SCENARIO 1 OVERVIEW

The crew will take the shift at 75% with instructions from the SM to reduce power to 50% in an expeditious manner as requested by the dispatcher.

After the crew has the shift, PT-505 fails low. The crew responds in accordance with OS1235.05, "Turbine Impulse Pressure PT-505 or PT-506 Instrument Failure". The failure of this instrument will result in inward rod movement if rod control is in AUTO. The RO should place rod control in manual to halt rod insertion. The crew will BYPASS PT-505 and continue with the startup with SM permission.

The crew continues with the power reduction. After the crew reduces power by 3-4%, the controlling PZR level channel, LT-459, fails low. Charging flow will increase and letdown will isolate. The RO is expected to take manual control of the PZR level controller and restore PZR level. The RO will also restore letdown to service.

After PZR level is stabilized and letdown is restored, the main generator breaker trips open causing a loss of load and reactor trip. The crew is expected to enter E-0, "Reactor Trip or Safety Injection".

RCS and S/G pressures should rise due to trip. One PZR PORV and two S/G safety valves on S/G 'A' open and fail open during the transient. If pressure does not get high enough to lift them, the simulator instructor will fail them open and stick them open.

It is expected that the crew will identify the stuck open PZR PORV early in E-0 and shut the associated block valve, mitigating the vapor space LOCA. If they do not, they will be directed to E-1, "Loss of Reactor or Secondary Coolant" where they will be directed to shut the affected block valve.

The stuck open S/G safeties should cause transition from E-0 to E-2, "Faulted Steam Generator".

All 4 MSIVs are faulted at the beginning of the scenario such that they do not close automatically. Operator action will be required to shut the MSIVs, which will compound difficulties during the S/G depressurization due to the stuck open safeties.

Crew should remain in E-1 until S/G 'A' blows down completely after which the crew will be directed to ES-1.1, "SI Termination". The scenario can be terminated when the crew transitions to ES-1.1 or when the lead examiner is satisfied.

Part C – Operating Exam – Scenario 1

The purpose of scenario one is to observe the crew combat various instrument and component failures as well as a reactor trip with complications.
The crew takes the watch with instructions to continue a downpower maneuver to 50%. Shortly after taking the shift, PT-505 Turbine Impulse Pressure transmitter fails low. This instrument failure will cause rods to insert automatically. The RO is expected to verify plant conditions, stop rod motion, and restore plant conditions to program band. The US should direct actions in accordance with OS1235.05, "Turbine Impulse Pressure PT-505 or PT-506 Instrument Failure".

Event Description:		**PT-505 TURBINE FIRST STAGE PRESSURE TRANSMITTER FAILS LOW**
Time	Position	Applicant's Actions or Behavior
	NOTE	Shaded items are CRITICAL TASKS.
	CREW	Continue power decrease in accordance with OS1000.06, "Power Decrease".
	NOTE	The first event will take place shortly after the crew assumes the watch and prior to any actions to reduce power so that the first event takes place while control rods are in AUTO.
	CUE	After the crew has the watch and on the lead examiner's cue, PT-505 transmitter fails. This generates a B7457 ROD MOTION DETECTED and a D4421 TAVE-TREF DEVIATION alarm on the VAS. The sound of rods stepping in should be noted by the crew.
	RO	RO may take manual control of rods as a skill of the operator. He is expected to check that the rod motion is not warranted by high Tave or turbine load reduction first.
	BOP	Checks FW-PI-505 and determines it has failed low and informs US.
	US	Enters OS1235.05, "Turbine Impulse Pressure PT-505 Or PT-506 Instrument Failure"
	RO	Places rod control in MANUAL. Manually controls rods to restore Tavg to program level.
	BOP	Place steam dump controller to PRESSURE mode and adjust steam dump pressure setpoint to 1092 psig.
	BOP	Verifies other plant status items (AMSAC, P-13)
	US	Verify TS compliance TS 3.3.1 table 3.3-1 item 18.f. Rx Trip System Instrumentation. Action 8: determine by observation of the associated permissive annunciator windows that the interlock is in its required state for the existing plant condition, or apply Specification 3.0.3. Contacts maintenance/I&C about channel failure. Directs I&C to place AMSAC channel in BYPASS.
	NOTE	I&C will be called to troubleshoot the failed instrument. The instrument will be put in BYPASS which will remove input to any control/protection systems. The I&C personnel will also conduct any tripping of bistables called for by Technical Specification Action Statements.

The crew continues with the power reduction. After the crew reduces power by 3-4%, and when directed by the lead examiner, the controlling PZR level channel, LT-459, fails low. Charging flow will increase and letdown will isolate. The RO is expected to take manual control of the PZR level controller and restore PZR level. The RO will also restore letdown to service.

Event Description:		**FAILURE OF CONTROLLING PZR LEVEL INSTRUMENT**
Time	Position	Applicant's Actions or Behavior
	CREW	After crew completes OS1235.05, SM directs them to continue shutdown. Allow candidates to demonstrate reactivity control by reducing power by 3-4% (lead examiner's discretion).
	NOTE	During power reduction, RO must maintain AFD within administrative limits.
	BOP	If US directs, place heater level controls in Local (Level) Control Mode.
	RO	DETERMINE the quantity of boric acid required to make the desired reactivity change from RS1735,"Reactivity Calculations"
	RO	SET CS-FK-110, RCS boric acid makeup flow controller, to the desired flow rate
	RO	SET the boric acid supply counter to the desired acid quantity
	RO	TURN the BLENDER MODE START SWITCH to STOP
	RO	PLACE the BORIC ACID BLENDER MODE SELECTOR SWITCH to BORATE.
	NOTE	Operators are required to remain at the makeup controls during the boration/dilution and makeup evolution. This will ensure proper system response is verified as well as the desired amount.
	RO	TURN the BLENDER MODE START SWITCH to START
	RO	When the boric acid supply counter has added its preset quantity, VERIFY the boration stops. TURN the BLENDER MODE START SWITCH to STOP.
	RO	PLACE the BORIC ACID BLENDER MODE SELECTOR SWITCH to OFF.
	RO	As directed by US, RETURN the makeup controls to automatic blended makeup.
	RO	As directed by US, if RCS boron concentration is being changed by greater than 50 ppm, OPERATE pressurizer heaters to force spray to equalize boron concentration between the RCS and pressurizer.
	RO	RO will manually insert/withdraw rods to maintain axial flux difference in band.
	BOP	Use the LOAD SELECTOR load decrease push-button or LOAD LIMIT SET potentiometer to reduce load to the desired load but not less than 45%.
	BOP	If reducing load with the load selector, FOLLOW the load set with the load limit set potentiometer and the standby load set.
	BOP	Maintain generator VARs consistent with load per The Turbine Generator Capability Curve and load dispatcher's instructions.

	BOP	Maintain the manual voltage regulator nulled.
	BOP	Maintain speed deviations for both main feed pumps nulled.
	RO	Recognizes controlling channel (LI-459) has failed low. Recognizes letdown has isolated. Informs US.
	US	Enters and directs action IAW OS1202.07, "PZR Level Instrument Failure".
	RO	Takes manual control of PZR level controller RC-LK-459 or controls level with letdown and charging flow.
	RO	Selects an alternate level channel for CONTROL/BACKUP as necessary. Selects an alternate RECORDER channel.
	RO	Determines that letdown can be restored and restores letdown IAW OS1201.07.
	RO	Establish normal letdown: OPEN CC-V341, place CS-TK-130 in AUTO, CLOSE CS-HCV-189, CLOSE CS-HCV-190, OPEN RC-LCV-459, OPEN RC-LCV-460, OPEN CS-V145, establish letdown flow using letdown flow control valves.
	RO	Returns PZR level controller to AUTO after new controlling channel selected.
	US	Verifies TS compliance 3.3.1 table 3.3-1 item 11 and TS 3.3.3.6 Accident Monitoring Instrumentation. Verifies redundant channel bistables NOT tripped and inform I&C of controller failure.
	NOTE	Table 3-3.1 item 11: inoperable channel LT-459 tripped within 6 hours.
	NOTE	TS 3.3.3.6 requires that LT-459 be returned to operable status within 7 days.

