

Facility: Fermi 2

Scenario No.: SCN #1

Op-Test No: ILO-2020-301

Examiners: See Attached Exam Matrix

Operators: See Attached Exam Matrix

Initial Conditions: MODE 2 at ~3-4% CTP. RPV pressure is 350 psig.

Turnover: The plant is in MODE 2 at ~3-4% CTP during a startup. RPV pressure is 350 psig. Plans for the shift are to re-commence power ascension by increasing pressure. The GOP directs the startup of a Reactor Feedwater Pump. Another group of operators is preparing to start the North Reactor Feed Pump. The STA is plotting HUR. The ATC will make all power adjustments with rods and the pressure regulator. The STA has reviewed the steam tables, and the crew can raise reactor pressure to 855# and not violate the 90°F limit. The crew is to FIRST raise Reactor Pressure by closing the bypass valves using the pressure regulator and then recommence control rod withdrawal. A severe wind advisory is in effect for Monroe county.

Critical Tasks: RPV-LOCA(CT1), PC-TWL-ISO(CT2).

Event No.	Malf No.	Event Type*	Event Description
1		R (ATC) R (SRO)	Raise Rx Pressure per GOP
2	C51MF0010	I (ATC) I (SRO)	IRM B Upscale Failure (value = 130). ATC bypasses IRM B. ATC resets half scram. SRO evaluates LCO 3.3.1.1. (Tracking)
3	C11MF0469	C (ATC) C (SRO) TS	A control rod drift alarm will actuate, and rod 26-31 will drift into the core. The crew will perform the Control Rod Drift AOP and disarm the control rod at position "00" and evaluate Technical Specifications 3.1.3.
4	TA03T4100C00 5_MTFSSHEAR	C (BOP) C (SRO) TS	High winds cause Reactor Building HVAC Center exhaust fan to fail. CRS will evaluate TS.
5	B31MF0066 C97MF1087 C93FR0001	M (All)	A seismic event causes a torus leak and small LOCA.
6	P603_A048_4	C (ATC) C (SRO)	Mode Switch Failure - Manual Scram Push buttons insert SCRAM
7	N20MF0018 N20MF0019 N20MF0020	C (BOP) C (SRO) CT1	Loss of Condensate - <u>RPV-LOCA(CT1)</u>
8	E11MF0047	M (All) CT2	Torus Leak - on Low Pressure Feed source. Operators Isolate feed source and establish new feed source. <u>PC-TWL-ISO(CT2)</u>
9	G51RF0016	C (BOP) C (SRO)	TWMS Isolation failure.

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

D1 Supplement

A. NARRATIVE SUMMARY

MODE 2 at ~3-4% CTP. RPV pressure is 350 psig.

The plant is in MODE 2 at ~3-4% CTP during a startup. RPV pressure is 350 psig. Plans for the shift are to recommence power ascension by increasing pressure. The GOP directs the startup of a Reactor Feedwater Pump. Another group of operators is preparing to start the North Reactor Feed Pump.

The STA is plotting HUR. The ATC will make all power adjustments with rods and the pressure regulator. The STA has reviewed the steam tables, and the crew can raise reactor pressure to 855# and not violate the 90°F limit. The crew is to FIRST raise Reactor Pressure by closing the bypass valves using the pressure regulator and then recommence control rod withdrawal.

A severe wind advisory is in effect for Monroe county.

Event: 1

Per GOP 22.000.02, Plant Startup To 25% Power, the crew will use the pressure regulator to increase reactor pressure.

Event: 2

IRM B will fail Upscale, causing half scram. IRM B will be bypassed, and the half scram reset. The CRS will evaluate LCO 3.3.1.1. (Tracking)

Event: 3

A control rod drift alarm will actuate, and rod 26-31 will drift into the core. The rod will stop drifting before full insertion if the crew does not take the required actions to insert the control rod completely. The crew will perform the Control Rod Drift AOP and disarm the control rod at position "00" and evaluate Technical Specifications 3.1.3.

Event: 4

High winds cause Reactor Building HVAC Center exhaust fan to fail; this will require the crew to start a train of RBHVAC. The CRS will evaluate TS.

Event: 5 to 9

Following an earthquake, a LOCA occurs, requiring placing the MODE S/W in shutdown. The MODE S/W will fail; however, the Manual Scram Pushbuttons will insert a scram. Condensate will then trip and be unavailable to maintain RPV level, and SBFW will not inject. Due to the LOCA pressure will lower in the RPV and the low-pressure system will inject. The operators must control these systems to prevent overfeeding the RPV. Once RPV level is controlled and maintained by a single low-pressure system, a leak from the Torus will occur. A High Torus Room Sump Level causes both sumps pumps to run, which is an EOP entry condition. The High Torus Room Sump Level will generate an isolation signal on the Torus Water Management System (TWMS). However, the TWMS system will fail to isolate, requiring manual operator action. The operators will implement a leak isolation strategy; the leak will isolate when the single low-pressure system that is maintaining RPV level is isolated. The operators will then maintain RPV level using a different low-pressure system.

