

Draft Submittal

(Pink Paper)

1. Operating Test Simulator Scenarios

OCONEE EXAM

50-269, 270, 287/2002-301

FEBRUARY 11 - 15, 2002

OCONEE

02/04/2002

**OPERATING EXAM
(SIMULATOR)**

Facility: **Oconee**Scenario No.: **1R6**

Op-Test No.: _____

Examiners: _____

Operators: I -SRO (1-3)R-OATC (1-3)U-BOP (1-3)

Initial Conditions:

- 75% Reactor Power EOL, per dispatcher request (IC-42)

Turnover:

- Unit 1 TD EFDW Pump OOS to repair Oil leak, expected returned this shift
- SASS in manual for I&E testing
- AMSAC/DSS bypassed for I&E testing
- NI-9 OOS, to be replaced next outage
- Keowee Unit 2 OOS for unplanned reasons
- Keowee Unit 1 aligned to underground, operability test complete
- PT/1/A/0600/15 (Control Rod Movement) to be performed after turnover

Event No.	Malfunction No.	Event Type*	Event Description
0a	Pre-Insert MSS330		TD EFDW Pump Fails to Start
0b	Pre-Insert Updater		SASS in manual
0c	Pre-Insert Updater		AMSAC/DSS bypassed
0d	Pre-Insert MEL180		Keowee Unit 2 Emergency Lockout
0e	Pre-Insert MNI082		NI-9 OOS
1		N, BOP, SRO	Perform Control Rod Movement
2	MCR021 Override	C, OATC, SRO	Drop CR Group 2 Rod 6, (pip O-01-03316) (TS) Diamond blocked from AUTO operation
3		R, OATC	Power Reduction
4	MPS440 (40-80%)	C, BOP, SRO	1A ₁ RCP High Vibration
5	MPI281	I, OATC, SRO	ΔT_c fails HIGH when RCP secured
6	MCR022	C, OATC, SRO	Second dropped control rod, requiring a manual reactor trip
7	MEL090	M, ALL	CT-1 Lockout (Loss of Power) ATWS
8	MEL180	M, ALL	Keowee Unit 1 Emergency Lockout (blackout, PRA)

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

Op-Test No.: _____ Scenario No.: 1 Event No.: 1 Page 1 of 1

Event Description: **Perform Control Rod Movement PT: (N, BOP/SRO)**

Time	Position	Applicant's Actions or Behavior
	BOP/SRO	Perform PT/1/A/0600/15, Control Rod Movement Conduct pre-job briefing Review Limits and Precautions Place SAFETY RODS OUT BYPASS Switch in Bypass. Take manual control of reactor and feedwater <ul style="list-style-type: none"> • SG Master in Hand • Diamond in manual Test CRD Group 1 <ul style="list-style-type: none"> • Transfer CRD Group 1 to Aux power supply OP/1105/009 (Control Rod Drive System) • Insert CRD Group 1 • Withdraw CRD Group 1 • Transfer CRD Group 1 to DC Hold Power Supply Test CRD Group 2 <ul style="list-style-type: none"> • Transfer CRD Group 2 to Aux power supply per OP/1105/009 (Control Rod Drive System) • Insert CRD Group 2 • Withdraw CRD Group 2
		This event is completed when Group 2 Rod 6 drops into the core (during Group 2 withdrawal) or as directed by the lead evaluator.

Op-Test No.: _____ Scenario No.: 1 Event No.: 2 Page 1 of 3

Event Description: **Dropped Control Rod: (C, OATC/SRO) (TS)**

Time	Position	Applicant's Actions or Behavior
		<p>When crew begins to withdraw CRD Group 2, rod #6 drops into the core.</p> <p>Plant response:</p> <p>Statalarms</p> <ul style="list-style-type: none"> • 1SA-2/B-10, CRD Position Error • 1SA-2/D-9, CRD Out Inhibit <p>Position Indicating Panel</p> <ul style="list-style-type: none"> • API indication of dropped rod on individual meter • In limit (zero %) green light on respective dropped rod. • Loss of respective dropped rod out limit (100%) red light. • Amber 7" asymmetric lights on the dropped rod and the entire group. <p>Diamond Panel indications</p> <ul style="list-style-type: none"> • 9" asymmetric lamp. • Out inhibit lamp if NI Flux is above 60%. • Group In Limit (green) lamp on respective group.
	ALL	<p>Crew will use "plant stabilization process" to stabilize the plant.</p> <ol style="list-style-type: none"> The OATC will perform the following: <ol style="list-style-type: none"> Acknowledge and verbalize to the SRO the most important Statalarm received for the failure. Verbalize to the SRO reactor power level and direction of movement. The BOP will perform the following: <ol style="list-style-type: none"> Recognize that a valid runback should be occurring but is not because the ICS is in manual. The SRO should use the OAC to monitor unit status. The crew should determine that the use of AP/1/A/1700/15, Dropped Control Rods is required.

