

DUANE ARNOLD ENERGY CENTER

NRC REQUALIFICATION EXAM

SIMULATOR EVALUATION

SCENARIO GUIDE

NUMBER 20

**TITLE: Hydraulic Lock ATWS-Unisolable Steam Leak in
Steam Tunnel-Failed HPCI Isolation**

DEVELOPED BY:

Name

Date

OPERATIONS SUPERVISOR
APPROVAL:

Name

Date

TRAINING SUPERVISOR
APPROVAL:

Name

Date

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V PDC

OBJECTIVES

A. TERMINAL OBJECTIVE:

The operator, acting as a member of a shift operating crew, must demonstrate competence in performance of license duties required to protect the public health and safety while operating the plant in accordance with approved instructions and procedures.

B. ENABLING OBJECTIVES:

1. Following a pre-shift brief, each crew member will be able to provide a detailed plant status report to include:
 - a. Status of safety-related systems, running equipment, and inoperable equipment.
 - b. STPs in progress and any existing LCOs.
 - c. Pertinent night orders and planned evolutions.
2. Using plant installed instrumentation and plant procedures, as well as information obtained by operating personnel outside the Control Room, the operating crew will correctly diagnose plant problems.
3. The OSS will be able to use appropriate plant procedures to ensure completion of immediate actions and direct subsequent actions as required.
4. When using plant procedures, the NSOE/ANSOE will be able to:
 - a. Locate the proper section of the procedure.
 - b. Follow the procedure correctly.
 - c. Locate and observe installed instrumentation.
 - d. Analyze system response.
 - e. Direct plant operators (Second ANSOE and Auxiliary Operators).
 - f. Inform the OSS when complete.
5. While operating in accordance with the Emergency Operating Procedures, the OSS will:
 - a. Identify all EOP entry conditions.
 - b. Direct the NSOE/ANSOE to perform required actions for control of reactor power, level, pressure, or containment parameters.
 - c. Specify the plant systems to be used to control plant parameters.
 - d. Evaluate changes in plant conditions against current actions being taken and make corrections as necessary.
6. When directed by the OSS to perform actions in accordance with the Emergency Operating Procedures, the NSOE/ANSOE will:
 - a. Utilize the systems designated by the OSS.

- b. Monitor system performance; i.e., pressure flow, etc.
- c. Inform the OSS immediately when a system becomes unavailable for further use.
- d. Inform the OSS of plant trends in response to actions taken.
7. Given a set of plant conditions, the OSS will be able to comply with the requirements of Technical Specifications and the Administrative Procedures.
8. The OSS will be able to utilize the Emergency Plan to properly:
 - a. Evaluate plant conditions and determine the emergency classification.
 - b. Ensure requisite notifications are made.
9. The STA will assist the operating crew as required to:
 - a. Ascertain that plant response is as predicted in the UFSAR during transients, accidents, and plant emergencies and report abnormalities to the OSS.
 - b. Provide technical assistance and perform whatever activities are deemed necessary by the OSS because of specific plant conditions.
 - c. Review the status of inoperable equipment to determine whether the loss of the equipment is a situation addressed by Technical Specifications requiring specific action by the plant staff.
10. The crew members will demonstrate effective communications, exchanging complete and relevant information in order to make team decisions in a timely manner.
11. The NSOE/ANSOE will be able to perform the following operator actions, in response to plant events:
 - a. Conducts all rod movement IAW pull sheet.
 - b. Diagnoses failed Group I isolation.
 - c. Recognize failure to successfully insert all rods on the scram.
 - d. Restores and maintains RPV level 170-211.
 - e. Control reactor pressure using .LLS, HPCI, RCIC.
 - f. Insert rods per EOP-C's.
 - g. Recognize failed HPCI isolation.

NARRATIVE SUMMARY

The plant is operating at 75% power with the "A" CRD pump inop for motor bearing replacement.

Shortly after assuming the watch, the crew will have indications of a loss of continuity for the "B" squib valve in the Standby Liquid Control system. This will require the crew to enter a 7-day LCO per section 3.4 of Tech Specs.

A steam leak will then develop on the HPCI steam line in the tunnel. As steam tunnel temperatures increase a Group I isolation will occur with a failure of the "A" Main Steam Line to isolate. A reactor scram will occur with only partial rod insertion due to a hydraulic lock in the Scram Discharge Volume. The crew will enter EOP ATWS and EOP-3. Manually closing the MSIV's will result in the closure of the outbd MSIV only.