When directed by the lead examiner, the main turbine generator output breaker will trip open due to a faulty 86 relay. This will cause a reactor trip. Immediately after the reactor trip, PZR PORV 456A is failed open and 2 safety valves on S/G 'A' are failed open. The MSIVs are failed open such that they will close only with manual operation. The 'A' S/G will depressurize fairly rapidly. The crew should enter E-0 then transition to E-2 then ES 1.1 where the scenario can be terminated. A brief transition to E-1 may be made if the crew does not shut the PZR PORV early in the event.

Event Description:		**MAIN GENERATOR BREAKER TRIP / REACTOR TRIP**
Time	Position	Applicant's Actions or Behavior
	CUE	After the US discusses TS requirements for the failure of controlling PZR level instrument, and at the discretion of the lead examiner, the main turbine generator output breaker will open on fault resulting in a loss of load/reactor trip. The first-out alarm will be TURBINE TRIP in addition to several trip related alarms.
	CUE	PZR PORV 456A fails OPEN. The operators have the red valve open indicator lamp as indication that the valve is OPEN. Two SG safeties fail open on SG 'A'. It is expected that the PZR PORV will be detected early. The SG safeties may not be noticed until appropriate diagnosis step in E-0. SG A EFW OPEN indicators on UL-2 and UL-4 indicate that SG 'A' is at low pressure and EFW has been automatically secured to it on high EFW flow.
	US	Enters E-0, "Reactor Trip or Safety Injection"
	RO	The RO may ask permission from the US to take manual control of PORV 456A and shut it (skill of the trade). The valve will fail to close. The RO will be directed to close the associated block valve.
	RO/BOP	Reactor trip immediate actions: verify reactor trip, turbine trip, power to AC buses, and SI actuated.
	BOP	Performs ESF Actuation Verification per Attachment A of E-0 (SI will actuate approximately 1 minute after the reactor trip due to low RCS pressure).
	BOP/RO	Check main steam line isolation required. Crew may not meet criteria in this step to shut MSIVs yet. MSIVs will NOT automatically isolate (they are faulted OPEN). BOP will have to manually shut MSIVs if required here.
	BOP	Verify Total EFW Flow – Greater than 500 GPM. BOP may recognize at this point that EFW is isolated to 'A' S/G on high flow (if S/G pressure is low enough).
	BOP	Stabilize S/G water levels – maintain S/G water levels 25-50% narrow range by opening EFW pump mini-flow valves and throttling EFW flow. (operator action summary page)
	RO/BOP	Monitor RCS temperature – Stable At or Trending to 557F. RCS will be cooling down due to PZR PORV open and steam demand from stuck open S/G safeties. Stop dumping steam to condenser and atmosphere. OPEN EFW min-flow valves AND throttle total feed flow to maintain greater than 500 gpm. If cooldown continues, close MSIVs and MSIV bypasses.
	RO	Check RCS isolated. Verify letdown isolated. Verify PORVs Closed. If not already done, the RO will shut the faulted PORV's block valve

		If not already done, the RO will shut the faulted PORV's block valve manually. PZR PORV must be shut BEFORE an ORANGE path exists on core cooling status tree (FR-C.2).
	BOP	Check if SG Pressure Boundary is Faulted. S/G 'A' pressure is decreasing in an uncontrolled manner or may be completely depressurized.
	US	Directs transition to E-2, "Faulted Steam Generator" based on S/G 'A' depressurization.
	BOP	Verify MSIVs and Bypass Valves of ALL S/Gs closed. BOP should manually close the MSIVs and Bypass valves if not already done. MSIVs must be closed and EFW flow into the S/G must be secured prior to an ORANGE path on Integrity (P) status tree.
	BOP	Identify Faulted S/Gs. 'A' S/G is positively identified at this time (may have been earlier).
	BOP	CLOSE MS-V393 (steam supply to EFW pump). CLOSE MSD-V44 (main steam drain to S/G 'A'). CLOSE SB-V9 (blowdown isolation valve to S/G 'A'). The isolation of the 'A' S/G mitigates radioactive release to the public and is a critical task per NUREG 1021 App D.
	NOTE	If S/G boils dry, the BOP may adjust ASDV setpoints to stabilize RCS temperature as directed by Operator Action Summary page of E-2.
	RO/US	Check if ECCS Flow Should Be Reduced. Crew is directed to ES-1.1, "SI Termination".
	CUE	Lead examiner may terminate scenario at any point in ES-1.1
	NOTE	Ensure the MSIVs are closed before an ORANGE path condition on the pressurized thermal shock CSF tree. Ensure that the PORV was closed prior to an ORANGE condition on core cooling CSF tree.

Simulator Instructor Instructions for Scenario 1

RESET simulator to IC 101, 75% power.

Please track the following parameters in addition to the standard set (if any):

SR, IR, and PR power level
Loop 2 Tave
Loop2 Tc
Thermocouples (2 channels)
RCS pressure
PZR level
RVLIS (all level channels)
CCP, RHR, SI flow rates into the RCS
S/G 'A' water level (NR and WR)
S/G 'A' pressure
All MSIV position indication.

Perform immediately after simulator is in RUN:

Fail MSIV's OPEN on automatic signals only.

MALFUNCTIONS	REACTOR PROTECTION SYSTEM	
MFRPS019	INSERT	
MFRPS020	INSERT	

Shortly after the crew assumes the watch and only after lead examiner's cue:

PT-505 Failure.

Component Malfunction - Feedwater		
ptFWPT505	FailLow	INSERT

The crew will contact I&C to respond to PT-505. Simulator operator will play role of I&C. When directed by crew, bypass PT-505. If the crew does not make a decision on bypass/trip status, call in as SM and direct BYPASS of PT-505.

To select operator bypass for PT-505:

PANEL OVERVIEW	AMSAC CP-519
Select SWITCH SW12 to TBIMP(P505)	

Crew continues power reduction.

When directed by lead examiner:
Fail Controlling PZR Level Transmitter.

Component Malfunction – Reactor Coolant		
LTRCLT459	FailLow	INSERT

When I&C is directed to bypass LT-459:
To select operator bypass for LT-459:

PANEL OVERVIEW	CP1 - BTI
CP-1 DOOR OPEN SWITCH to OPEN	
BYPASS ENABLE SWITCH to ENABLE	
Select LB-459A BYPASS	

When directed by lead examiner:

Main Generator Breaker Trip:

MFED037 – Main Generator Breaker Trip	INSERT

Insert following 2 malfunctions immediately after Main Generator Breaker Trip:

PZR PORV 456A Fails OPEN

Component Malfunction Reactor Coolant		
VpRCPCV456A	FailOpen	INSERT

S/G 'A' Safeties Fail OPEN

SimDiagram MS-1		
MS-V6	FailOpen	INSERT
MS-V7	FailOpen	INSERT

Briefing Sheet for Scenario 1

The dispatcher has requested that Seabrook Station reduce power to 50% in an expeditious manner.

No equipment is out of service.

SCENARIO 2 OVERVIEW

The crew will take the watch at 10^{-8} amps on the intermediate range channels. CCP 'B' is tagged out for maintenance. The crew is instructed to continue a power increase in accordance with OS1000.07, "Approach to Criticality" and OS1000.02, "Plant Startup from Hot Standby to Minimum Load".

NOTE: The control rods are faulted such that they will not insert from the beginning of the scenario.

