 5: Main generator voltage regulator failure

Insert **IMF EG03 95 10** for main generator voltage regulator failed.

Acknowledge as SM voltage regulator failure, on line risk assessment, requests for maintenance and OAD support, and IR requests.

Acknowledge as Generation Dispatch failure of generator voltage regulator.

Event 6: 1CV-121 failed open

IMF CV10 200 30 132 (note: "final value, ramp time, initial value")

If dispatched as EO to investigate 1CV-121, report valve is responding normally.
SM acknowledge failure, online risk evaluation and IR initiation

Event 7: Steam line pressure detector 1PT-507 fails low.

Insert **IMF RX05 0 30** for 1PT-507 failed low.

If dispatched as EO to investigate 1PT-507, wait two minutes report no visible damage to 1PT-507.

Acknowledge as SM 1PT-507 failure, on line risk assessment, request for maintenance support, and IR requests.

Event 8: Dual unit loss of all AC power.

Insert and verify the following actuate:

- **IMF ED15C**
- **IMF ED15E**
- **IMF EG08A**

After STA requested, as STA report CSF status – Yellow on inventory if pressurizer level < 17%.

When requested as EO to start the U1 D/Gs, report that 1A D/G is seized, 1B DG does not have control power, and 1BOA ELEC-3 was ineffective.

Acknowledge as EO request to depress U1 DG emergency stop push buttons and insert the following:

- **MRF EG19 TRIP**
- **MRF EG20 TRIP**

As Unit 2 operator, report **ONLY** Bus 241 is energized from 2A DG, acknowledge request to perform 2BCA-0.3, and acknowledge request to monitor crosstie current as loads are started.

Insert the following to align Unit 2 4KV ESF buses to Unit 1:

- **MRF ED006 CLOSE** to close ACB 2414.

Acknowledge as EO request to monitor 1B AF pump and request to maintain 1B AF pump day tank level.

As EO, respond to request to throttle 1AF005E-H locally.

- **MRF FW161, FW162, FW163, FW164 as appropriate to requested flowrates**

Acknowledge as EO request to isolate RCP seals, wait three minutes and insert the following to isolate the RCS seal injection. Report RCP seal isolation to MCR.

- **MRF CV41 0 (1A seal injection filter) or MRF CV42 0 (1B seal injection filter) as appropriate for 1CV8384A or B.**

Event 8: Dual unit loss of all AC power. (continued)

If asked as Unit 2 for 2SX016A and 2SX027A status, report 2SX016A and 2SX027A are open.

Acknowledge request as EO to close 1SX016B and 2SX016B. Wait three minutes and report 1SX016B and 2SX016B are closed.

If dispatched as EO to check 1SX005 position locally, wait two minutes and report 1SX005 is open.

If asked as Unit 2 for 2SX005 status, report 2SX005 is closed.

If dispatched as EO to close 1SX004, wait two minutes and report 1SX004 is closed.

Acknowledge request as EO to throttle SX to the CC HXs. Wait two minutes and report 0SX007 is closed, 1SX007 is closed and 2SX007 is 20% open.

If requested as Unit 2 to open 2SX005, wait one minute and report 2SX005 is open.

If asked as Unit 2 for 2SX033 and 2SX034 status, report 2SX033 and 2SX034 are open.

If dispatched as EO to throttle 1SX007 to 10% open, report 1SX007 is 10% open.

Acknowledge request as Unit 2 to monitor 2A SX pump amps (120 a) and discharge pressure (94 psi).

If asked as Unit 2 for crosstie loading capability, report adequate capacity exists prior to starting Unit 1 loads.

Acknowledge as EO request to isolate CC surge tank auto makeup and insert the following to isolate CC surge tank makeup:

- **MRF CC51 0** to close 1CC185
- **MRF CC52 0** to close 1CC184

Acknowledge as EO request to drain CC surge tank to normal level and insert the following as needed to initiate CC surge tank drain:

- **MRF CC15 100** to open 1CC2020B
- **MRF CC16 100** to open 1CC2020A

| Scenario No: NRC 16-5 | | Event No. 1 |
|---|----------|--|
| Event Description: Ramp unit to 97% power | | |
| Time | Position | Applicant's Actions or Behavior |
| | CUE | <ul style="list-style-type: none"> • Provide candidates with 1BGP 100-4T3, Load Change Instruction Sheet and ReMa |
| | SRO | <ul style="list-style-type: none"> • Implement 1BGP 100-4T3 for a normal ramp <ul style="list-style-type: none"> • Direct RO to borate in accordance with ReMa (30 gallons, 8 rod steps) • Direct BOP to ramp in accordance with 1BGP 100-4T3 and supplied ReMa |
| | RO | <ul style="list-style-type: none"> • Set up boration IAW ReMa and BOP CV-6 • Initiate boration using BOP CV-6 or BOP CV-6T1 checklist <ul style="list-style-type: none"> • Select STOP on RMCS Makeup Control Switch • Select BORATE on RMCS Mode Select Switch • Enter desired boration amount in BA totalizer • Turn ON RMCS Makeup Control Switch • Verify 1CV110B OPEN • Verify 1CV110A MODULATING • Verify 1AB03P STARTS • Verify proper AB flow on 1FR110 • Coordinate boration with start of unit ramp by BOP |
| | BOP | <ul style="list-style-type: none"> • Set up DEH for ramp IAW 1BGP 100-4T3 <ul style="list-style-type: none"> • Enter desired ramp rate (from ReMa) in the RATE window • Press ENTER • Enter desired MW output (from ReMa) in the REF DEMAND window • Press ENTER • Press GO/HOLD • Press GO and verify load lowers • Initiate ramp • Coordinate ramp with boration by RO. |
| EVALUATOR NOTE: When ramp is complete, crew will continue with 1BOSR 5.5.8.AF-1c | | |

| Scenario No: | NRC 16-5 | Event No. | 2 |
|--|---------------------------|---|---|
| Event Description: | Perform 1BOSR 5.5.8.AF-1c | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> Provide candidates with marked copy of 1BOSR 5.5.8.AF-1c | |
| | SRO | <ul style="list-style-type: none"> Implement 1BOSR 5.5.8.AF-1c <ul style="list-style-type: none"> Instruct BOP to perform 1BOSR 5.5.8.AF-1c steps F.2, F.5 and F.6. Instruct RO to monitor reactor power during performance of 1BOSR 5.5.8.AF-1c | |
| | RO | <ul style="list-style-type: none"> Monitor reactor power during performance of 1BOSR 5.5.8.AF-1c | |
| | BOP | <ul style="list-style-type: none"> Perform 1BOSR 5.5.8.AF-1c <ul style="list-style-type: none"> <i>NOTE: Signed off and placekept to step F.1.k</i> Place U0921 and U0923 to TEST in POINT DETAILS Start 1A AF pump per BOSR Contact EO to report 1A AFP recirc flow or check on HMI or Group Trend Record AF flows in BOSR Adjust AF flowrate to at least 200 gpm per SG using 1AF005 valves <i>NOTE: F.3 and F.4 are N/A'ed</i> Shutdown 1A AF pump per BOP AF-6 Contact EO to start 1A AFP ALOP locally | |
| <p>EVALUATOR NOTE: When Step F.5 (1A AFP is stopped) of 1BOSR 5.5.8.AF-1c is complete, or at the discretion of the lead examiner, continue with the next event.</p> | | | |

| Scenario No: | NRC 16-5 | Event No: | 3 |
|---|-----------------|--|---|
| Event Description: Loss of DC to 1B DG. | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> Annunciator DG 1B TROUBLE/FAIL TO START (1-22-C8) Annunciator DG 1B DIFF LOCKOUT/OVERSPEED (1-22-D8) DG 1B stop light de-energized. SER point 2491 1B ED Control Panel Trouble. | |
| | BOP | <ul style="list-style-type: none"> Refer to BARs | |
| | RO/ BOP | <ul style="list-style-type: none"> Dispatch EO to 1B EDG room. | |
| | CUE | <ul style="list-style-type: none"> EO reports both DC control power lights for the 1B EDG are de-energized. Faint acrid smell in 1PL08J panel. If EO dispatched to DC bus 112, reports that both breakers for 1B DG control power are tripped. If closure is attempted breakers will not close. | |
| <p>EVALUATOR NOTE: The crew may elect to place the 1B DG and ACB 1423 control switches to pull out due to the DG inoperability.</p> | | | |
| | BOP | <ul style="list-style-type: none"> Place 1B DG control switch to pull out at 1PM01J. Place ACB 1423 control switch to pull out at 1PM01J. May request EO to place 1B EDG in Maintenance Outage | |
| | SRO | <ul style="list-style-type: none"> Determine 1B DG is inoperable, determines TS 3.8.1, Cond B is applicable. Inform SM of TS entry, asks for IR and Sys Eng/maintenance help. Identify performance of 1BOSR 3.8.1.1 Unit 1 Offsite AC Power Availability Surveillance required within one hour and contacts the WEC or SM to request assistance of another NSO. | |
| <p>EVALUATOR NOTE: Once the crew identifies 1BOSR 8.1.1 is required to be performed, the SM will report that an Extra NSO will perform the surveillance.</p> | | | |
| <p>EVALUATOR NOTE: Initiate the next event when the lead examiner approves.</p> | | | |

