Facility: IP2 Scenario No.: 4 Op Test No.: 1

Examiners: _____ Candidates: _____ CRS

_____ _____ RO

_____ _____ PO

Initial Conditions: 50% power MOL

21 Charging Pump OOS

21 CCW Pump OOS

Small SG Tube Leak < 5 GPD

Turnover: Turbine 21 rupture disc is leaking. Reduce Power to 250 MWe at 200 MWe per hour and remove Main Turbine and Generator from service

Critical Tasks: Manually actuate at least one train of SIS-actuated safeguards before any of the following:

- Transition to any E-1 series, E-2 series, or E-3 series procedure or transition to any FRP
- Completion of step 5.a of ES-0.1

Trip all RCPs prior to completion of E-0 step 12

Isolate the LOCA outside of containment before transition out of ECA-1.2

Event No.	Malf. No.	Event Type*	Event Description
1		R (RO) N (CRS)	Reduce load
2	MAL-CRF002AV	C (CRS) C (RO)	Rod P-6 Dropped Rod during rod motion
3	MOT-CFW001B	C (CRS)	21 Condensate Pump Failure
4	MAL-SGN004A PLP-RHR022	M (ALL)	Steam Line Rupture Downstream of MSIVs. RCS Leak Outside of VC.
5	RLY-PPL487 RLY-PPL488	C (CRS) C (RO)	Failure of automatic actuation of Safety Injection. Manual initiation required.

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

The team will assume the shift and continue with a load reduction in progress in accordance with POP-3.1, beginning at step 4.14.

When rod motion occurs, Control Rod P-6 will ratchet into the core due to a moving gripper failure, requiring the load reduction to be stopped and the condition evaluated IAW AOP-ROD-1.

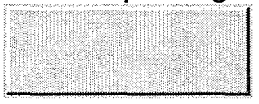
When the plant is stable, a bearing failure on 21 Condensate Pump will occur. The team will start the standby Condensate Pump IAW AOP-FW-1, Loss of Feedwater.

When SG Levels are stable, a Steam Line Rupture downstream of the MSIVs will occur, requiring a reactor trip. Subsequently, Automatic SI actuation will fail to occur when demanded, requiring manual actuation. Simultaneous with reactor trip, a rupture will occur on the RHR discharge header outside of containment.

EOP flow path: E-0 – ECA-1.2 – E-1

Indian Point Unit 2
2003 NRC Initial License Examination
Simulator Scenario Setup
Scenario 4

Reset simulator to IC-226 (PW nano1007)
Place diskette in A drive
Click the button to run batch file New#1.bat and verify that the following malfunctions are active or pending:



21 Charging Pump OOS:	IRF LOA-EPS010 (-1 0) OUT Place pump control switch in TPO and apply danger tag
21 CCW Pump OOS:	IRF LOA-EPS013 (-1 0) OUT Place pump control switch in TPO and apply danger tag
Auto SI Master Relays Stuck Contacts	IMF RLY-PPL487 (-1 0) 2 IMF RLY-PPL488 (-1 0) 2
MAL-CRF002AV P6 Dropped Rod	IMF MAL-CRF002AV (-1 0) 1
BRG 1 Failure Condensate Pump 21 MTR	IMF MOT-CFW001B (2 0) 0.000 600 0.000 Event trigger #2
S/G 21 HDR LEAK DNSTRM CHK VLV	MAL-SGN004A Event trigger #3
RHR PUMP DISCHARGE HDR Leak	IMF FLX-RHR008 (30 0) 0.000 0 0.000 IRF PLP-RHR033 (30 0) 100.000 0 IRF PLP-RHR022 (30 0) 100.000 0 Event trigger #30 on reactor trip

Materials needed for scenario:

- POP-3.1 marked up to step 4.14
- Graph Book
- Tags for tagged equipment
- Reactivity Summary Sheet

Note: None

- The plant is at 50% power, steady state conditions exist.
- Middle of Life, C_b is 1029 ppm.
- EFPD = 340
- Control Bank D = 195 steps
- Tavg = 553.5 °F
- RCS Pressure = 2235 psig
- Pressurizer Level = 42%
- A small Steam Generator Tube Leak exists on 23 SG, less than 5 gallons per day.
- Risk Assessment = GREEN
- Daily Risk Factor = 0.94

The following equipment is out of service:

- 21 Charging Pump. Return expected in approximately 6 hours.
- 21 Component Cooling Water Pump. Return to service in approximately 8 hours.

Team instructions:

- The Main Turbine 21 Rupture Disc is leaking approximately 12 SCFM.
- In accordance with POP-3.1, continue to shut down at a rate of 200 MWe per hour and remove the Main Turbine and Generator from service.

Op Test No.: 1	Scenario # 4	Event # 1	Page 5 of 25
Event Description: Reduce Load			

Time	Position	Applicant's Actions or Behavior
		Note: Proceed to event 2 when rod motion causes the dropped/misaligned rod malfunction to occur.
	CRS	Refers to POP 3.1
		Note: CRS may review previously performed steps in the POP to verify that they have been completed.
	RO	BORATE per SOP 3.2, Reactor Coolant System Boron Concentration Control, as necessary to maintain control banks above insertion limits required by GRAPH RPC-6, Cycle 14 Core Operating Limits Report. **Note: Actions for boration are on pages 7 of this scenario guide**
	RO	IF necessary, PLACE rod control in MANUAL to maintain rods above the Insertion Limit.
	RO	MAINTAIN delta flux within the target band.
	BOP	MONITOR condenser sextants for sodium increase.
	RO	VERIFY T_{AVE} AND Pressurizer Level are maintained on program per Graph RCS-2, Pressurizer Level V.S. T_{AVE}.
	RO	MAINTAIN steam generator levels between 40 and 50 percent Narrow Range.

