

SRO INSTANT Scenario #1	
SRO Normal Evolution	Secure FW-P-1A during Power Operations
Component Failure	Dropped Rod
RO Reactivity Change	Manual power reduction from 68-60% power.
Instrumentation Failure	Pressurizer Level Controller Failure
Major Malfunction	Loss of Main Feedwater
Instrumentation Failure	RPS Auto Trip Failure (ATWS)
Major Malfunction	LOCA, with Loss of SCM.
Component Failure	HPI Pump Automatic Start Failure.

SRO INSTANT Simulator Scenario #1			
Quantitative Attributes		Target	Actual
Total Malfunctions		5-8	6
Dropped Control Rod	ATWS		
Pzr Level Controller Failure	LOCA		
FWP Trip	HPI Pump Failure		
Malfunctions After EOP Entry		1-2	2
LOCA			
HPI Pump failure			
Abnormal Events		2-4	2
Dropped control rod.			
Manual Pressurizer level control.			
Major Transients		1-2	2
Loss of Main Feedwater.			
LOCA with loss of subcooling margin.			
EOPs Entered With Substantive Actions		1-2	1
EOP-002, Loss of Subcooling Margin.			
EOP Contingencies Requiring Substantive Actions		0-2	1
EOP-010, Abnormal Transients, Rules, Guides and Graphs			
Critical Tasks		2-3	2 RO 1 SRO
RO	Initiate manual reactor trip.		
RO	Trip RCPs within 1 minute following loss of subcooling margin.		
SRO	Transition from OP-TM-EOP-001, Reactor Trip, to OP-TMI-EOP-002, Loss of 25F Subcooling Margin.		

Simulator Scenario #1				
SRO INSTANT			Req'd	Actual
As RO	Reactivity		1	1
	Manual power reduction from 68% to less than 60%.			
	Instrument/Component Failures		2	4
	I – Pzr level controller	C - Dropped control rod		
	I – RPS auto trip failure	C – HPI Pump failure		
	Major		1	2
Loss of Main Feedwater				
LOCA, with loss of Subcooling Margin				
As SRO	Normal Evolution		1	1
	Secure FW-P-1A			
	Instrument/Component Failure		2	4
	I – Pzr level controller	C - Dropped control rod		
	I – RPS auto trip failure	C – HPI Pump failure		
	Major		1	2
Loss of Main Feedwater				
LOCA, with loss of Subcooling Margin				

GENERAL DESCRIPTION OF SCENARIO

This scenario provides the opportunity for the team and individuals to demonstrate ability to utilize normal, emergency, and accident mitigation procedures, and compliance with Technical Specifications requirements.

It exposes the examinees to operational situations that enable examiners to evaluate the ability of the crew to:

- 1) Perform normal operations (secure a Main Feedwater pump).
- 2) Execute a forced power reduction (due to a dropped control rod) with the Integrated Control System (ICS) in manual control mode, in order to comply with plant technical specifications and plant emergency procedures designed to protect against unacceptable core power distributions that could result in excessive core power densities and core temperatures.
- 3) Manually control Pressurizer level to maintain RCS inventory control following failure of an automatic controller.
- 3) Implement emergency operating procedures to respond to loss of Main Feedwater and Main Turbine trip concurrent with an ATWS (reactor fails to trip).
- 4) Prioritize operator actions to mitigate effects of a loss of reactor coolant accident that produces saturated liquid conditions in the reactor core:
 - Inject sufficient water into the Reactor Coolant System to prevent gross fuel damage due to overheating the reactor core.
 - Ensure Containment Building isolation to minimize radioactive releases to the environment.

Estimated scenario time - 60 minutes.

Critical Tasks

1 SRO Critical Task
2 RO Critical Tasks

REFERENCES

A. 10 CFR 55.45 Operating Tests, (a) Content (3), (4), (5), (6), (7), (8), (9), (12), (13)

B. PROCEDURES

OP 1102-4	Power Operation (marked up copy)
OP 1105-4	Integrated Control System
OP-1106-3	Feedwater System
OP 1105-9	Control Rod Drive System
EP 1202-8	CRD Equipment Failure
EP 1202-29	Pressurizer System Failures
OP-TM-EOP-001	Reactor Trip
OP-TM-EOP-002	Loss of 25°F Subcooled Margin
OP-TM-EOP-006	LOCA Cooldown
OP-TM-EOP-010	Abnormal Transients Rules, Guides and Graphs

Alarm Responses:

G-2-1	CRD PATTERN ASYMMETRIC
G-1-8	TSAT MARGIN A/B LO
M-1-1	FW-P-1A TRIP

C. OTHER

SIMULATOR INITIALIZATION

- A. IC16 100% power, steady state, MOC.
 Reduce power to 68% and stabilize the plant.
 Transfer ICS to Manual:
 Rx-Stm Gen Master
 FW Loop Masters A and B
 ICS Reactor Master H/A Station

Secure all MOPs
 Start FWP auxiliary. oil pumps, LO-P-8A and LO-P-8B.
 Reduce to 4 Powdex Vessels.

- B. EVENT TRIGGERS
 None

- C. MALFUNCTIONS

Malfunction	Description	Activation Instructions
RD28	Automatic Reactor Trip Block	IMMEDIATELY
MU23C	MU-P-1C ES Start Failure	IMMEDIATELY
RD0117	Dropped Rod (Group 7, Rod 1)	Event 2
FW15B	FW-P-1B Trip	Event 5
MU16A	Line (A) HPI Leak in RB (downstream of venturi)	25% Severity on Event 7

- D. REMOTE FUNCTIONS

1. **FWR34** Powdex Vessel A to Standby **immediately (at 68% power)**.

- E. OVERRIDES

1. 02A5A06-ZAIRC1LIC Set at 0 and assign to **Event #4** (fails MU-V-17 auto controller so valve closes in automatic).

- F. MONITOR

Set MSK2609A = 215.7 immediately (auxiliary steam pressure).

SHIFT BRIEFING

NOTE: This sheet is to be provided to the examinees for review.

Reactor power has been reduced to 68% in preparation for removing FW-P-1A from service for maintenance (shaft coupling problem).

ICS is in manual due to OTSG-Reactor Master failure.

Plant is stable.

Xenon reactivity is rising.

Orders for the shift:

1. Secure FW-P-1A in accordance with OP 1106-3, Feedwater System.
2. Maintain 68% power during FW-P-1A maintenance activities.

Scenario Outline

Simulation Facility:	Three Mile Island Unit 1	Scenario No.:	#1	Op Test No.:	
Examiners	_____	Operators	_____	CRS	
	_____		_____	URO	
	_____		_____	PRO	
Description	Evaluate the ability of the crew to perform normal operations (secure FWP) and forced power reduction (due to dropped control rod) with ICS in manual. Following the power reduction, a controller failure requires the operator to implement manual Pressurizer level control. When the only operating Feedwater Pump trips, the Main Turbine trips, but the reactor does not (ATWS). The operator is required initiate a manual reactor trip. Following reactor trip, an RCS piping break results in loss of Reactor Coolant, and saturated liquid conditions. The overall scenario provides the opportunity to demonstrate ability to utilize normal, emergency, and accident mitigation procedures, and compliance with Technical Specifications requirements.				
Initial Conditions	ICS in manual due to SG-Rx Master controller failure (Malfunction IC23 OTSG Reactor Master output fails to zero volts). Plant is at 68% power, ready to secure FW-P-1A for coupling repair.				
Turnover	See Attached "Shift Turnover" Sheet				

Event No.	Malf. No.	Event Type*	Event Description
1		URO ARO N US	Secure feedwater pump (FW-P-1A) .
2	RD0117	C URO C ARO US	Dropped Control Rod in controlling group.
3		R URO ARO US	Manual power reduction due to dropped rod. Technical Specification compliance.
4	AI OVERRIDE	I URO I ARO US	Pressurizer level controller fails to 0% demand, closing makeup control valve (MU-V-17).
5	FW15B	M URO M ARO M US	Loss of feedwater due to feedwater pump (FW-P-1B) failure.
6	RD28	I URO I ARO US	"ATWS – RPS Auto Trip Failure.
7	MU16A	M URO M ARO M US	Small Break LOCA, Loss of Subcooling Margin
8	MU23C	C URO C ARO C US	High pressure injection pump (MU-P-1C) fails to automatically start.

