Facility: _Cook Plant Unit 1 & Unit 2_ Scenario No.: COOK08-02 Op-Test No.: Sets 1, 2 & 3

Examiners: _____ Operators: _____
_____ _____
_____ _____

Initial Conditions: IC-34 (965), MOL; 50% power, 1223 ppm Boron, 8 GWD, 561°F Tave
CBD @ 176 steps, 527 MWe.

Turnover: 2CD EDG has been out of service for one day for fuel rack repairs. MSRs are out of service due to power level.

Event No.	Malf. No.	Event Type*	Event Description
1		N-BOP	Swap #3 Control Fluid Pump for #1 Control Fluid Pump
2		R-RO	Lower Power to 45% Power.
3	RX19A @ 0	I-RO TS	Turbine Impulse Transmitter (MPC-253) fails LOW
4	RX08B @ 100%	C-RO	Pressurizer Spray Valve Controller NRV-164 fails to 100% opening 2-NRV-164
5	SW07A @ 0	C-BOP	Main Turbine Oil Cooler Controller (WRV-970) fails LOW
6	RX21C @ 2	I-BOP TS	SG Feed Flow Instrument (FFC-220) fails LOW
7a 7b	ED19 @ 25 ED01 ED25 EG01	M	Electrical Grid Load Rejection Loss of All AC Power (10 sec delay)
8	EG08A	C-BOP	2AB EDG Speed Governor failure
9	FW48C	C-BOP	TD AFW pump fails to AUTO start

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

Event 1 occurs when the crew is directed start #3 Control Fluid Pump and place #1 Control Fluid Pump in AUTO to even out pump run times.

Event 2 will be the power reduction to 45% power.

Event 3 is a failure of Turbine Impulse instrument (MPC-253). This results in a control rod insertion. The associated steam flow main steam isolation setpoint signal will decrease. When the setpoint is reduced below actual steam flow the trip status lights and alarms will come in but no steam line isolation will occur until Tave is below the lo-lo Tave setpoint 541°F. The auto rod control circuit will see a power mismatch causing the rods to move in, decreasing reactor power and Tave. The auto rod control circuit will also see a decreased Tref (min 547 deg f) causing rods to move in. RO will be required to place rod control in manual. The tref signal for the steam dump system Tave /Tref controller (load reject controller) will also increase. The steam dump load reject circuit will arm if transmitter is failed down by more than 10% power. The P-13 and P-7 Permissives will be half in. Trip status light will not come on. Crew will be required to implement AOP actions to stabilize the plant and trip Bistables.

Event 4 will be the failure of the Pressurizer Spray Valve controller for NRV-164 failing to 100% causing NRV-164 to go full open. RCS pressure will begin to lower. The RO will be required to take manual control of NRV-164 and close the spray valve then return pressure to the normal band. Pressurizer pressure control may still be operated in AUTO with NRV-163.

Event 5 is an AUTO controller failure of the Main Turbine Lube Oil Cooler temperature control valve (WRV-970). The BOP will be required to take manual control of WRV-970 and restore Main Turbine Lube Oil temperature to the normal band.

Event 6 will involve a LOW failure of #22 Steam Generator Feed Flow instrument (FFC-220). This will result in a rise in feedwater flow to #22 SG with corresponding SG level rise. The BOP will be required to take manual control of FRV-220. Crew will be required to implement AOP actions to stabilize the plant and trip bistables.

Events 7 – 9 (Major Event) will involve a GRID load rejection leading to a total loss of all AC power. The unit will trip. Failure of the only available EDG will require entry into ECA-0.0 actions. Failure of the TDAFW pump to auto start will require a manual start to restore feedwater flow. The crew will be required to take actions to restore emergency (EP) power. The crew should transition to ECA-0.1 once power has been restored to one Safeguards Bus. The scenario will terminate when the crew has restored emergency power and transitioned to ECA-0.1.