| Scenario No: | NRC 16-5 | Event No. | 4 |
|--------------------|--|---|----------|
| Event Description: | Turbine impulse pressure channel 1PT-505 fails high. | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> ○ Annunciator 1-14-E1, TAVE CONT DEV LOW ● 1PI-505, first stage pressure, indication rising. ○ Control rod outward motion ● 1TR-0412, Auct Tave/Tref recorder, Tref indication rising ● 1SI-412, Rod Speed, indicates higher than normal, up to 72 steps per minute | |
| | RO/BOP | <ul style="list-style-type: none"> ○ Implement BHC for Uncontrolled Rod Motion. ● Perform the following at 1PM05J: <ul style="list-style-type: none"> ○ Determine control rods withdrawing. <ul style="list-style-type: none"> ● Identify 1PT-505 is failing high. ● Report failure to SRO ○ Determine turbine power stable at 1PM06J or OWS drop 210. ● Place rod bank select switch to manual at 1PM05J to stop uncontrolled rod withdrawal. | |
| | CREW | <ul style="list-style-type: none"> ● Reference BARs 1-14-E1. ● Identify entry conditions for 1BOA INST-2, OPERATION WITH A FAILED INSTRUMENT CHANNEL, ATTACHMENT D. | |
| | SRO | <ul style="list-style-type: none"> ● Notify SM of plant status and procedure entry ● Request evaluation of Emergency Plan conditions ● Implement 1BOA INST-2 "OPERATION WITH A FAILED INSTRUMENT CHANNEL", Attachment D "TURBINE IMPULSE PRESSURE CHANNEL FAILURE" and direct operator actions of 1BOA INST -2. | |
| | RO/BOP | <ul style="list-style-type: none"> ● Restore steam dumps. <ul style="list-style-type: none"> ● Check C-7 bypass permissive NOT LIT at 1PM05J. ● Perform the following at 1PM02J: <ul style="list-style-type: none"> ● Place 1PK-507, MS header pressure controller, in manual. ● Lower 1PK-507 demand to 0%. ● Place steam dump mode select switch to STM PRESS mode. ● Place 1PK-507 in auto. ● Defeat 1PT-505 at 1PM05J: ● Place 1PS505Z, turbine impulse pressure defeat C/S, to DEFEAT 505 | |
| | RO | <ul style="list-style-type: none"> ● Check if rod control can be placed in auto (if rods were in manual) ● Check C-5 bypass permissive NOT LIT at 1PM05J. ● Check Tave/Tref stable and within 1°F. <ul style="list-style-type: none"> ● 1TR-412 at 1PM05J ○ Adjust Tave – Tref within 1°F by manually inserting control rods at 1PM05J ○ Place rod bank select switch in AUTO. | |
| | RO/BOP | <ul style="list-style-type: none"> ● Check P13 interlock <ul style="list-style-type: none"> ● Turbine power > 10% ● Check P-13 bypass permissive NOT LIT at 1PM05J | |
| | Extra NSO | <ul style="list-style-type: none"> ● Check status of AMS system ● Operating Bypass switch in OFF locally. | |
| | Extra NSO/ | <ul style="list-style-type: none"> ● Locally trip bistables for AMS/BOP verifies correct bistable operation at 1PM05J. | |