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

Event No. 1 – Secure Feedwater Pump (FW-P-1A).		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
<i>SRO Normal Evolution</i>	US	1.1 Direct the ARO to secure feedwater pump FW-P-1A in accordance with OP 1106-3, Feedwater System, Section 3.5.
	URO	1.2 Monitor plant parameters (ICS is in manual), and assist as directed.
	ARO	1.3 Secures FW-P-1A using OP 1106-3, Feedwater System, Section 3.5:
	ARO	1.3.1 Transfer FW-P-1A ICS control station to Hand.
	ARO	1.3.2 Reduce FW-P-1A load and pump speed while verifying FW Valve DP is maintained by FW-P-1B.
	ARO	1.3.3 When all load is transferred to FW-P-1B, reduce FW-P-1A speed demand to 0%.
	ARO	1.3.4 Using the Motor Speed Changer, reduce FW-P-1A speed until the LOW SPEED STOP light illuminates, and the HIGH SPEED STOP light de-energizes.
	ARO	1.3.5 Depress FW-P-1A Manual Trip pushbutton.
	ARO	1.3.6 Verify MAP M-1-1 actuates.
	ARO	1.3.7 Verify FW-P-1A TRIP Light illuminates.
	ARO	1.3.8 Verify HP and LP stop valves closed.
	ARO	1.3.9 Verify FW-P-1A TRIP light illuminates.
	ARO	1.3.10 Verify FW-V-1A is closed.
	ARO	1.3.11 Using the radio, direct an AO to open CO-V-374A (CO-V-9A equalizing valve) to keep FW Pump warm and filled.
	ARO	1.3.12 Close FW-P-1A suction valve.
ARO	1.3.13 Open FP Turbine A drain valves.	
ARO	1.3.14 Start FW-P-1A Turning Gear motor.	
ARO	1.3.15 Using the plant radio, direct an AO to adjust FW-P-1A cooling as needed, and to monitor lube oil filter DP.	

Events No. 2 and 3 – Dropped Rod and Manual Power Reduction.			
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>	
<i>RO/SRO Component Failure - Dropped Rod</i>	<i>Team</i>	1.0 Recognizes and announces dropped control rod.	
	<i>US</i>	2.0 Concurs with plant conditions, and directs team to perform EP 1202-08, CRD Equipment Failure, immediate actions for the dropped rod (Section B of the procedure).	
	<i>RO Reactivity Change</i>	<i>URO</i>	3.0 Manually reduces reactor power to less than 60%. Since ICS is in manual, ARO assists with manual reductions in Loop A and Loop B Main FW Flow, FW-P-1B speed, and Main Turbine Load.
		<i>ARO</i>	3.1 Assists with the manual power reduction in coordination with URO.
		<i>URO</i>	3.2 Announces completion of EP 1202-8 Section B, Dropped Rod, immediate actions.
		<i>US</i>	3.3 Concurs with completion of EP 1202-8 Section B, Dropped Rod, immediate actions for dropped rod.
		<i>US</i>	4.0 Supervises CRO activities to stabilize the plant.
		<i>US</i>	5.0 Announces transition to follow-up actions of EP 1202-8, Section B, and begins directing actions.
		<i>US</i>	5.1 Verifies rod group overlap between groups 6 and 7 is 25% ±5%.
		<i>US</i>	5.2 Obtains a computer printout of Nuclear Applications Software (NAS) displays 1, 4, 5, 18, and 20.
<i>US</i>		5.3 Notifies Plant Operations Management, Plant Nuclear Engineers and the dispatcher regarding current plant status.	
<i>SRO Tech Spec Compliance</i>		<i>US</i>	5.4 Ensures compliance with Technical Specifications and Cycle Operating Limits Report (COLR): <ul style="list-style-type: none"> • Core power distribution limits. • Axial imbalance. • Quadrant power tilt. • Rod index.
	<i>US</i>	5.5 Approximately 15 minutes after the plant is stable, obtains printouts from Nuclear Applications Software (NAS) displays #1, 5, 17, and 18.	

Event No. 4 – Pressurizer Level Controller Failure.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
	URO	1.0 Recognizes and announces lowering Pressurizer level.
	URO	2.0 Recognizes and announces 0 gpm Makeup Flow.
	URO	3.0 Diagnoses MU-V-17 closure.
		4.0 Announces entrance into EP 1202-29 Section D, Malfunction in Pressurizer Level Indication or Control.
		5.0 Directs URO to perform immediate actions of EP 1202-29 Section D, Malfunction in Pressurizer Level Indication or Control.
	URO	5.1 Transfers MU-V-17 to Manual control.
	URO	5.2 Manually opens MU-V-17, to terminate reduction in Pressurizer level.
	URO	6.0 Announces completion of applicable immediate actions of EP 1202-29 Section D, Malfunction in Pressurizer Level Indication or Control.
	US	6.1 Concurs that immediate applicable manual actions of EP 1202-29 Section D, Malfunction in Pressurizer Level Indication or Control, have been completed.
	US	7.0 Directs URO to manually adjust valve position as required to return Pressurizer level to normal (220 inches) and then to maintain Pressurizer level at 220 inches.
	URO	8.0 Adjusts valve position as required to return Pressurizer level to normal (220 inches) and then to maintain Pressurizer level at 220 inches.
	US	9.0 Announces transition to follow-up actions of EP 1202-29 Section D, Malfunction in Pressurizer Level Indication or Control.
	US	9.1 Directs performance of follow-up actions of EP 1202-29 Section D, Malfunction in Pressurizer Level Indication or Control.
	ROs	9.2 Perform follow-up actions of EP 1202-29 Section D, Malfunction in Pressurizer Level Indication or Control, as directed by the US.

Events No. 5 and 6 – Loss of Main Feedwater, Turbine Trip, ATWS.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>	
<i>RO Critical Task</i>	<i>US RO</i>	1.0 Recognizes and announces FW-P-1B trip, Main Turbine trip, and ATWS.	
	<i>US</i>	2.0 Concurs with plant conditions, and requirement to manually trip the reactor in accordance with OP-TM-EOP-001.	
	<i>US</i>	3.0 Directs URO to manually trip the reactor and perform EOP-001 Immediate Actions.	
	<i>URO US</i>	4.0 URO (from memory) performs and verbalizes Immediate Actions of OP-TM-EOP-001, Reactor Trip, and the US performs concurrent verification.	
	<i>URO</i>	4.1 Depresses the "Reactor Trip" and "DSS" pushbuttons.	
	<i>URO</i>	4.2 Verifies reactor is shutdown (power is less than 7%).	
	<i>URO</i>	4.3 Depresses the Main Turbine Trip pushbutton.	
	<i>URO</i>	4.4 Verifies all 4 Main Turbine stop valves are closed.	
		4.5 Depresses the Global Alarm Silence pushbutton.	
	<i>URO</i>	4.6 Announces to the Team that EOP-001 Immediate Actions have been completed, and Global Alarm Silence has been initiated.	
	<i>US</i>	4.7 Concurs that EOP-001 Immediate Actions have been completed.	
	<i>US</i>	5.0 Directs ARO to deliver Symptom Check Report to the Team.	
	<i>ARO</i>	5.1 Provides Team with Symptom Check Report.	
	<i>US</i>	5.2 Concurs with Symptom Check Report.	
		5.2.1 Does NOT announce transition out of EOP-001 due to the (negative results) symptom check.	
	Actions include announcement of EFW actuation on plant page/radio.	<i>RO</i>	6.0 Implements and reports successful completion of Guide 15, EFW Actuation Response.
		<i>RO</i>	7.0 Implements and reports successful completion of Guide 9, RCS Inventory Control.
		<i>US</i>	8.0 Opens the EOP book to OP-TM-EOP-001, Reactor Trip, to

Events No. 5 and 6 – Loss of Main Feedwater, Turbine Trip, ATWS.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
Reactor trip announcement should include announcement of EFW actuation if not already performed IAW Guide 15.		continue to direct trip response actions.
	<i>US ROs</i>	8.1 Directs ROs to perform remaining VSSV Actions in EOP-001.
	<i>US</i>	8.2 US announces transition from EOP-001 VSSV to follow-up actions.
	<i>US ROs</i>	8.3 US directs ROs to perform follow-up Actions of EOP-001.

