

Loss of Instrument Air/Loss of Heat Sink

<b>Program:</b>	TRPR 33.0,Licensed Operator Continuing	<b>Duration:</b>	3 hours
<b>Author:</b>	Pat Murphy	<b>References:</b>	AOP-5B, EOP-0, CSP-H.1, EOP-2, and EOP-1.1
<b>Commitments:</b>	None		

1.0 PURPOSE:

This is an NRC style performance mode scenario. The crew will respond to an instrument air leak, a turbine trip from full power, a failure of the reactor to automatically trip, a faulted SG, and a loss of heat sink.

2.0 OVERVIEW:

2.1 Event

Instrument air leak on the steam dump control manifold
Automatic turbine trip
Failure of automatic reactor trip
Safety valve fails open (after EOP entry)
P-38A starts then trips (after EOP entry)
AF-4019 fails open causing P-38B to trip (after EOP entry)

4/19/99

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Loss of Instrument Air/Loss of Heat Sink

2.2 Session Outline:

The initial conditions for this event has both plants at 100% power with the Unit 1 Steam driven AFP, 1P-29 tagged out for governor repair. The session starts with an instrument air leak on the manifold that controls the steam dump valves, the low pressure feedwater bypass valve, and the main generator hydrogen cooler for unit 1. After that is finished the turbine will trip but the reactor will not trip automatically. It will trip manually. As a result of the pressure transient caused by the turbine trip with no reactor trip and reduced steam dump capability, the SG safeties will open. One of them fails to reseal. After the trip occurs, both motor driven AFPs will trip causing a loss of heat sink. The crew will use CSP-H.1 to feed the SGs with main feed or condensate. After they establish feed they will transition back to EOP-0. They will transfer to EOP-2 to isolate the faulted SG. The exam will be terminated after the transition to EOP-2.

Loss of Instrument Air/Loss of Heat Sink

3.0 **BOOTH OPERATOR GUIDELINE:**

PREPARE and START the video equipment using Simulator Guideline SIMGL-08.0, AUDIO/VISUAL EQUIPMENT OPERATION, if required

3.1 **INITIALIZE** the simulator:

LOAD IC 2 or IC 21 which has the initial malfunctions loaded.

3.2 **VERIFY** the simulator setup for training per PBF-6801.

3.3 **ENTER** the simulator commands and set to enable as follows:

Initiator	Unit	Failure	Component	Option	Value	Ramp	Delay	Act	Condition
Setup	1	LOA	SGN2	N/A	0	N/A	N/A	D	N/A
Setup	1	VLV	SGN25	1	N/A	N/A	N/A	D	N/A
Setup	1	VLV	SGN15	1	N/A	N/A	N/A	D	N/A
Setup	1	VLV	SGN16	1	N/A	N/A	N/A	D	N/A
Setup	1	OVR IND	AFW17	N/A	0	N/A	N/A	D	N/A
Setup	1	VLV	SGN3	3	N/A	N/A	0	C	JCRFTR
Setup	1	MAL	PPL1A	2	1	N/A	N/A	D	N/A
Setup	1	MAL	PPL1B	2	1	N/A	N/A	D	N/A
Setup	1	BKR	AFW1	1	N/A	N/A	45	C	JPPLSI
Setup	1	CNH	AFW2	2	0	0	20	C	JPPLSI
Setup	1	BKR	AFW2	1	N/A	N/A	120	C	JPPLSI

Loss of Instrument Air/Loss of Heat Sink

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The pre-loads are used to tag out 1P-29, fail open a SG safety valve after the reactor trip, prevent an automatic reactor trip, and cause failure of both motor driven AFW pumps.

When crew has the watch	1	LEAK	CAS1	NODE 28	1500	60	0	D	N/A
After the air leak is addressed	1	MAL	EHC8	N/A	N/A	0	0	D	N/A

When sent to determine local flow rates, **DIS FT:3081, DIS FT:3082**. When sent as the AO to find the leak, tell the control room that the air leak is on the air manifold going to the controller for the steam dumps and the Low Pressure Feedwater heater Bypass valve. It can be isolated by closing IA-93 which can be accessed by using a ladder, which is in the area but it will take about 5 minutes to do this. To simulate this, **LOA CAS54 0**. The AO may be sent to gag valve 2273. If so use **LOA CFW44 0**. If sent to gag the hydrogen cooler use **LOA CFW38 .28** to open it to its current position of  $\approx 70\%$  open.