During attempts to insert rods, a HPCI steam supply line break will occur in the HPCI room, causing temperatures to rise. A HPCI isolation will fail to close the steam supply isolation valves (MO-2238, MO-2239) requiring the operators to manually close the valves and continue with efforts to shutdown the reactor.

SIMULATOR SETUP

1. GENERAL INSTRUCTIONS

- a. Reset to I.C. 36 (75% power)
- b. Verify rod pull sheet correct and IPOI-3 in progress

2. LIST OF MALFUNCTIONS

Type RMF ESG20

Time	Malf.	Description	ET	Delay	F. Sev.	Ramp.	I. Sev.
0	RP05F	ATWS Hydraulic Lock					
0	MS05A	CV4412 Disc Failure			100%		
0	MS20B	CV4413 Group 1 Isolation Fail					
0	MS31C	Group 6 Isol. Value Fail to Close (2238)					
0	MS31D	Group 6 Isol. Value Fail to Close (2239)					
0	RD11A	CRD Pump Trip (A pump)					
5	SL03B	Squib Valve Loss of Continuity					
15	SW35	Steam Tunnel Coolers GSW Flow Blockage			100%		
15	MS08	HPCI Steam Line Break in Tunnel			0.4%	4 min	0%
15	SW35	Steam tunnel cooler blockage			100%	60 sec.	0%
20	MS08	HPCI Steam Line Break in Tunnel			20%	10 min	0.4%
30	HP05	HPCI Steam Supply Line Break			0.15%	4 min	0%

3. Remote Functions

4. LIST OF OVERRIDES (t= 0, type ROR ESG20)

TAG	ET	DEL	OR VALUE
RDHS 1807A (Green)			OFF
RDHS 1807A (White)			OFF
RDHS 1807A (Red)			OFF
RDHS 1830			NORM

LIST OF CRITICAL TASKS

CRITICAL TASKS	RO/SRO
1. Declare 7 day LCO per Tech Spec. 3.4.B.1	A OSS
2. Recognize failure of the "A" Main Steam Line to isolate on a Group I isolation.	NSOE
3. Manually isolate the "A" Main Steam line (outbd valve only).	NSOE
4. Recognize that all rods did not fully insert.	ANSOE
5. Perform Alternate Rod Insertion procedures per EOP-C section 5.0 as directed.	ANSOE
6. Recognize failure of HPCI steam supply to isolate.	NSOE
7. Manually isolate the HPCI steam supply line.	NSOE
8. Direct Boron injection prior to reaching the Boron Injection Initiation Temperature.	A OSS
9. Inject Boron prior to reaching the Boron Injection Initiation Temperature, when directed.	ANSOE
10. Direct injection into the vessel be secured except CRD and SBLC. Direct level be maintained in accordance with ATWS Level/Power Criteria.	A OSS
11. Secure injection into the vessel and maintain RPV level as directed.	ANSOE
12. Direct Torus Cooling be maximized if Torus temperature > 95°F.	A OSS
13. Maximize Torus Cooling when directed.	NSOE
14. Declare an Alert.	A OSS
15. Notify State/County within 15 minutes, and NRC within 1 hour.	B OSS
16. Evacuate the plant if an Alert or above is declared.	B OSS
<p>Note: Specific Critical Tasks may be assigned to specific individuals; however, any crew member may perform the task without causing a failure of the assigned individual.</p>	

SHIFT TURNOVER

PLANT CONDITIONS: Reactor at 75% power. No evolutions currently in progress.

EQUIPMENT STATUS: "A" CRD pump inop for motor bearing replacement.

TIME/NOTES	INSTRUCTOR ACTIVITY	EXPECTED ACTIONS/BEHAVIOR
T = 5 min	<p>When the crew has completed the shift brief insert malfunction SL03B.</p> <p>Respond as SAN SOE/AUX. Operator, report all power supplies operable.</p>	<p>Crew investigates squib valve continuity problem. ARP 1C05A (B-2)</p> <ul style="list-style-type: none"> ▪ Investigate power supplies * A OSS: Declare 7 day LCO per Tech Spec. 3.4.B.1
T ≈ 15 min	<p>Insert malfunction SW35 at 100%.</p> <p>Insert malfunction MS08 at 0% and ramp to 0.4% over 4 minutes.</p>	<p>Crew responds to Hi Steam Leak and/or Hi ΔT alarm.</p> <ul style="list-style-type: none"> ▪ Check temperature indications at 1C2I ▪ OSS enters EOP-3 on high steam tunnel temperatures.