Op-Test No.: _____ Scenario No.: 1 Event No.: 2 Page 2 of 3

Event Description: **Dropped Control Rod: (C, OATC/SRO) (TS)**

Time	Position	Applicant's Actions or Behavior
	OATC/SRO	<p>SRO will direct actions per AP/1/A/1700/15, Dropped Control Rods.</p> <ol style="list-style-type: none"> 1. Verify \leq one dropped control rod. 2. Verify \leq one control rod misaligned $> 9"$ (6%) from group average. 3. Verify Reactor is critical 4. Verify runback to 55% FP in progress. <ul style="list-style-type: none"> • OATC should determine that a runback is not in progress due to ICS in manual.
	BOP	<ol style="list-style-type: none"> 5. Initiate Enclosure 5.1 (Control of Plant Equipment During Shutdown)
	OATC/SRO	<ol style="list-style-type: none"> 6. Notify I&E (SPOC) to perform the following: <ul style="list-style-type: none"> • Investigate cause of dropped rod • Prepare to reduce RPS Flux/Flow-Imbalance and RPS High Flux setpoints. 7. Within 1 hour verify $> 1\%$ SDM with the allowance for inoperable control rod(s) by performing PT/1/A/1103/15, Reactivity Balance Calculations. 8. Within 2 hours, ensure reactor power is less than 60% of the allowable power per the RCP combination. <p>Note: The crew may elect to place the Diamond in Auto to let the unit runback. However going to Auto is blocked by a malfunction of the auto/manual pushbutton.</p> <ol style="list-style-type: none"> 9. The OATC should begin reducing reactor power to less than 60% with the ICS in manual.

Op-Test No.: _____ Scenario No.: 1 Event No.: 2 Page 3 of 3

Event Description: **Dropped Control Rod: (C, OATC/SRO) (TS)**

Time	Position	Applicant's Actions or Behavior
	SRO	<p>10. The SRO should refer to TS 3.1.5 (Safety Rod Position Limits) and determine Condition "A" applies.</p> <ul style="list-style-type: none">• Verify SDM within COLR limit in 1 hour• Declare the rod inoperable in 1 hour. <p>11. The SRO should refer to TS 3.1.4 (Control Rod Group Alignment Limits) and determine Condition "A" applies.</p> <ul style="list-style-type: none">• Verify SDM is within the limit specified in the COLR within 1 hour.• Reduce power to $\leq 60\%$ of allowable thermal power within 2 hours.• Reduce overpower trip setpoints within 10 hours
		When power is being reduced with the ICS in manual this event is completed.

Op-Test No.: _____ Scenario No.: 1 Event No.: 3 Page 1 of 1		
Event Description: Power Reduction: (R, OATC)		
Time	Position	Applicant's Actions or Behavior
	OATC/SRO	<p>The OATC will reduce reactor power with the ICS in manual.</p> <ul style="list-style-type: none">• Reduce FDW to reduce power• Insert control rods to control Tave. <p>Note: The crew may elect to put FDW back in AUTO. If so, manually reducing FDW will not be required.</p>
		When power has been reduce by at least 5% or when directed by the lead evaluator this event is completed.

Op-Test No.: _____ Scenario No.: 1 Event No.: 4 Page 1 of 1

Event Description: **1A₁ RCP High Vibration: (C, BOP/SRO)**

Time	Position	Applicant's Actions or Behavior
	BOP/SRO	<p>During the power reduction Statalarm 1SA-9/D-2, RC Pump Vibration High, will alarm.</p> <ul style="list-style-type: none"> • The BOP should refer to the ARG • Verify RCP vibration conditions by using RCP OAC Display Group RCP • Refer to AP/1/A/1700/16, Abnormal Reactor Coolant Pump Operation. <ul style="list-style-type: none"> ➤ Determine if RCP immediate trip criteria is met by referring to Enclosure 5.1 (RCP Immediate Trip Criteria). ➤ An immediate trip condition based on vibration is one of the immediate trip criteria. Sustained actual Emergency High Vibration as verified by Enclosure 5.1 (RCP Immediate Trip Criteria). ➤ Since immediate trip criteria is not met then notify the OSM and request an evaluation of the RCP vibration condition by the RCP Component Engineer. <p>Statalarm 1SA-9/E2 (RCP VIBRATION EMERG HIGH) will actuate.</p> <ul style="list-style-type: none"> • The BOP should determine that the trip criteria are met based on Enclosure 5.1 (RCP Immediate Trip Criteria) and inform the SRO. • The SRO should direct the BOP to trip the 1A1 RCP.
	BOP	Trip the 1A1 RCP.
		When crew has tripped the RCP this event is completed.

Op-Test No.: _____ Scenario No.: 1 Event No.: 5 Page 1 of 1

Event Description: ΔT_c fails HIGH: (I, OATC/SRO)

Time	Position	Applicant's Actions or Behavior
	OATC/SRO	<p>When the 1A₁ RCP is secured ΔT_c fails HIGH</p> <ul style="list-style-type: none">• Statalarm 1SA-02/B-5, RC Cold Leg Diff. Temperature High, will actuate.• FDW flow will ratio based on the failure• "A" FDW flow will increase causing "A" loop T_c to decrease.• "B" FDW flow will decrease causing "B" loop T_c to increase.• This will cause actual ΔT_c to increase• The OATC should diagnose the ΔT_c failure by observing the ΔT_c meter on 1UB1. It should return to zero but is staying a + 3.5 degrees.• Take the Feedwater Masters to MANUAL and re-ratio feedwater using the loop T_c meters to return actual ΔT_c to near zero.
		<p>When the OATC has re-ratioed FDW and returned T_c to near zero or when directed by the lead examiner this event is completed.</p>

Op-Test No.: _____ Scenario No.: 1 Event No.: 6 Page 1 of 1

Event Description: **Second dropped Control Rod (Manual Reactor Trip): (C, OATC/SRO)**

Time	Position	Applicant's Actions or Behavior
	OATC/SRO	<p>After the plant is stable and when directed by the lead examiner a second control rod will drop.</p> <ul style="list-style-type: none">• The OATC should determine that a second control rod has dropped into the core by observing the CRD PI Panel and manually trip the reactor. OATC will attempt to trip the reactor by depressing the reactor trip pushbutton. <p>Note: The reactor will not trip when the button is depressed.</p> <ul style="list-style-type: none">• SRO should ensure that a manual reactor trip is performed.
		<p>After the reactor pushbutton has been depressed this event is completed.</p>

Op-Test No.: _____ Scenario No.: 1 Event No.: 7 Page 1 of 3

Event Description: **CT-1 Lockout and an ATWS: (M, ALL)**

When the manual reactor trip push button is depressed, the reactor will not trip and an ATWS will occur. When reactor power is less than 5% the turbine will be tripped and CT-1 (startup transformer) will lockout, which will result in a loss of power. Power will be restored from Keowee Unit 1 in approximately 35 seconds via the underground path and CT-4.