After the crew assumes the watch, they will continue power ascension in accordance with OS1000.07, "Approach to Criticality". Once the lead examiner is satisfied with the reactivity addition, the 'C' S/G level transmitter, LT-539, fails HIGH. The high input to the feed control system will cause 'C' S/G feed regulating bypass valves to modulate closed, securing feed to 'C' S/G. The is no redundant channel for this level transmitter thus the BOP operator must maintain manual control of S/G 'C' feed regulating bypass valve for the remainder of the startup.

Once level control is regained in the S/Gs (proper level not necessary), a 30 gpd tube leak develops on S/G 'A'. The crew should respond to the leak in accordance with OS1227.02, "Steam Generator Tube Leak". This procedure has the crew verify lineups and notify Chemistry of the tube leak. The crew will begin calculating leak rate. While making the proper notifications, S/G 'A' ASDV will fail OPEN. The BOP will take manual control of the valve and close it. The US will verify TS compliance.

After the ASDV is closed, the controlling PZR pressure instrument fails high. PZR spray initiates. RCS pressure will decrease rapidly. It is expected that the RO will verify RCS pressure is normal and manually secure PZR spray flow. If the crew is too slow, the plant may trip on low pressure. A plant trip will not negatively affect the scenario at this point because the control rods are faulted. If the crew trips the plant, the S/G tube rupture will be inserted immediately (500gpm) on S/G 'A'.

When PZR sprays are secured and RCS pressure is steady or rising, a 500 gpm tube rupture will start on S/G 'A'. PZR level will decrease as the leak rate is greater than the capacity of the charging system. When the crew manually initiates SI, the 'A' CCP trips. The US will order a manual safety injection at this point if the plant did not trip automatically. Control rods will not insert in response to any action by the crew.

Crew combats ATWS in accordance with FR-S.1, "Response to Nuclear Power Generation /ATWS". CCP 'A' tripped, thus the normal emergency boration flow path is not available. The RO will line up and start the positive displacement pump to complete the emergency boration.

The crew will address the tube rupture in accordance with E-3, "Steam Generator Tube Rupture".

The scenario is complete when the crew completes a cooldown to the target value in E-3.

Part C – Operating Exam – Scenario 2

The purpose of scenario two is to observe the crew combat various instrument and component failures as well as actions for a S/G tube rupture and ATWS event.
The crew takes the watch with instructions to continue a power increase from 10^{-8} amps to minimum loading on the main turbine. CCP 'B' is danger tagged for maintenance. The S/G 'C' level transmitter, LT-539, fails high resulting in S/G 'C' feed regulating bypass valves modulating closed, securing feed to S/G 'C'.

Event Description:		**S/G 'C' LEVEL TRANSMITTER FAILS HIGH**
Time	Position	Applicant's Actions or Behavior
	NOTE	Shaded items are CRITICAL TASKS.
	CREW	Crew assumes the watch and continues with power ascension on step 4.7 of OS1200.07, "Approach to Criticality" then starts OS1200.02, "Plant Startup from Hot Standby to Minimum Loading". Expect a reactivity brief.
	NOTE	Step 4.7.1 of OS1200.07: The reactor is critical and power is being maintained at approximately 10^{-8} amps in the intermediate range. To continue plant startup to minimum load, refer to OS1000.02.
	NOTE	Caution: Do not exceed the capacity of the startup feed pump (191 amps or 3% RTP). Do NOT exceed a STABLE start up rate of 1 DPM.
	RO	Increase reactor power to between 1% and 3% by soluble boron control or control rod motion, and maintain TAVG greater than or equal to TREF and within the limits of Figure 2, TAVG Program.
	RO	RO will have manual control of control rods and withdraw rods at a rate determined by US, probably 2-step increments.
	CUE	Once the reactivity manipulation is completed satisfactorily, the lead examiner will direct the failure of the 'C' S/G level transmitter, LT-539, to it's HIGH value. The high S/G level will cause 'C' S/Gs feed regulating bypass valve to modulate closed and 'C' S/G water level to decrease. No immediate alarm is received. If crew does not notice failure, the SG C LEVEL HI/LO annunciator will come in.
	BOP	Informs US of lowering S/G water levels in 'C' S/G. The BOP will verify level deviation on controlling level channel, FW-LI-539 OR FW-LI-553. The BOP will take manual control of S/G 'C' feed regulating bypass valve and restore S/G 'C' water levels to the program level.
	US	The US will enter and direct action from OS1235.03, "S/G Level Instrument Failure".
	BOP	Place 'C' steam generator bypass feed control valve in MANUAL.
	BOP	Control S/G water level manually between 50-70% on the narrow range level detectors.
	BOP	BOP may select different channel for feed regulating valve control in anticipation of future use during startup.
	US	Verify redundant bistables NOT tripped. Verify Technical Specification Compliance, TS 3.3.1 table 3.3-1 item 13 Reactor Trip

		System Instrumentation, TS 3.3.2 table 3.3-3 , items 5.b, 6.a, 7.c, and 10.c Engineered Safety Features Actuation System Instruments, TS 3.3.3.6 table 3.3-10, item 7 Accident Monitoring Instruments.
	NOTE	TS Actions required: For 3.3.1 and 3.3.2: startup and/or power operation may proceed provided the inoperable channel is placed in the tripped condition within 6 hours and the minimum channels OPERABLE requirement is met. The channel may be bypassed up to 4 hours for surveillance of other channels. For 3.3.3.6: requires LT-539 to be returned to OPERABLE status within 7 days.
	US	Notifies I&C of level channel failure and directs them to come to the control room.

A 30 gpd tube leak develops on S/G 'A'. This leak is not large enough to be noticeable on level instruments but will be detected on radiation monitors. While the crew is making the proper notifications for the tube leak, the 'A' S/G ASDV will fail open.

Event Description:		**30 GPD PRIMARY TO SECONDARY TUBE LEAK ON S/G 'A'**
Time	Position	Applicant's Actions or Behavior
	CUE	At lead examiner's cue, a 30 gpd leak develops on S/G 'A'. RDMS alarms alert the crew to the leak. The first indication of the leak is S/G blowdown lines in an ALERT status on RDMS. Expected VAS alarms are B8442, PRI to SEC Leak Rate of Change HI and B8443 PRI to SEC Leak Rate of Change HI HI. Note: 30gpd tube leak will not be noticeable in any plant parameters except radiation monitors.
	US	Enters and directs action of OS1227.02, "Steam Generator Tube Leak".
	BOP/RO	Identify affected steam generators. Check RDMS for increasing radiation levels: main steam line monitors and S/G blowdown sample monitors.
	BOP/RO	Notify Chemistry to implement CS0905.08, "Response to a Primary to Secondary Leak". Chemistry may recommend RDMS setpoint changes and report results of grab samples. Notifications to HP, plant management, and waste services will be made to facilitate station response to the leak.
	CUE	While the crew is implementing OS1227.02 (during notifications), a S/G 'A' ASDV will begin to fail open. The failure is ramped over 30 seconds. The ATMOS STM DUMP VALVE OPEN annunciator will come in as well as the VAS alarm D5214 ASDV A NOT FULL CLOSED.
	BOP	Place ASDV control switch to close. Closing or isolating the ASDV stops the release of fission products and other radioisotopes to the public and hence is a critical task.
	BOP	Place controller for ASDV to manual - MINIMUM
	US	Verifies Technical Specifications are met. T.S. 3.7.1.6 Atmospheric Release Valve and T.S. 3.6.3 Containment Isolation Valves.
	NOTE	TS 3.7.1.6 and 3.6.3 are not applicable due to ASDV being manually operable.
	US	Refer to FR-H.4, "Response To Loss Of Normal Steam Dump Capabilities"

After the crew shuts the 'A' S/G ASDV manually, the controlling PZR pressure channel fails high. This results in a rapid pressure decrease in the RCS. The crew will have to take action to manually shut the PZR spray valves or take manual control of the master pressure controller to mitigate the pressure decrease.