CRITICAL TASKS

RPV-LOCA(CT1) With RPV level lowering and RPV pressure lowering and approaching injection pressure for CS and LPCI pumps, MAINTAIN RPV WATER LEVEL ABOVE TAF, by INJECTING with all available system(s) AND prevent injection from CS and LPCI pumps not required for ACC such that RPV LEVEL DOES NOT REACH 279 INCHES (Main Steam Lines) at any time during the scenario.

NUREG 1021 App D BASIS:

Safety Significance – Controlling RPV level above TAF assures adequate core cooling exists, precluding fuel damage. Controlling level below the main steam lines ensures main steam line piping remains intact, precluding additional coolant inventory loss, and potential release outside primary containment.

Safety significant boundary conditions are defined by BWROG EPG rev 3. Top of active fuel and the main steam lines are bounding levels with significant impact to reactor safety. RPV level dropping below TAF can result in core damage. RPV water level above the main steam lines can result in damage to system piping and subsequent additional loss of coolant, and potential release of radioactive material outside primary containment.

NUREG 1021 App D – D.1.c Failure Criteria reasoning: Candidate will fail if RPV water level drops below TAF or rises above than the main steam lines.

Initiating Cue - RPV is lowering and a high drywell pressure ECCS initiation signal exist.

Measurable Performance - RPV level is controlled within the prescribed control band.

Performance Feedback - RPV level indication is within band.

Expected action – Operate available injection systems in accordance with station procedures to control RPV water level within the prescribed band

PC-TWL-ISO(CT2) With suppression pool water level lowering due to an isolable leak from the suppression pool AND a LOCA, isolate the leak before suppression pool water level, reaches -38 inches.

NUREG 1021 App D BASIS:

Safety Significance and Boundary conditions -Per BWROG EPG/SAG App B Vol II, rev 4.6:

"Suppression pool water level must be maintained above the elevation of the Mark I/II downcomer vent openings. If suppression pool water level cannot be maintained above the specified minimum value, steam may not be adequately condensed, and primary containment pressure could exceed allowable limits. "

Therefore, with suppression pool level lowering, and a LOCA not isolating the suppression pool leak before uncovering the downcomer openings will result in a loss of the Pressure Suppression Function of containment and DIRECT pressurization of the air space above the suppression pool.

NUREG 1021 App D – D.1.c Failure Criteria reasoning: Candidate will fail if Torus water level is -38 inches or lower.

Initiating Cue - Suppression pool level is lowering.

Measurable Performance Standard -The Torus Water Level (TWL) is higher than -38 inches.

Performance Feedback - TWL is stable or increasing.

Expected action - Crew will isolate the leak before -38 inches TWL.

Facility: Fermi 2

Scenario No.: SCN #2

Op-Test No: ILO-2020-301

Examiners: See Attached Exam Matrix

Operators: See Attached Exam Matrix

Initial Conditions: MODE 1. 100% reactor power. East CRD Pump is out of service.Turnover: The East CRD Pump is tagged out and work is progressing to repair an oil leak. Work is expected to be completed in about 2 days. Plans for the shift are to maintain 100% power. Main Circ Water pump lineup shift is required to prepare for maintenance. After taking the shift the crew will shutdown #3 Main Circ Water pump.Critical Tasks: ATWS-ADS(CT1), ATWS-PWR(CT2)

Event No.	Malf No.	Event Type*	Event Description
1		N (BOP) N (SRO)	Shift Main Circ Water pump
2	BADCB21N096 ATVSP	TS	Condenser Pressure Instrument Failure. CRS will evaluate LCO 3.3.6.1.
3	P43MF0023	C (BOP) C (SRO)	A leak will occur on the North TBCCW pump. The crew will shift to the standby TBCCW pump and isolate the North TBCCW pump.
4	C11MF0004	C (ATC) C (SRO)	The 'A' CRD Flow Control Valve will fail. High CRD temperatures will alert the crew to the failure. The crew will enter AOP 20.106.03 and switch to B FCV.
5	NHAIALARM_U NIT554497REV	R (ATC) R (SRO)	4D53 - AVR General Alarm. The crew will diagnose that there is a failure of one thyristor bank. The ARP requires reducing reactor power, so generator output is <2400 Field Amps.
6	E41MF0010	C (BOP) C (SRO) TS	Spurious start of HPCI, BOP will shut down HPCI, and SRO will complete TS evaluation.
7	N30MF0020 C71MF0006 C11MF0001	M (All) CT1 CT2	AVR Trip of Turbine, the crew will place Mode Switch to Shut down. Manual RPS Fails to Cause a Scram (Total Scram Failure). ATWS actions required. <u>ATWS-ADS(CT1), ATWS-PWR(CT2)</u>
8	C41MF0004 C41MF0003	C (ATC) C (SRO)	SRO directs SLC injection. ATC Injects SLC. RWCU requires manual isolation.