Time	Position	Applicant's Actions or Behavior
	OATC	<p>Recognize that the Reactor should have tripped and begin performing immediate manual actions.</p> <p>The OATC should recognize that Power Range NIs are not < 5% FP and perform Rule 1. (CT-E.1, CT-E.2)</p> <ul style="list-style-type: none"> ▪ Verify that at least one Power Range NI is $\geq 5\%$ FP. ▪ Initiate manual control rod insertion to the IN LIMIT. ▪ Open 1HP-24 & 1HP-25 (1A and 1B BWST Suction) ▪ Ensure 1A or 1B HPIP is operating. ▪ Start 1C HPIP. ▪ Open 1HP-26 & 1HP-27 (1A and 1B HP Injection) ▪ Dispatch operators to the Cable Room and to the 600V Load Centers 1X9 and 2X1 to de-energize the CRD System. ▪ Notify the Procedure Director to GO TO UNPP tab.
	SRO	<p>Transfer to the UNPP tab from IMAs.</p> <ul style="list-style-type: none"> ▪ Ensure Rule 1 is in progress or complete. ▪ Verify Main FDW available. ▪ IAAT <u>all</u> power range NIs are <5% FP, THEN ensure the turbine-generator is tripped. <ul style="list-style-type: none"> ➤ This action will result in a unit loss of power for ≈ 35 seconds due to CT-1 lockout. (refer to page 3 of event 7) ▪ Verify <u>all</u> wide range NIs $\geq 1\%$ FP. ▪ Maximize letdown. ▪ Verify Main FDW available. ▪ Adjust Main FDW flow as necessary to control RCS temperature. ▪ Verify overcooling NOT in progress. ▪ Ensure makeup to the LDST is secured. ▪ WHEN <u>all</u> NIs are <1% FP, AND decreasing, THEN continue in this tab.

Op-Test No.: _____ Scenario No.: 1 Event No.: 7 Page 2 of 3

Event Description: **CT-1 Lockout and an ATWS: (M, ALL)**

When the manual reactor trip push button is depressed, the reactor will not trip and an ATWS will occur. When reactor power is less than 5% the turbine will trip and CT-1 (startup transformer) will lockout, which will result in a loss of power. Power will be restored from Keowee Unit 1 in approximately 35 seconds via the underground path and CT-4.

Time	Position	Applicant's Actions or Behavior
	BOP	<p>Perform symptoms check and when asked report no other symptoms.</p> <p>When power is regained on the Main Feeder Buses perform AP/11, Recovery from Loss of Power.</p> <ul style="list-style-type: none"> ▪ IAAT Pzr level > 80" [180" acc], THEN ensure Pzr heaters in AUTO ▪ Verify load shed is complete as indicated by LOAD SHED COMPLETE on <u>any</u> ES Module (Channel 1 or 2). ▪ Dispatch an operator to perform Encl 5.2 (Restoring Loads Outside the Control Room). ▪ Dispatch an operator to perform Encl 5.4 (Actions to Restore ESV System to Normal Operation). ▪ Verify condenser vacuum maintained. ▪ Verify IA header pressures \geq 90 psig:
	OATC	<p>Determine the Main Feedwater Pumps have tripped as a result of the loss of power and perform RULE 3 (Loss of Main or Emergency FDW).</p> <ul style="list-style-type: none"> ▪ Ensure any EFDWP operating ▪ Initiate Enclosure 5.9 (Extended EFDW Operation) ▪ Throttle EFDW as necessary to prevent overcooling.

Op-Test No.: _____ Scenario No.: 1 Event No.: 7 Page 3 of 3

Event Description: **CT-1 Lockout and an ATWS: (M, ALL)**

When the manual reactor trip push button is depressed, the reactor will not trip and an ATWS will occur. When reactor power is less than 5% the turbine will trip and CT-1 (startup transformer) will lockout, which will result in a loss of power. Power will be restored from Keowee Unit 1 in approximately 35 seconds via the underground path and CT-4.

Time	Position	Applicant's Actions or Behavior
	SRO	<p>When the turbine is tripped and power is lost:</p> <p>Two possible paths</p> <ol style="list-style-type: none"> GO TO the "Blackout" tab per parallel actions page <ul style="list-style-type: none"> In the blackout tab, the crew will: verify power restored, initiate AP/11(Recovery from Loss of Power) and transfer to Subsequent Actions. <p>OR</p> If power is restored prior to transferring to blackout tab, SRO will complete UNPP tab. <ul style="list-style-type: none"> Determine that the reactor has tripped and power is $\leq 1\%$ power. Direct an RO to throttle HPI per Rule 6 and adjust Letdown if needed. Determine that CC and HPI are lost and initiate AP/25 (SSF Emergency Operating Procedure) When power is regained to the 4160-switchgear use a "Parallel Actions" transfer from the yellow page to initiate AP/11(Recovery from Loss of Power). Transfer to Subsequent Actions <ul style="list-style-type: none"> Verify all control rods are inserted Verify all 4160V switchgear (1TC, 1TD, 1TE) energized. Verify Main FDW is not operating and ensure SG level are approaching 240" XSUR.
		<p>This event is completed when power is regained to 4160V switchgear, reactor is shutdown, EOP Subsequent Actions are in progress, and when directed by the lead examiner.</p>