Event Description:		**FAILURE OF CONTROLLING PZR PRESSURE CHANNEL PT-455**
Time	Position	Applicant's Actions or Behavior
	CUE	When the 'A' ASDV is closed and the US has addressed any TS issues, the controlling PZR pressure instrument, PT-455, fails high. PZR spray initiates. RCS pressure decreases quickly. The crew will receive VAS alarm F7860 PZR PRESS HI CHANNEL TRIP and the PRESSURIZER PB-455A PRESS HI annunciator will come in.
	RO	Uses VAS alarm procedure or skill of the operator to identify failed PT-455 instrument. The RO may take manual control of the master pressure controller or spray valves to control RCS pressure.
	US	Enters and directs actions in OS1201.06, "PZR Pressure Instrument PT-455/458 Failure".
	NOTE	If pressure decrease is not stopped quickly, the reactor will trip on low pressure. This should not affect the course of the scenario because the control rods are already faulted. The simulator instructor will insert the tube rupture immediately if the plant trips on low pressure.
	RO	Realign Pressure Instruments. If not done so already, the RO will either take manual control of the master pressure controller or spray flow to return RCS pressure to program band.
	RO	Select an alternate pressure channel for CONTROL/BACKUP.
	RO	The RO will verify that there are no other pressure boundary breaches and will verify pressure setpoints on the master controller.
	US	Verify Redundant Channel Bistables NOT TRIPPED and Verify Technical Specification Compliance: TS 3.3.1 table 3.3-1, items 7,9, and 10 Reactor Trip System Instrumentation. TS 3.3.2 table 3.3-3 items 1.d and 10.a ESFAS Instrumentation. TS 3.2.5 DNB Parameters (if RCS pressure drops below 2185 psig). Ensures I&C is informed and directs all appropriate bistables in attachment A are tripped within 6 hours.
	NOTE	TS Actions: For 3.3.1: startup and/or power operation may proceed provided the inoperable channel is placed in the tripped condition within 6 hours and the minimum channels OPERABLE requirement is met. The channel may be bypassed up to 4 hours for surveillance of other channels. For 3.3.2: determine by observation of the associated permissive annunciator windows that the interlock is in its required state for the existing plant condition, or apply Specification 3.0.3. For 3.2.5: with pressure below 2185psig, restore pressure to its normal limits within 2 hours or reduce thermal power to less than 5% RTP within the next 4 hours.

After the crew stabilizes RCS pressure and restores RCS pressure control to automatic, the tube leak in S/G 'A' develops into a 500 gpm tube rupture. The crew will manually SI because PZR level cannot be maintained with normal charging. Control rods will fail to insert on the SI. The crew will take action for an ATWS when they realize that control rods will not insert. CCP 'A' trips on overcurrent when the SI is manually initiated, preventing the crew from performing a normal emergency boration. Emergency boration will be lined up in an alternate lineup using the positive displacement pump (PDP).

Event Description:		**500 GPM TUBE RUPTURE / ATWS**
Time	Position	Applicant's Actions or Behavior
	CUE	After the US determines TS compliance for PT-455, the 500 gpm tube rupture will be inserted on S/G 'A'. The 500 gpm leak is beyond the capability of both centrifugal charging pumps. The crew should receive VAS alarms PZR Pressure Lo & B/U Heaters On and PZR LEVEL DEVIATION annunciators and RDMS alarm "MAIN STEAM LINE LOOP 1 – HIHI'.
	US	Will determine that PZR level CANNOT be maintained with leak this large. Per OS1227.02 caution statement before step 1, SI is to be initiated if PZR level cannot be maintained greater than 5% with normal charging lineup. CCP 'A' fails when SI is initiated.
	RO	Manually initiates SI. Control rods do not insert. Informs US of ATWS condition. Isolates letdown based on decreasing PZR level.
	US	Enters and directs actions of E-0. Acknowledges ATWS condition.
	RO	Verify Reactor Tripped. RO determines that the reactor is NOT tripped and reports this to US.
	US	Transition to FR-S.1, "Response to Nuclear Power Generation/ATWS". Directs NSO to locally trip reactor.
	RO	Verify reactor tripped: reactor is NOT tripped.
	RO	Initiate Emergency Boration of the RCS. The RO should note that there are NO CCPs running.
	RO	Manually start positive displacement pump by: opening CS-V205, start the PDP, place CS-FK-121 in manual and increase controller output to 100%, place RC-SK-459A, PDP speed controller in manual and charge at maximum rate, close CS-V205.
	RO	Start at least one boric acid pump.
	RO	Open emergency borate valve – CS-V426. Establishing/maintaining emergency boration is a critical task as defined in NUREG 1021 App D.
	RO	Align charging flow path: align CCP suction to RWST by opening CS-LCV-112D and –112E. Isolate VCT by closing CS-LCV-112B and –112C.
	BOP	Performs attachment A of E-0 in conjunction with this procedure to verify proper ECCS operation.
	CUE	Once the emergency boration lineup is complete and injecting, the NSO will open the reactor trip breakers locally.

	US	Returns to E-0 (procedure in effect) after FR-S.1 is completed.

The crew will address the 500 gpm tube rupture in accordance with E-3, "Steam Generator Tube Rupture", after FR-S.1 is exited. The scenario is complete once the crew isolates S/G 'A'. The US will be expected to make an EAL evaluation for the end state of the scenario and complete section A.4 of the Administrative JPM Examination.

Event Description:		**500 GPM TUBE RUPTURE ON S/G 'A'**
Time	Position	Applicant's Actions or Behavior
	CUE	When crew reaches step 13 of E-0 they will be directed to E-3, "Steam Generator Tube Rupture"
	RO/BOP	Identify ruptured steam generator using S/G narrow range level (increasing uncontrollably) or radiation monitors.
	BOP	Adjust ruptured S/Gs ASDV controller setpoint to 1125psig.
	BOP	Shut MS-V393, steam supply to steam driven EFW pump.
	BOP	Close S/G 'A' upstream drain valve MSD-V44. (on back panel)
	BOP	Close S/G 'A' MSIV and Bypass valves. The critical task is to isolate all feed flow to and all steam flow from the ruptured S/G before a transition to ECA-3.1 is required.
	NOTE	The 'A' S/G is now isolated.
	RO	Opens EFW pump mini-flow valves AND stops feed flow to S/G 'A'.
	US	Determines required core exit temperature using table in step 7 of E-3.
	BOP	Place the steam dump pressure controller in manual and at minimum output.
	BOP	Transfer steam dump control mode selector to steam pressure.
	BOP	Bypass Low Low Tavg interlock as necessary to maintain steam dump operation during cooldown.
	BOP	Slowly OPEN steam dumps to prevent a steamline isolation AND establish a maximum cooldown rate.
	RO	Maintain PZR pressure less than 1900 psig using normal PZR spray. Use PORV if spray not available.
	NOTE	The cooldown and RCS depressurization of the RCS is a critical task to ensure adequate subcooling, minimize break flow and refill the PZR. If the crew was to allow a plant heatup or RCS pressure increase, the barrier to fission product release will have been degraded.
	CUE	Scenario 2 is complete when target cooldown temperature and pressure is reached or at lead examiner's discretion.

Simulator Instructor Instructions for Scenario 2

RESET simulator to IC 194, 10^{-8} amps & critical.