Op Test No.: 1	Scenario # 4	Event # 1	Page 6 of 25
Event Description: Reduce Load			

Time	Position	Applicant's Actions or Behavior
	RO	NULL manual setpoint on feedwater regulating valve control to facilitate rapid transfer from AUTOMATIC to MANUAL control.
NOTE WHEN erratic governor operation is observed, governor oil pressure may be raised above the controlling load limit to avoid adverse Main Turbine operation.		
	RO	INITIATE load decrease using either of the following as directed by CRS: o Governor control o Load Limit control

Op Test No.: 1 Scenario # 4 Event # 1 Page 7 of 25

Event Description: Reduce Load

Time	Position	Applicant's Actions or Behavior
	RO	Refers to SOP-3.2 for boration
	RO	DETERMINE RCS Boron concentration from reactor coolant sample analysis. o IF analysis following concentration adjustment is NOT yet available, ESTIMATE Boron concentration based on latest readings.
NOTE Determinations should be based upon rod position, RCS Boron concentration, Xenon level variations, incremental Boron and rod worth, and operating experience.		
	RO	DETERMINE magnitude of increase in Boron concentration necessary to accomplish desired reactivity change using one or more of the following references: o GRAPH CVCS-3A, Boration Nomograph for Hot RCS o GRAPH CVCS-3B, Boration Nomograph for Cold RCS o GRAPH CVCS-6, Boration - Dilution Tables o GRAPH RV-2, Total Power Defect (PCM) as a Function of Power and Boron Concentration at MOL o GRAPH RV-3, Differential Boron Worth (Hot Zero Power) at MOL o GRAPH RV-4, Total Temperature Defect (PCM) as a Function of Temperature and Boron Concentration at MOL o GRAPH RV-9, IP2 Cycle 15 Reactivity Equivalents o POP 1.2, Reactor Startup o WCR 1, Reactivity Summary
	RO	IF the change in RCS Boron concentration is anticipated to be greater than or equal to 25 ppm, OPERATE Pressurizer heaters to open spray valve.

Op Test No.: 1 Scenario # 4 Event # 1 Page 8 of 25

Event Description: Reduce Load

Time	Position	Applicant's Actions or Behavior
	RO	ESTIMATE total volume of boron required for boration from boration graphs or references listed in step 4.5.2.
	RO	PLACE the RCS Makeup Control switch to STOP.
	RO	SET Boric Acid Integrator to amount determined in step 4.5.3.
	RO	PLACE the RCS Makeup Mode Selector switch to BORATE.
	RO	FCV-110A, Boric Acid Flow Control, may be left in AUTO or placed in MANUAL as directed by CRS.
	RO	VERIFY boric acid transfer pumps are in AUTO.
	RO	PLACE the RCS Makeup Control switch to START.
		NOTE BATPs shifting to fast speed is verified by both counter operation and by the respective fast speed lights illuminating.
	RO	VERIFY BATPs shift to fast speed.
	RO	IF in manual, ADJUST FCV-110A, Boric Acid Flow Control, to obtain desired boric acid flow rate (may be greater than meter range).

Op Test No.: 1	Scenario # 4	Event # 1	Page 9 of 25
Event Description:	Reduce Load		

Time	Position	Applicant's Actions or Behavior
	RO	IF desired to maximize Boron flow, CLOSE the appropriate BATP recirculation valve. o HCV-104 Inlet CVCS/Boric Acid Tank 22 BA o HCV-105 Inlet CVCS/Boric Acid Tank 21 BA
	RO	MONITOR Nuclear Instrumentation, Rod position, and RCS temperature closely during any reactivity changes.
	RO	WHEN boration operation has been completed, PERFORM the following: o PLACE the RCS Makeup Control switch to STOP. o PLACE the Makeup Mode Selector switch to MANUAL. o ADJUST FCV-110A, Boric Acid Flow Control, dial setting to the new RCS Boron concentration per applicable CVCS Graph: o GRAPH CVCS-1A, Blended Makeup - (0-500) with 120 Gpm PW o GRAPH CVCS-1B, Blended Makeup - (0-2000) with 120 Gpm PW o GRAPH CVCS-1C, Blended Makeup with Various PW Flows
	RO	VERIFY FCV-110A control switch in AUTO.
	RO	PLACE the RCS Makeup Control switch to START.

Op Test No.: 1	Scenario # 4	Event # 1	Page 10 of 25
Event Description: Reduce Load			

Time	Position	Applicant's Actions or Behavior
	RO	VERIFY approximately 30 gallons of blended makeup flows through blender.
	RO	PLACE RCS Makeup Control switch to STOP.
	RO	SELECT AUTO on RCS Makeup Mode Selector switch.
	RO	PLACE the RCS Makeup Control switch to START.
	CRS	IF Reactor is shutdown, REQUEST a sample for RCS Boron concentration within 30 minutes of completing the boration.
	RO	LOG amount of boric acid added to system for boration in CCR Log Book.
When rod motion occurs, proceed to event 2		

Op Test No.: 1	Scenario # 4	Event # 2	Page 11 of 25
Event Description:	Misaligned/Dropped Control Rod P-6		

Time	Position	Applicant's Actions or Behavior
Booth Instructor: When rod motion occurs, Control Rod P-6 should ratchet into the core. **Note: The more Control Bank D inserts the more deviation rod P-6 will experience.**		
Indications received: *Alarm SF 2-7 Control Rod or Power Distribution Trouble* *Alarm FC 2-4 NIS Power Range Channel Deviation 3%* *Control Rod P-6 IRPI indicates lower than the rest of Control Bank D* *PICS alarms for Rod to Bank deviation and Rod to Rod deviation*		
	CRS	Implements AOP-ROD-1Rod Control and Indication Systems Malfunctions
	RO	Determines continuous unwarranted rod motion is NOT occurring.
	RO	Determines that indication of a dropped or misaligned rod or IRPI failure exists.
	RO	Diagnoses malfunction as a misaligned control rod