The AO will be directed to investigate 1AF-4019. He will find it open with the gag on the floor. He is unable to close it. If told to close any other valve, report that the bushing is stripped.

When the AO is directed to start the MFP seal water pumps use **LOA CFW83 2** for P-99A and **LOA CFW84 2** for P-99B.

If a MFP cannot be started the AO may be directed to open the breaker for the discharge MOV. To do this use the following component failures.

**VLV CFW15 Option 1 for CS-2190. Press ACT when the CO directs you to open the breaker**  
**VLV CFW13 Option 1 for CS-2189. Press ACT when the CO directs you to open the breaker**

Loss of Instrument Air/Loss of Heat Sink

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4.0 **POTENTIAL OPERATOR PROBLEMS:**

- 4.1 Review the cycle reports for specific areas of concern.
- 4.2 The crew direct the AO to shut IA-93 before they gag the affected valves which would cause a reactivity insertion.
- 4.3 The crew may not use the attachment in AOP-5B to determine the affects of the failure.
- 4.4 The crew may inappropriately transition to CSP-S.1 when the reactor fails to trip automatically.
- 4.5 The crew may not recognize the loss of heat sink immediately.
- 4.6 The crew may take manual control of the atmospheric of the intact SG and lower its setpoint while in CSP-H.1 which depletes the SG inventory sooner.
- 4.7 The crew may have difficulty establishing main feed to the SGs after the AFPs have all failed.

5.0 **IMPROVEMENT AREAS:**

- 5.1 Have the DSS tell the crew the area(s) that he expects them to work on during this session.
- 5.2 Communications should stress yes/no value trend during AOP/EOP usage. One individual should be assigned to monitor this and report this to the crew as part of the post-event debrief.

6.0 **OPERATING EXPERIENCE:**

There are several instances of inadvertent turbine trips in the industry.

At the Salem plant they had a failure of an automatic reactor trip but the manual trip was successful.

Loss of Instrument Air/Loss of Heat Sink

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7.0 **SESSION GUIDELINES:**

- 7.1 Tell the crew that this is a performance mode scenario. As long as the crew has the watch, they have the normal responsibilities of monitoring and operating the control boards. The DSS will lead the post-event debrief with assistance from the instructor. The DSS will conclude this session by updating the areas for improvement, as necessary. The instructor's role is to support the DSS in the training of his crew.
- 7.2 DSS or training assign roles based on individual needs ensuring crew rotation occurs.
- 7.3 Discuss the differences between the plant and the simulator, if necessary.

8.0 **TRAINING:**

- 8.1 The Instructor will conduct a shift turnover using information on the Shift Turnover Information sheet.
- 8.2 Place the simulator in RUN if not already done.

Loss of Instrument Air/Loss of Heat Sink

**Event 1: Loss of Instrument Air**

**Brief Description:** Air leak on the air manifold to the steam dumps.

Position	Expected Response		Instructor Notes
CO1	1.1	Respond to the Instrument Air Header Low Pressure alarm.	This satisfies the entry condition for AOP-5B.
DOS	1.2	Enter and direct the actions of AOP-5B.	When the standby air compressor starts the air header pressure will recover so the initial use of the AOP will be to verify that recovery of the air pressure is occurring.
ALL	1.3	Determine affected equipment when notified by the AO of the location of the air leak.	The steam dumps will not modulate, the Low Pressure Heater Bypass will fail open as will the hydrogen cooler temperature control valve. The crew will need to have a contingency plan to address these concerns as they determine their course of action. This contingency needs to address the fact that there is a potential for a reactivity transient if the FW bypass opens. Attachments S & T will help.

Loss of Instrument Air/Loss of Heat Sink

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**Event 2:** Main Turbine trip with no automatic reactor trip

**Brief Description:** The Main Turbine will inadvertently trip. This should cause an automatic reactor trip but that won't occur.