Critical Tasks

Establish AFW (Start TDAFWP)
Restore Emergency Power to Safeguards Bus

Procedures

E-0, Reactor Trip or Safety Injection
ECA-0.0, Loss of All AC Power

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 1

Event Description: **Swap #3 Control Fluid Pump for #1 Control Fluid Pump**

Time	Position	Applicant's Actions or Behavior
	US/BOP	Briefs on use of 02-OHP-4021-050-006, Main and MFP Turbine Control Fluid Operation, Attachment 1, Control Fluid System Operation, Section 4.2, for swapping Control Fluid Pumps.
	BOP	Places Control Fluid Pump #3 in RUN
	BOP	Acknowledges Alarms on MT DCS Ann. Panel: • Drop 179, No Ctrl Fluid Pump in Auto 2 • Drop 208, More than 1 CTRL FLD Pump in Manual and Running
	BOP	Places Control Fluid Pump #1 in OFF
	BOP	Places Control Fluid Pump #1 in AUTO 2
	BOP	Acknowledges Alarms clearing on MT DCS Panel.
	RO	Provides peer checks during evolution as appropriate

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 2

Event Description: **Reduce Power to 45% Power**

Time	Position	Applicant's Actions or Behavior
	RO	Calculates boric acid addition per 02-OHP-4021-005-001, Attachment 9 , Boration or Dilution Volume Determination.
	RO	Briefs crew on reactivity plan for power reduction.
	US	Reviews reactivity plan.
	US	Directs RO to commence Power Reduction in accordance with 02-OHP-4021-001-003.
	RO	Commences power reduction: • Lowers turbine load (reactor power) using the HMI. • Maintains Tave/Tref deviation within limits by boration and turbine load adjustments. • Ensures Axial Flux Difference (AFD) is maintained within target band by manual control rod movement as needed.
	US	Acts as reactivity manager by peer checking RO during blender operations and by verifying appropriate reactivity feedback.
	BOP	Monitors and maintains main electrical generator temperatures within limits per: • 02-OHP-4021-059-001, Generator Stator Cooling Water System • 02-OHP-4021-080-003, Generator Hydrogen Gas System

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 3

Event Description: **First Stage Turbine Impulse Transmitter (MPC-253) Fails Low**

Time	Position	Applicant's Actions or Behavior
	RO/BOP	Recognizes and reports multiple annunciators on Ann. Panels 211, 213, and 214 for a Turbine Impulse pressure failure.
	RO	Performs the following: • Verifies no runback in progress • Places rod control switch in MANUAL • Reports failure of MPC-253 instrument
	US	Enters and directs actions of 02-OHP-4022-012-003, Continuous Control Bank Movement procedure (If Rods in AUTO).
	RO	Performs the following as directed (If Rods in AUTO): 1. Checks for no turbine runback 2. Ensures control rods are in manual with no rod motion 3. Checks rod position above low-low rod insertion limit 4. Checks axial flux difference (AFD) within target band Note: Depending on the amount of rod motion, operators may find themselves in TS for AFD limits. 5. Initiates restoration of equilibrium conditions using either: • Control rod movement • Turbine load adjustment 6. Identifies failed Turbine First Stage Impulse Pressure Instrument
	US	Directs actions per 02-OHP-4022-013-016, Turbine First Stage Impulse Pressure Instrument Malfunction.
	RO	Performs the following: 1. Verifies rod control in manual. 2. Places AMSAC bypass/test switch in BYPASS/TEST 3. Places Steam Dump selector control switches to OFF 4. Reduce Turbine load or Withdraw rods to restore Tave-Tref and AFD
	US	Initiates actions to trip bistables for MPC-253 failure per Attachment A of 02-OHP-4022-013-016.
	RO	Verifies proper bistable tripping per Attachment A. (if bistables are tripped)

	US	Refers to TS (LCO): • TS 3.3.1 Reactor Trip System (RTS) Instrumentation (Table 3.3.1-1) o Function 18e, *Reactor Trip System Interlocks - Turbine First Stage Pressure, P-13.* Condition L • TS 3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation (Table 3.3.2-1) o Function 4e, *Steam Line Isolation - High Steam Flow in Two Steam Lines (per steam line), Coincident with Tavg – Low Low* Condition D • TRM 8.3.6 ATWS Mitigation System Actuation Circuitry (AMSAC) **Note: P-13 interlock (Conditions L) must be verified in correct state within 1 hour. All other actions are greater than 1 hour.**

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 4

Event Description: **Pressurizer Spray Valve Controller NRV-164 fails to 100%, Opening 2-NRV-164**

Time	Position	Applicant's Actions or Behavior
	RO	Performs the following: • Recognizes and reports Ann. Panel 208, Drop 8, PRESSURIZER PRESS LOW DEV BACKUP HTRS ON. • Identifies that NRV-164 PRZ spray valve is open
	US/RO	Directs RO to take Manual Control of 2-NRV-164 and Restore Pressurizer pressure.
	RO	Performs the following: • Manually closes 2-NRV-164 PRZ Spray Valve • Monitors PRZ pressure control system and ensures pressure returns to normal conditions (~2235 psig).
	US	May enter the following TS if Pressure lowers to <2200 psig during the transient: • TS 3.4.1, RCS Pressure, Temperature, and Flow DNB Limits. Condition A

