

Facility : PBNP Scenario No.: 3 OP-Test No.: 2000-1

Examiners: \_\_\_\_\_  
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Operators: \_\_\_\_\_  
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Initial Conditions: Unit 1 @ 75 % Power, MOL, Xenon has peaked following downpower. RCS Cb is 820 ppm. Unit 2 @ 100% Power, BOL. Today is Sunday (present clock time is real time). Normal shift complement with exception of 3<sup>rd</sup> SRO.

Turnover: Unit 1 was reduced to 75% 5 hours ago for a maintenance evaluation of a lube oil leak on 1P-28A, Main Feedwater Pump.

Maintenance has just completed their evaluation and determined that the Main Feedwater Pump must be removed from service.

The objective of the shift is to reduce power to 55% and secure 1P-28A.

OP-3A is the procedure in effect and has been completed through step 4.6.

P-38B, Electric Auxiliary Feedwater Pump has been OOS for two days to repair recirc line cracks.

Two L/D orifices are in service with two banks of PZR heaters in manual for down-power.

Event No.	Malf. No.	Event Type*	Event Description
1		I/ (RO)	HC-135, Letdown Line Pressure Controller Fails High.
2		N/ (RO)	Place Excess Letdown in service.
3		C/ (ALL)	Loss of Condenser Vacuum
4		R/ (RO) N/ (ALL)	Rapid Plant Down-Power IAW AOP-17A due to vacuum loss.
5		M/ (ALL)	Condenser Vacuum degrades to reactor trip criteria.
6		C/ (RO)	Main Turbine Fails to AUTO & MANUALLY Trip.
7		C/ (BOP)	1P-29, Turbine Driven Auxiliary Feedwater Pump trips on overspeed.
8		C/ (BOP)	P-38A, Electric Driven Auxiliary Feedwater Pump Discharge Valve Controller Fails.
9		M/ (ALL)	Loss of Heat Sink that is recoverable using Main Feedwater.

\* (N)ormal, Reactivity, (I)nstrument, (C)omponent, (M)ajor

Event Description: **Letdown Line Pressure Controller (HC-135) fails high which results in a Loss of Letdown and Establish Excess Letdown to Control PZR Level**

Time	Position	Applicant's Actions or Behavior
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**At the Lead Examiners discretion, the crew should brief the down-power in the classroom prior to entering simulator. This is for consistency (previous scenario), even though the intent of the scenario is not to observe this portion of the down-power**

	CREW	Begin briefing normal down-power
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**Shortly after the crew begins briefing normal down-power, Insert Event # 1**

	RO	Acknowledge and respond to receipt of annunciator 1C04 1C 1-6, 2-6 and 4-6 1. Operator Actions: <ul style="list-style-type: none"> <li>- Check for associated alarms</li> <li>- Check operation of PCV-135 and correct high pressure condition</li> <li>- Take manual control of letdown pressure controller (HC-135)</li> <li>- Shift TCV-145A to bypass the demineralizers if flow is greater than 80 gpm for one mixed bed ion exchanger</li> <li>- Shut one orifice if more than one is open, if required</li> <li>- Notify DSS/DOS</li> </ul>
	RO	Identify failure of HC-135 (Letdown Line Pressure Controller)
	DOS	Direct entry into AOP-24, "Response to Instrument Malfunctions"
	RO/DOS	Identify Failed Instrument <ul style="list-style-type: none"> <li>- Determine HC-135 controller has failed and proceed to step 3 of AOP-24</li> </ul>
	RO	Establish Manual Control <ul style="list-style-type: none"> <li>- Take manual control of HC-135</li> <li>- Determine it does not control in manual</li> <li>- Recommend isolating letdown and reducing charging to minimum</li> </ul>

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Time	Position	Applicant's Actions or Behavior
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	RO/DOS	Secure normal letdown (may use OP-5E, "Establishing and Securing Excess Letdown")
	DOS	Review OP-5E evolution and conducts control room brief - Notes precaution and limitation that if CI occurs excess letdown must be immediately secured
	RO/DOS	Return parameters to desired value - Establish Excess letdown per OP-5E
	RO/DOS	Initiate monitoring of reactor power using Delta Ts IAW 0-TS-RE-001 (PPCS RTO NOT RELIABLE)
	RO/DOS	Continue with OP-5E steps - CVCS aligned per CL-5A - One CCW pump running - CC-719 and CC-769 verified OPEN - CV-312 is in DIVERT - CV-285 verified SHUT - CV-1299 OPEN - Throttle CV-285 OPEN to obtain 5 to 10 psi increase on PI-121 - Divert RCDT as needed until 20% rise in RCDT - SHUT CV-285 - Place CV-312 to NORMAL - Throttle open CV-285 to obtain 5 to 10 psi
	RO/DOS	Begin establishing PZR level back to normal programmed band