Op-Test No.: _____ Scenario No.: 1 Event No.: 8 Page 1 of 1

Event Description: **Keowee Unit 1 Emergency Lockout, Unit Blackout: (M, ALL)**

Time	Position	Applicant's Actions or Behavior
	ALL	<p>When directed by the lead examiner Keowee Unit 1 Emergency Lockout will occur.</p> <p>Keowee Unit 1 Emergency Lockout will result in a Unit Blackout.</p> <ul style="list-style-type: none"> Determine that CC and HPI are lost and initiate AP/25 (SSF Emergency Operating Procedure) <p>The SRO will make a "Parallel Actions" transfer to the Blackout tab.</p> <ul style="list-style-type: none"> Close 1HP-31 (RCP Seal Flow Control) and 1HP-21 (RCP Seal Return). Determine SGs are not being feed and dispatch operators to the Atmospheric Dump Valves. <p>Note: Since the TD EFDW Pump is OOS no source of FDW is available to the SGs until power is restored from CT - 5.</p> <ul style="list-style-type: none"> Notify SSF operators that feeding with SSF ASW is required. Initiate Enclosure 5.39 (Restoration of Power) (CT-A.8)
	BOP	<p>Perform Enclosure 5.39 (Restoration of Power)</p> <ul style="list-style-type: none"> Determine CT-1 has no voltage Determine no Keowee Units operating Verify CT-5 indicates 4160 volts. Place various auto/manual transfer switches in manual Close SL1 and SL2 breakers Close S1 and S2 breakers <p>Note: This will power the Main Feeder Buses.</p>
		<p>This event and the exam are complete when power has been regained to the MFBs or when directed by the lead examiner.</p>

Scenario #1 Overview

Initial Conditions: Unit 1: 75% power - 430 EFPD, Unit 2: 100%, Unit 3: 100%

Turnover:

- Unit 1 TD EFDW Pump OOS to repair Aux Oil Pump
- SASS in MANUAL for I&E testing
- AMSAC/DSS bypassed for I&E testing
- NI-9 OOS, to be replace next outage
- Keowee Unit 2 OOS for unplanned reasons
- Keowee Unit 1 aligned to underground, operability test complete
- PT/1/A/0600/15 (Control Rod Movement) to be performed after turnover

1) Perform Control Rod Movement PT: (N, BOP)

- a) The ICS is put in manual by placing the Diamond and the Steam Generator Master in manual.
- b) PT/1/A/0600/15, Control Rod Movement, will be used to exercise the control rods. During the movement of group two control rods, Group 2 Rod 6 will drop into the core.

TIME = 20 minutes

2) Dropped Control Rod: (C, OATC) (TS)

- a) The crew should utilize the "plant stabilization process" to stabilize the plant and recognize that a runback is not in progress.
- b) Perform actions per AP/15, Dropped Control Rods, including reducing reactor power to less than 60% within 2 hours.
- c) The crew may try to return the ICS to AUTO. However, the Diamond will be blocked from returning to AUTO requiring a manual power reduction.

TIME = 10 minutes, TOTAL 30 min.

3) Power Reduction: (R, OATC)

- a) The CRSRO will direct the OATC with the help of the BOP to commence a unit shutdown with the ICS in manual.

TIME = 10 minutes, TOTAL 40 min.

4) 1A₁ RCP High Vibration: (C, BOP)

- a) During the power reduction the 1A₁ RCP will experience High Vibration. This will require entry into AP/16, Abnormal Reactor Coolant Pump Operation. RCP vibration will increase and the decision will be made to secure the 1A₁ RCP.

TIME = 5 minutes, TOTAL 45 min.

Scenario #1 Overview

5) ΔT_c fails HIGH: (I, OATC)

- a) When the 1A₁ RCP is secured ΔT_c fails HIGH requiring the OATC to manually re-ratio feedwater using the Feedwater Masters.

TIME = 3 minutes, TOTAL 48 min.

6) Second dropped Control Rod (Manual Reactor Trip): (C, OATC)

- a) After the plant is stable a second control rod will drop. This will require a manual reactor trip.

TIME = 2 minutes, TOTAL 50 min.

7) CT-1 Lockout and an ATWS: (M, ALL; R, OATC)

- a) The reactor will not trip and an ATWS will occur requiring utilization of the Unanticipated Nuclear Power Production tab and RULE 2 from the EOP. Manually inserting control rods, deenergizing control rod drives and Emergency Boration will be required. When reactor power is less than 5% the turbine will be tripped. This will cause a loss of power due to CT-1 (startup transformer) lockout. Main Feeder Bus power will automatically be restored from Keowee via CT-4 and the Standby Bus. This will require entering AP/11, Recovery From Loss of Power, to restore plant loads and secondary equipment required for the recovery of condenser vacuum. When NIs indicate less than 1% UNPP tab directs transfer back to Subsequent Actions tab.

TIME = 10 minutes, TOTAL 60 min.

8) Keowee Unit 1 Emergency Lockout, Unit Blackout: (M, ALL)

- a) Keowee Unit 1 Emergency Lockout will result in a Unit Blackout. This will cause the CRSRO to transfer to the Blackout tab of the EOP for guidance on manually restoring power to Unit 1's Main Feeder Busses from Central Switchyard via CT-5. After power is restored to the 4160 volt switchgear AP/11 will be restarted. The scenario will be completed after power has been restored to the Main Feeder Buses and AP/11 has been restarted.

TIME = 10 minutes, TOTAL 70 min.