Initial Setup:
Conditions to make control rods untrippable from control room:

MALFUNCTIONS REACTOR PROTECTION		
MFRPS001	AUTOMATIC REACTOR TRIP FAILURE TRA	INSERT
MFRPS002	AUTOMATIC REACTOR TRIP FAILURE TRB	INSERT
COMPONENT MALFUNCTIONS ROD CONTROL		
bkCPRTA		FAILCLOSED
bkCPRTB		FAILCLOSED
PANEL PDF12B		
Override Rx Trip Switches to RELEASE		

Place Train 'A' Control Room Ventilation in Filter Recirc Mode

Conditions for having charging pump 'B' tagged out:

RACKOUT CS-P-2B		
Override CS-V197 CLOSED		
Place CS-P-2B in PTL		
COMPONENT REMOTE FUNCTIONS CHEMICAL AND VOLUME CONTROL		
BKCS1P2B_52	RF: RACKOUT	
ECCS TRAIN B BYPASS/INOP CVCS TRB PUSHBUTTON		
PANEL PDF11A		
INSERT OVERRIDE		
CS-V197	CLOSE	
SELECT	CLOSE	
INSERT		
INSERT OVERRIDE		
CS-V197	REDLIGHTOFF	
SELECT	OFF	
INSERT		
INSERT OVERRIDE		
CS-V197	GREENLIGHTOFF	
SELECT	OFF	
INSERT		

S/G LEVEL TRANSMITTER FAILURE
After crew achieves their reactivity addition and on the lead examiner's cue, fail the S/G 'C' level transmitter.

COMPONENT MALFUNCTIONS FEEDWATER			
	LTFWLT539	FAILHIGH	INSERT

(Perform actions for BTI for failed channel if lead examiner requests.)

To trip bistables:

PANEL OVERVIEW
TRIP CP-1
DOOR OPEN SELECT OPEN
Place following switches to TEST/TRIP (or BYPASS):
LB 539A
LB 539B

S/G 'A' TUBE LEAK
Once level is restored in 'C' S/G, insert tube leak in S/G 'A'

MALFUNCTIONS STEAM GENERATOR		
	MFSG002	SG A TUBE RUPTURE
	FINAL VALUE 0.021 GPM	INSERT

S/G 'A' ASDV FAILURE
When the crew is making notifications for the tube leak, the lead examiner will cue the ASDV failure.

COMPONENT MALFUNCTIONS MAIN STEAM			
	PTMSPK3001	FAIL TO SPECIFIED VALUE	1500
	RAMP 30 SECS	INSERT	

PZR PRESSURE TRANSMITTER FAILS HIGH
After the crew gets the S/G 'A' ASDV shut and on the lead examiner's cue fail PT-455 high.

COMPONENT MALFUNCTION REACTOR COOLANT			
	PTRCPT455	FAILHIGH	INSERT

If the reactor trips due to low pressure, IMMEDIATELY insert the rod control and 500gpm tube rupture below.

Otherwise, once RCS pressure is stable, and on the lead examiners cue, insert the rod control failure and 500 gpm tube rupture on S/G 'A'.

ROD CONTROL FAILURE

MALFUNCTION	ROD CONTROL		
IMF	MFCP005	AUTO/MANUAL ROD MOTION FAILURE	INSERT

500 GPM TUBE RUPTURE ON S/G 'A'

MODIFY MFSG002 TO 500 GPM	
SET FINAL VALUE TO 500	INSERT

FAILURE OF CCP 'A'

When the crew manually initiates SI, fail the remaining CCP.

MALFUNCTIONS	CHEMICAL AND VOLUME CONTROL		
	MFCC016	CS-P-2A OC TRIP	INSERT

TRIP REACTOR

After the crew establishes emergency boration with the PDP, manually open the reactor trip breakers.

DELETE MALFUNCTIONS MFRPS001 AND MFRPS002 (and/or breaker MALFUNCTIONS) TO TRIP REACTOR.

Report to the control room that trip breakers have been opened locally.

Scenario 2 ends when target temperature is reached during E-3 cooldown.

Scenario 2 Briefing Sheet

The reactor is at 10^{-8} amps. Step 4.6 of OS1000.07, "Approach to Criticality" is complete. The crew will continue a power increase in accordance with OS1200.02, "Plant Startup from Hot Standby to Minimum Loading".

The "B" CCP is tagged out for maintenance.

SCENARIO 3 OVERVIEW

The crew takes the watch with reactor power at 75%. The crew is instructed to continue with a power reduction to remove steam generator feed pump 'A' from service for corrective maintenance.

When the crew assumes the watch they will continue with a downpower maneuver IAW OS1000.06, "Power Decrease". After the crew takes the watch but before they commence the power reduction, Loop 1 Tc fails high resulting in Tave for loop 1 failing high. This results in an automatic rod insertion. The RO should take manual control of control rods and stop uncontrolled insertion. The crew will respond to the broken Tc instrument IAW OS1201.08, "TAVG-Delta T Instrument Failure". The crew should defeat affected loop delta-T and Tavg inputs.

Once all bistables are tripped, channels defeated for the loop 1 Tavg instrument, the crew will continue with the power decrease. After a sufficient reactivity change is observed by the examining team, the lead examiner will cue the next event. The SGFP master speed controller setpoint is failed to zero, resulting in SGFPs slowing down. The RO will take manual control of each SGFP and restore proper feed flow.

Once feed flow is stabilized and plant condition is assessed by the US, a leak develops in the PCCW system to the supply of RCP cooling. The leak is 90gpm on the 'C' RCP oil cooler. The leak is great enough to cause RCP shaft and frame vibrations above the ALERT limit. The US should direct a reactor trip based on RCP frame vibration greater than 5 mils.

When the crew completes immediate actions of E-0, "Reactor Trip or Safety Injection", a large break LOCA develops. The crew is expected to enter E-1, "Reactor Coolant or Secondary Coolant Leak" to combat the LOCA.

Both RHR pumps and both SI pumps will fail to start automatically requiring manual action by the RO to restore injection to the RCS.

Containment isolation phase B fails to auto-initiate. Manual action is required to complete containment isolation.

The crew will have to transition to a coldleg recirculation scheme or a cooldown/depressurize scheme based on RCS pressure. It is expected that RCS pressure will be less than 260 psig at this point which results in transition to ES-1.3, "Transition to Cold Leg Recirculation".

After the crew aligns the ECCS for recirculation, the 'A' RHR pump and a valve in the 'B' RHR train will fail resulting in a loss of recirculation cooling. The crew will transition to ECA-1.1 to supply makeup water to the RWST.

The scenario is complete when makeup water is being supplied to the RWST.

Part C – Operating Exam – Scenario 3

The purpose of scenario three is to observe the crew combat various instrument and component failures as well as actions for a large break LOCA with complications. The crew takes the watch with instructions to continue a power decrease from 75% to 50% to remove 'A' SGFP from service. SW 'C' is danger tagged for maintenance. Loop 1 Tc instrument will fail high resulting in a high Tavg for loop 1. Auctioneered high Tavg will fail high resulting in inward rod motion.