Op-Test No: 2000-1 Scenario No: 3 Event No: 1, 2 Page \_\_\_ Of \_\_\_

Event Description: **Letdown Line Pressure Controller (HC-135) fails high which results in a Loss of Letdown and Establish Excess Letdown to Control PZR Level**

Time	Position	Applicant's Actions or Behavior
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	DOS	Determine ICP 10.2 is N/A and informs DSS of plant status
	DOS	Check for TS applicability (none are applicable)
	DOS	Exit AOP-24

**At the discretion of the lead examiner, the exam team will proceed to the next event.**

Event Description: **Loss of Condenser Vacuum which leads to a rapid down-power and eventually degrades to Reactor/Turbine Trip Criteria.**

Time	Position	Applicant's Actions or Behavior
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	BOP/DOS	Recognize Condenser Vacuum is slowly lowering - Vacuum gages on C-03 - Turbine MW electric are lowering - Condenser Vacuum Low Annunciator 1C03 1F 1-4
<p><b>At the discretion of the Lead examiner, it could be reported from the System Control Supervisor that it is noted MW electric are lowering at PBNP Condenser Vacuum alarm does not come in until 3 inches of back-pressure</b></p>		
	DOS	Direct entry into AOP-5A, "Loss of Condenser Vacuum"
	DOS	Brief AOP notes and inform operators that if a reactor trip or SI occurs during this procedure EOP-0 will be entered and AOP-5A will be paralleled (continuous action)
	RO/DOS	Maintain RCS Tavg (continuous action) - If not Trip Reactor and enter EOP-0
	DOS/BOP	Check condenser pressure in BOTH condenser sections within Figure 1 limits (continuous action) - If not trip reactor
	BOP	Place ALL available primary and secondary air ejectors in service per Attachment B - BOP directs AO to perform Attachment B steps
	BOP/DOS	Use Priming A/E on condenser if desired - Determine that this action is not effective if > 25 in vacuum (5 inches back-pressure) - Note: If DSS is asked he will ask for recommendation

Event Description: **Loss of Condenser Vacuum which leads to a rapid down-power and eventually degrades to Reactor/Turbine Trip Criteria.**

Time	Position	Applicant's Actions or Behavior
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	RO/BOP/DOS	Notify Plant Personnel with Gai-tronics announcement (may task DSS with this action)
	DOS	Notify plant personnel <ul style="list-style-type: none"> <li>- STA</li> <li>- DCS</li> <li>- SCS</li> <li>- Regulatory Service Person</li> <li>- NRC Resident</li> <li>- (may task DSS with these actions)</li> </ul>
	DOS	Consider a plant load reduction at a rate consistent with the severity of vacuum loss rate to prevent turbine trip. <ul style="list-style-type: none"> <li>- Determine a load reduction is necessary (if asked, DSS will acknowledge a load reduction or at the lead examiner discretion will direct one so that the reactivity manipulation is observed)</li> </ul>
	DOS	Direct concurrent entry into AOP-17A, "Rapid Power Reduction" while continuing in AOP-5A
	DOS	Enter AOP-17A and direct RO/BOP actions.
	DOS	Determine desired power level or condition to be met (DOS may elect up to a 5%/min ramp rate and should base his decision to continue based on how fast vacuum degrades)
	DOS	Notify System Control Supervisor of load reduction (or asks the DSS to perform this action)
	RO/DOS	Check Rod Control System in AUTO

Event Description: **Loss of Condenser Vacuum which leads to a rapid down-power and eventually degrades to Reactor/Turbine Trip Criteria.**