Facility: **Oconee** Scenario No.: **2R5** Op-Test No.: _____

Examiners: _____ Operators: U-SRO (1-4)

_____ I-OATC (1-3)

_____ R-BOP (1-3)

Initial Conditions:

- 25% Reactor Power, startup in progress (IC-45)

Turnover:

- Unit 1 TD EFDW Pump OOS to repair oil leak
- SASS in MANUAL for I&E testing
- AMSAC/DSS bypassed for I&E testing
- NI-9 OOS, to be replaced next outage
- Keowee Unit 2 OOS for unplanned reasons
- Keowee Unit 1 aligned to underground
- Operability test of Keowee Unit 1 is to be performed per PT/620/009 (Keowee Hydro Operation) after turnover and before startup continues, ONS to perform remote Keowee start

Event No.	Malfunction No.	Event Type*	Event Description
0a	Pre-Insert MSS330		TD EFDW Pump Fails to Start
0b	Pre-Insert		SASS in manual
0c	Pre-Insert		AMSAC/DSS bypassed
0d	Pre-Insert MNI082		NI-9 OOS
0e	Pre-Insert MEL180		Keowee Unit 2 Emergency Lockout
1	Override	N, BOP, SRO C, BOP, SRO	Operability test Keowee Unit 1 Keowee Unit 1 Gen Field Flashing Breaker fails to OPEN automatically
2	MPS090	C, OATC, SRO	1HP-120 (RC Volume Control) Fails closed
3	MNI032	I, OATC, SRO	Controlling NI fails LOW
4	Override	C, BOP, SRO	Seismic event (PRA) 1A RBCU rupture (TS)
5	MPS020 5%-25%	C, ALL	1B SG Tube leak (ramp 10 – 100 gpm over 30 min) (TS)
6		R, OATC	Unit Shutdown
7	MSS360,50	M, ALL	1A Main Steam line break in RB

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

Op-Test No.: _____ Scenario No.: 2 Event No.: 1 Page 1 of 1

Event Description: **Operability test Keowee Unit 1 (N, BOP/SRO)**
Keowee Unit 1 Gen Field Flashing Breaker fails to OPEN
automatically (C, BOP/SRO)

Time	Position	Applicant's Actions or Behavior
	BOP/SRO	<p>PT/620/009 (Keowee Hydro Operation) is used to perform operability test of unit 1</p> <p>Use OP/1106/019 (Keowee Hydro At Oconee) to perform an "Automatic Startup" of Keowee Unit 1</p> <p>Initial Conditions</p> <ol style="list-style-type: none"> 1. Verify applicable Statalarms and breaker positions 2. Notify Keowee operator to give Oconee control of Keowee # 1. 3. Review Limits and Precautions <p>Procedure</p> <ol style="list-style-type: none"> 1. Place UNIT 1 LOCAL MASTER switch to "START" AND hold until Keowee Unit starts. 2. Verify the following: <ul style="list-style-type: none"> • GEN 1 FIELD BREAKER closes • GEN 1 SUPPLY BREAKER closes • GEN 1 FIELD FLASHING BREAKER closes 3. Ensure GEN 1 FIELD FLASHING BREAKER trips. <ul style="list-style-type: none"> • Candidate should diagnose that the breaker did not open automatically and should open the breaker manually and initiate a work request or contact SPOC. • SRO should direct the BOP to continue with the startup. <p>Note: GEN FIELD FLASHING BREAKER automatically trips ≤ 45 seconds after receiving close signal. Failure of breaker to trip automatically does NOT make the KHU inoperable. Startup procedure may continue.</p> <ol style="list-style-type: none"> 4. Verify ACB-1, Keowee 1 Generator Breaker, closed. 5. Verify Unit 1 EMER FDR ACB 3 closed 6. Verify ≈ 4.16 KV on CT4 Volts (2AB3) 7. Close SK1 and SK2 (CT4 STBY BUS 1/2 FEEDER) 8. Shutdown Keowee #1.
		Event is complete when operability test is complete or when directed by the lead examiner.

Op-Test No.: _____ Scenario No.: 2 Event No.: 2 Page 1 of 1Event Description: **1HP-120 (RC Volume Control) Fails closed (C, OATC/SRO)**

Time	Position	Applicant's Actions or Behavior
	OATC/SRO	<p>1HP-120 fails closed during Keowee #1 operability test. This will allow OATC diagnoses of failure.</p> <ol style="list-style-type: none"> Diagnose 1HP-120 (RC Volume Control) Failed closed: <ul style="list-style-type: none"> RCS makeup flow goes to zero. PZR level begins to decrease. LDST level begins to increase. Valve position <u>demand</u> for 1HP-120 begins to increase to the 100% demand value and valve position indication will indicate closed (green light). Refer to AP/14 (Loss of Normal Makeup and/or RCP Seal Injection). <ul style="list-style-type: none"> Determine Seal Injection is not lost Determine loss of suction to HPI pumps has not occurred. Verify <u>any</u> HPI pump operating. Verify RCP seal injection flow exists. Verify RCP RCP seal injection or HPI makeup line leak is not indicated. Verify 1HP-120 has failed and GO TO Step 4.167. Perform the following as necessary to maintain Pzr level > 200": <ul style="list-style-type: none"> Close 1HP-6 (Letdown Orifice Stop) Throttle 1HP-7 (Letdown Control) Throttle 1HP-26 ((1A HP Injection) Contact SPOC to repair 1HP-120. <p>Note: 1HP-120 will remain failed for the duration of the scenario.</p>
		<p>When PZR level is being controlled manually or when directed by the lead examiner this event is completed.</p>