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 5

Event Description: **Main Turbine Oil Cooler Controller (WRV-970) Fails Low**

Time	Position	Applicant's Actions or Behavior
	BOP	Recognizes and reports Main Turbine alarms on Ann. Panel 218 indicative of oil temperature problem (may include): • Drop 9, MAIN TURBINE OIL CLR DISCH REC TEMP HIGH • Drop 30, MAIN TURB BRG 9 LUBE OIL TEMP HIGH
	BOP	Recognizes and reports that 2-WRV-970 failed CLOSED in AUTO.
	US	Enters annunciator response action, and directs operator actions to place 2-WRV-970 controller to manual and restore cooling.
	BOP	Takes manual control of 2-WRV-970 and stabilizes MT temperatures. **Note: Operator may open WMO-970 if WRV-970 is thought to be malfunctioning.**
	US	Directs operator to monitor turbine temperatures for signs of bearing damage.

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 6

Event Description: **SG 22 Feedwater Flow Transmitter (FFC-220) Fails Low**

Time	Position	Applicant's Actions or Behavior
	BOP	Recognizes and reports annunciators on Ann. Panel 213 indicative of the Feed Flow Transmitter failure (may include): • Drop 32, STEAM GEN 2 WATER LVL HI DEVIATION • Drop 42, STEAM GEN 2 FEEDWATER FLOW HIGH • Drop 43, STEAM GEN 2 SF > FWF FLOW MISMATCH
	BOP	Performs the following: • Verifies 2-FRV-220, SG 22 MFW Reg. Valve controller in manual • Lowers controller output to match the operable feed flow channel with steam flow and restores SG 22 level to program.
	US	Enters and directs actions of 02-OHP-4022-013-015, Feedwater Flow Instrument Malfunction, procedure.
	BOP	Performs the following actions as directed: 1. Restores SG 22 level using manual control of 2-FRV-220 2. Reports 2-FFC-220 has failed 3. Places 2-FS-520-C selector switch in channel 2 position. 4. Nulls and returns 2-FRV-220 controller to auto.
	US	Initiates actions to trip bistables associated with 2-FFC-220 FW Flow Failure per Attachment B-1 of 02-OHP-4022-013-015.
	US	Refers to TS (LCO): • TS 3.3.1 Reactor Trip System (RTS) Instrumentation (Table 3.3.1-1) o Function 15, *SG Water Level – Low (per SG), Coincident with Steam Flow/Feedwater Flow Mismatch (per SG).* Condition D • TRM 8.3.6 ATWS Mitigation System Actuation Circuitry (AMSAC) • TRM 8.7.14 Leading Edge Flow Meter (Mode 1 > 3411 applicability)

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 7/8/9

Event Description: **Electrical Grid Load Rejection Followed by a Complete Loss of All AC Power / 2AB Emergency Diesel Generator Failure; Turbine Driven AFW Pump Fails to Auto Start**

Time	Position	Applicant's Actions or Behavior
	CREW	Recognize and report a load rejection event, Identifies Main Generator instability. Due to the rapid nature of the turbine response, plant may trip prior to full recognition of event.
	CREW	Recommends\Verifies a Generator-Reactor Trip
	US	Directs RO/BOP to perform the immediate actions of E-0, Reactor Trip or Safety Injection.
Note: Crew may enter ECA-0.0, Loss Of All AC Power, directly.		
	RO	Performs the (primary) immediate actions of E-0: 1. Checks reactor trip 2. Checks safety injection status
	BOP	Performs the (secondary) immediate actions of E-0: (Note – May enter ECA-0.0 Directly) 1. Checks turbine trip 2. Checks power to AC emergency buses: · Reports that NO AC emergency buses are energized
	US	Announces transition (or entry) to ECA-0.0, Loss Of All AC Power and directs RO/BOP to perform immediate actions for ECA-0.0.
	RO/BOP	Performs the immediate actions of ECA-0:0: • Checks reactor trip / turbine trip
	US	Ensures immediate actions are completed and directs subsequent actions of ECA-0.0.
	RO	Checks RCS isolated: 1. Checks PRZ PORVs closed: 2. Checks letdown isolation valves closed 3. Checks excess letdown isolation valves closed
	BOP **Critical Task #1**	Checks AFW flow > 240,000 PPH: **1. Manually starts the Turbine Driven AFW Pump**
	US	Identifies that **NEITHER** the T21A nor the T21D bus is energized.