Event Description:		**LOOP1 TC INSTRUMENT FAILS HIGH**
Time	Position	Applicant's Actions or Behavior
	NOTE	Shaded items are CRITICAL TASKS.
	CREW	Crew assumes the watch and continues downpower from 75% to 50%.
	CUE	Shortly after assuming the watch, upon lead examiner's cue, a loop 1 Tc fails high resulting in high Tave for loop 1. The following VAS alarms will come in due to the failure: B7457 ROD MOTION DETECTED, D4422 AUCTIONEERED TAVG HIGH, and D4421 TAVG-TREF DEVIATION. The sound of rods driving inward will also cue the operators. Operators will have visual indication on loop 1 Tavg and delta-T instrumentation of which instrument has failed.
	RO	RO should identify which channel is faulted by using Tavg and Delta-T instruments.
	RO	Verify rod motion unnecessary and place rod control in MANUAL to stop insertion. The RO may do this very quickly prior to referencing any procedure as a skill of the trade.
	US	Enters and directs action of OS1201.08, "TAVG-Delta T Instrument Failure"
	RO	Determine loop 1 TAVG channel failed HIGH.
	RO	Place rod control in MANUAL (required by procedure at this point).
	RO	Depress loop 1 delta-T defeat pushbutton. Depress loop 1 Tavg defeat pushbutton.
	RO	Restore Tavg within 1F of Tref by manually controlling rod motion. The operators may choose to reduce turbine load instead because they are performing a power decrease procedure – this is acceptable.
	RO	Place rod control in AUTO.
	US	Verify redundant channel bistables NOT tripped and verify technical specification compliance. TS 3.3.1 table 3.3-1 items 7 & 8. Coordinate with I&C for bypass operation or bistable tripping within 6 hours.
	NOTE	TS Actions required: For 3.3.1 ITEMS 7 & 8: startup and/or power operation may proceed provided the inoperable channel is placed in the tripped condition within 6 hours and the minimum channels OPERABLE requirement

		is met. The channel may be bypassed up to 4 hours for surveillance of other channels.

The steam generator feed pump (SGFP) master controller fails such that SGFP speed decreases (setpoint failed to zero), reducing feed flow to all S/Gs. Manual control of the SGFPs must be taken to restore S/G water level. The crew will continue with the a power reduction in this segment.

Event Description:		**FAILURE OF SGFP MASTER CONTROLLER**
Time	Position	Applicant's Actions or Behavior
	CUE	After the US determines TS compliance, crew will continue with power reduction.
	NOTE	During power reduction, RO must maintain AFD within administrative limits.
	BOP	If US directs, place heater level controls in Local (Level) Control Mode.
	RO	Calculates and aligns boration in accordance with OS1008.01, "Chemical and Volume Control System Makeup Operations". See reference.
	RO	DETERMINE the quantity of boric acid required to make the desired reactivity change from RS1735,"Reactivity Calculations"
	RO	SET CS-FK-110, RCS boric acid makeup flow controller, to the desired flow rate
	RO	SET the boric acid supply counter to the desired acid quantity
	RO	TURN the BLENDER MODE START SWITCH to STOP
	RO	PLACE the BORIC ACID BLENDER MODE SELECTOR SWITCH to BORATE.
	NOTE	Operators are required to remain at the makeup controls during the boration/dilution and makeup evolution. This will ensure proper system response is verified as well as the desired amount.
	RO	TURN the BLENDER MODE START SWITCH to START
	RO	When the boric acid supply counter has added its preset quantity, VERIFY the boration stops. TURN the BLENDER MODE START SWITCH to STOP.
	RO	PLACE the BORIC ACID BLENDER MODE SELECTOR SWITCH to OFF.
	RO	As directed by US, RETURN the makeup controls to automatic blended makeup.
	RO	As directed by US, if RCS boron concentration is being changed by greater than 50 ppm, OPERATE pressurizer heaters to force spray to equalize boron concentration between the RCS and pressurizer.
	RO	RO will manually insert/withdraw rods to maintain axial flux difference in band.
	BOP	Use the LOAD SELECTOR load decrease push-button or LOAD LIMIT SET potentiometer to reduce load to the desired load but not less than 45%.
	BOP	If reducing load with the load selector, FOLLOW the load set with the load limit set potentiometer and the standby load set.
	BOP	Maintain generator VARs consistent with load per The Turbine Generator Capability Curve and load dispatcher's instructions.

	BOP	Maintain the manual voltage regulator nulled.
	BOP	Maintain speed deviations for both main feed pumps nulled.
	CUE	Once crew has demonstrated a satisfactory reactivity addition, the SGFP master controller fails such that the SGFPs slow down. The following annunciators should illuminate: S/G A LEVEL HI/LO, S/G B LEVEL HI/LO, S/G C LEVEL HI/LO, S/G D LEVEL HI/LO. VAS alarms D4770 SG A LVL REF DEVIATION, D4770 SG A LVL REF DEVIATION, D4770 SG A LVL REF DEVIATION, and D4770 SG A LVL REF DEVIATION will come in.
	BOP	The RO should notice that the SGFP controller is malfunctioning and report condition to US (the RO will notice that the setpoint indicates 0).
	BOP	Takes manual control of SGFP master controller and controls speed manually to restore proper S/G water levels.
	NOTE	The BOP should reference the Secondary Technical Data Book to determine the proper delta-P for flow desired.
	BOP	Manually controls SGFPs to maintain proper differential pressure for feed flow.
	NOTE	No TS compliances issues with this failure.

A PCCW leak develops in the 'C' RCP oil cooler. The lack of cooling causes pump vibration and low levels in the PCCW expansion tank. The US will direct a reactor trip due to high vibrations on RCP 'C'. A large break LOCA develops immediately after the reactor trip. Both RHR pumps and both SI pumps fail to inject automatically and phase B containment isolation will fail to automatically initiate. The crew will eventually transition to either ES-1.3, "Transition To Cold Leg Recirculation" (expected) or ES-1.2, "Post LOCA Cooldown and Depressurization". The RH-P-8A pump will fail after the recirculation lineup is established followed by closure of CBS-V14 (suction valve for pump RH-P-8B) resulting in a loss of ECCS cooling. The crew will transition to ECA-1.1, "Loss of Emergency Coolant Recirculation".

Event Description:		**PCCW LEAK ON RCP 'C' OIL COOLER/LARGE BREAK LOCA**
Time	Position	Applicant's Actions or Behavior
	CUE	When manual control of the SGFP master controller is complete and S/G water levels are being restored, insert a PCCW leak on RCP 'C' oil cooler. Many VAS alarms will come in, including D5781 RCP C MOTOR VIBRATION HIGH and D4313 RCP C UPPER OIL RESVR LEVEL HIGH. The RCP VIBRATION HI annunciator will come in.
	CREW	Will use plant computer to investigate RCP C – will determine that frame and shaft vibrations are high.
	US	Orders reactor tripped because frame vibrations are greater than 5 mils. The ALARM level is 5 mils for RCP frame vibrations and will result in a manual reactor trip and subsequent securing of RCP 'C'.
	RO	Manually TRIP the reactor. RCP 'C' will be secured after immediate actions of E-0 are completed.
	US	Enters and directs actions of E-0, "Reactor Trip or Safety Injection"
	CUE	After immediate actions of E-0 are taken, a large break LOCA develops in the RCS.
	BOP	Stabilize S/G water levels – maintain S/G water levels 25-50% narrow range by opening EFW pump mini-flow valves and throttling EFW flow. (Operator Action Summary page)
	BOP	At step 7 of E-0 – if containment pressure has risen above 18 psig, containment isolation must be verified. Actual containment pressure reaches approximately 30 psig. Operators should notice that phase 'B' failed to initiate at this point. Actuate BOTH CBS/P/CVI manual actuation switches for each train.
	BOP	Manually align valves and equipment necessary by status panel (phase B status panel)
	BOP	Stop all RCPs. RCPs may have been tripped earlier because subcooling is below 40F.
	RO	The RO performs attachment A of E-0 (SI alignment verification). The operators should notice that SI and RHR pumps have not started and start them manually per Attachment A.
	US	At step 14. CHECK IF RCS IS INTACT. Containment radiation levels, pressure and water levels will cause transition to E-1, "Loss of Reactor or Secondary Coolant".
	US	Will acknowledge RED path on P FR status tree. Enters FR-P.1. No operator action required.