Events No. 7 and 8 – LOCA, MU-P-1C ES Start Failure.		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
Examiner: Log the exact time when MAP G-1-8 (red window) actuates:	US RO	1.0 Recognize and announce lowering RCS pressure, Pressurizer level, and rising Reactor Building pressure and activity levels.
	RO	2.0 Initiate implementation of Guide 9, RCS Inventory Control.
	US RO	3.0 Recognize and announce loss of RCS SCM.
	US	4.0 Concur that loss of RCS subcooled margin has occurred.
	US	4.1 Direct implementation of Rule 1, SCM.
	US	4.2 Makes decision and announces symptom-based mitigation strategy to transition from EOP-001, Reactor Trip, to EOP-002, Loss of 25°F Subcooled Margin.
	US RO	5.0 RO performs actions of Rule 1, SCM, which are the Immediate Actions of EOP-002. <ul style="list-style-type: none"> • The US performs concurrent verification of EOP-002 Immediate Actions.
	RO	5.1 Implement Rule 1, SCM.
	RO	5.2 Verify the reactor is shutdown.
	RO	5.3 Trip all RCPs within one minute of loss of SCM.
Examiner: Log the exact time when the 4 th RCP is tripped:	RO	5.4 Ensures HPI and LPI have actuated.
	RO	5.5 Ensures EFW has actuated.
	RO	5.6 Verifies all HPI and LPI components are in the ES condition. 5.6.1 Recognizes MU-P-1C did not start. 5.6.2 Initiates Guide 4 HPI Failure 5.6.3 Manually Starts MU-P-1C.
	RO	5.7 Initiates Guide 15, EFW Actuation.
	RO	
MU-P-1C will not automatically start an any ES signal, but will start manually from the control switch.		

Events No. 7 and 8 – LOCA, MU-P-1C ES Start Failure.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
IAW Rule 4, FWC, Section B, minimum required EFW flow is 215 gpm to each OTSG until level reaches 75% or SCM is restored.		5.8 Ensures OTSG levels are being raised to 75-85%. 5.8.1 Transfers EF-V-30A/B/C/D to manual. 5.8.2 Increases EFW flows to both OTSGs to begin raising OTSG levels to 75-85%.
	RO	5.9 Announces completion EOP-002 immediate actions, with Rule 1, SCM, still in progress to raise OTSG levels.
	US	5.10 Concurs that immediate actions of EOP-002 have been completed (Rule 1 still in progress to raise OTSG levels).
	US	6.0 Announces transition to EOP-002 Follow-up Actions.
	US	6.1 Directs ROs in performance of EOP-002 Follow-up Actions, including initiation of Attachment 1.
Step 3.15 requires transfer to EOP-006 if HPI is required for RCS Inventory Control and SCM is <25°F.	US	7.0 Announces transition from EOP-002 to EOP-006, LOCA Cooldown.
	US	7.1 Directs ROs in performance of EOP-006 Follow-Up Actions.
IAW Guide 11, CDR Limits, there is no maximum cooldown rate limit in effect if <25°F.	RO	8.0 With US concurrence, RO throttles EFW IAW Guide 11, Cooldown Rate Limits – if SCM is restored.
Throttling should not be necessary if RCS remains <25°F.	RO	9.0 With US concurrence, RO throttles HPI IAW Rule 2, HPI/LPI Throttling, and/or Rule 6, Pressurized Thermal Shock, as applicable.

TERMINATION CRITERIA

When all of the following conditions exist:

1. Reactor is shutdown.
2. HPI is actuated.
3. Both OTSG levels are 75-85%.
4. RCS cooldown in progress.

EMERGENCY PLAN CLASSIFICATION

ALERT FA1 Loss of Reactor Coolant System Barrier

or

ALERT MA4 Auto SCRAM not successful, and manual trip from the Control Room was successful.

TECHNICAL SPECIFICATIONS

- 3.5.2 Control Rod Group and Power Distribution Limits
3.5.2.2 defines allowed operation with inoperable rods.
- 4.7.1 Defines what constitutes an inoperable rod.

SRO INSTANT Scenario #2	
SRO Normal Evolution	Switch Operating Condensate Pumps.
Instrumentation Failure	RCS T-Hot Instrument Failure.
Instrumentation Failure	Generator Hydrogen Gas Leak.
RO Reactivity Change	Manual Load Reduction to 850 MW.
Component Failure	Auxiliary Transformer Fault.
Major Malfunction	Steam Line Rupture Inside Containment Building.
Component Failure	Stuck Open High Pressure Injection Valve.

SRO INSTANT Simulator Scenario #2			
Quantitative Attributes		Target	Actual
Total Malfunctions		5-8	6
RCS T-Hot Instrument Failure.	1A Auxiliary Transformer Fault.		
Main Generator Hydrogen Gas Leak.	Steam Line Rupture Inside RB.		
ICS Controller Failures.	HPI Valve Failure.		
Malfunctions After EOP Entry		1-2	1
HPI Valve Failure.			
Abnormal Events		2-4	4
RCS T-Hot Instrument Failure.	ICS Controller Failures.		
Main Generator Hydrogen Leak.	1A Auxiliary Transformer Fault.		
Major Transients		1-2	1
Steam Line Rupture Inside RB.			
EOPs Entered With Substantive Actions		1-2	1
EOP-003, Excessive Primary-to-Secondary Heat Transfer.			
EOP Contingencies Requiring Substantive Actions		0-2	1
EOP-010, Abnormal Transients, Rules, Guides and Graphs.			
Critical Tasks		2-3	1 RO 1 SRO
SRO	Direct operator actions following OTSG isolation to prevent RCS heat-up and re-pressurization.		
RO	Termination of high pressure injection flow.		

Simulator Scenario #2				
SRO INSTANT			Req'd	Actual
As RO	Reactivity		1	1
	Manual Load reduction to 800 MW.			
	Instrument/Component Failures		2	I = 2 C = 4
	I - RCS T-Hot instrument failure.	C - 1A Auxiliary Transformer fault.		
	C - Main Generator Hydrogen Gas Leak.	C - HPI Pump ES Auto Start Failure.		
	I - ICS controller failures.	C - HPI valve failure.		
	Major		1	1
Main Steam Line Rupture In Containment.				
As SRO	Normal Evolution		1	1
	Switch Condensate Pumps			
	Instrument/Component Failure		2	I = 2 C = 4
	I - RCS T-Hot instrument failure.	C - 1A Auxiliary Transformer fault.		
	C - Main Generator Hydrogen Gas Leak.	C - HPI Pump ES Auto Start Failure.		
	I - ICS controller failures.	C - HPI valve failure.		
	Major		1	1
Main Steam Line Rupture Inside Containment.				

GENERAL DESCRIPTION OF SCENARIO

This scenario provides the opportunity for the team and individuals to demonstrate ability to utilize normal, emergency, and accident mitigation procedures, and compliance with Technical Specifications requirements.

It exposes the examinees to operational situations that enable examiners to evaluate the ability of the crew to:

- 1) Perform normal operations (switch operating Condensate pumps).
- 2) Implement annunciator response and normal operating procedures to stabilize the plant parameters and switch to a valid instrument following failure of a control system input signal.
- 4) Determine electrical load limitations due to low gas pressure in the Main Generator due to a Hydrogen leak, and execute a forced load reduction in order to prevent overheating the Main Generator.
- 5) Reduce power with the Integrated Control System (ICS) in manual control mode.
- 6) Use plant procedures to respond to loss of an Auxiliary Transformer during power operations, and verify compliance with plant electrical technical specifications.
- 7) Implement emergency operating procedures to respond to a major steam line rupture inside the Containment Building.
- 8) Navigate symptom-based accident mitigation procedures and prioritize rule based operator actions to mitigate effects of excessive RCS heat removal through the ruptured stream line following reactor trip.
 - Isolate sources of water to the affected OTSG in order to limit and terminate the overcooling event.
 - Inject sufficient water into the Reactor Coolant System to prevent loss of subcooled margin and potential fuel damage.
 - Prevent RCS reheat and re-pressurization following isolation of the affected OTSG.
 - Stabilize RCS system pressure and temperature to limit mechanical stresses in the dry OTSG in order to prevent potential tube failures (LOCA into the RB).

Estimated scenario time

60 minutes.

Critical Tasks

1 SRO Critical Task.
2 RO Critical Tasks.

REFERENCES

A. 10 CFR 55.45 Operating Tests, (a) Content (3), (4), (5), (6), (7), (8), (9), (12), (13)

B. PROCEDURES:

OP 1102-4	Power Operation.
OP 1105-4	Integrated Control System.
OP 1105-6	Non-Nuclear Instrumentation and Controls.
OP 1106-1	Turbine Generator.
OP 1106-2	Condensate System.
OP 1106-8	Hydrogen Seal Oil and Gas System.
OP 1107-2A	Emergency Electrical – 4KV and 480 Volt.
OP 1107-11	TMI Grid Operations.
OP-TM-EOP-001	Reactor Trip.
OP-TM-EOP-003	Excessive Primary-to-Secondary Heat Transfer.
OP-TM-EOP-010	Abnormal Transients Rules, Guides and Graphs.
OP-TM-861-902	Diesel Generator EG-Y-1B Emergency Operations

C. ALARM RESPONSES:

AA-1-8	AUX XFMR 1B TRIP.
H-2-5	RX OUTLET T-HOT HI.
H-3-2	SASS MISMATCH.
L-1-6	GEN H2 SEAL OIL TROUBLE.
L-2-3	GEN CORE MONITOR TROUBLE.