| | | | |
|---|--|--|---|
| Scenario No: | NRC 16-5 | Event No. | 4 |
| Event Description: | Turbine impulse pressure channel 1PT-505 fails high. | | |
| Time | Position | Applicant's Actions or Behavior | |
| | BOP | <ul style="list-style-type: none"> Place Operating Bypass switch to TIP-1 locally. Place Operating Bypass Input to TEST-TRIP locally. | |
| | SRO | <ul style="list-style-type: none"> Determine TS 3.3.1 conditions A and P are applicable. Contact SM to perform risk assessment, initiate IR, and contact maintenance to investigate/correct instrument failure and rod control malfunction | |
| <p>EVALUATOR NOTE: After the actions for the turbine impulse pressure channel failure are complete and with lead examiners concurrence, insert the next event.</p> | | | |

| Scenario No: NRC 16-5 | | Event No: 5 |
|---|----------|---|
| Event Description: Generator voltage regulator failure | | |
| Time | Position | Applicant's Actions or Behavior |
| | CUES | <ul style="list-style-type: none"> • Annunciator GENERATOR VOLT REG TROUBLE (1-19-C8) • Annunciator GENERATOR FIELD FORCING (1-19-B6) • 1IIMP023, Exciter Field Current, rising. • 1VIMP006, Main Generator Output VARS, rising. |
| | SRO | <ul style="list-style-type: none"> • Direct/Ensure BOP takes manual control of generator voltage regulator and lowers generator field current. • Inform SM of voltage regulator failure. <ul style="list-style-type: none"> ○ Direct BOP/RO to stop load ramp/dilution |
| | BOP | <ul style="list-style-type: none"> • Implement BHC for Generator Field Forcing • Perform the following at 1PM01J: <ul style="list-style-type: none"> • Place voltage regulator to off. • Place base adjuster to lower. • Lower generator voltage to < 100 amps prior to main generator trip. ○ Refer to BAR |
| | CREW | <ul style="list-style-type: none"> • Refer to 1BGP 100-3A6 and 1BGP 100-3A7 for generator MW, and generator VARS within limits |
| | BOP | <ul style="list-style-type: none"> • Maintain generator field current, generator MW, and generator VARS within limits by operating the base adjuster. |
| | RO | <ul style="list-style-type: none"> • Refer to BARs • Monitor primary and secondary panels and assist BOP as requested |
| | SRO | <ul style="list-style-type: none"> • Contact SM to perform risk assessment, initiate IR, and contact maintenance to investigate/correct instrument failure. • Notify Generation Dispatch, NDO and TSO of voltage regulator failure. |

| Scenario No: | NRC 16-5 | Event No. | 6 |
|--|-----------------|---|---|
| Event Description: 1CV121 failure OPEN | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciator 1-9-D3, CHG LINE FLOW HIGH LOW LIT • Charging flow RISING • VCT level LOWERING | |
| EVALUATOR NOTE: Crew may enter 1BOA Pri-1 for Excessive Primary Leakage | | | |
| | RO | <ul style="list-style-type: none"> • Place 1FK-121 in MANUAL • Lower charging flow • Balance charging flow with letdown to restore and stabilize Pzr level | |
| | BOP | <ul style="list-style-type: none"> ○ Review BARs • Monitor primary and secondary panels as RO responds to CV malfunction | |
| | SRO | <ul style="list-style-type: none"> • Notify SM for IR | |
| <i>If Crew enters 1BOA Pri-1 for Excessive Primary Leakage</i> | | | |
| | SRO | <ul style="list-style-type: none"> ○ <i>(If 1BOA Pri-1 is entered) Notify SM for procedure entry and EAL evaluation</i> | |
| | RO/BOP | <ul style="list-style-type: none"> ○ <i>Check Charging Pumps running</i> ○ <i>Throttle 1CV121 and 1CV182 to maintain Pzr Level</i> | |
| <i>If Crew isolates and bypasses 1CV121 (May use P&ID or BOP CV-26)</i> | | | |
| | RO/BOP | <ul style="list-style-type: none"> • <i>Direct EO to open 1CV8387A while RO/BOP closes 1CV121</i> | |
| | RO/BOP | <ul style="list-style-type: none"> • <i>Adjust 1CV182 to maintain proper seal injection flow</i> | |
| | RO/BOP | <ul style="list-style-type: none"> ○ <i>Direct EO to close 1CV8384A & B to isolate 1CV121</i> | |
| EVALUATOR NOTE: After the actions to control charging flow are complete and with lead examiners concurrence, insert the next event. | | | |