	US	Will acknowledge ORANGE path on Z FR status tree. Enters FR-Z.1. No actions by applicants required. Staff will align hydrogen analyzers.
	BOP	Open EFW pump mini-flow valves AND control feed flow to maintain narrow range level between 5% and 50% (25% and 50% for adverse containment).
	RO	Resets SI (step 10 of E-1).
	BOP	Stops unloaded EDGs and resets them for auto-start. Press both emergency stop buttons. After the EDG has stopped, reset the EDG for auto-start. ISOLATE SW to the EDG.
	NOTE	At step 12, the US will determine to either transition to ES-1.2, "Post LOCA Cooldown and Depressurization" or go to ES-1.3, "Transfer to Cold Leg Recirculation" based on RCS pressure being less than or greater than 260 psig. It is expected that RCS pressure is less than 260psig and the crew will transition to ES-1.3.

The crew transitions to ES-1.3, "Cold Leg Recirculation". Once the crew completes the initial lineup, RHR pump RH-P-8A will trip on overcurrent and the suction valve for RH-P-8B will shut, isolating all RHR flow from the RCS. The crew must then transition to ECA 1.1 to line up makeup water supply to the RWST.

Event Description:		**COLD LEG RECIRC/RHR PUMP FAILURE DURING RECIRC**
Time	Position	Applicant's Actions or Behavior
	CUE	The crew transitions to ES-1.3, "Cold Leg Recirculation".
	NOTE	Steps 1 through 3 must be performed within 3 minutes after receiving RWST Lo Lo level alarm. The remainder of the procedure should be performed without delay. FRPs should NOT be implemented prior to completion of this procedure. Establishing ECCS recirculation flow is a critical task.
	RO	Reset SI.
	RO	Simultaneously CLOSE CBS-V2 and CBS-V5
	NOTE	Any pumps taking suction from RWST should be stopped upon RWST EMPTY alarm.
	RO	Place RHR pump switches in the normal-after-start position.
	RO	CLOSE SI pump miniflow valves: SI-V89, SI-V90, SI-V93.
	BOP	Energize MCC-E522 and MCC-E622.
	RO	CLOSE RH-V14.
	RO	OPEN CS-V460. OPEN CS-V461. OPEN CS-V475.
	RO	OPEN RH-V35. OPEN RH-V36.
	RO	Start any pump that was stopped due to RWST EMPTY alarm.
	NOTE	The following steps isolate RWST feed to SI pumps and CCPs.
	RO	CLOSE CBS-V47. CLOSE CBS-V51.
	RO	CLOSE CS-LCV-112D. CLOSE CS-LCV-112E.
	RO	Deenergize CCP suction valves: CS-LCV-112D MCC-E512 and CS-LCV-112E MCC-E612.
	RO	Deenergize MCC-E522 and MCC-E622.
	NOTE	RHR pump P-8A trips on overcurrent
	US	Transitions back to E-1 (end of ES-1.3).
	NOTE	Suction valve for RHR pump P-8B fails shut (Loss of ECCS Recirculation).
	US	Transitions to ECA-1.1, "Loss of Emergency Coolant Recirculation". Transition criteria are on the operator action summary page of E-1.

	RO	Check containment sump valve CBS-V14 is OPEN- NO – if valve cannot be opened, then stop corresponding RHR and CBS pumps. RO should stop RH-P-8B and CBS pump 'B'.
	RO	Reset SI
	RO	Reset automatic switchover S SIGNAL RESET FOR S/RWST LO-LO CBS-V8 or CBS-V14 AUTO OPEN.
	US	Locally OPEN makeup valves to RWST. Orders the following valves opened: CS-V446 and CS-V444.
	RO	Set BA flow counter for greater than 10,000.
	RO	Set total makeup flow counter for greater than 30,000.
	RO	Set total flow controller, CS-FK-111, for 120 gpm.
	RO	Set BA flow controller, CS-FK-110, for 40 gpm.
	RO	Place one RMW pump in AUTO. Place one BA pump in AUTO.
	RO	Aligns the following valves: CS-FCV-110A AUTO, CS-FCV-111A AUTO, CS-FCV-110B CLOSED, and CS-FCV-111B CLOSED.
	RO	Place the boric acid blender switch in MANUAL.
	RO	Place blender mode start switch to START.
	CUE	Once BA flow and total makeup flow have been verified, the scenario can be terminated by the lead examiner.

The following script is provided in the case that the crew transitions to ES-1.2 instead of ES-1.3 following the LOCA. The scenario will be terminated when the crew establishes the maximum cooldown rate in step 8.

Event Description:		ES-1.2, "POST LOCA COOLDOWN AND DEPRESSURIZATION" CONTINGENCY
Time	Position	Applicant's Actions or Behavior
	RO	Reset SI.
	RO	Reset Phase A and Phase B Containment Isolation Signals (T signal reset and P signal reset).
	RO	Place all PZR heater switches in OFF position.
	US	Consult with TSC for a recommended minimum indicated PZR water level that will ensure heaters are covered.
	BOP	OPEN EFW pump miniflow valves AND control feed flow to maintain narrow range level between 5% and 50% (25% and 50% for adverse containment).
	RO	Monitors shutdown margin during cooldown.
	NOTE	Maintain cooldown rate in RCS cold legs less than 100F/HR.
	BOP	Place the steam dump pressure controller in MANUAL and at minimum output.
	BOP	Transfer steam dump control mode selector to steam pressure.
	BOP	Bypass Low Low Tavg interlock as necessary to maintain steam dump operation during cooldown.
	BOP	Slowly OPEN steam dumps to prevent a steamline isolation AND establish a cooldown rate less than 100F/HR.
	CUE	The lead examiner may terminate the scenario at this point after observing a portion of the cooldown.

Simulator Instructor Instructions for Scenario 3

RESET simulator to IC101, 75% power.

PLEASE TRACK THE FOLLOWING PARAMETERS IN ADDITION TO WHAT IS NORMALLY TRACKED:
Loop 2 Tave, Tc
RCS pressure
SR, IR, and PR power
RHR flow rate into RCS
PZR level
RVLIS (some indication of water level in the reactor vessel)
Containment pressure

Initial Setup:

SW Pump 41C tagged out for maintenance

COMPONENT REMOTE FUNCTIONS
SELECT CSW41C BREAKER RACKED IN
INSERT: RF: RACK-OUT

SI Pumps fail to start on SI

MALFUNCTIONS SAFETY INJECTION	
MFSI003	SI PUMP P-6A FAILS TO AUTO START
MFSI004	SI PUMP P-6B FAILS TO AUTO START

RHR Pumps fail to start on SI

MALFUNCTIONS	RESIDUAL HEAT REMOVAL
MFRH005	RH-P-8A FAILS TO AUTO START
MFRH006	RH-P-8B FAILS TO AUTO START

Phase B Containment Isolation Fails

MALFUNCTIONS	REACTOR PROTECTION	
MFRPS013	P SIGNAL FAILS TO AUTO ACTUATE TRA	
MFRPS014	P SIGNAL FAILS TO AUTO ACTUATE TRB	

Shortly after the crew assumes the watch, the lead examiner will cue event #1 which is failure of Loop 1 Tc HIGH.

Failure of Loop 1 Tc

COMPONENT MALFUNCTION	REACTOR COOLANT	
ttRCTT411	FAILHIGH	INSERT

To trip bistables for loop 1 Tc/Tavg:

PANEL OVERVIEW
TRIP CP-1
DOOR OPEN SELECT OPEN
Place the following switches to TEST/TRIP:
TB-411G OP-delta T
TB-411C OT-delta T
TB412G Low Tavg for feedwater
TB412D Low Low Tavg for P12

To Bypass the Tc instrument:

PANEL OVERVIEW
BTI CP1
DOOR OPEN SELECT OPEN
SELECT ENABLE
Place the following switches to BYPASS:
TB-411G OP-delta T
TB-411C OT-delta T
TB412G Low Tavg for feedwater
TB412D Low Low Tavg for P12

After TS evaluations are made for the Tc instrument, the reactor power decrease will continue. Once the lead examiner is satisfied with the reactivity change, he will cue the next event.