D. PRINTS

302-301	Generator Gas & Vents
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SIMULATOR INITIALIZATION – IC-41			
✓	Action	Comments/Instructions	Description
	<u>Initialization</u> IC-16.	100% HFP, ICS in full automatic.	Xenon equilibrium. Middle of Cycle (MOC).
	<u>Control Console</u> Main Generator reactive load.	Adjust Main Generator automatic voltage regulator for +200 MVAR ±20.	Scenario support - TSO orders.
	<u>Remote Function</u> FWR(37)	Value: IN. When: Immediately.	Places the 6 th Powdex Vessel into service in preparation for shifting CO- P-1A/B.
	<u>Remote Function</u> EGR14.	Value: CLOSE. When: Immediately.	Closes valve G-07 to isolate Main Generator Hydrogen supply.
	<u>Malfunction</u> NI31B.	Severity: 100%. Ramp: 300 seconds. Event: 2.	RC4A-TE4 RC Hot Leg Temperature Transmitter Failure.
	<u>Digital I/O Override</u> 02A4A37- ZDIICS1MCS(4)	Value: OFF. Event: 3.	Blocks ability to lower ICS Unit Load Demand from ULD Toggle Switch.
	<u>Digital I/O Override</u> 02A4A11- ZDIICS13MCS(4)	Value: OFF. Event: 3.	Fails Rx Steam Generator Master Lower Toggle Switch.
	<u>Digital I/O Override</u> 02A4A12- ZDIICS13MCS(4)	Value: OFF. Event: 3.	Fails Reactor Master Lower Toggle Switch.
	<u>Malfunction</u> ED02A.	Event: 5.	1A Auxiliary Transformer Fault.
	<u>Malfunction</u> MS02A.	Severity: 10%. Ramp: 2 seconds. Event: 6.	Main Steam Leak in RB.
	<u>Malfunction</u> MU08C.	When: Immediately.	HPI Valve Fails As Is (MU-V-16C).
	<u>Event Trigger</u> 7	Define as MUVMOV16C>0.99.	Activates Malfunction MU08C to stick MU-V-16C when the valve is wide open.
	<u>Monitor</u> EGPH2PRESS	Assign to Monitor.	Main Generator Gas Pressure.
	<u>Monitor</u>	Assign to Monitor.	Fractional rate for Main Generator gas leakage.

	EGKH2LOSS		
	<u>Monitor</u> MSK2609A.	Assign to Monitor. Value: 214.7 psia. When: immediately.	Matches Auxiliary Steam header pressure to nominal value for normal operations.

This sheet is to be provided to the examinees for review.

SHIFT BRIEFING

Reactor power is 100% with ICS in full automatic.

Due to current grid conditions, Dispatcher has ordered the station to maintain Main Generator reactive load at +200 MVAR ± 20 .

Preparations are complete for removing CO-P-1A from service for maintenance (excessive shaft vibration).

- CO-P-1B will be started before stopping CO-P-1A.
- All OP 1106-2 Limits and Precautions are satisfied.
- CO-P-1B has been fully primed and vented.
- Seal water is lined up from the seal water head tank.
- Six Powdex Vessels are in service.

Orders for the shift:

1. Switch Condensate Pumps IAW OP 1106-2, Condensate System, Section 3.3.2 (provide signed off procedure section, pages 30 & 31).
2. Return Powdex Vessel 'A' to standby after shifting Condensate pumps.
3. Maintain 100% power.
4. Maintain +200 MVAR ± 20 .

Scenario Outline

Simulation Facility: Three Mile Island Unit 1 **Scenario No.:** #2 **Op Test No.:**

Examiners _____ **Operators** _____ CRS
 _____ _____ URO
 _____ _____ PRO

Description This scenario provides operational situations to evaluate the ability of crew members to implement plant procedures to perform normal operations (switch Condensate Pumps) and to respond abnormal and emergency conditions. While operating at full power, a control system instrumentation failure upsets the balance of plant control. After re-establishing plant stability, a hydrogen gas leak lowers Main Generator gas pressure, requiring a forced load reduction to protect the generator. Because of an Integrated Control System malfunction the load reduction must be performed manually. Following the load reduction, protective relay operation transfers loads off the 1A Auxiliary Transformer to 1B Auxiliary Transformer and Emergency Generator EG-Y-1B. A major steam line rupture inside the Containment Building causes the reactor to be tripped. Excessive OTSG heat transfer results in a core overcooling event, and ESAS actuation. Following isolation of feedwater sources to the affected OTSG, crew members are required take actions to prevent RCS reheat and re-pressurization. RCS pressure and temperature are required to be stabilized to protect OTSG and RCS components from excessive stresses that could lead to material failure and fission product release. Control and termination of HPI flow is complicated by a stuck open injection valve.

Initial Conditions Plant is at 100% power, with ICS if full automatic. Dispatcher ordered +200 MVAR ±20. Ready to switch Condensate Pumps.

Turnover See Attached "Shift Turnover" Sheet.

Event No.	Malf. No.	Event Type*	Event Description
1		N URO N ARO N US	Switch operating Condensate Pumps.
2	NI27B	I URO I ARO I US	RCS Loop A T-hot transmitter failure (high), affecting ICS T-Ave indication.
3		C URO C ARO C US	Main Generator hydrogen gas leak.
4		R URO ARO US	Manual load reduction to 800 MW due to ICS controller failures.
5	ED02A	C URO C ARO C US	1A Auxiliary Transformer fault (Technical Specifications).
6	MS02B	M URO M ARO M US	Main Steam Line Rupture Inside the RB with ESAS actuation.
7	MU08C	C URO ARO C US	Stuck open high pressure injection valve.

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

Event No. 2 – RCS T-Hot Instrument Failure.		
(7 minutes)		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
Activate Event 2 to Fail T-Hot Instrument.		
<i>RO/SRO Instrument Failure</i>	<i>URO</i>	1.0 Announces unexpected alarm H-3-2 SASS Mismatch.
<p>Procedural guidance for this is found in OP 1105-4, ICS, Section 3.6 (Level 1) and H-3-2 ARP.</p> <p>If requested, Booth Operator will use Remote Function ICR15 to clear alarm MAP H-3-2.</p>	<i>URO US</i>	2.0 Recognizes and announces automatic control rod in-motion.
	<i>URO US</i>	3.0 May recognize and announce elevated RCS T-Hot and Tave indications.
	<i>URO</i>	4.0 May transfer ICS stations to manual to terminate automatic control system response to failed T-Hot detector. 1105-4, ICS, Section 3.3.
	<i>URO US</i>	4.1 Balance plant parameters to establish stable plant control.
	<i>URO US</i>	5.0 Verify validity of the alternate narrow range Loop A T-Hot instrument using Plant Process Computer.
	<i>URO US</i>	6.0 Manually select valid narrow range Loop A T-Hot signal for indication/control.
	<i>URO US</i>	7.0 If applicable, transfers ICS back to automatic mode of control. 1105-4, ICS, Section 3.3, Placing and Operation of the ICS in Manual and Return to Auto.
	<i>US ARO</i>	7.0 Place an EDT sticker on the selector pushbutton for the failed instrument.
	<i>US ARO</i>	8.0 Dispatch personnel to the Relay Room to operate local controls to: <ul style="list-style-type: none"> • Clear H-3-2 annunciator. • Defeat the failed instrument input to MAP H-3-2 (optional).