Op Test No.: 1	Scenario # 4	Event # 2	Page 12 of 25
Event Description:	Misaligned/Dropped Control Rod P-6		

Time	Position	Applicant's Actions or Behavior
	RO	Places rod control in MANUAL
	CRS	Refers to the following Technical Specifications ◊ 3.10.3, Quadrant Power Tilt Limits ◊ 3.10.5, Rod Misalignment Limitations ◊ 3.10.7, Inoperable Rod Limitations
	CRS	Notify I&C to investigate for cause of misaligned rod
	RO	Determines actual position of misaligned rod
Booth Operator: Call as I&C and inform that time compression is being utilised. I&C has determined that the cause of the failure was a blown fuse and the fuse has been replaced.		
	CRS	Initiates a CR to document malfunction
	RO	Determines that affected rod is below remainder of rods in its group.

Op Test No.: 1	Scenario # 4	Event # 2	Page 13 of 25
Event Description:	Misaligned/Dropped Control Rod P-6		

Time	Position	Applicant's Actions or Behavior
	BOP	Obtains the following from Reactor Engineer:
Booth Operator: Respond as RE that reactor should stay at or below current power level for rod withdrawal, and no rate limitation on withdrawal.		
When ready to realign the rod, or at Lead Evaluator's discretion, proceed to Event 3		

Op Test No.: 1	Scenario # 4	Event # 3	Page 14 of 25
Event Description:	21 Condensate Pump Trips		

Time	Position	Applicant's Actions or Behavior
		Booth Instructor: When directed by lead evaluator, insert the following command: [redacted] **TRG!2, Actuates event trigger 2:** BRG 1 Failure Condensate Pump 21 MTR IMF MOT-CFW001B (2 0) 100 600 0.000
		Indications available: *Increasing amps on panel SC meter for 21 Condensate Pump Amps* *21 MBFP speed slowly increases* *Alarm SE 3-2 Bearing Monitor after about 3 minutes* *21 Condensate Pump trips after about 4.5 minutes* After pump trip: *S/G levels decrease* *Multiple S/G level alarms* *21 MBFP Low Suction Pressure Cutback actuates*
	BOP	Diagnoses 21 Condensate Pump malfunction
NOTE: The CRS may direct the BOP operator to manually trip 21 Condensate pump due to indications of failure.		
	CRS	Direct performance of immediate actions of AOP-FW-1 Loss of Feedwater
	RO	Checks if any MBFP is operating (yes) Announces immediate actions complete
	CRS	Reviews Immediate actions using the procedure
	ALL	Determine that a Condensate Pump has tripped

Op Test No.: 1 Scenario # 4 Event # 3 Page 15 of 25

Event Description: 21 Condensate Pump Trips

Time	Position	Applicant's Actions or Behavior
	BOP	Determine that 22 Condensate pump is not running Start 22 Condensate Pump
	RO	Check if load reduction is necessary to maintain FF>SF and MBFP suction pressure >310 (expected result is no load reduction necessary)
	RO	Check Tave maintained on program
	RO	Check if MBFP suction pressure cutback is actuating
Evaluator Note: Continue with Event 4 when SG levels are increasing with FF>SF, or at the discretion of the lead evaluator		

Op Test No.: 1	Scenario # 4	Event # 4, 5	Page 16 of 25
Event Description:	Steam Line Rupture, Auto SI Actuation Failure, LOCA Outside Containment		

Time	Position	Applicant's Actions or Behavior
		Booth Instructor: When directed, insert the following command: [redacted] **TRG!3, Actuates Event Trigger 3** S/G 21 HDR LEAK DNSTRM CHK VLV IMF MAL-SGN004A (3 0) 25 180 0.000 Actuates when reactor trip breakers open: RHR PUMP DISCHARGE HDR Leak IMF FLX-RHR008 (30 0) 100 0.00 0 IRF PLP-RHR033 (30 0) 100.000 0 IRF PLP-RHR022 (30 0) 100.000 0
		Indications available: *Reactor Power Increases* *Turbine Load Decreases* *S/G levels increase* *ALARM SA 3-2, PZR Low Pressure 2185* *ALARM SA 3-3, PZR Low Level* *Auto Reactor Trip* *SI First Out Alarm*
	TEAM	Determine reactor trip required.
	CRS	Direct reactor trip and entry to E-0, Reactor Trip or Safety Injection
	RO	Verify reactor trip
	RO	Verify Turbine Trip
	BOP	Verify Power to 480 V Buses

Op Test No.: 1	Scenario # 4	Event # 4, 5	Page 17 of 25
Event Description:	Steam Line Rupture, Auto SI Actuation Failure, LOCA Outside Containment		

Time	Position	Applicant's Actions or Behavior
Critical Task: **Manually actuate at least one train of SIS-actuated safeguards before any of the following:** ◊ **Transition to any E-1 series, E-2 series, or E-3 series procedure or transition to any FRP** ◊ **Completion of step 5.a of ES-0.1**		
Critical Task	RO	Check if SI is actuated (no) Determines that SI is required but not actuated. PERFORMS Manual SI actuation by depressing both manual SI actuation pushbuttons on panel SB-2
	CRS/BOP	CRS directs BOP to perform E-0 Attachment 1
	RO	Verify AFW Pumps Running (yes)
	RO	Verify total AFW flow greater than 400 gpm (yes)
	RO	Verify SI System Flow Places one RHR pump to pullout
Booth Instructor: Call as Nuclear Watch NPO and report a large leak of apparently RCS steam/Liquid in the piping penetration area. The leak appears to be on RHR discharge piping and you cannot get close due to steam temperature and radiation levels.		
	RO	Check RCP Seal Cooling Starts 22 Service Water Pump