| Scenario No: | NRC 16-5 | Event No. | 7 |
|--|-----------------|---|---|
| Event Description: Steam line pressure detector 1PT-507 fails low. | | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> • Annunciators S/G 1A/B/C/D LEVEL DEVIATION HIGH/LOW (1-15-A9/B9/C9/D9) • BOTH main feedwater pump speed/flow – LOWERING. • 1PI-507, S/G HDR PRESS, - LOWERING | |
| | CREW | <ul style="list-style-type: none"> • Refer to BARS • Determine 1PT-507 failing low at 1PM04J. <ul style="list-style-type: none"> ○ Dispatch operators to investigate 1PT-507 failure. | |
| | SRO | <ul style="list-style-type: none"> • Direct/Ensure BOP takes manual control of FW pump speed and raises FW pump speed. • Inform SM of 1PT-507 failure. <ul style="list-style-type: none"> ○ Direct BOP/RO to stop load ramp/dilution | |
| | BOP | <ul style="list-style-type: none"> • Implement BHC for SG Level • Perform the following at 1PM04J: <ul style="list-style-type: none"> • Place 1SK-509A, Master FW pump speed controller in manual. • Raise demand on 1SK-509A. • Raise FW pump speed sufficiently to restore SG levels to normal. • Maintain SG levels by operating 1SK-509A in manual. ○ Determines steam dumps not available in STM PRESS mode. | |
| | RO | <ul style="list-style-type: none"> • Perform the following at 1PM05J: <ul style="list-style-type: none"> • Monitor reactor response to SG under and overfeeding transient. | |
| | SRO | <ul style="list-style-type: none"> • Contact SM to perform risk assessment, initiate IR, and contact maintenance to investigate/correct instrument failure. | |

| Scenario No: | NRC 16-5 | Event No: | 8 |
|--------------------|-----------------------|--|---|
| Event Description: | Loss of all AC power. | | |
| Time | Position | Applicant's Actions or Behavior | |
| | CUE | <ul style="list-style-type: none"> Annunciator LOSS OF OFFSITE POWER (1-20-A1) Annunciator DG1A TROUBLE/FAIL TO START (1-21-C8) BOTH 4KV ESF bus alive lights NOT LIT. | |
| | CREW | <ul style="list-style-type: none"> Determine Loss of All AC Power has occurred. | |
| | SRO | <ul style="list-style-type: none"> Enter/Implement 1BCA-0.0, "LOSS OF ALL AC POWER", and direct operator actions of 1BCA-0.0 to establish the following conditions: <ul style="list-style-type: none"> Direct operator actions of 1BCA-0.0. Notifies SM of plant status and procedure entry. Requests evaluation of Emergency Plan conditions. | |
| | RO | Perform immediate operator actions of 1BCA-0.0: <ul style="list-style-type: none"> Manually trip reactor at 1PM05J or 1PM06J. Verify reactor trip at 1PM05J: <ul style="list-style-type: none"> Reactor trip & Bypass breakers - OPEN Neutron flux – DROPPING | |
| | BOP | Perform immediate operator actions of 1BCA-0.0: <ul style="list-style-type: none"> Manually Isolate Steamlines at 1PM05J or 1PM06J: <ul style="list-style-type: none"> Actuate main steamline isolation. Verify all MSIVs and MSIV Bypass valves – CLOSED. | |
| | BOP | <ul style="list-style-type: none"> Verify AF flow at 1PM06J: <ul style="list-style-type: none"> AF flow >500 gpm (1B AF train only) | |
| | RO | <ul style="list-style-type: none"> Verify RCS isolated at 1PM05J: <ul style="list-style-type: none"> BOTH PZR PORVs closed. 1CV8149A, B & C closed. 1CV459 and 1CV460 closed. 1CV8153A & B closed. | |
| | BOP | <ul style="list-style-type: none"> Try to restore power to any/both Unit 1 4KV ESF buses at 1PM01J: <ul style="list-style-type: none"> DGs – NONE RUNNING. Actuate SI. | |
| | BOP/ SRO | <ul style="list-style-type: none"> Prepare for Unit 2 crosstie: <ul style="list-style-type: none"> Dispatch operator to depress emergency stop push buttons on both U1 DGs. <ul style="list-style-type: none"> Reset SI at 1PM06J. | |
| | SRO | <ul style="list-style-type: none"> Check status of Unit 2 ESF buses at 1PM01J: <ul style="list-style-type: none"> Bus 241 – ENERGIZED from 2A DG. Notify Unit 2 to implement 2BCA-0.3, RESPONSE TO OPPOSITE UNIT LOSS OF ALL AC POWER. Bus 242 – DEENERGIZED <ul style="list-style-type: none"> GO TO 1BCA-0.0, Step 14 (limited crosstie). | |
| | BOP/ SRO | <ul style="list-style-type: none"> Energize bus 141 using limited Unit 2 crosstie (DG 2A) at 1PM01J: <ul style="list-style-type: none"> Bus 241 energized from 2A DG. Check Bus 141 – NOT FAULTED: <ul style="list-style-type: none"> ACB 1413 (DG feed) in PULL OUT. | |