Events No. 3 and 4		
Respond to Main Generator Hydrogen Leak.		
Forced Load Reduction (In Manual)		
(15 minutes)		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
<p>Booth Operator – Monitor EGP2PRESS. Set EGKH2LOSS TO 0.03</p> <p>When Hydrogen pressure reduces to 40 psig, return EGKH2LOSS to 5.79E-05.</p> <p>Then, immediately report over the radio:</p> <ul style="list-style-type: none"> <input type="checkbox"/> You responded to noise at the Main Generator Hydrogen Control Panel, and isolated a hydrogen gas leak by: <ul style="list-style-type: none"> <input type="checkbox"/> Closing valve HG-V-G02 <input type="checkbox"/> Turning valve HG-V-G01 to CO2 position (CCW). <p>H2 gas leakage has been terminated.</p>		
	US	1.0 Direct ROs to refer to ARP to respond to MAP L-1-6 GEN H2 SEAL OIL TROUBLE.
	ARO	1.1 Refer to ARP for MAP L-1-6. 1.2 Dispatch an AO to determine cause for local alarm.
	US RO	2.0 Using OP 1106-1 Figure B-2B, Generator Reactive Capability Curve, determine maximum permissible generator load for 40 psig at +200 MVAR.
	US	3.0 Direct ROs to reduce generator load to approximately 850 MW at ___%/minute, while maintaining +200 MVAR ±20.
	URO	3.1 Attempt to reduce ICS Unit Load Demand to 850 MW.
	URO	3.2 Recognize and announce ICS controller failure.
	US	3.3 Direct ROs to reduce load with ICS in manual.
	URO	3.3.1 Transfer Steam Generator – Reactor Master to manual.
	URO	3.4 Recognize and announce Stm Gen-Rx Master controller

Events No. 3 and 4		
Respond to Main Generator Hydrogen Leak.		
Forced Load Reduction (In Manual)		
(15 minutes)		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
		failure.
	<i>URO</i>	3.4.1 Transfer DTC, Loop A and Loop FW Masters, Reactor Master to manual.
	<i>URO</i>	3.5 Recognize and announce Reactor Master controller failure.
	<i>URO</i>	3.5.1 Transfer Diamond Control Panel to manual.
<i>RO Reactivity Evolution</i>	<i>URO</i> <i>ARO</i>	3.3.2 Manually reduce plant load to 850 MW at rate specified by the US.
	<i>ARO</i>	3.3.3 Adjust Automatic Voltage Regulator Setpoint as required to maintain +200 MVAR ±20.

Event No. 5 – 1A Auxiliary Transformer Fault.		
(12 minutes)		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
Activate Event 5.	US RO	1.0 Recognize and announce loss of Auxiliary Transformer 1A, and loss of #8 230 KV Bus.
	US RO	2.0 Perform and verify Immediate Manual Actions for the following Emergency Procedures:
	US RO	2.1 1203-15, Loss of Makeup/RCP Seal Injection. <ul style="list-style-type: none"> • Determine cause for loss of MU/SI. • Isolate Makeup and SI. 2.1.1 Significant Follow-Up Actions: <ul style="list-style-type: none"> • Start MU-P-1A. • Re-establish RCP Seal Injection. • Re-establish RCS Makeup.
	US RO	2.2 1202-38, NS River Water Failure. <ul style="list-style-type: none"> • May close NR-V-1A. • May match flags.
	US RO	2.3 1203-20, NSCC Failure. <ul style="list-style-type: none"> • May match flags.
	US RO	2.2 1203-19, RW Systems Failure DR/SR. <ul style="list-style-type: none"> • May SR match flags.
	US	2.0 May direct efforts to respond to loss of 1A Auxiliary Transformer IAW MAP AA-1-7.
	ROs	2.0.1 Verify automatic actions: <ul style="list-style-type: none"> • 230 KV Breakers open to de-energize 1A Auxiliary Transformer. • Fast Transfer to 1B Auxiliary Transformer <ul style="list-style-type: none"> • 1A 7KV Bus. • 1A, 1B 4KV Bus. • 1E 4KV ES Bus re-energized by emergency diesel generator EG-Y-1B.

Events No. 6 and 7 – Main Steam Line Rupture Inside Containment.

High Pressure Injection Valve Sticks Open.

(16 minutes)

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>	
<p>Activate Event 6.</p> <p>Excessive primary to secondary heat transfer may be diagnosed during performance of the reactor trip EP immediate actions. If so, then Steps A – D here will be performed during (in parallel with) EOP-001 immediate actions.</p>			
	US RO	1.0	Recognize and announce lowering RCS pressure, Pressurizer level, and rising Reactor Building pressure and activity levels.
	US	2.0	Concurs with plant conditions, and requirement to manually trip the reactor in accordance with OP-TM-EOP-001.
	US	3.0	Directs URO to manually trip the reactor and perform EOP-001 Immediate Actions.
	URO US	4.0	URO (from memory) performs and verbalizes Immediate Actions of OP-TM-EOP-001, Reactor Trip, and the US performs concurrent verification.
	URO	4.1	Depresses the "Reactor Trip" and "DSS" pushbuttons.
	URO	4.2	Verifies reactor is shutdown (power is less than 7%).
	ARO	A.	May recognize and declare excessive primary-to-secondary heat transfer, and announce applicability of Rule 3, XHT.
	ARO	B.	Manually reduce Main FW Flow to the OTSGs (FW Loop Masters are in Hand at time of reactor trip).
	US	C.	Concurs with excessive primary-to-secondary heat transfer, and applicability of Rule 3, XHT.
	ARO	D.	Initiates Rule 3, XHT.
	URO	4.3	Depresses the Main Turbine Trip pushbutton.
	URO	4.4	Verifies all 4 Main Turbine stop valves are closed.
		4.5	Actuates Global Silence.
	URO	4.5	Announces to the Team that EOP-001 Immediate Actions have been completed, and that Global Silence has been initiated.

**Events No. 6 and 7 – Main Steam Line Rupture Inside Containment.
High Pressure Injection Valve Sticks Open.**

(16 minutes)

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
	US	4.6 Concur that EOP-001 Immediate Actions have been completed, and acknowledges initiation of Global Silence.
	US	5.0 Requests ARO to deliver Symptom Check Report to the Team.
	ARO	5.1 Provides Team with Symptom Check Report, identifying excessive primary-to-secondary heat transfer, and implementation of Rule 3, XHT.
	US	5.2 Concur with Symptom Check Report. Announces transition from EOP-001, Reactor Trip, to EOP-003, Excessive Primary-to-Secondary Heat Transfer.
	US	6.0 Directs operator actions to perform immediate actions of EOP-003, Excessive Primary-to-Secondary Heat Transfer..
	RO	6.1 Implement Rule 3, XHT (may already implemented as described earlier).
	RO	6.2 Initiate Guide 9, RCS Inventory.
	US	7.0 Direct both ROs to implement Guide 12, Stabilization following OTSG Isolation.
	US	7.1 Direct RO to adjust OTSG 1B pressure to prevent RCS heatup following isolation of OTSG 1A
	RO	7.1.1 Reduce OTSG pressure to prevent RCS reheat and re-pressurization due to coolant expansion, as directed by US.
	US	7.2 Direct RO to throttle/terminate HPI IAW Rule 2, LPI/HPI Throttling.
RO will actually need to terminate HPI, since there is no RCS leak.	RO	7.2.1 Bypass and defeat Train A and B ESAS actuation signals to gain control of ES equipment.
	RO	7.2.2 Reduce HPI flow to prevent RCS re-pressurization due refill, as directed by the US.
The only way to terminate flow through MU-V-16C is to stop MU-P-1C, either at this point or at Step 7.2.4 below.		7.2.2.1 Recognize and announce that MU-V-16C is stuck open.

**Events No. 6 and 7 – Main Steam Line Rupture Inside Containment.
 High Pressure Injection Valve Sticks Open.**

(16 minutes)

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
	RO	7.2.3 Open MU-V-36 and MU-V-37 (minimum recirc valves) prior to reducing HPI flow below 115 gpm per operating pump.
	RO	7.2.4 Stop MU-P-1C, allowing MU-P-1A to continue to operate to provide RCP seal Injection and RCS makeup flow.
	RO	7.2.5 Dispatch and AO to manually close MU-V-16C.
Should not apply to current conditions.	US RO	7.3 May close MU-V-14A and MU-V-14B to isolate MU-P-1B suction from the BWST when the Makeup Tank level is >55 inches (IAW Guide 9, RCS Inventory Control).
Should not apply to current conditions – not being fed.	US RO	7.4 Review Rule 6, PTS, for applicability.
Should not apply to current conditions.	US RO	7.5 Review Guide 13, Dry OTSG, for applicability.
	US RO	7.6 Review Guide 14, TSDT Limit Guide, for applicability.
	RO	7.7 Implement and announce successful completion of Guide 15, EFW Actuation.
	US	8.0 Announce transition to EOP-003 Follow-up Actions.
	US	9.0 Direct RO actions to complete EOP-003 Follow-up Actions.
	RO	9.1 Perform EOP-003 Follow-up Actions as directed by the US.
Required if RB Pressure >2 psig.	US	9.2 May direct RO to initiate OP-TM-534-901, Reactor Building Emergency Cooling Operations if RB pressure >2 psig.
Required if RB Pressure >2 psig.	RO	9.2.1 Initiate OP-TM-534-901, Reactor Building Emergency Cooling Operations if RB pressure, as directed by the US.
	US	9.3 Announce transition from EOP-003 Follow-up Actions to EOP-001 VSSV (IAW Step 3.15).
	US	9.0 Direct RO actions to complete EOP-001 VSSV actions.
	RO	9.0 Perform EOP-001 VSSV actions as directed by the US.
	US	9.0 Announce transition EOP-001 Follow-up Actions.
Scenario can be terminated.	US	9.0 Direct RO actions to complete EOP-001 Follow-up actions.