Time	Position	Applicant's Actions or Behavior
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	BOP/DOS	Select rate reduction method and reduce load: <ul style="list-style-type: none"> <li>- Note that Operator Auto-Impulse In provides the most linear response</li> <li>- Select desired EHC system mode of operation</li> <li>- Select desired rate on load rate thumb-wheel</li> <li>- Select target end-point on reference control</li> <li>- Depress GO pushbutton</li> </ul>
	RO/DOS	Borate as necessary to maintain rods above the low-low insertion limit alarm (continuous action) <ul style="list-style-type: none"> <li>- Set boric acid flow totalizer (1YIC-110) to desired quantity</li> <li>- Set boric acid flow controller (1HC-110) to desired flowrate</li> <li>- Start second boric acid transfer pump if desired</li> </ul>
	RO/DOS	Check Pressurizer Pressure Stable at or trending to 1985 psig (continuous action)
	RO/DOS	Check Pressurizer Level Stable at or trending to program level (continuous action)
	BOP/DOS	Check steam generator level controlling in AUTO (continuous action)
	RO/DOS	Maintain RCS Tavg (continuous action) <ul style="list-style-type: none"> <li>- Greater than 540 F</li> <li>- Within 10F of Tref</li> </ul>

**Between 60-65 % NI power (or at the Lead examiners discretion) Condenser Vacuum will degrade more rapidly to a required trip condition. Note that since the Turbine will not auto trip it is desired to force the crew into this situation prior to reducing power < 49% (P-9). Proceed to event # 3.**

**The following actions are additional steps that may be concurrently directed while performing down-power**

Op-Test No: 2000-1 Scenario No: 3 Event No: 3, 4, 5 Page     Of    

Event Description: **Loss of Condenser Vacuum which leads to a rapid down-power and eventually degrades to Reactor/Turbine Trip Criteria.**

Time	Position	Applicant's Actions or Behavior
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	BOP/DOS	Ensure proper circulating water system operations - check alarms - check adequate water supply to circulating pumps
	BOP/DOS	Bypass air removal filtration and flow monitor - BOP directs actions in step 10 of AOP-5A
	DOS	Check condenser vacuum returning to normal - Determine vacuum is still degrading - Direct BOP to have AO perform Attachment C, "follow-up actions for probable cause of system air in-leakage"
	BOP	Direct AO to walk-down systems per Attachment C to find cause of loss of vacuum

**When vacuum loss degradation is recognized proceed to the next event.**



Event Description: **Reactor/Turbine Trip (Excessive Condenser Vacuum Loss) with failure of Turbine to Trip Automatically or Manually leading to a Loss of Heat Sink due to Auxiliary Feedwater problems (Turbine Driven AFP over-speeds & P-38A discharge valve controller fails)**

Time	Position	Applicant's Actions or Behavior
	BOP/RO/DOS	Recognize plant conditions are rapidly deteriorating based on: <ul style="list-style-type: none"> <li>- Condenser Vacuum loss is more rapid and cause unknown</li> <li>- Power reduction is not effective in correcting vacuum loss</li> <li>- Reactor power is &gt; 49% (P-9 setpoint)</li> </ul>
<p><b><i>Critical Task: Manually trip Reactor and Turbine prior to auto trip of Turbine at 22 inches of Vacuum. Recognize Turbine did not manually trip and perform EOP-0 step 2 immediate actions to correct this situation up to and including ensuring MSIVs are shut</i></b></p>		
	DOS	Direct a Manual Reactor Trip and entry into EOP-0, "Reactor Trip or Safety Injection"
	RO	Perform Immediate Actions of EOP-0 (Steps 1-4) and informs DOS they are complete <ul style="list-style-type: none"> <li>- Verify reactor trip</li> <li>- <i>Verify turbine trip: determine turbine did not trip and is required to be tripped, depresses turbine trip pushbutton (also ineffective), and manually runs back turbine, places both EHC pumps in Pull-Out and ensures MSIVs are shut.</i></li> <li>- Verify safeguard buses energized</li> <li>- Check if SI is actuated</li> </ul>
	DOS/RO	Verify Reactor Trip <ul style="list-style-type: none"> <li>- Check reactor trip and bypass breakers OPEN</li> <li>- Check all rod bottom lights LIT</li> <li>- Check all rod position indicators ON BOTTOM</li> <li>- Check neutron flux LOWERING</li> </ul>

Event Description: **Reactor/Turbine Trip (Excessive Condenser Vacuum Loss) with failure of Turbine to Trip Automatically or Manually leading to a Loss of Heat Sink due to Auxiliary Feedwater problems (Turbine Driven AFP over-speeds & P-38A discharge valve controller fails)**