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

D1 Supplement

A. NARRATIVE SUMMARY

MODE 1. 100% reactor power. East CRD Pump is out of service.

The East CRD Pump is tagged out and work is progressing to repair an oil leak. Work is expected to be completed in about 2 days. Plans for the shift are to maintain 100% power.

Main Circ Water pump lineup shift is required to prepare for maintenance. After taking the shift the crew will shutdown #3 Main Circ Water pump.

Event: 1

Main Circ Water pump lineup shift is required to prepare for maintenance. After taking the shift the crew will shutdown #3 Main Circ Water pump.

Event: 2

A failed Condenser Pressure Instrument results in a ½ isolation of NSSSS and the evaluation of Technical Specifications.

Event: 3

A leak will occur on the North TBCCW pump. The crew will receive alarms and field indications that will result in shifting to the standby TBCCW pump and isolating the North TBCCW pump.

Event: 4

Failure of CRD Flow Control Valve 'A' causes high CRD temperatures. The crew will enter the AOP and switch to B FCV.

Event: 5

4D53 - AVR General Alarm will alarm due to thyristor bank blocked.

Based on the ARP, the crew will reduce Reactor Power, so Generator output <2400 Field amps.

Event: 6

HPCI will start. Evaluation by the crew will show that HPCI is running without an initiation signal. The crew will shutdown HPCI and complete TS evaluation.

Event: 7 to 8

The turbine trips because of an AVR failure. A manual scram by the crew results in an Anticipated Transient Without Scram(ATWS). SLC will inject, however RWCU will require manual isolation. The crew will manually insert control rods while controlling the RPV water level per the Emergency Operating Procedures (EOP)s. And as a result, Reactor Power will lower to below the power range.

CRITICAL TASKS

ATWS-PWR(CT2) When directed by the EOPs, TAKE ACTION TO REDUCE POWER BELOW 3% by injecting SLC or Boron using the alternate means; -OR- lowering RPV water level; -OR- inserting control rods prior to exceeding the Heat Capacity Limit curve (HCL).

NUREG 1021 App D BASIS:

Safety Significance – The challenge to containment becomes the limiting factor that defines the requirement for reactor power reduction in an ATWS condition. Thus, reducing reactor power below 3% can preclude failure of containment or equipment necessary for the safe shutdown of the plant.

NUREG 1021 App D – D.1.c Failure Criteria reasoning: Candidate will fail if reactor power is NOT reduced sufficiently to prevent operation in the “DO NOT OPERATE IN THIS AREA” region of the HCL curve of 29.100.01 sheet 6.

Safety significant boundary conditions are defined by the BWROG EPGs/SAGs, appendix B, rev 3. This document identifies limiting primary containment heatup as the basis for reducing reactor power using boron, control rods, or lowering RPV water level. The scenario validation process provided assurance that the HCL curve will be violated if power is not sufficiently reduced prior to the MSIV isolation.

Initiating Cue -- Reactor scram required and reactor not shutdown.

Measurable Performance -- Reduce reactor power using boron, control rods, or RPV level.

Performance Feedback – Reactor Power is decreasing until below 3%.

Expected action - Inject SLC; and/or insert control rods; and/or lower RPV water level while monitoring reactor power to ensure power is reduced <3%.

ATWS-ADS(CT1) With a reactor scram required, reactor not shutdown, INHIBIT ADS to prevent an uncontrolled RPV depressurization.

NUREG 1021 App D BASIS:

Safety Significance - In order to affect a reduction in reactor power, actions may be taken to lower RPV water level to a level below the automatic initiation setpoint of ADS. Actuation of ADS under ATWS conditions could result in core damage, therefore automatic ADS actuation should be prevented.

NUREG 1021 App D – D.1.c Failure Criteria reasoning: Candidate will fail if there is a valid SCRAM signal (automatic or manual) AND the reactor will NOT remain shut down under all conditions without boron AND ADS automatically actuates and causes an RPV depressurization.

Safety significant boundary conditions Actuation of ADS imposes a severe thermal transient on the RPV and complicates the efforts to maintain RPV water level within the ranges specified in the ATWS RPV Control EOP. Further, rapid and uncontrolled injection of large amounts of relatively cold, unborated water from low pressure injection systems may occur as RPV pressure decreases to and below the shutoff heads of these pumps. Such an occurrence would quickly dilute in-core boron concentration and reduce reactor coolant temperature. When the reactor is not shutdown, or when the shutdown margin is small, sufficient positive reactivity might be added in this way to cause a reactor power excursion large enough to severely damage the core.

Initiating Cue – ATWS conditions.

Measurable Performance - Inhibit ADS.

Performance Feedback - ADS inhibited white lights and alarm window.

Expected action - Place both ADS inhibit switches to inhibit.