**Events No. 6 and 7 – Main Steam Line Rupture Inside Containment.
High Pressure Injection Valve Sticks Open.**

(16 minutes)

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Applicant Actions/Behaviors</u>
	RO	9.0 Perform EOP-001 Follow-up Actions as directed by the US.

TERMINATION CRITERIA

When all of the following conditions exist:

1. Reactor is shutdown.
2. OTSG 1A is isolated and depressurized.
3. HPI is terminated.
4. Flow through MU-V-16C has been terminated.
5. RCS pressure and temperature are stabilized.
6. EOP-003 actions are complete.
6. EOP-001 VSSV actions have been completed.
7. EOP-001 Follow-up Actions are in progress.

EMERGENCY PLAN CLASSIFICATION

ALERT HA4 Non-Bomb Explosion inside the Vital Area.

Exelon Standard E-Plan EALs.

TECHNICAL SPECIFICATIONS

3.7 Electrical

SRO INSTANT Scenario #3	
Instrumentation Failure	Pressurizer Level Instrument Failure.
SRO Normal Evolution	Swap Makeup Pumps.
Instrumentation Failure	MU-V-32 Failure.
Component Failure	OTSG Tube Leak (Small).
Instrumentation Failure	CRD Fails to Respond in Automatic.
RO Reactivity Change	Manual Power Reduction.
Major Malfunction	OTSG Tube Rupture.
Instrumentation Failure	ES Train Failure.

SRO INSTANT Simulator Scenario #3			
Quantitative Attributes		Target	Actual
Total Malfunctions		5-8	6
Pressurizer Level Instrument Failure.	CRD Fails to Respond in Auto.		
MU-V-32 Failure.	OTSG Tube Rupture.		
OTSG Tube Leak (Small).	ES Train Failure.		
Malfunctions After EOP Entry		1-2	2
CRD System Fails to Respond in Automatic.			
ES Train Failure.			
Abnormal Events		2-4	4
Pressurizer Level Instrument Failure.	CRD Fails to Respond in Auto.		
MU-V-32 Failure.	ES Train Failure.		
Major Transients		1-2	1
OTSG Tube Rupture.			
EOPs Entered With Substantive Actions		1-2	1
OP-TM-EOP-005, OTSG Tube Leakage.			
EOP Contingencies Requiring Substantive Actions		0-2	1
EOP-010, Abnormal Transients, Rules, Guides and Graphs.			
Critical Tasks		2-3	4
SRO Direct entry into OP-TM-EOP-005, OTSG Tube Leakage.			
RO Implement EOP-010 Guide 2 in response to HPI Train B Failure			
RO/SRO Maintain <1000 psig OTSG pressure to limit MSSV operation			
RO/SRO Minimize RCS Subcooled Margin to reduce tube leak rate.			

Simulator Scenario #3				
SRO INSTANT			Req'd	Actual
As RO	Reactivity		1	1
	Manual Power Reduction.			
	Instrument/Component Failures		2	I = 3 C = 2
	I - Pzr Level Instrument Fails.	I - CRD Auto Control Failure.		
	C -MU-V-32 Failure.	I -ES Train Failure.		
	C -OTSG Tube Leak (Small).			
	Major		1	1
OTSG Tube Rupture.				
As SRO	Normal Evolution		1	1
	Swap Makeup Pumps.			
	Instrument/Component Failure		2	I = 3 C = 2
	I - Pzr Level Instrument Fails.	I - CRD Auto Control Failure.		
	C -MU-V-32 Failure.	I -.ES Train Failure.		
	C -OTSG Tube Leak (Small).			
	Major		1	1
OTSG Tube Rupture.				

GENERAL DESCRIPTION OF SCENARIO

The scenario will be initiated at 30% power. Makeup Pump 1B (MU-P-1B) was removed from service for an oil change, and is now ready to be returned to service. Crew direction is to return MU-P-1B to service and maintain 30% Power steady state operation.

The selected Pressurizer level instrument slowly fails low. The crew will swap to the alternate Pressurizer level and temperature instruments.

The crew will swap from MU-P-1A to MU-P-1B IAW 1104-2, Makeup and Purification System.

Once MU-P-1B is in operation, MU-V-32, Seal Water Injection Flow Control valve will fail open, requiring the team to establish manual RCP seal injection flow control.

A small tube leak will occur. Alarm C-1-1, High Radiation, will actuate to cue the crew to the tube leak. The crew will respond IAW Alarm response procedure for MAP C-1-1, and implement OP-TM-EOP-005, OTSG Tube Leakage procedure.

The crew will commence a normal plant shutdown IAW OP-TM-EOP-005, MAP C-1-1, and Technical Specification requirements.

During the power reduction, the rod control diamond station will fail to respond in Auto. The crew will be required to continue the shutdown with Manual control of the Diamond CRD station and Feedwater ICS stations.

A large OTSG tube rupture develops. The crew will have to evaluate plant conditions, and should trip the reactor and initiate High Pressure Injection.

The 'B' train of Engineered Safeguards Actuation System will not actuate using the Manual Actuation pushbuttons, requiring manual HPI/LPI initiation at the component level.

Estimated scenario time - 60 minutes.

Critical Tasks

3 SRO Critical Tasks

3 RO Critical Tasks

REFERENCES

A. 10 CFR 55.45 Operating Tests, (a) Content (3), (4), (5), (6), (7), (8), (9), (12), (13)

B. PROCEDURES:

OP 1102-4	Power Operation.
OP 1104-2	Makeup and Purification System (marked up copy).
OP 1105-4	Integrated Control System.
EP 1202-12	Excessive Radiation Levels.
EP 1202-29	Pressurizer System Failure.
OP-TM-EOP-001	Reactor Trip.
OP-TM-EOP-005	OTSG Tube Leakage.
OP-TM-EOP-010	Abnormal Transient Rules, Guides and Graphs.

C. ALARM RESPONSES:

C-1-1	HIGH RADIATION.
F-1-5	RCP SEAL TOT INJECT FLOW HI/LO.
G-2-5	PZR LEVEL HI/LO.
G-3-5	PZR LEVEL LO-LO.

D. OTHER

Maintenance Risk Document for EF-P-2A.

SIMULATOR INITIALIZATION		
✓ Action	Comments/Instructions	Description
<u>Initialization IC-16.</u>	100% HFP, ICS in automatic.	Xenon equilibrium, Middle of Cycle (MOC).
<u>Control Console</u> Reduce power to 30%. Adjust Mvars to 0. Trip FW-P-1B, open drains. Start FW-P-1B AC Lube Pp. Reduce to 4 Powdex Vessels. Secure all MO-Ps. Stop HD-P-1A. Start MU-P-1A, stop P-1B. Start IC-P-1B, stop IC-P-1A. Tag EF-P-2A out of service.	When: Immediately. Use FW Remote Functions.	Scenario support.
<u>Malfunction</u> RC04A.	Severity: 100%. Ramp: 240 seconds. Event: 1.	Pressurizer Level instrument failure.
<u>Malfunction</u> MU07.	Severity: 100%. Ramp: 30 seconds. Event: 2.	MU-V-32, RCP seal injection control valve, fails open in automatic mode.
<u>Malfunction</u> TH17A.	Severity: 0.08%. Event: 3.	OTSG 1A Tube Rupture (Low).
<u>Malfunction</u> RD10C	Event: 4.	CRD Group 7 Automatic In-Motion Command Block.
<u>Malfunction</u> TH16A	Severity: 5.0%. Ramp: 1 second. Event: 5.	OTSG tube rupture (middle).
<u>Malfunction</u> ES01B ES02B	When: Immediately.	B Train ESAS Fail to Actuate at 1600# and 500# Setpoints.
<u>Remote Function</u> CCR12	Value: NS. When: Immediately.	Transfer MU-P-1A to NSCC cooling.
<u>Remote Function</u> FWR12	Value: OUT. When: Immediately.	Rack out EF-P-2A breaker to the disconnected position, remove fuses.
<u>Digital I/O Override</u> 03A4S02-ZDIPB1RBB	Value: OFF. When: Immediately.	Blocks B Train Manual 4# ES actuation.
<u>Digital I/O Override</u> 03A4S02-ZDIPB1RCB	Value: OFF. When: Immediately.	Blocks B Train Manual 1600# ES actuation.
<u>Event Trigger</u> 4	Define as CRQCRNM < 0.27.	Trigger is used to block automatic in-commands from Group 7 rods.
<u>Monitor</u> MSK2609A.	Assign to Monitor. Value: 215 psia. When: Immediately.	Matches Auxiliary Steam header pressure to nominal value for normal operations.