Time	Position	Applicant's Actions or Behavior
	DOS/RO	Verify Turbine Trip - <i>Inform DOS turbine did automatically or manually trip and RNO actions complete up to an including MSIV closure</i>
	DOS/RO	Verify Safeguard buses energized - Check at least one 4160 Vac safeguards bus energized (1A05 or 1A06) - Check at least one 480 Vac safeguards bus energized (1B03 or 1B04)
	DOS/RO	Check if SI is actuated: - 1C04-1B 4-2, Manual Safety Injection - 1C04 1B 4-3, Containment - 1C04-1B 4-4, Pressurizer Low Pressure SI - 1C04-1B 4-5, Steam Line A Pressure Low-Low - 1C04-1B 4-6, Steam Line B Pressure Low-Low
	DOS	Review foldout page criteria with the crew - Determines none are currently applicable
	RO/BOP	Verify feedwater isolation: - Feedwater Regulating and Bypass Valves SHUT - Both main feed pumps tripped - MFP discharge MOVs-BOTH SHUT

Event Description: **Reactor/Turbine Trip (Excessive Condenser Vacuum Loss) with failure of Turbine to Trip Automatically or Manually leading to a Loss of Heat Sink due to Auxiliary Feedwater problems (Turbine Driven AFP over-speeds & P-38A discharge valve controller fails)**

Time	Position	Applicant's Actions or Behavior
	BOP	Verify containment isolation: <ul style="list-style-type: none"> <li>- CI Panels A and B ALL LIGHTS LIT</li> <li>- ICC-17 and RS-SA-9 SHUT</li> <li>- No valves open under administrative control</li> <li>- <b>Note that CV-1299 and CV-285 were opened and one of these valves should be shut because it did not receive an automatic signal, if not previously shut</b></li> </ul>
	RO/BOP	Verify AFW Actuation: <ul style="list-style-type: none"> <li>- Both motor driven AFW pumps running (determines P-38B unavailable, P-38A has tripped)</li> <li>- S/G levels Both &lt; (51%) 25%, If NO go to step 8</li> <li>- If YES, Steam supply valves to turbine driven AFW pump OPEN</li> <li>- <i>Recognize the turbine driven AFP has tripped and informs DOS</i></li> </ul>
	BOP/DOS	Direct an AO to investigate AFW problems
	BOP	Check both SI pumps running
	BOP/RO	Check both RHR pumps running
	BOP/RO	Check only one CCW pump running

Event Description: **Reactor/Turbine Trip (Excessive Condenser Vacuum Loss) with failure of Turbine to Trip Automatically or Manually leading to a Loss of Heat Sink due to Auxiliary Feedwater problems (Turbine Driven AFP over-speeds & P-38A discharge valve controller fails)**

Time	Position	Applicant's Actions or Behavior
	BOP	Verify Service Water Alignment: <ul style="list-style-type: none"> <li>- 6 service water pumps running</li> <li>- Service water isolation valves shut (SW-2930A/2930B, 2927A, 2927B, 2816, 4479, 4478, 2817)</li> <li>- Direct AO to locally check SW-LW-61, SW-LW-62 shut</li> </ul>
	BOP	Verify Containment Accident Cooling Units Running <ul style="list-style-type: none"> <li>- All accident fans running</li> <li>- 1SW-2907 &amp; 2908 OPEN</li> <li>- Unit 1 Containment Recirc Coolers Water Flow Low Alarm CLEAR</li> </ul>
	BOP	Check Control Room Fans Armed: <ul style="list-style-type: none"> <li>- W-14A &amp; W-13B2 WHITE LIGHT OFF</li> </ul>
	BOP	Check Control Room Ventilation IN ACCIDENT MODE: <ul style="list-style-type: none"> <li>- At least one control room recirc fan RUNNING</li> <li>- Control room damper solenoid valve PURPLE LIGHT LIT</li> </ul>
	BOP	Check if Main Steam Lines Can Remain Open, checks both MSIVs SHUT
	BOP	Verify proper SI valve alignment: <ul style="list-style-type: none"> <li>- Unit 1 SI active status panel ALL LIGHTS LIT</li> <li>- Unit 1 SI-Spray Ready status panel NO LIGHTS LIT</li> </ul>
	RO/BOP	Verify containment spray not required: <ul style="list-style-type: none"> <li>- Recognize containment pressure has remained &lt; 25 psig</li> </ul>

Op-Test No: 2000-1 Scenario No: 3 Event No: 6, 7, 8 Page     Of    

Event Description: **Reactor/Turbine Trip (Excessive Condenser Vacuum Loss) with failure of Turbine to Trip Automatically or Manually leading to a Loss of Heat Sink due to Auxiliary Feedwater problems (Turbine Driven AFP over-speeds & P-38A discharge valve controller fails)**