Op Test No.: 1	Scenario # 4	Event # 4, 5	Page 18 of 25
Event Description:	Steam Line Rupture, Auto SI Actuation Failure, LOCA Outside Containment		

Time	Position	Applicant's Actions or Behavior
	RO	Check RCS Temperatures
	RO	Check PRZR PORVs and Spray valves closed
Critical Task **Trip all RCPs prior to completion of E-0 step 12**		
Critical Task	TEAM	Check if RCPs should be stopped Check SI pumps – At Least One Running Checks subcooling less than 23°F. PERFORMS - Stops all RCPs
	RO	Check if any SG is faulted (no)
	RO	Check if SG tubes are Intact (yes)
	RO	Check if RCS is intact (yes) NOTE: All containment parameters are normal
	RO	Check if SI should be terminated (no)
	CRS/BOP	Check if Attachment 1 is complete.
	CRS	Initiate monitoring of CSF Status trees

Op Test No.: 1	Scenario # 4	Event # 4, 5	Page 19 of 25
Event Description:	Steam Line Rupture, Auto SI Actuation Failure, LOCA Outside Containment		

Time	Position	Applicant's Actions or Behavior
	RO	Reset SI
	RO	Check if RHR Pumps should be stopped (yes)
	RO	Check SG Levels
	RO	Check PAB Radiation – Normal (NO)
	TEAM	Diagnose cause of abnormal PAB Radiation levels due to a Loss of RCS inventory outside of containment
	CRS	Transition to ECA-1.2, LOCA Outside Containment
	RO	Verify Proper valve alignment (all in correct position)
	CRS/RO	Verify SI has been reset
	BOP	Reset Containment isolation Phase A and Phase B
	BOP	Establish Instrument Air to Containment

Op Test No.: 1	Scenario # 4	Event # 4, 5	Page 20 of 25
Event Description:	Steam Line Rupture, Auto SI Actuation Failure, LOCA Outside Containment		

Time	Position	Applicant's Actions or Behavior
Critical Task: **Isolate the LOCA outside containment before transition out of ECA-1.2**		
Critical Task	TEAM	Try to identify and Isolate Break Sequentially close and open the following valves (or sets of valves) and monitor for an RCS pressure increase ◊ RHR Pump cold leg injection valves MOV-746 and MOV-747. Determines that the Leak is isolated when MOV-746 and MOV-747 are closed.
	RO	Check if break is isolated (yes) Determines RCS pressure is increasing
	CRS	Transitions to E-1, Loss of Reactor or Secondary Coolant
Terminate scenario when transition is announced to E-1		

Op Test No.: 1	Scenario # 4	Event # Attachment 1	Page 21 of 25
Event Description:	Attachment 1, Automatic Action Verification		

Time	Position	Applicant's Actions or Behavior
		Note **This attachment must be terminated upon CRS transition to ECA-0.0, Loss of All AC Power.**
	BOP	Verify proper Charging system operation: a. Start at least one charging pump in manual at maximum speed b. Align charging pump suction to the RWST • Open charging pump suction valve from RWST o LCV-112B • Close charging pump suction valve from VCT o LCV-112C • Place RCS Makeup Control switch to STOP
		Note o **Notify CRS of any automatic actions that failed to occur during performance of this attachment** o **Equipment found misaligned due to operator action should NOT be repositioned.**
	BOP	Check 345 KV MO Disc Switch F7-9 – Open (no) Checks generator output breakers – OPEN

Op Test No.: 1 Scenario # 4 Event # Attachment 1 Page 22 of 25

Event Description: Attachment 1, Automatic Action Verification

Time	Position	Applicant's Actions or Behavior
	BOP	Check status of 480 volt busses: 1. All 480V busses – ENERGIZED BY OFF-SITE POWER 2. Dispatch NPO to reset: ◊ All lighting ◊ MCC 24A ◊ MCC 27A ◊ MCC 29A 1. Stop all Condensate Pumps
	BOP	Verify FW Isolation: o Main Boiler Feed Pumps – TRIPPED o Main Boiler Feed Pump Discharge Valves – CLOSED o FW Regulating valves – CLOSED o FW Stop Valves – CLOSED o SG Blowdown Isolation Valves - CLOSED
	BOP	Check if Main Steam Lines should be isolated: a. Check for either: • High Steam Line flow with EITHER Tave less than 541 deg F OR Steam line pressure less than 525 psig. OR • Containment pressure – EVER GREATER THAN 24 psig b. Verify MSIVs - CLOSED
	BOP	Verify proper Service Water System operation: 1. Three Service Water Pumps – Running on Essential Header 2. Service Water valves from Diesel Generator - OPEN

Op Test No.: 1 Scenario # 4 Event # Attachment 1 Page 23 of 25

Event Description: Attachment 1, Automatic Action Verification

Time	Position	Applicant's Actions or Behavior
	BOP	Verify SI system pumps running: a. Three SI pumps – RUNNING b. 22 SI pump discharge isolation MOV-851A AND MOV-851B – OPEN c. Two RHR pumps - RUNNING
	BOP	Verify proper emergency SI System valve alignment: a. SI pump cold leg injection valves – OPEN o 856A o 856E o 856C o 856D b. RHR HX CCW outlet valves – OPEN o 822A o 822B c. RHR HX MOVs – OPEN o 746 o 747
	BOP	Verify Containment Fan Coolers – IN SERVICE: a. Five fan coolers - RUNNING b. NORM OUT valves - OPEN c. TCV-1104 and TCV-1105 – BOTH OPEN
	BOP	Verify AFW flow to all SGs