This sheet is to be provided to the examinees for review.

This sheet is to be provided to the examinees for review.

SHIFT BRIEFING

Reactor power is 30% with ICS in automatic.

FW-P-1A is in service.

FW-P-1B has been secured.

Emergency Feedwater Pump 2A (EF-P-2A) is tagged out for bearing replacement.

- Expected to be returned to service in next 24 hours.

Makeup Pump 1A is running to support an oil change on Makeup Pump 1B.

- Makeup Pump 1A is being cooled by Nuclear Services Closed Cooling Water.
- MU-P-1A and MU-P-1C are currently selected for ES.
- IC-P-1B is operating with IC-P-1A in standby.
- The oil change has been completed and Makeup Pump 1B is ready to be returned to service.

On-Line Risk Management Sheet #132 is attached for reference.

Orders for the shift:

1. Swap from Makeup Pump 1A to Makeup Pump 1B.
2. Continue 30% power operation.

Scenario Outline

Plant Facility:	Three Mile Island Unit 1	Scenario No.:	3	Op Test No.:
Examiners	_____	Operators	_____	CRS
	_____		_____	URO
	_____		_____	PRO
Description	<p>This scenario provides operational situations to evaluate the ability of crew members to implement plant procedures to perform normal operations, and to respond to abnormal and emergency conditions. While operating at reduced power, the operators are required to mitigate the effects of a controlling instrument failure by establishing manual control and then selecting alternate (valid) input signals. After re-establishing automatic RCS inventory control, the operators implement normal operating procedures to switch operating Makeup Pumps. An additional control system malfunction requires the operators to establish manual flow control for RCP seal injection. A small OTSG tube leak (greater than Technical Specification limits) forces the operators to implement an emergency operating procedure that includes plant shutdown. The power reduction is performed in manual due to an automatic control problem in the Control Rod Drive System. During the shutdown, a large OTSG Tube rupture develops, requiring the operators to initiate High pressure Injection and trip the reactor. One of the two ES Trains will not actuate automatically or manually at the Train level, requiring the operator is to initiate individual components. Following reactor trip, actions are performed to ensure the reactor is shutdown properly, establish radiological controls and isolate potential secondary release paths, prevent inadvertent operation of the Main Steam Safety Valves, and reduce RCS leakage through the OTSG tubes in order to limit off-site doses.</p>			
Initial Conditions	<p>Plant is at 30% power, with ICS in automatic. FW-P-1A is in operation. EF-P-2A is out of service for bearing replacement. MU-P-1A is operating, cooled by NSCC, to support MU-P-1B oil change.</p>			
Turnover	<p>See Attached "Shift Turnover" Sheet.</p>			

Event No.	Malif. No.	Event Type*	Event Description
1	RC04A	I URO ARO US	Pressurizer level instrument failure.
2		N URO ARO US	Switch operating Makeup Pumps.
3	MU07	C URO ARO US	MU-V-32, RCP seal injection valve, failure.
4	TH17A	C URO ARO US	Small OTSG 1A tube leak.
5		URO ARO US	Initiation of plant shutdown.
6	RD10C	I/R URO ARO US	Control Rod Drive System automatic control failure.
7	TH16A	M URO ARO US	OTSG tube rupture.
8	ES01B ES02B IO Override	I URO ARO US	ES Train failure.

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

Event No. 1		
Pressurizer Level Instrument Failure.		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>
<i>Diagnosis</i>	<i>RO</i> <i>US</i>	1.0 Recognize and announce Pressurizer level instrument failure from MAP alarms G-2-5, PZR LEVEL HI/LO, G-3-5, PZR LEVEL LO-LO, MU-V-17 response and redundant indications.
<i>Direct Operations</i>	<i>US</i>	2.0 Announce entry into EP 1202-29, Pressurizer System Failure.
	<i>URO</i>	2.1 Take MU-V-17 to Hand and adjust makeup flow to equal letdown flow minus seal injection.
	<i>URO</i>	2.2 Select alternate pressurizer level transmitter.
	<i>URO</i>	2.3 Select alternate pressurizer temperature transmitter.
	<i>URO</i>	2.4 Transfer MU-V17 back to automatic control mode (optional).
	<i>US</i>	3.0 US may request Equipment Deficiency Tag (EDT) be placed on LT-1 Pressurizer Level Transmitter Selector.
	<i>URO</i>	3.1 Place EDT on LT-1 Selector Switch, as directed by the US.

Event No. 2

Swap From Makeup Pump 1A to Makeup Pump 1B

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>
<i>Direct Operations</i>	URO	1.0 Direct Makeup Pump swap IAW OP 1104-2, Makeup and Purification System.
	RO	1.1 Verify MU-P-1B lube oil system is running normally.
ICO: MUR29 to MU-P1B	RO	1.2 Have AO ES select MU-P-1B.
	<i>Control Board Operations</i>	URO
	URO	1.4 Stop MU-P-1A when conditions stabilize.
	URO	1.5 Monitor makeup and seal injection flows and adjust as necessary.
ICO: MUR29 to MU-P1C	RO	1.6 Have AO ES select MU-P-1C.
ICO: CCR12 to DC	RO	1.7 Change MU-P-1A cooling water supply back to DCCW.
	US	2.0 US may direct operator to start IC-P-1A, stop IC-P-1B (optional).
	URO	2.1 Shift operating IC-Ps as directed by the US.

Event No. 3

MU-V-32, RCP Seal Injection Valve Failure.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>	
<i>System Response</i>	URO US	1.0	Recognize and announce rising seal injection flow from MAP alarm F-1-5, RCP SEAL TOT INJECT FLOW HI/LO, and seal injection flow console indication.
	URO	2.0	Diagnose MU-V-32 failure (valve open too far).
<i>Direct Operations</i>	US	2.1	Direct the operator to transfer MU-V-32 to Manual control, restore normal RCP Seal Injection flow, and maintain Manual flow control.
	URO	2.2	As directed by the US, transfer MU-V-32 to Hand and restore normal seal injection flow by throttling MU-V-32 in the closed direction.

Event No. 4			
Small Tube Leak Develops in OTSG 1A.			
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>	
<i>Diagnosis</i>	<i>US RO</i>	1.0	Diagnose a tube leak in OTSG 1A from MAP alarm C-1-1, HIGH RADIATION, and rising indication/alarms on RM-G-26, RM-A-5 and RM-A-15.
<i>Procedures</i>	<i>US</i>	2.0	Direct RO activities to implement ARP for MAP C-1-1, HIGH RADIATION.
<i>Direct Operations</i>	<i>US</i>	3.0	Direct RO Actions to implement Immediate Actions of EP 1202-12, Excessive Radiation Levels: <ul style="list-style-type: none"> • Page announcement. • Maintenance, operations or sampling is N/A. • Mark charts. • Contact GRCS.
	<i>US</i>	4.0	Direct STA to start a one-hour leak rate calculation.
	<i>US</i>	5.0	Direct RO/STA to perform a mass balance calculation for leak rate.
	<i>URO</i>	6.0	Perform mass balance and validate OTSG leak rate greater than 1 gpm.
<i>SRO Critical Task Technical Specifications</i>	<i>URO</i>	7.0	Determine that criteria is met for entry into OP-TM-EOP-005, OTSG Tube Leakage (greater than 1 gpm).

Event No. 5

Commence Plant Shutdown as Directed by OP-TM-EOP-005, OTSG Tube Leakage.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>	
<i>Procedures Technical Specifications</i>	US	1.0	Direct RO activities to implement OP-TM-EOP-005, OTSG Tube Leakage.
	US	1.1	Direct RO to close MU-V-3 as necessary and increase makeup to maintain Pressurizer level.
<i>Direct Operations</i>	US	1.2	Direct a plant shutdown to commence at a specified rate, using OP 1102-4, Power Operation.
	URO	1.3	Set ULD rate of change to value specified by US, and reduce ULD megawatt demand to commence a plant shutdown.
	US ROs	1.4	Monitor plant response as power reduction begins.
	US	1.5	Emergency classification will be obtained after the scenario since the examinee does not have the support of a Shift Manager for Emergency Plan implementation.
	US	1.6	Direct notification of Chemistry and Rad Con and for sampling and surveys.