Time	Position	Applicant's Actions or Behavior
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	BOP	Verify SI Flow: <ul style="list-style-type: none"> <li>- RCS pressure &lt;1400 psig</li> <li>- If NO, proceed to RNO and next step</li> </ul>
	RO/BOP/DOS	Verify Secondary Heat Sink: <ul style="list-style-type: none"> <li>- Level in at least one S/G &gt;(51%) 29%</li> <li>- If NO RNO directs pumps manually started and valves realigned as necessary to establish AFW &gt; 200gpm</li> <li>- Determines cannot establish &gt; 200 GPM and transitions to CSP-H.1, "Response to Loss of Secondary Heat Sink"</li> </ul>

**Note that if S/G level is > 29% in previous step the crew could either make the decision to continue on in EOP-0 or immediately transition based on operator judgement. If the decision is made to continue on, the STA will commence monitoring Critical Safety Functions and will report a Red Path once conditions are met**

**Proceed to Next Event. (Recoverable Loss of Heat Sink)**

Event Description: **Recoverable Loss of Heat Sink using Main Feedwater Pumps**

Time	Position	Applicant's Actions or Behavior
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*Critical Step: It is critical that the crew recognizes a loss of secondary heat sink, properly transitions to CSP-H.1 and restores feedwater to the S/G's prior to Feed and Bleed Criteria.*

	DOS	Enter CSP-H.1 and brief foldout page criteria, cautions and notes
	RO	Check if secondary heat sink is required - Check RCS pressure greater than any non-faulted S/G pressure - Check RCS hot leg temperature > 350 F
	CREW	Check if RCS Bleed and Feed is required - Wide range S/G level in BOTH S/Gs < (145 inches) 55 inches OR - RCS pressure > 2335 psig due to loss of secondary heat sink - If either condition satisfied go to step 27 (continuous action per foldout page)
	RO/BOP	Verify S/G Blowdown and Sample isolation - Ensure S/G blowdown isolations SHUT - Ensure sample isolations SHUT
	RO/BOP	Check control room indications for cause of AFW failure - Check all suction pressure trips and overspeed trips-NOT ACTUATED - Ensure power supply to both motor driven AFW pumps - Ensure turbine driven AFW pump steam supply valves - AT LEAST ONE OPEN - Ensure AFW valves-PROPERLY ALIGNED

**Event Description: Recoverable Loss of Heat Sink using Main Feedwater Pumps**

Time	Position	Applicant's Actions or Behavior
	RO/BOP	Check total feed flow to S/Gs > 200 gpm - Recognize NO and performs RNO actions - Dispatch operator to locally align AFW valves per Attachment B - Continue attempts to restore AFW from Control Room
	RO	Stop both RCPs
	RO/BOP	Check condensate pumps --AT LEAST ONE RUNNING
	RO/BOP	Maintain hotwell level > 5 inches (continuous action)
	RO/BOP	Check condensate and feedwater piping--INTACT
<p><b>If asked, he AO will report that feedwater piping appears to be intact after a period of time</b></p>		
	RO/BOP	Establish feedwater flow path - Reset SI - Reset feedwater regulating valve(FRV) bypasses - Check FRV bypasses- AT LEAST ONE CAPABLE OF BEING OPENED
	RO/BOP	Check Main Feedwater Pumps – AT LEAST ONE RUNNING - Direct AO to locally start 1P-99A and 1P-99B - Ensure main feed AC lube oil pumps running (1P-73A/73B) - Manually open low pressure feedwater heater bypass valve (1CS-2273) - Start one MFW Pump

Event Description: **Recoverable Loss of Heat Sink using Main Feedwater Pumps**

Time	Position	Applicant's Actions or Behavior
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	RO/BOP	Check MFW Pump discharge MOV on running pump(s)- OPEN - 1CS-2190 (for 1P-29A) - 1CS-2189 (for 1P-28B)
	RO/BOP	Establish S/G levels - Throttle open FRV bypasses to establish flow to S/Gs (1CS-480/481) - Verify flow to S/Gs - CET STABLE or TRENDING LOWER - LEVEL in at least one S/G TRENDING HIGHER - Maintain feedwater flow to restore at least one S/G level to > (51%) 29%

**Upon restoration of feedwater flow and at the discretion of the Lead Examiner, this scenario can be terminated. Examinees may be asked to remain in the simulator until any evaluator follow-up questions are answered**