Op Test No.: 1 Scenario # 4 Event # Attachment 1 Page 24 of 25

Event Description: Attachment 1, Automatic Action Verification

Time	Position	Applicant's Actions or Behavior
	BOP	Verify Containment Ventilation Isolation: 1. Containment Purge Valves – CLOSED ◊ FCV-1170 ◊ FCV-1171 ◊ FCV-1172 ◊ FCV-1173 2. Containment Pressure Relief Valves - CLOSED ◊ PCV-1190 ◊ PCV-1191 ◊ PCV-1192
Note Attachment 2 provides a list of Phase A valves		
	BOP	Verify Containment Isolation Phase A 1. Phase A – ACTUATED ◊ Train A master relay CA1 (above rack E) ◊ Train B master relay CA2 (above rack F) 2. Phase A valves – CLOSED ◊ IVSW valves – OPEN ◊ 1410 ◊ 1413 ◊ SOV-3518 ◊ SOV-3519 ◊ WCP valves – OPEN: ◊ PCV 1238 ◊ PCV 1239 ◊ PCV 1240 ◊ PCV 1241 3. Place personnel and equipment hatch solenoid control switches to INCIDENT on SM panel 4. Dispatch NPO to periodically check ◊ IVSW Tank ◊ Level – GREATER THAN 92% ◊ Pressure – GREATER THAN 57 PSIG ◊ WCP header pressures – GREATER THAN 52 PSIG

Op Test No.: 1	Scenario # 4	Event # Attachment 1	Page 25 of 25
Event Description:	Attachment 1, Automatic Action Verification		

Time	Position	Applicant's Actions or Behavior
Evaluator note: The following step is intended for High Containment pressure condition. It will not be performed if conditions aren't met		
	BOP	Check if Containment Spray should be actuated: 1. Containment Pressure – EVER GREATER THAN 24 PSIG 2. Verify spray pumps – RUNNING 3. Verify spray pump discharge valves – OPEN ◊ MOV-866A ◊ MOV-866B ◊ MOV-866C ◊ MOV-866D 4. Verify Containment Isolation Phase B valves – CLOSED 5. STOP all RCPs 6. Verify IVSW Isolation Valves – OPEN ◊ 7864 ◊ 7865 ◊ 7866 ◊ 7867
	BOP	Verify CCR Air Conditioner Train A and B – RUNNING IN INCIDENT MODE 2
	BOP	Notify CRS that Attachment 1 is complete

Facility: IP2 Scenario No.: 5 Op Test No.: 1

Examiners: _____ Candidates: _____ CRS

_____ _____ RO

_____ _____ PO

Initial Conditions: 15% power MOL

Turnover: The plant tripped 76 hours ago due to a switchyard fault. Repairs have been completed and plant startup is in progress IAW POP 1.3 at step 4.53. Continue with the plant startup at a rate of 200 MW per hour.

Critical Tasks: Establish at least 400 gpm AFW flow to the SGs before SG dry-out occurs (WR level less than 14%)

Isolate RCP Seal Injection before starting a Charging Pump.

Event No.	Malf. No.	Event Type*	Event Description
1		R (RO) N (BOP)	Increase Load
2	XMT-RCS028A	I (RO)	PT-455 PRZR Pressure Controlling Channel fails high
3	MAL-EPS007D	C (ALL)	Loss of 480V Bus 6A
4	FLX-CFW050 MAL-EPS001	M (ALL)	Feed water Header leak inside containment. Loss of all AC power
5	MOC-SWS009	C (BOP)	ESW Pumps Fail to Auto Start

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

The team will assume the shift and continue with a plant startup in progress in accordance with POP-1.3, beginning at step 4.53.

During the power increase, PRZR Pressure Controlling Transmitter PT-455 will fail high requiring manual control of PRZR Pressure IAW AOI-28.0 and AOI-28-5. The CRS will refer to Technical Specifications.

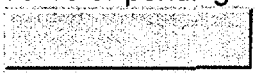
480V AC Bus 6A will fault requiring implementation of AOI-27.1.13. The team will perform immediate operator actions that include starting a Charging Pump, and starting a Service Water Pump on the essential header. Bus 6A will not be recovered due to failure.

A rupture of the feed water piping to 21 SG inside of containment will result in a reactor trip and safety injection actuation. Simultaneous to the reactor trip, a fault will occur on the Station Auxiliary Transformer resulting in a loss of offsite power. 21 EDG will start, but its output breaker will not close. 22 EDG will fail to start. 23 EDG will start but cannot be used to energize faulted bus 6A. The team will diagnose a loss of all AC power and transition to ECA-0.0. During execution of ECA-0.0, Bus 5A will be energized from the 13.8KV power source. The scenario will be terminated when transition to ECA-0.2 is announced.