Event No. 6		
Diamond Fails to Respond in Automatic.		
<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>
ICO: When Reactor power is less than 27%, verify Event #4 activates to fail the Diamond CRD panel to respond in Auto. <i>Diagnosis</i>	US ARO	1.0 Recognize and announce Diamond CRD panel failure to respond by ICS alarms and cessation of CRD movement.
	US	2.0 Direct ROs to transfer ICS to Manual to continue the power reduction.
	ROs	2.1 Place ICS in Hand and recommence power reduction as directed by the US.
NOTE: Requires the following stations (as a minimum) to be transferred to Hand: <ul style="list-style-type: none"> • Feedwater Demand A & B. • ICS Reactor Demand. • Diamond CRD Panel. 		

Events No. 7 and 8

Large OTSG Tube Rupture Develops, B Train ESAS Actuation Fails.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>	
<i>Diagnosis Communications</i>	URO	1.0 Recognize and announce significant leak rate increase from Pressurizer level reduction, MU-V-17 valve position demand, and rising Makeup flow.	
	RO	2.0 Close MU-V-3 to conserve RCS inventory.	
	ROs	3.0 Continue power reduction in Hand.	
	<i>System Response</i>	URO	4.0 Recognize Pressurizer level lowering below 150 inches while Reactor power is greater than 25%.
		<i>Procedures</i>	URO
	US		5.0 Concur with requirement to initiate High Pressure Injection, and to trip the reactor IAW step 3.3.1.A, and then to perform EOP-001 Immediate Actions.
	URO		5.1 Depress Manual 1600 psig ESAS Actuation Buttons for High Pressure Injection.
	URO		5.2 Recognize and announce the failure of "B" Train ESAS manual actuation.
	<i>RO Critical Task</i> This task is critical to event mitigation strategy due to the degraded condition of High Pressure Injection.	URO	6.0 Implements Guide 2, HPI/LPI Initiation.
		URO	6.1 Manually initiates two HPI Pumps and two LPI Pumps in ES alignment at the component level as follows: <ul style="list-style-type: none"> • Open MU-V-14B. • Start MU-P-1C. • Open MU-V-16C. • Open MU-V-16D. • Close MU-V-37. • Start DC-P-1B. • Start DR-P-1B. • Close MU-V-3. • Open DH-V-5B. • Start DH-P-1B. • Open DH-V-4B.
URO US	7.0 URO (from memory) performs and verbalizes Immediate Actions of OP-TM-EOP-001, Reactor Trip, and the US performs concurrent verification.		
URO	7.1 Depresses the "Reactor Trip" and "DSS" pushbuttons.		
URO	7.2 Verifies reactor is shutdown (power is less than 7%).		

Events No. 7 and 8

Large OTSG Tube Rupture Develops, B Train ESAS Actuation Fails.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>
	URO 7.3	Depresses the Main Turbine Trip pushbutton.
	URO 7.4	Verifies all 4 Main Turbine stop valves are closed.
	URO 8.0	Actuates Global Alarm Silence.
	URO 9.0	Announces to the Team that EOP-001 Immediate Actions have been completed.
	US 10.0	Concurs that EOP-001 Immediate Actions have been completed, and acknowledges actuation of Global Alarm Silence.
	US 11.0	Directs ARO to deliver Symptom Check Report to the Team.
	ARO 11.1	Provides Team with Symptom Check Report.
	US 12.0	Concurs with Symptom Check Report.
	US 13.0	Announces transition out of EOP-001 back to EOP-005 due to the OTSG tube leak.
	US 13.0	Direct follow up actions of EOP-005, OTSG Tube Leakage.
		13.1 Notify SM to evaluate EALs.
		13.2 Determine affected OTSG.
		13.3 Initiate Attachment 2 to establish radiological controls and isolate secondary release paths.
		13.4 Transfer Gland Steam System to the Auxiliary Steam supply.
		13.5 Perform a Symptom Check.
		13.6 Announce reactor trip over plant page and radio system.
		13.7 Dispatch AO to verify all Main Steam Safety Valves (MSSVs) are closed.
		13.7 Direct performance of an alarm review.
SRO/RO Critical Task	US RO	13.8 Direct Operators to reduce and maintain OTSG pressure to less than 1000 psig to prevent lifting Main Steam Safety Valves.
	US RO	13.9 Direct ROs to implement Guide 8, RCS Pressure Control to minimize Subcooled Margin (SCM).

Events No. 7 and 8

Large OTSG Tube Rupture Develops, B Train ESAS Actuation Fails.

<u>Examiner Notes and Actions</u>	<u>Pos</u>	<u>Expected Operator Actions</u>
		13.9.1 Implement Guide 8, RCS Pressure Control to minimize Subcooled Margin (SCM), as directed by the US.
<p><i>SRO/RO Critical Task</i> This task is critical in order to reduce the primary to secondary leak rate to reduce the dose to the public.</p>		13.9.2 Reduce RCS pressure until SCM is between 70° and 30°F. <ul style="list-style-type: none"> • Turn off Pressurizer heaters. • Open Pressurizer Spray Valve RC-V-1. • Close RC-V-1 when SCM has been minimized (between 70° and 30°F).

TERMINATION CRITERIA

When all of the following conditions exist:

1. Plant cooldown is in progress.
2. OTSG pressures are both less than 1000 psig.
3. Subcooled Margin has been reduced to between 30 and 70°F.
4. The examinees have had the opportunity to perform all critical tasks.

EMERGENCY PLAN CLASSIFICATION (Based on Exelon Standard Emergency Plan)

FA1 ALERT Potential Loss of RCS Barrier (> 160 gpm Primary to Secondary leak)

TECHNICAL SPECIFICATIONS

3.4 Decay Heat Removal Capability

3.4.1.1 a. (2) gives 72-hour time clock for one Emergency Feedwater Pump out of service, or be in Cold Shutdown within the next 12 hours.

3.1.6 Leakage

3.1.6.3 is LCO for exceeding 1 gpm primary to secondary leakage, however, the Operating License only allows 0.1 gpm above baseline leakage rate.

FOR TRAINING ONLY

TMI
ON-LINE STATION RISK EVALUATION DOCUMENT

ON-LINE RISK # 132

Tag# MU-P-0001B

Rev : 1

Station Risk Color		
Yellow	Yellow	Yellow

1. Description of Work and/or Plant Condition

Work involves oil change on MU-P-1B. Scheduled duration of work is approximately 4 hours. MU-P-1A will be placed in service with NSCCW supplying cooling. Normal Makeup Pump suction and discharge valve line up will be maintained.

Originator: FOR TRAINING ONLY Date:

2. Risk Concerns Evaluated

Reduction in HPI capacity
Loss of redundancy of makeup and seal injection
HPI line break

Operating Experience: Yes

3. SSCs Which need to be maintained OPERABLE

LPI Trains A and B
HPI Trains A and B
Building Spray Train A and B
EFW Train A and B
RB Emergency Cooling Train A and B
DC Power Train A and B
AC ES Power Train A and B
EG-Y-1A and EG-Y-1B
IC-P-1B and IC-P-1A
ICCW RCP Seal Cooling Function

4. Actions to Reduce Risk

COMPENSATORY ACTIONS (Actions Taken)

NSCCW lined up to provide cooling to MU-P-1A.
IC-P-1B will be placed in service to address vulnerability to loss of 1D 4160 Bus.

FOR TRAINING ONLY

FOR TRAINING ONLY

CONTINGENCY ACTIONS: (Actions taken if other conditions change)

If the MU-P-1B outage is to be extended beyond the scheduled duration and it is desired to provide backup seal injection capability, obtain Director, Operations approval, open the discharge cross connects, and commence a 72 hour TS time clock.

5. Additional Briefing notes

Error Likely Situations:

6. Basis for Station Risk Evaluation

ORAM-Sentinel Other

Describe basis:

Risk Evaluator : FOR TRAINING Date: _____

Ops Director : FOR TRAINING Date: _____

Engineering : FOR TRAINING Date: _____

Engineering Concurrence is required if Station Risk Condition is lower than ORAM-Sentinel Output

Plant Manager: FOR TRAINING Date: _____