TIME/NOTES	INSTRUCTOR ACTIVITY	EXPECTED ACTIONS/BEHAVIOR
<p>T ≈ 15 min (continued)</p>	<p>SANSOE: If requested, report steam tunnel temperatures by using monitored parameter HVTMSLAR</p> <p>When a Group 1 isolation occurs modify malfunction MS08 to ramp to 20% over 10 minutes.</p> <p>When requested, insert EOP-C Defeat 3 (RMF Defeat3)</p>	<p>Crew responds to Group 1 isolation and Partial ATWS</p> <ul style="list-style-type: none"> * NSOE: Recognize failure of the "A" Main Steam line to isolate on a Group 1 isolation. * NSOE: Manually isolate isolate the "A" Main Steam line (Note: only the outbd valve will close using the handswitch) * ANSOE: Recognize that all rods did not fully insert <p>A OSS: Enters EOP ATWS and directs the following:</p> <ul style="list-style-type: none"> ▪ Reactor level maintained +15" - +211". ▪ Pressure controlled using HPCI, RCIC or SRV's. ▪ Manual scram inserted using pushbuttons. ▪ Mode switch taken to 'Shutdown". ▪ Verify Recirc pump runback and insert ARI trip ▪ Lockout ADS ▪ Bypass CV-4371A ▪ Alternate Rod Insertion per EOP-C's. <ul style="list-style-type: none"> * ANSOE: Perform Alternate Rod Insertion procedures per EOP-C section 5.0 as directed. ▪ Reset scram, drain SDV, and scram reactor. ▪ Manually drive rods <p>NSOE: Control pressure using HPCI, RCIC or LLS.</p>

TIME/NOTES	INSTRUCTOR ACTIVITY	EXPECTED ACTIONS/BEHAVIOR
<p>T ≈ 15 min (continued)</p>		<ul style="list-style-type: none"> * A OSS: Direct Torus Cooling be maximized if Torus Water temperature > 95°F. * NSOE: Maximizes Torus Cooling when directed. <p>The following actions will be required if Torus Water temperature approaches 110°F:</p> <ul style="list-style-type: none"> * A OSS: Direct Boron injection prior to reaching the Boron Injection Initiation Temperature curve. * ANSOE: Inject Boron prior to reaching the Boron Injection Initiation Temperature curve, when directed. * A OSS: Direct injection into the vessel be secured except CRD and SBLC. Direct level be maintained IAW ATWS Power/Level criteria * ANSOE: Secure injection into the vessel and maintain RPV level as directed. <p>NSOE: Control Pressure using HPCI, RCIC, or SRV's.</p>
<p>T ≈ 30 min (or if HPCI started)</p>	<p>Insert malfunction HP05 at 0% and ramp to 0.15% over 4 minutes</p> <p>SANSOE/AUX. Operator: If requested to investigate HPCI room status following isolation, report the room is steamy but indications are such that the leak appears to be stopped.</p>	<p>Crew responds to rising temperatures in HPCI room and HPCI LOGIC AUTO ISOLATION INITIATED alarms (1C03C, D-3,4)</p> <ul style="list-style-type: none"> * NSOE: Recognize failure of HPCI steam supply line to isolate * NSOE: Manually isolate the HPCI steam supply line ▪ Use handswitches to close MO-2238,2239

TIME/NOTES	INSTRUCTOR ACTIVITY	EXPECTED ACTIONS/BEHAVIOR
		<ul style="list-style-type: none"> * A OSS: Declare an Alert * B OSS: Notify State/County within 15 minutes, and NRC within 1 hour. * B OSS: Evacuate the plant <p>Crew continues to re-scrum and drain SDV until all rods are in.</p> <ul style="list-style-type: none"> ▪ When all rods are in, EOP-ATWS is exited and EOP-1 is entered.
T ≈ 50 min	When the reactor is shutdown with all rods inserted and reactor level and pressure are under control, containment parameters are stable, and the OSS has addressed the Emergency Plan, place the simulator in freeze.	