| Scenario No: NRC 16-5 | | Event No: 8 |
|---|---|---|
| Event Description: Loss of all AC power. | | |
| Time | Position | Applicant's Actions or Behavior |
| | | <ul style="list-style-type: none"> • ACB 1411 (Non-ESF bus tie) in PULL OUT. • ACB 1412 (SAT feed) in PULL OUT. • ACB 1414 (Reserve feed) in PULL OUT. • Verify Bus 141 alarms NOT LIT: <ul style="list-style-type: none"> • Annunciator BUS 141 FD BRKR ACB 1412 TRIP (1-21-A7). • Annunciator BRKR 1414 CROSS-TIE OVERCURRENT (1-21-B8). • Annunciator DG 1A OVERLOAD (1-21-B9). |
| | BOP/ SRO [CT] UFSAR 8.3.1.1. 2.2 | <ul style="list-style-type: none"> • Energize bus 141 using limited Unit 2 crosstie (DG 2A) at 1PM01J: (Cont'd) • Place ESF loads in PULL OUT: <ul style="list-style-type: none"> • BOTH CENT CHG pumps • BOTH RH pumps • BOTH SI pumps • 1A AF pump • ALL RCFCs (HI and LO) • BOTH CS pumps • ALL CC pumps (1A, 1B, and 0) • BOTH SX pumps • BOTH MCR chillers • U-1 SX Tower Fans • Check ACB 2414 closed (reserve feed light lit.). • Synch and Close Bus 141/241 reserve feeder breaker: <ul style="list-style-type: none"> • Close ACB 1414 • Check Bus 141 energized. • Check Bus 131X energized. • Check VC Train 0A fans – RUNNING: <ul style="list-style-type: none"> • Start 0A supply fan, 0A return fan, & 0A makeup fan. • Notify Electrical Operations to implement an emergency AC restoration program. • GO TO step 16. |
| | BOP/ RO | <ul style="list-style-type: none"> • Check AF pump status at 1PM06J: <ul style="list-style-type: none"> • 1B AF pump – RUNNING. • Check SG levels at 1PM05J: <ul style="list-style-type: none"> • Maintain NR levels between 10% (31%) and 50%. • Dispatch operator to monitor 1B AF pump. |
| | BOP/ RO [CT-27] | <ul style="list-style-type: none"> • Isolate RCP seals: <ul style="list-style-type: none"> • Dispatch operator to locally close 1CV8384A & B. • Close 1CC9438 at 1PM06J. • Close 1CV8100 at 1PM05J. |
| | RO /BOP | <ul style="list-style-type: none"> • Verify Equipment loaded on bus 141 at 1PM06J: <ul style="list-style-type: none"> • Annunciator 125V DC BATT CHGR 111 TROUBLE - NOT LIT (1-21-E8) • Annunciator Bus 111 INVERTER TROUBLE NOT LIT (1-4-A5) • Annunciator Bus 113 INVERTER TROUBLE NOT LIT (1-4-C5) |
| | SRO | <ul style="list-style-type: none"> • Identify transition to 1BCA-0.0, "LOSS OF ALL AC POWER", "ATTACHMENT C, STATION BLACKOUT – ALTERNATE SX COOLING" |

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|---|-----------------------|---------------------------------|---|
| Scenario No: | NRC 16-5 | Event No. | 8 |
| Event Description: | Loss of all AC power. | | |
| Time | Position | Applicant's Actions or Behavior | |
| EVALUATOR NOTE: Scenario is terminated at this point | | | |

(Final)