Position	Expected Response		Instructor Notes
CO1	1.1	Note and announce the turbine trip with no reactor trip. Manually trip the reactor using either set of pushbuttons.	<b>It is a critical task to trip the reactor in EOP-0 instead of transitioning to CSP-S.1. (E-0 - -A)</b>
DOS	1.2	Direct the tripping of the reactor if the CO does not do so.	The critical task is satisfied if the CO trips without direction to do so or if the DOS directs the CO to trip.
OS/DSS	1.3	Implement E-Plan.	This will be an alert based on valid RPS signal without a reactor trip.



Loss of Instrument Air/Loss of Heat Sink

**Event 3: Loss of Heat Sink**

**Brief Description: 1P-29 tagged is out to start the scenario. Both motor driven AFPs subsequently trip.**

Position	Expected Response		Instructor Notes
CO1,3 <sup>rd</sup>	1.1	Report the tripping of the AFPs.	This causes a loss of heat sink.
DOS	1.2	Implement CSP-H.1	This should be done based on a red path if the transition is made to EOP-0.1 or if the SI occurs early then EOP-0 will direct this at step 19. It is a critical task to establish feed flow into at least 1 SG before SG level drops to less than 55" in both SGs. (FR-H.1 - - A)
STA	1.3	Inform the DOS that heat sink is red path which requires a transition to CSP-H.1.	This may occur early if the transition to EOP-0.1 occurs before the SI occurs since the STA will be monitoring the CSFSTs as soon as the transition is made.

Loss of Instrument Air/Loss of Heat Sink

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**Event 4: Faulted SG**

**Brief Description:** One SG safety valve fails to reseal.

Position	Expected Response		Instructor Notes
CO1	1.1	Report the faulted SG.	This will be done after the transition back to EOP-0.
DOS	1.2	Implement EOP-2 to isolate the faulted SG.	It is a critical task to isolate the faulted SG before transition out of EOP-2. (E-2 - - A)
STA	1.3	Assist the crew in monitoring the status of the plant.	

9.0 **TERMINATION:**

- \* **TERMINATE** the scenario at the direction of the Lead Evaluator or when the faulted SG is isolated. It is acceptable to terminate after the first meaningful action is taken in EOP-2. If this is done then the last crew critical task is not applicable.
- \* **STOP** the video equipment if in use.
- \* **BRIEF** the DSS on the simulator session, if necessary.

Loss of Instrument Air/Loss of Heat Sink

10.0 **POST SIMULATOR EXERCISE DEBRIEF:**

The DSS (or his designee) or the Instructor will facilitate the critique.

\***Distribute** the Learning Objectives (Attachment 1) to the crew members if they were not distributed during the pre-exercise turnover.

<b><u>DID THE INDIVIDUALS:</u></b>	<b><u>DID THE CREW:</u></b>
Recognize off-normal trends	Diagnose the event
Interpret alarms and annunciators	Understand plant response
Diagnose events	Comply with procedures/Tech Specs
Demonstrate understanding of plant response	Function as a team
Adhere to and use plant procedures	Perform briefs
Operate Control Room equipment properly	Set clear goals and resolve any conflicts
Communicate and interact with the crew	Communicate in accordance with the communication standard
Direct shift operations/Make conservative decisions	Maintain proper control room conduct
Use Pre-action feedback	
Minimize the use of two-handed operation	

\* **DOCUMENT** comments on the Instructor Comment sheet and forward to the LOR Program Administrator for requal sessions

\* **REVIEW** instructor comments and any scenario attachments, as applicable

\* **REVIEW** video, as applicable

Loss of Instrument Air/Loss of Heat Sink

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11.0 **TASKS:**

**CONTROL OPERATOR:**

P000.036COT	Respond to a loss of instrument air.
P000.006COT	Respond to a reactor trip or safety injection
P000.027COT	Respond to turbine generator trips.
P000.028COT	Respond to loss of secondary heat sink.
P000.037COT	Respond to secondary coolant leaks.

**SENIOR REACTOR OPERATOR:**

P119.611SRO	Control personnel access and conduct in the control room.
P119.304SRO	Direct personnel to mitigate emergency/abnormal events.

**SHIFT TECHNICAL ADVISOR:**

C000.002STA	Provide independent assessment of off-normal plant conditions.
C000.003STA	Provide assessment of the crew's response to abnormal plant conditions.
C000.004STA	Advise the crew on actions needed to terminate or mitigate the consequences of an off-normal event.
C000.005STA	Perform monitoring of critical safety function status trees.