EOP flow path: E-0 – ECA-0.0 – ECA-0.2

Indian Point Unit 2
2003 NRC Initial License Examination
Simulator Scenario Setup
Scenario 5

Reset simulator to IC-227(PW nano1007)
Place diskette in A drive
Click button to run batch file New#2.bat and verify that the following malfunctions are active or pending:

 bat New#2.bat

PT-455 PZR PRESS CH.1 fails high	XMT-RCS028A (1 0) 2255 60 2235 Event trigger #1
480V Bus 6A Fault	IMF MAL-EPS007D (2 0) TRUE Event Trigger #2
Feedwater Header Leak in VC	IMF FLX-CFW050 (3 0) 25 900 0.000 Event Trigger #3
EDG 21 Output Breaker Failed As-Is	IMF BKR-DSG001 (-1 0) 5
EDG 22 Air Start Failure	IMF MAL-DSG003B (-1 0) TRUE
LOA to transfer BA Pumps	IRF LOA-CVC093 (30 0) 0.000000 0 IRF LOA-CVC084 (30 2) 100.000 5 Event trigger #30
Trigger to Close Seal Water MOVs	IMF MOV-CVC002 (29 0) 2 IMF MOV-CVC005 (29 5) 2 IMF MOV-CVC006 (29 10) 2 IMF MOV-CVC007 (29 15) 2 IMF MOV-CVC008 (29 20) 2 IMF MOV-CCW004 (29 30) 2 Event trigger #29
Trigger to open Bus 5A MCC breakers	IRF LOA-EPS052 (28 0) TRIP IRF LOA-EPS049 (28 5) TRIP IRF LOA-EPS053 (28 10) TRIP IRF LOA-EPS755 (28 15) TRIP Event trigger #28

Materials needed for scenario:

- POP-1.3 marked up to step 4.53
- Graph Book

Note: None

Op Test No.: 1	Scenario # 5	Event # 1	Page 5 of 18
Event Description: Increase Load			

Time	Position	Applicant's Actions or Behavior
	CRS	Refers to POP 3.1
		Note: CRS may review previously performed steps in the POP to verify that they have been completed.
	RO	Withdraw Control Rods as necessary to MAINTAIN delta flux within the target band and Tave on program
	RO	DILUTE per SOP-3.2, Reactor Coolant System Boron Concentration Control, as necessary to maintain delta-Flux within the target band and Tave on program. **Note: Actions for DILUTION are on pages 6 of this scenario guide**
	RO	VERIFY T_{AVE} AND Pressurizer Level are maintained on program per Graph RCS-2, Pressurizer Level V.S. T_{AVE}.
	RO	MAINTAIN steam generator levels between 40 and 50 percent Narrow Range.
	RO	NULL manual setpoint on feedwater regulating valve control to facilitate rapid transfer from AUTOMATIC to MANUAL control.
	BOP	INITIATE load increase using either of the following as directed by CRS: o Governor control o Load Limit control

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Event Description: Increase Load

Time	Position	Applicant's Actions or Behavior
	RO	Refers to SOP-3.2 for dilution
	RO	DETERMINE RCS Boron concentration from reactor coolant sample analysis. o IF analysis following concentration adjustment is NOT yet available, ESTIMATE Boron concentration based on latest readings.
NOTE Determinations should be based upon rod position, RCS Boron concentration, Xenon level variations, incremental Boron and rod worth, and operating experience.		
	RO	DETERMINE magnitude of decrease in Boron concentration necessary to accomplish desired reactivity change using one or more of the following references: o GRAPH CVCS-6, Boration - Dilution Tables o GRAPH RV-2, Total Power Defect (PCM) as a Function of Power and Boron Concentration at MOL o GRAPH RV-3, Differential Boron Worth (Hot Zero Power) at MOL o GRAPH RV-4, Total Temperature Defect (PCM) as a Function of Temperature and Boron Concentration at MOL o GRAPH RV-9, IP2 Cycle 15 Reactivity Equivalents o POP 1.2, Reactor Startup o WCR 1, Reactivity Summary
	RO	IF the change in RCS Boron concentration is anticipated to be greater than or equal to 25 ppm, OPERATE Pressurizer heaters to open spray valve.
	RO	ESTIMATE total volume of PW required for dilution from graphs

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Event Description: Increase Load

Time	Position	Applicant's Actions or Behavior
		or references listed in step 4.5.2.
	RO	PLACE the RCS Makeup Control switch to STOP.
	RO	SET Primary Water Integrator to amount determined in step 4.5.3.
	RO	PLACE the RCS Makeup Mode Selector switch to DILUTE.
	RO	PLACE the RCS Makeup Control switch to START.
	RO	MONITOR Nuclear Instrumentation, Rod position, and RCS temperature closely during any reactivity changes.
	RO	WHEN dilution operation has been completed, PERFORM the following: o PLACE the RCS Makeup Control switch to STOP. o PLACE the Makeup Mode Selector switch to MANUAL. o ADJUST FCV-110A, Boric Acid Flow Control, dial setting to the new RCS Boron concentration per applicable CVCS Graph: o GRAPH CVCS-1A, Blended Makeup - (0-500) with 120 Gpm PW o GRAPH CVCS-1B, Blended Makeup - (0-2000) with 120 Gpm PW o GRAPH CVCS-1C, Blended Makeup with Various PW Flows

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Event Description: Increase Load

Time	Position	Applicant's Actions or Behavior
	RO	SELECT AUTO on RCS Makeup Mode Selector switch.
	RO	PLACE the RCS Makeup Control switch to START.
	RO	LOG amount of PW added to system for dilution in CCR Log Book.

When reactor power has been changed by approximately 10%, or at the discretion of the lead evaluator, proceed to event 2.