Op-Test No.: _____ Scenario No.: 2 Event No.: 3

Page 1 of 1

Event Description: **Controlling NI fails LOW (I, OATC/SRO)**

Time	Position	Applicant's Actions or Behavior
	OATC/SRO	<p>When directed by the lead examiner the controlling NI will fail low.</p> <p>Plant response:</p> <p>1SA-02/A-12, ICS Tracking, will actuate. Diamond will transfer to manual on NI flux < 1.5% and FDW will decrease due to reactor cross limit. RCS pressure and temperature will increase.</p> <p>Crew response:</p> <ol style="list-style-type: none"> 1. When the ICS TRACKING alarm is received, the candidates should utilize the "plant stabilization process" to stabilize the plant and recognize that the controlling NI has failed. 2. Verify reactor power. 3. Place the FDW Masters in manual and stabilize the plant. Adjust T_{ave} using control rods and FDW and stabilize the plant 4. The SRO should direct the NCOs to check OAC and the control board NI meters to determine the status of the NI signals that can be used in the ICS. <ul style="list-style-type: none"> • Refer to AP/28, ICS Instrument Failures • SPOC should be contacted to repair NI-5. <p>Note: The ICS will remain in manual for the remainder of the scenario.</p>
		<p>When the plant is stable or when directed by the lead examiner this event is completed.</p>

Op-Test No.: _____ Scenario No.: 2 Event No.: 4 Page 1 of 1Event Description: **Seismic event (PRA)**
1A RBCU rupture (C, BOP/SRO) (TS)

Time	Position	Applicant's Actions or Behavior
	BOP/SRO	<ol style="list-style-type: none"> 1SA-9/B-9, LPSW RBCU A Cooler Rupture will actuate and RB normal sump level will increase. <ul style="list-style-type: none"> The BOP should refer to ARG Verify alarm is valid by checking RBCU 1A Inlet Flow and RBCU 1A delta flow. Verify 1LPSW-18 (RBCU 1A Outlet) open Verify adequate LPSW flow is available; check LPSW pump operation Monitor RBNS Level for any unexplained increase (Notify Chemistry to sample RBNS for boron to determine if a cooler rupture has occurred. Diagnose a Cooler Rupture is indicated and Isolate the 1A RBCU Cooler. The SRO should determine that isolation of LPSW to a RBCU places the Unit in Tech Spec 3.0.3, which will require a unit shutdown. The control room will receive a phone call from security that indicates that a tremor has been felt but no damage has been noted. The SRO should refer to AP/05, Earthquake. <ul style="list-style-type: none"> Dispatch operators to perform plant inspections <p>Note: No damage will be reported.</p> <ul style="list-style-type: none"> *Notify SPOC to develop the Strong Motion Accelerometer tape. *Verify NO fuel handling activities in progress. <p>* These items may not be completed depending on how soon the next event is started.</p> <p>Note: Team may decide at this time to begin a unit shutdown. Refer to event 6.</p>
		When the Earthquake AP has been initiated, the RBCU has been isolated, or at the direction of the Lead Examiner this event is completed.

Op-Test No.: _____ Scenario No.: 2 Event No.: 5 Page 1 of 2Event Description: **1B SG Tube leak (ramp 10 – 100 gpm over 30 min) (C, ALL) (TS)**

Time	Position	Applicant's Actions or Behavior
	C, ALL	<p>1B SG tube leak occurs following RBCU isolation and initiation of AP/5, Earthquake, or when directed by the lead evaluator.</p> <p>Plant response:</p> <ol style="list-style-type: none"> The following alarms actuate: <ul style="list-style-type: none"> 1SA-8/B-9, RM PROCESS MONITOR RADIATION HIGH 1SA-8/D-10, RM CSAE EXHAUST RADIATION HIGH PZR level will decrease and RC makeup flow will increase. <p>Crew response:</p> <ol style="list-style-type: none"> Diagnose and take actions for a Tube leak in the 1B SG: Refer to the ARG for the following alarms: <ul style="list-style-type: none"> 1SA-8/B-9, RM PROCESS MONITOR RADIATION HIGH 1SA-8/D-10, RM CSAE EXHAUST RADIATION HIGH Refer to AP/1/A/1700/31 (Primary to Secondary Leakage) Open and Red Tag TB Sump pump breakers. Monitor primary parameters; PZR Level and LDST level to determine that gross leakage exist and transfer to step 4.65. Determine OTSG tube leak size is initially less than 25 gpm. Greater than 25 will require entering the EOP. Log RIA readings (a rough log is adequate) Initiate a Unit shutdown to met requirements of Encl. 5.1 (Unit Shutdown Requirements). <p>Note: As the scenario develops the leak will increase to greater than 25 gpm and transfer to the EOP will be required.</p>

Op-Test No.: _____ Scenario No.: 2 Event No.: 5 Page 2 of 2
 Event Description: **1B SG Tube leak (ramp 10 – 100 gpm over 30 min) (C, ALL) (TS)**

Time	Position	Applicant's Actions or Behavior
	C, ALL	<p>9. Primary inventory should be monitored and when the leak rate is determined to be > 25 gpm transfer to the SGTR tab of the EOP.</p> <p>10. EOP SGTR tab will perform the following:</p> <ul style="list-style-type: none"> • Determine that the Reactor is not tripped. • Maintain PZR level \geq 220 inches using Enclosure 5.5 (PZR and LDST Level Control). (CT-D.1) <ul style="list-style-type: none"> ➤ Open HP-24 and 25 (1A and 1B BWST Suction) • Monitor RIA-16 ("A" MS Header) and 17 ("B" MS Header) to identify all SGs with tube ruptures. • Start the Outside Air Booster Fans on both Units 1 and 3. <p>11. The Procedure Director should direct the OATC to begin a unit shutdown at a rate between 9.9% per hour and 20% per minute (MAXIMUM RUNBACK).</p> <p>Note: A shutdown with the ICS in manual is required.</p> <p>Note: This event will remain in progress for the remainder of the scenario.</p>