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 7/8/9

Event Description: **Electrical Grid Load Rejection Followed by a Complete Loss of All AC Power / 2AB Emergency Diesel Generator Failure; Turbine Driven AFW Pump Fails to Auto Start**

Time	Position	Applicant's Actions or Behavior
	US	Identifies Emergency power (EP) source is AVAILABLE
	US	Directs Restoration of 4KV Power From EP using Attachment D
	RO	Directs AEO to manually isolate RCP Seals by closing : • 2-CS-311S • 2-CS-311N • 2-CS-307
	BOP/US	Identifies that the TRAIN B (Bus T21A) Load Shed lights are LIT and that the Offsite Emergency Power is supplying the EP bus.
	BOP **Critical Task #2**	**Energizes T21A emergency bus from EP as directed:** **1. Checks T21A bus – not faulted** **2. Places DG2AB supply to bus T21A in pull to lock** **3. Paces Train B Load Conservation Switch in LOAD CON** **4. Closes 4KV EP supply to bus T21A and energizes bus**
	RO/BOP	Isolates Seal Return and RCP CCW Return line from Thermal Barrier: • QCM-350 – CLOSED • CCM-454 – CLOSED
	BOP	Energizes T21B emergency bus from EP as directed: 1. Checks T21B bus – not faulted 2. Places DG2AB supply to bus T21B in pull to lock 3. Closes 4KV EP supply to bus T21B and energizes bus
	RO/BOP	Checks RCS Temperature stable or trending to No-Load

Op-Test No.: Sets 1, 2 & 3 Scenario No.: COOK08-02 Event No.: 7/8/9

Event Description: **Electrical Grid Load Rejection Followed by a Complete Loss of All AC Power / 2AB Emergency Diesel Generator Failure; Turbine Driven AFW Pump Fails to Auto Start**

Time	Position	Applicant's Actions or Behavior
	RO/BOP	Realigns Equipment following power restoration: • ESW • Load Conservation Switch • Control Room Air Conditioning Places the following equipment in pull to lock: • MDAFPs • CCPs • RHR pumps • SI pumps • CTS pumps • CCW pumps • NESW pumps • East ESW pump Verifies Pressuirzer Heater supply from T21A is open with green target.
	US	Based in status of SI, announces transition to: • ECA-0.1, Loss Of All AC Power Recovery Without SI Required **-OR-** • ECA-0.2, Loss Of All AC Power Recovery With SI Required if Pressurizer level is < 20%.
	CREW	**If transition is made to ECA-0.1, Loss Of All AC Power Recovery Without SI Required, then performs the following:** • Begins monitoring CSF Status Trees for Information Only • Check RCP Seal Isolation Status. • Check Containment Isolation Phase A Status
	CREW	**If transition is made to ECA-0.2, Loss Of All AC Power Recovery With SI Required, then performs the following:** • Begins monitoring CSF Status Trees for Information Only • Check SI Signal Status - RESET • Manually aligns valves to establish ECCS valve alignment

TERMINATE SCENARIO

Task	Elements	Results
#1 **Manually Starts Turbine Driven AFW Pump**	**Cueing:** • **Check AFW Flow…Verify TDAFP Running (ECA-0.0, Step 4, RNO)** **Performance Indicators:** **Establish AFW flow before SG dryout occurs (<15% WR level):** • **Manually starts the TDAFP from the control room.** **Performance Feedback:** • **TDAFP speed rising** • **AFW flow > 240E3 PPH**	**SAT / UNSAT**
#2 **Restore Emergency Power**	**Cueing:** • **Restore AC Power (ECA-0.0)** • **T21 A, B, C, D Energized Lights – NOT Lit** **Performance Indicators:** **Power should be restored prior to depressurizing intact SGs to 190 psig (ECA-0.0, Step 19):** • **Restores emergency power (EP) to at least one 4KV emergency (pump) bus (i.e., T21A or T21D).** **Performance Feedback:** • **T21A or T21D bus energized** • **Power available to safeguards equipment.** **Note: Procedurally directed to restore bus with Pumps disabled from Starting (T21A has Load Shed Lights Lit). T21D pumps may start if not placed in PTL.**	**SAT / UNSAT**

Setup:

1. Reset to IC- 34 (965), MOL; 50% power, 1223 ppm Boron, 8 GWD, 561°F Tave, CBD @ 176 steps, 527 MWe.
2. Reset control rods and check group step counters
3. Place Master Annunciator Silence pushbutton lockout ring in LOCKOUT position
4. Advance chart recorder paper & clear chart recorder memory
5. Update PPC Chart Recorders VCT 20-70, PWR 45 - 55%, Tave/Tref 555-565°F
6. Activate the following malfunctions to place 2CD EDG OOS:
   - EG10B **IMF EG10B**
   - EG06B **IMF EG06B**
   - EGR14 **IRF EGR14** Value **RO**
   - EGR15 **IRF EGR15** Value **RO**
   - EGR02 **IRF EGR02** Value **RO**
   - O101FQTCD1[GF **IOV ZLO1012QTCD1 [GRN]** Value **OFF**
   - O101FQTCD2[GF **IOV ZLO1012QTCD2 [GRN]** Value **OFF**
7. Place RED clearance tags on the following switches positioned as indicated:
   - T21C3 - PTL
   - T21D8 – PTL
   - CB2DGTCD – CENTER
   - DG2CD STOP-RUN - CENTER
   - 2-QT-106-CD1 - STOP
   - 2-QT-106-CD2 - STOP

8. Go to **RUN** and acknowledge/clear alarms

9. Verify/Activate the following (pre-load) malfunctions:

   - EG08A **IMF EG08A,** 2AB EDG Speed Governor Failure
   - FW48C **IMF FW48C,** TD AFW pump fails to AUTO start

10. Assign the following **Event Trigger 9**:

   - ED19 **IMF ED19,** Final Value **25**, Grid Load Rejection
   - ED01 **IMF ED01,** Delay **10 secs**, Loss of 345 KV Bus 1
   - ED25 **IMF ED25,** Delay **10 secs**, Loss of 765/345 KV Transformer Bank No. 4
   - EG01 **IMF EG01,** Delay **10 secs**, Main Generator Trip

Scenario:

EVENT #1

No Additional Actions

EVENT #2

No Additional Actions

EVENT #3

IMF RX19A, Final Value **0**, to cause First Stage Impulse Pressure Channel (MPC-253) to fail LOW, after the crew has swapped control fluid pumps and performed sufficient power change.

RX19A

If directed to trip bistables for MPC-253 use:

Override ZLOSTMC2[6] to ON to simulate opening cabinet door

ZLOSTMC2[6]

(Override Lights/Relays – RX Flux panel)

Remote		Bistable
RPR021	RPR021	**FS/512B**
RPR027	RPR027	**FS/522B**
RXR03	RXR03	**PS/505C**
RPR033	RPR033	**FS/532B**
RPR039	RPR039	**FS/542B**
RXR01	RXR01	**PS/505A**

Override ZLOSTMC2[1] to ON to simulate lifting Test Rack

ZLOSTMC2[1]

Delete Override ZLOSTMC2[6] to simulate closing cabinet Door

ZLOSTMC2[6]

EVENT #4

IMF RX08B, to cause the Pressurizer Spray Valve Controller NRV-164 to fail to 100% opening 2-NRV-164

RX08B

EVENT #5

IMF SW07A, Final Value **0,** to fail Main Turbine Lube Oil Cooler Controller (WRV-970) LOW

SW07A

If contacted as MTI investigate Main Turbine Lube Oil Cooler Controller, report back after some 5 min. delay that additional testing will be required to identify the problem.

EVENT #6

IMF RX21C, Final Value **2,** to fail SG 22 Feed Flow Channel (FFC-220) LOW

RX21C

If directed to trip bistables for FFC-220 use:

Override ZLOSTMC2[6] to ON to simulate opening cabinet door

ZLOSTMC2[6]

(Override Lights/Relays – FW panel)

Remote		Bistable
RPR023	RPR023	**FS-520A**
RPR024	RPR024	**FS-520B**

Override ZLOSTMC2[1] to ON to simulate lifting Test Rack

ZLOSTMC2[1]

Delete Override ZLOSTMC2[6] to simulate closing cabinet Door

ZLOSTMC2[6]

EVENT #7 - 9

Event Trigger 9, assigned the following:

- **IMF ED19,** Final Value 25, Grid Load Rejection
- **IMF ED01,** Delay 10 secs, Loss of 345 KV Bus 1
- **IMF ED25,** Delay 10 secs, Loss of 765/345 KV Transformer Bank No. 4
- **IMF EG01,** Delay 10 secs, Main Generator Trip

Event 9

If directed to locally close seal injection valves (2-CS-311N, 311S and 307) then activate remote functions:

- CVR20 **IRF CVR20,** Final Value **0 (CLOSE)**
- CVR21 **IRF CVR21,** Final Value **0 (CLOSE)**