Op Test No.: 1	Scenario # 5	Event # 2	Page 9 of 18
Event Description:	PRZR PRESS CH1 FAILS HIGH		

Time	Position	Applicant's Actions or Behavior
Booth Instructor: When directed by lead evaluator, click button to insert the following command: [redacted] **TRG!1, Actuates event trigger 1:** PT-455 PZR PRESS CH.1 fails high XMT-RCS028A (1 0) 2255 60 2235		
Indications received: *Pressurizer Pressure Channel 1 indication increases to 2255 over 60 seconds* *Spray valves modulate open* *Actual Pressurizer Pressure decreases* *Alarm SA 3-2 PRZR Low Pressure 2185 PSIG*		
	RO	Diagnoses Pressurizer pressure control system malfunction
	CRS	Directs RO to perform immediate operator actions of AOI-28.0, Instrument Failures
	RO	*(NOTE: bulleted steps may be performed in any order)* Performs Immediate Actions from memory. Verifies the following controls: ◊ Turbine Load – Stable ◊ Rod Control – Stable ◊ PRZR Pressure Control – NOT STABLE Determines S/G control is not affected Places PRZR Pressure master controller or individual spray valve controllers in manual and closes spray valves ◊ PRZR Level Control – Stable ◊ MBFP Speed – Normal ◊ S/G Levels – Normal ◊ S/G Pressure Control – Normal Announces Immediate Actions Complete

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Event Description: PRZR PRESS CH1 FAILS HIGH

Time	Position	Applicant's Actions or Behavior
	CRS	Directs review of immediate Operator Actions using the procedure.
	BOP	Performs Alarm Response Procedures for annunciators in alarm
	RO	Diagnose PRZR Pressure Channel 1 instrument malfunction
	CRS	Transition to AOI-28.5 Pressurizer Pressure Channel Fails High
	RO	Determine that the failed channel is the controlling channel
	RO	Verifies Pressurizer Pressure control is in MANUAL
	RO	Manually controls Pressurizer Pressure at 2235 or within the band directed by the CRS
	BOP	Places P/455A Pressurizer Pressure Defeat Switch in rack B6 to Defeat 1&4
	RO	Return Pressurizer Pressure control to AUTO
	CRS	Determine that placing bistable trip switches to trip for affected channel will not cause a reactor trip.

Op Test No.: 1	Scenario # 5	Event # 2	Page 11 of 18
Event Description:	PRZR PRESS CH1 FAILS HIGH		

Time	Position	Applicant's Actions or Behavior
	BOP	Trips bistable trip switches in Red A-4 rack ◊ PC-455B Hi Press Trip (Alarm and proving lamp) ◊ PC-455A Lo Press Trip (Alarm and proving lamp) ◊ PC-455E SI (Alarm and proving lamp) ◊ PC-455C Unblock SI (No alarm, no light) ◊ TC-411A Overtemp Trip (Alarm and proving lamp)
	CRS	Refers to Technical Specification Tables 3.5-2 and 3.5-3
Proceed to event 3 when bistables have been tripped, or at the discretion of the lead evaluator.		

Op Test No.: 1	Scenario # 5	Event # 3	Page 12 of 18
Event Description:	Loss of 480V Bus 6A		

Time	Position	Applicant's Actions or Behavior
		Booth Instructor: When directed by lead evaluator, insert the following command:
		TRG!2, Actuates event trigger 2:
		480V Bus 6A Fault IMF MAL-EPS007D (2 0) TRUE
		Indications received: *21 and 22 EDGs start. 22 EDG Fails to start* *Multiple Alarms associated with deenergized 480V bus and breaker trips.* *Deenergized equipment powered from bus 6A including the running charging pump*
	BOP	Diagnoses 480V Bus 6A de-energized
	CRS	Directs RO and BOP to perform immediate operator actions of AOI-27.1.13, Loss of a 480 V Bus
	RO	Check Charging Pumps Determine that no Charging Pumps are running Starts 21 or 22 Charging pumps
	BOP	Checks Service Water Pumps Determines that ESW header pressure is low Starts 24 SW Pump
	BOP	Checks RCS temperature > 200°F Checks CRDM fans – At Least three running (expect 4 running) Announces Immediate Actions Complete
	CRS	Directs review of immediate actions using the procedure

Op Test No.: 1 Scenario # 5 Event # 3 Page 13 of 18

Event Description: Loss of 480V Bus 6A

Time	Position	Applicant's Actions or Behavior
Booth instructor: Click button to swap inservice boric acid pumps, when Nuke Side NPO is dispatched. [redacted] Swaps BAT Pumps by activating trigger 30		
	BOP	Diagnose 480 Volt Bus 6A De-energized
	BOP	Determine Bus 6A Lockout Status light is not lit
	TEAM	Place control switches for bus 6A loads in pullout and OPEN bus 6A MCC Feeder breakers
	BOP	Dispatch NPO to perform visual inspection of switchgear for Bus 6A equipment
Booth Instructor: NPO should report that Bus 6A has apparently suffered a catastrophic failure. Report that the back of Bus 6A switchgear is deformed and paint is blistered and smell of acrid odor.		
	BOP	Determine that amber light for breaker 52/6A is lit
	BOP	Dispatch NPO to shutdown 23 EDG
	CRS	INITIATE Technical Specification Shutdown
Note: Proceed to event 4 when the team has determined that a shutdown is required, or at the lead evaluator's discretion.		

Op Test No.: 1 Scenario # 5 Event # 4, 5, 6 Page 14 of 18

Event Description: Attachment 1, Automatic Action Verification

Time	Position	Applicant's Actions or Behavior
		Booth Instructor: When directed by lead evaluator, insert the following command: [redacted] **TRG!3, Actuates event trigger 3:** Feedwater Header Leak in VC IMF FLX-CFW050 (3 0) 25.000 900 0.000
		Indications available: *Containment Sump level alarms on panel SB-1* *Containment Humidity alarm on panel SM* *21 SG Feed Flow decreases and 21 SG Level decreases* *Auto reactor trip if no manual trip actuated.* *Auto SI on High Containment Pressure and Steam Line Delta-P* Following Trip *Loss of Offsite Power occurs* *Loss of All 480 V busses*
	RO	Diagnoses 21 SG Level decreasing rapidly and containment conditions degrading
		NOTE: The CRS may direct the RO to manually trip the reactor due to rapidly deteriorating plant transient.
	CRS	Direct performance of immediate actions of E-0, Reactor Trip or Safety Injection
	RO	Verifies Reactor Tripped
	RO	Verifies Turbine Tripped
	BOP	Checks Status of 480V Busses Determines that no 480V Bus is energized Announces to team that transition to ECA-0.0 is required