Op-Test No.: _____ Scenario No.: 2 Event No.: 6

Page 1 of 1

Event Description: **Unit Shutdown (R, OATC)**

Time	Position	Applicant's Actions or Behavior
	BOP/SRO	<p>The BOP will utilize Enclosure 5.19 (Control of Plant Equipment During Shutdown for SGTR).</p> <p>Note: With the unit at \approx 25% power only applicable steps will be performed.</p> <ul style="list-style-type: none">• Notify WCC SRO to make notifications• Transfer electrical auxiliaries
	OATC/SRO	<p>The OATC will use the FDW Masters and the Diamond to reduce power while monitoring Reactor Power, Tave, and other plant parameters.</p> <p>If the reactor trips automatically the team must return to IMAs.</p>
		<p>When a unit shutdown of > 5% has occurred or when directed by the lead examiner this event is concluded.</p>

Op-Test No.: _____ Scenario No.: 2 Event No.: 7

Page 1 of 2

Event Description: **1A Main Steam line break in RB (M, ALL)**

Time	Position	Applicant's Actions or Behavior
	ALL	<p>1A main steam line will occur following event 6 as directed by the lead examiner.</p> <p>Plant response:</p> <ol style="list-style-type: none"> 1. Statalarm 1SA-02/A-9, MS Press High/Low, actuates 2. "A" and "B" main steam (MS) pressure decreases 3. Reactor trips. <ul style="list-style-type: none"> • "B" MS line pressure stops decreasing • "A" MS line pressure continues to decrease 4. Main FDW pumps trip <ul style="list-style-type: none"> • EFDW initiates <p>Crew response:</p> <ol style="list-style-type: none"> 1. The Crew should respond to the MSLB in the "1A" SG 2. The SRO will "Parallel Action" to transfer to the Excessive Heat Transfer (EHT) tab and direct the Crew's actions as follows: <ul style="list-style-type: none"> • The Crew will perform IMAs. • The OATC will perform and verify the performance of IMAs while the BOP performs a symptoms check. • The BOP will perform Rule #5 (Main Steam Line Break) after receiving concurrence from the PD. (CT-B.1.3) • Enclosure 5.1 (ES Actuation) will be performed. 3. Excessive Heat Transfer (EHT) tab will: 4. Verify excessive heat transfer stopped 5. Throttle HPI to stabilize RCS pressure and maintain PZR level > 80" (180" acc)

Op-Test No.: _____ Scenario No.: 2 Event No.: 7 Page 1 of 2Event Description: **1A Main Steam line break in RB (M, ALL)**

Time	Position	Applicant's Actions or Behavior
	ALL	<ol style="list-style-type: none">6. Verify letdown in service7. Feed and steam all intact SGs to stabilize RCS P/T. (CT-B.1.1)8. Minimize SCM using the following methods as necessary: (CT-B.1.2)<ul style="list-style-type: none">• De-energizing all PZR heaters• Using PZR spray• Throttling HPI9. Initiate Enclose 5.16 (SG Tube-to-Shell Δ T Control)10. GO TO Steam Generator Tube Rupture (SGTR) tab.
		When the SRO has transferred to the SGTR tab or when directed by the Lead Examiner the event and scenario is completed.

Scenario #2 Overview

Initial Conditions: Unit 1: 25% power - 430 EFPD, Unit 2: 100%, Unit 3: 100%

Turnover:

- Unit 1 TD EFDW Pump OOS to repair Aux Oil Pump
- SASS in manual for I&E testing
- AMSAC/DSS bypassed for I&E testing
- NI-9 OOS, to be replaced next outage
- Keowee Unit 2 OOS for unplanned reasons
- Keowee Unit 1 aligned to underground
- Operability test of Keowee Unit 1 is to be performed per PT/620/009, Keowee Hydro Operation, after turnover

1) Operability test Keowee Unit 1 with failure of Gen Field Flashing Breaker: (N, BOP; C, BOP)

- a) Keowee Unit 1 will be started from the control room as part of the operability test. During startup the Gen Field Flashing Breaker fails to open automatically. This should be recognized and the breaker should be opened manually. This does not make the Keowee unit inoperable.

TIME = 15 minutes

2) 1HP-120 (RC Volume Control) Fails CLOSED: (C, OATC)

- a) 1HP-120 (RC Volume Control) Fails CLOSED due to a ruptured diaphragm. This should be diagnosed and AP/14, Loss of Normal HPI Makeup and/or RCP Seal Injection, should be followed. The AP will give guidance on maintaining PZR level and instruct the crew to call SPOC to repair the valve. 1HP-120 (RC Volume Control) will remain broken for the remainder of the scenario.

NOTE: Events 1 and 2 will occur at about the same time.

TIME = 10 minutes, TOTAL 25 min.

3) Controlling NI fails LOW: (I, OATC)

- a) The crew should utilize the "plant stabilization process" to stabilize the plant and recognize that the controlling NI has failed. The ICS will be placed in manual to stabilize the unit. The ICS will remain in manual for the remainder of the scenario.

TIME = 5 minutes, TOTAL 30 min.

4) Seismic event (PRA) and 1A RBCU rupture (TS): (C, BOP)

- a) A seismic event will occur which will cause the 1A RBCU to rupture. AP/5, Earthquake, will be entered. RBCU rupture should be diagnosed and subsequently isolated to prevent diluting the RB sump.

TIME = 5 minutes, TOTAL 35 min.

Scenario #2 Overview

5) 1B SG Tube leak (ramp 10 – 100 gpm over 30 min): (M, ALL) (TS)

- a) The seismic event will also cause a tube leak in the 1B Steam Generator. This leak will initially be small (about 10 gpm) and increase over the next 30 minutes to about 100 gpm. This leakage will require entry into AP/31, Primary to Secondary Leakage. After determining the leak is greater than TS limits, a unit shutdown will be initiated. During the shut down the leak will continue to increase requiring transfer to the Steam Generator Tube Rupture tab of the EOP.