12.0 **EVALUATION AND MAKEUP:**

12.1 Evaluation will be done during the scenario by the OM or the AOM with assistance from the instructor.

12.2 If feasible, makeups shall be completed by attending another simulator session. If not, the makeup should consist of an instructor-led, simulator walk-through of the applicable procedures and Technical Specifications for each event in the Simulator Guide.

Loss of Instrument Air/Loss of Heat Sink

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13.0 LOR SAMPLE PLAN INFORMATION (For LOR use only)

<u>Lesson plan setting</u>	<u>Hours</u>	<u>Topic areas</u>	<u>Hours</u>
Classroom	0.0	Systems	0.0
Simulator	<u>3.0</u>	AOPs	1.0
		TS/Admin/DCS	0.0
		EOPs/SEPs	1.5
		OPs/OIs/RPs	0.0
		Outage	0.0
		Industry Events	0.0
		ECA/CSP	0.5
		Fundamentals	<u>0.0</u>
Total hours	3.0		3.0

Loss of Instrument Air/Loss of Heat Sink

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**SHIFT STAFFING:** (For requalification scenarios send to LOR Program Administrator)

Scenario Title:	Crew:	Cycle:	Date:
DSS			
DOS			
OS			
STA			
CO1			
CO2			
3 <sup>rd</sup>			

**INSTRUCTOR'S COMMENTS:**

Include as a minimum the following items:

- Any simulator fidelity problems
- Any crew procedural problems
- Any equipment operation problems or systems knowledge weaknesses exhibited by the crew
- Any changes needed to the Simulator System Failures manual

Loss of Instrument Air/Loss of Heat Sink

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**ATTACHMENT 1  
LEARNING OBJECTIVES**

STATE the immediate action steps of EOP-0 and given access to appropriate Site Specific Simulator indications, VERIFY that their intent is satisfied. (031.02.LP0405.006)

RECOGNIZE the existence of or the need for an SI Actuation. (031.02.LP0405.007)

Given access to the Site Specific Simulator or specific plant conditions, ASSESS response of the Safeguards systems to specified accident conditions. Assessment should include conditions requiring actuation and the systems response to each actuation signal. (031.02.LP0405.013)

RECOGNIZE and DESCRIBE the differences in plant response for a Turbine Trip below P-9 (49%) and a Turbine Trip above P-9 (49%). (055.03.SG0015.001)

Given access to the Site Specific Simulator and specific plant conditions, RECOGNIZE Reactor Trip Criteria and RESPOND to these criteria as required. (055.03.SG0015.003)

Given access to the Site Specific, EVALUATE plant indications associated with the following events: (055.03.LP2439.004)

- a. Secondary Coolant System leak
- b. Loss of Instrument Air

PREDICT/EXPLAIN the primary and secondary plant effects for a more subcooled liquid entering the Steam Generators (such as bypassing the LP Feedwater Heaters) and potential impact on safety limits. (043.02.LP2462.001)

RECOGNIZE when a loss of Heat Sink occurs. (043.03.LP1998.002)

APPRAISE and PRIORITIZE each operator-initiated recovery technique in its ability to restore the Heat Sink Critical Safety Function. (043.03.LP1998.007)

Loss of Instrument Air/Loss of Heat Sink

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**ATTACHMENT 2**  
**SHIFT TURNOVER INFORMATION**

1.0 PLANT CONDITIONS:

**UNIT 1**

Time in core life: MOL  
Reactor power: 100%  
Boron concentration: 827 ppm  
Rod height: D @ 220 steps

**UNIT 2**

Time in core life: BOL  
Reactor power: 100%  
Boron concentration: 1310 ppm  
Rod height: D @ 220 steps

Day of week, support staff Sunday, no plant groups on site except the crew working on 1P-29.

2.0 LCO/TECHNICAL SPECIFICATIONS IN EFFECT:

TS Number  
15.3.4.C.1

Description  
72 hour LCO

Reason  
Governor valve repair

3.0 EQUIPMENT OUT OF SERVICE:

1P-29 is tagged out for maintenance on the governor valve. It has been out of service for 6 hours and is expected back within another 6 hours.

4.0 PLANNED EVOLUTIONS:

NONE

5.0 TURNOVER INFORMATION

NONE