Op Test No.: 1 Scenario # 5 Event # 4, 5, 6 Page 15 of 18

Event Description: Attachment 1, Automatic Action Verification

Time	Position	Applicant's Actions or Behavior
	CRS	Directs team to perform immediate actions of ECA-0.0, Loss of All AC Power
	RO	Verify Reactor Trip
	RO	Verify Turbine Trip Announce immediate actions complete
	CRS	Verify immediate actions using the procedure
	RO	Check if RCS is isolated ◊ Checks PORVS closed ◊ Checks letdown isolation valves closed ◊ Checks excess letdown isolation valve closed
Critical task **Establish at least 400 gpm AFW flow to the SGs before SG dry-out occurs (WR level less than 14%)**		
Critical Task	TEAM	Verify AFW Flow – Greater than 400 GPM ◊ Manually open PCV-1139 Steam Supply regulator Valve to start 22 AFW Pump ◊ Manually align 22 AFWP FCVs as necessary ◊ Adjust HCV-1118 Steam Supply Speed Control valve

Op Test No.: 1 Scenario # 5 Event # 4, 5, 6 Page 16 of 18

Event Description: Attachment 1, Automatic Action Verification

Time	Position	Applicant's Actions or Behavior
	BOP	Try to restore power to any 480V bus ◊ Check EDGs running (22 not running, 21 EDG running) ◊ Attempt to close 21 EDG output breaker (will not close) ◊ Dispatch NPO to emergency start 22 EDG ◊ Locally trip running EDGs (Note, they will probably be auto tripped before this step is performed due to lack of SW cooling) ◊ Attempt to manually energize 480V bus using any available power supply per AOI-27.1.1 and AOI-27.1.13
	BOP/CRS	Determine that 480 Bus cannot be readily energized from CCR
Booth Instructor: NPO dispatched to start 22 EDG reports that both air start motors appear to be mechanically bound. 22 EDG will not start. NPO will contact work control for assistance. **Booth Instructor: When asked, DO reports that 13.8 KV power is available from 13W92** **Evaluator Note: When power is restored to any 480V bus, then recovery actions should continue starting with step 24 of ECA-0.0**		
	RO	Place Equipment in Pullout: ◊ CS Pumps ◊ SI Pumps ◊ FCUs ◊ Motor Driven AFW Pumps ◊ Turning Gear Oil Pump ◊ Bearing Oil Pump ◊ Turbine Auxiliary Oil Pump ◊ CCW Pumps ◊ RHR Pumps
	CRS	Dispatch personnel to Locally Restore AC Power

Op Test No.: 1	Scenario # 5	Event # 4, 5, 6	Page 17 of 18
Event Description:	Attachment 1, Automatic Action Verification		

Time	Position	Applicant's Actions or Behavior
	CRS	Check 13.8KV feeder 13W92 ENERGIZED (yes)
	CRS/BOP	Attempt to restore power to busses per the following while continuing with step 8: ◊ AOI-27.0 Diagnosis and Response to Electrical Failure ◊ SOP-27.1.3 Operation of 13.8KV System ◊ AOI-27.1.1 Loss of Normal Station Power ◊ AOI-27.1.13 Loss of 480V Bus
Critical Task **Isolate RCP Seal Injection before starting a Charging Pump.**		
Critical Task	TEAM	Dispatch personnel to locally close valves to isolate RCP Seals and Place valve Switches to CLOSED position ◊ MOV-222 RCP seal return isolatin valve outside containment ◊ MOV-250A-D, RCP seal injection isolation valves outside containment ◊ MOV-789, RCP thermal barrier CCW return isolation valve outside containment
Booth Operator: When NPO directed to Isolate RCP seals, click the button: **When NPO directed to open MCC breakers on Bus 5A, click this button:**		
	BOP	Place 52/SS5 and 52/EG1 in Pullout
	BOP	Energize Bus 5A from 13.8KV via 52/GT25
	BOP	Direct NPO to remove control power fuses for 52/5A and manually close breaker 52/5A

Op Test No.: 1 Scenario # 5 Event # 4, 5, 6 Page 18 of 18

Event Description: Attachment 1, Automatic Action Verification

Time	Position	Applicant's Actions or Behavior
		Booth Instructor: When NPO dispatched, click to execute
		Remove control power fuses breaker 52/5A
		Mechanically locally close breaker 52/5A
	BOP	Press 86/5A reset pushbutton and verify white light is on
	BOP	Close 52/SS5. Inform team that Bus 5A is energized
	CRS	Determine that ECA-0.0 Step 24 should be performed per step 6 CAUTION.
	RO	Manually control SG atmospheric Steam Dumps to stabilize SG Pressures
	BOP	Verify Service Water system operation
	BOP	Verify the following equipment is loaded onto bus 5A ◊ MCC 26A ◊ MCC 29A ◊ 21 Battery Charger ◊ 21 Static Inverter on alternate power
Evaluator Note: Team will be unable to close breaker for MCC 29A due to blackout relay not reset. **Booth Operator: If NPO dispatched to reset MCC29A, inform the CCR that MCC29A breaker will not close.**		
	CRS	Select Recovery Procedure Determine transition to ECA-0.2 (expected)
Terminate scenario when transition from ECA-0.0 is announced.		