TIME = 20 minutes, TOTAL 55 min.

6) Unit Shutdown: (R, OATC)

- a) As a result of the previous instrument failure the unit shutdown will be conducted with the ICS in manual. If the crew did not return 1HP-120 (RC Volume Control) to auto, primary inventory will also require manual control during the shutdown. The leak will increase beyond the capacity of normal HPI makeup requiring the use of additional makeup and suction from the BWST.

TIME = 5 minutes, TOTAL 60 min.

7) 1A Main Steam line break in RB: (M, ALL)

- a) A main steam line break will occur in the 1A main steam line. This will require use of RULE 5, Main Steam Line Break, to isolate the leak. The CRSRO will transfer to the Excessive Heat Transfer tab of the EOP to ensure excessive heat transfer has been stopped and the plant stabilized. Transfer will then be made back to the Steam Generator Tube Rupture tab of the EOP. The scenario will be completed when the 1A main steam line has been isolated and a transfer to the Steam Generator Tube Rupture tab of the EOP has been made.

TIME = 15 minutes, TOTAL 75 min.

Facility: **Oconee**Scenario No.: **SPARE**

Op-Test No.: _____

Examiners: _____

Operators: _____

Initial Conditions:

- 100% Reactor Power EOL

Turnover:

- Unit 1 TD EFDW Pump OOS to repair Aux Oil Pump
- SASS in manual for I&E testing
- AMSAC/DSS bypassed for I&E testing
- NI-9 OOS, to be replace next outage
- Keowee Unit 2 OOS for unplanned reasons
- Keowee Unit 1 aligned to underground, operability test complete

Event No.	Malfunction No.	Event Type*	Event Description
0a	Pre-Insert MSS330		TD EFDW Pump Fails to Start
0b	Updater		SASS in manual
0c	Updater		AMSAC/DSS bypassed
0d	Pre-Insert MNI082		NI-9 OOS
0e	Pre-Insert MEL180		Keowee Unit 2 Emergency Lockout
1	Override	N, BOP C, BOP	Pressurize LDST with H ₂ 1H-1, LDST Supply, fails OPEN
2	MSI051 MSI061	I, OATC	Turbine Header Pressure fails LOW
3	MPS405, 50	C, ALL	40 gpm RCS leak in RB (TS)
4	MSS080	R, OATC C, OATC	Unit Shut Down 1FDW-41, 1B Main FDW Control, Failed "as is"
	Override	C, BOP	1CC-8, CC Return Outside Block, Fails CLOSED (Requires Manual Reactor Trip)
5	MPS400, 5	M, ALL	SBLOCA
6	MPS400, 100	M, ALL	LBLOCA

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

Scenario Spare Overview

Initial Conditions: Unit 1: 100% power - 430 EFPD, Unit 2: 100%, Unit 3: 100%

Turnover:

- Unit 1 TD EFDW Pump OOS to repair Aux Oil Pump
- SASS in MANUAL for I&E testing
- AMSAC/DSS bypassed for I&E testing
- NI-9 OOS, to be replace next outage
- Keowee Unit 2 OOS for unplanned reasons
- Keowee Unit 1 aligned to underground, operability test complete

1) Pressurize the LDST with N₂, 1H-1 fails OPEN: (N, ALL; C, BOP)

Statalarm will actuate indicating that LDST H₂ pressure is low. Crew should refer to the "LDST Pressure Vs Level" curve and add H₂ to LDST. 1H-1 (LDST Supply) will fail OPEN requiring the BOP to call the primary NLO to close the isolation valve to stop the H₂ addition. If this action is delayed BOTH trains of HPI must be declared inoperable due to being outside of permissible Operating Region on the "LDST Pressure Vs Level" curve.

TIME = 10 minutes

2) Turbine Header Pressure fails LOW: (I, OATC)

- a) The crew should utilize the "plant stabilization process" and take Both FDW Masters and the Diamond to manual to mitigate the transient and stabilize the plant. The ICS will remain in manual.

TIME = 10 minutes, TOTAL 20 min.

3) 40 gpm RCS leak in Reactor Building (TS) (M, ALL)

- a) A 40 gpm RCS leak in the RB will develop and the crew should refer to AP/2, Excessive RCS Leakage, because leakage is greater than the TS limit. The crew should determine a Unit shutdown is required.

TIME = 10 minutes, TOTAL 30 min.

4) Unit Shut Down with 1FDW-41 failed "as is": (R, OATC)

- a) The CRSRO will direct the OATC with the help of the BOP to commence a unit shutdown with the ICS in manual. In addition to manual control of control rods and FDW, THP will also be manually controlled because the Turbine Master is in manual. Feedwater flow in the "B" loop will stay the same and a ΔT_c will develop. The crew will not be able to manually control "B" loop FDW flow.

TIME = 15 minutes, TOTAL 45 min.

Scenario Spare Overview

5) SBLOCA : (M, ALL)

- a) The RCS leak will increase to a SBLOCA. This will cause a unit trip and entry into the EOP. The BOP will complete RULE 2 when a loss of subcooling occurs. The CRSRO will transfer to Loss of Subcooling Margin and the LOCA CD tabs.

TIME = 20 minutes, TOTAL 65 min.

6) LBLOCA : (M, ALL)

- a) The RCS leak will increase into a LBLOCA. The CRSRO be required to "If At Anytime" transfer based on LPI flow to mitigate a LBLOCA.

TIME = 10 minutes, TOTAL 75 min.