REFERENCES

PROCEDURE	SECTION	PROCEDURE REVISION
Annunicator Response Procedures <ul style="list-style-type: none"> ▪ ARP 1C05A ▪ ARP 1C04B ▪ ARP 1C03C 	X-B-2 B-4, D-4 D-3, D-4	11 11 12
Integrated Plant Operating Instructions IPOI 5	3.1, 3.2	4
Emergency Operating Procedures EOP 1 EOP 2 EOP 3 EOP ATWS EOP C's	A11 A11 A11 A11 5.0	0 0 0 0 11
Emergency Plan Implementing Procedures EIPs	1.1, 1.2, 1.3	60

ENTRY CONDITION: Placing Second Reactor Feed Pump in Operation		
K/A System/Evolution	Ability No.	RO/SRO
259001 Reactor Feedwater	A1.01	3.3/3.3
	A1.03	2.8/2.8
	A4.01	3.6/3.5
	A4.02	3.9/3.7
	A4.04	3.1/2.9
	A4.05	4.0/3.9
	A4.07	3.3/3.2
	A4.08	3.3/3.3
	SG #9	3.7/3.5
	SG #10	3.2/3.3
	SG #13	3.6/3.4
259002 Reactor Water Level Control	A1.01	3.8/3.8
	A1.02	3.6/3.5
	A1.04	3.6/3.6
	A1.05	2.9/2.9
	A3.02	3.4/3.4
	A3.04	3.2/3.2
	A4.01	3.8/3.6
	A4.02	3.7/3.6
	A4.03	3.8/3.6
	SG #9	3.8/3.6
	SG #13	3.8/3.5

DAEC TASKS

ENTRY CONDITION: Placing Second Reactor Feed Pump in Operation		
DAEC System	RO Task No.	SRO Task No.
Feedwater (BB)	BB.0018	BB0018

ENTRY CONDITION: Any Auto Reactor Scram Signal - Full Scram		
K/A System/Evolution	Ability No.	RO/SRO
212000 RPS	A1.06	4.2/4.2
	A1.07	3.4/3.4
	A1.08	3.4/3.4
	A1.11	3.4/3.3
	A2.20	4.1/4.2
	A3.01	4.4/4.4
	A3.03	4.2/4.2
	A3.04	3.9/3.8
	A3.05	3.9/3.9
	A3.07	3.6/3.6
	SG #13	4.1/4.1
	SG #14	4.3/4.4
	295006 Scram Abnormal Plant Evolution	AA1.01
AA1.02		3.9/3.8
AA1.03		3.7/3.7
AA1.04		3.1/3.2
AA1.05		4.2/4.2
AA1.06		3.5/3.6
AA1.07		4.1/4.1
AA2.01		4.5/4.6
AA2.02		4.3/4.4
AA2.03		4.0/4.2
AA2.04		4.1/4.1
AA2.05		4.6/4.6
AA2.06		3.5/3.8
SG #6		4.1/4.2
SG #10		4.1/4.2
SG #11	4.3/4.5	
SG #12	3.8/4.4	

DAEC TASKS

ENTRY CONDITION: Any Auto Reactor Scram Signal		
DAEC System	RO Task No.	SRO Task No.
IPOI (SSS)	**SSS.004	**SSS.004
Admin (UUU)		UUU.018 UUU.027

ENTRY CONDITION: MALF MS04A - MSL "A" Rupture Inside Primary Containment/W MSIV Failure		
K/A System/Evolution	Ability No.	RO/SRO
239001 Main and Reheat Steam System	A2.04	3.5/3.6
	A2.07	3.8/3.9
	A2.11	4.1/4.3
	A2.12	4.2/4.3
	A3.01	4.2/4.1
	A4.03	3.5/3.5
	A4.04	3.8/3.7
	A4.05	2.7/2.7
	A4.06	3.6/3.8
	A4.07	3.3/3.3
	A4.08	3.7/3.7
	A4.09	3.9/3.9
A4.10	3.8/3.8	
	SG #15	4.2/4.3
223002 PCIS/NSSS	A2.09	3.6/3.7
	A3.01	3.4/3.4
	A3.02	3.5/3.5
	SG #15	4.1/4.3

ENTRY CONDITION:		
K/A System/Evolution	Ability No.	RO/SRO
295033 HIGH Secondary Containment Temp.	EK1.01	3.6/3.8
	EK1.02	3.6/4.0
	EK3.01	3.5/3.8
	EAI.05	3.7/3.9
	SG #1	3.1/4.0
	SG #2	2.9/4.4
	SG #6	3.8/3.7
	SG #10	3.8/3.6
	SG #11	4.1/4.2
	SG #12	3.6/4.4

DAEC TASKS

ENTRY CONDITION: MALF MS04A - MSL "A" Rupture Inside Primary Containment/W MSIV Failure		
DAEC System	RO Task No.	SRO Task No.
EOP's (TTT)	TTT.0011	TTT.0011
	TTT.0020	TTT.0020
Administrative (UUU)		UUU.0050
		UUU.0051
		UUU.0052
		UUU.0053