SGFP Master Controller Failure

COMPONENT MALFUNCTION		FEEDWATER	
CTFWFK509A	FAILSETPOINT	0	INSERT

After the crew restores proper S/G water level and at the discretion of the lead examiner, insert the PCCW leak.

PCCW Leak to RCP 'C'

MALFUNCTIONS REACTOR COOLANT		
MFRC006	'C' RCP CC TO OIL COOLER LEAKAGE	INSERT

The crew will trip the reactor and enter E-0. When the immediate actions of E-0 are complete and no later than 30 seconds after the trip, insert the LOCA.

Large Break LOCA

MALFUNCTIONS REACTOR COOLANT		
MFRC024	RCS COLD LEG LOCA (DOUBLE ENDED SHEAR)	INSERT

The crew will transition to ES-1.3, "Transfer To Cold Leg Recirculation". Once the crew aligns the ECCS system for recirculation, RH-P-8A fails.

Failure of RHR Pump 8A

MALFUNCTIONS RESIDUAL HEAT REMOVAL		
MFRH003	RHR PUMP P-8A OC TRIP	INSERT

The crew will transition back to E-1, when the crew reaches E-1, the RH-P-8B suction valve will fail shut.

Failure of CBS-V14

CONTAINMENT BUILDING SPRAY		
cCBSV14	GO TO POSITION "0"	INSERT

On cue from the lead examiner, place the simulator in FREEZE.

Scenario 3 Briefing Sheet

The reactor is at 75%. Your crew is to continue a power decrease in accordance with OS1000.06, "Power Decrease" to 50% to facilitate taking SGFP 'A' out of service for maintenance.

SW pump 'B' is tagged out for maintenance.

SCENARIO 4 OVERVIEW

The candidates will take the shift at 75% with instructions from the SM to continue a power increase in accordance with OS1000.05, "Power Increase" to 100%. The 'B' EDG is failed such that it will not start when called upon. The main turbine output breaker is failed such that it will not open automatically on a trip. After an appropriate reactivity manipulation is completed by the crew, main steam header pressure transmitter, PT-507, will fail high. The failure of this instrument will result in a feed demand signal. SGFPs will increase in speed and feed header pressure will rise.

After feed flow is stabilized, the PZR master pressure controller PK-455A setpoint fails high resulting in the pressure control system sensing that RCS pressure is too low. All PZR heaters energize to raise pressure. The crew will have to take manual control of the pressure controller to mitigate pressure increase.

After the crew regains pressure control and evaluates technical specifications, centrifugal charging pump CS-P-2B trips on overcurrent. Letdown must be manually isolated due to regenerative heat exchanger temperatures rising and flashing in the letdown line. CS-P-2A will have to be started. The operators will manually restore letdown system to operation.

Once letdown is restored and the US evaluates TS compliance, the 11A DC BUS de-energizes on fault. S/G water levels decrease rapidly resulting in a plant trip. The main turbine output breaker will not open automatically on the plant trip. The BOP operator must open the breaker manually. Following the plant trip is a loss of offsite power. EDG 'B' will fail to start. The loss of DC bus 11A will prevent EDG 'A' from starting resulting in a loss of all AC power. A 90 gpm small break LOCA develops as a result of RCP seal failure. The DC bus 11A will be reenergized once step 6 of ECA-0.0 is complete, allowing the crew to start EDG 'A'.

The scenario is complete when the crew restores ECCS flow to the RCS in ECA-0.1, "Loss Of All AC Power Recovery Without SI Required" or ECA-0.2, "Loss Of All AC Power Recovery With SI Required".

Part C – Operating Exam – Scenario 4

The purpose of scenario two is to observe the crew combat various instrument and component failures as well as actions for loss of all AC power and subsequent small break LOCA due to RCP seal failure. The scenario will terminate when ECCS flow is restored to the RCS after AC power recovery.

The 'B' EDG is failed such that it will not start when called upon. The main turbine output breaker is failed such that it will not open automatically on a trip. After an appropriate reactivity manipulation is completed, main steam header pressure transmitter, PT-507, fails high. The failure of this instrument will result in a feed demand signal. SGFPs will increase in speed and feed header pressure will rise.

The crew takes the watch with instructions to continue a power increase from 75% to full power.

Event Description:		**MAIN STEAM HEADER PRESSURE INSTRUMENT, PT-507, FAILS HIGH**
Time	Position	Applicant's Actions or Behavior
	NOTE	Shaded items denote a CRITICAL TASK.
	CREW	Crew assumes the watch and continues with power ascension.
	NOTE	Loading the turbine may be done using the LOAD SET, LOAD LIMIT SET, or STANDBY LOAD CONTROL, per direction of the US. Startup procedure is written assuming the LOAD SET is being used to control the load.
	RO	SELECT the desired loading rate as directed by the US on the LOADING RATE LIMIT.
	BOP	It may be necessary to THROTTLE OPEN the in service SCCW heat exchanger outlet valve as power increases. Reference ON1037.02, "SCCW System Operation" and CR 00-12472.
	BOP	Adjust the LOAD LIMIT SET 1% or 2% above the actual plant load.
	BOP	On the load selector, depress the INCREASE LOAD pushbutton and verify the LOAD INCREASING light illuminates.
	BOP	Verify turbine load increasing until either the AT SET LOAD or LOAD LIMIT LIMITING light illuminates.
	BOP	Continue with load increase by utilizing the LOAD LIMIT SET 1% to 2% above the load set until reaching desired load not to exceed 100% RTP.
	BOP	Starts a second heater drain pump per ON1038.01.
	BOP	When control valve 4 is greater than 10% open, perform OX1431.03 for control valve 4.
	BOP	When control valve 4 is greater than 10% open, CLOSE MSD Group B Drains and Group A Drains (MCB-FF).
	RO	Maintain AFD within the administrative control band in RN1740.

	BOP	Maintain generator VARs consistent with load per The Turbine Generator Capability Curve and load dispatcher's instructions.
	BOP	Maintain the manual voltage regulator nulled if automatic voltage regulator is being used.
	BOP	Maintain speed deviations for both main feed pumps nulled.
	CUE	When lead examiner is satisfied with power increase, cue the failure of PT-507. VAS alarm B8181 FEEDWATER HEADER PRESSURE HI comes in.
	BOP	Identifies that PT-507 failed high. Take manual control of PK-509, feedwater master controller and restore feedwater/steam header differential pressure to the program value located in the Secondary Technical Data Book on a chart of DP vs Power Level.
	US	Enters and directs actions of ON1230.01, "Steam Header Pressure PT-507 Instrument Failure"
	BOP	If not already done from VAS procedure: Transfer main feed pump master control to MANUAL. Will use graph in Secondary Technical Data Book to determine proper delta P for required feed flow and adjust feed output accordingly.

The PZR master pressure controller PK-455A setpoint fails high resulting in the pressure control system sensing that RCS pressure is too low. All PZR heaters energize to raise pressure.

Event Description:		**PZR PRESSURE INSTRUMENT 455A SETPOINT FAILURE**
Time	Position	Applicant's Actions or Behavior
	CUE	At lead examiner's cue, the master PZR pressure controller setpoint fails high. The MASTER PRESS CTLR OUTPUT LO annunciator comes in. PZR heaters energize to raise pressure to the new setpoint.
	US	Enters and directs actions of OS1201.06, "PZR Pressure Instrument PT-455/458 Failure"
	RO	Determines that PK-455A setpoint is failed HIGH.
	RO	Takes manual control of master PZR pressure controller and restores normal pressure. The operator may also elect to manually spray down RCS to reduce pressure.
	RO	Selects an alternate pressure channel for CONTROL/BACKUP, as necessary.
	RO	If setpoint cannot be restored, the operator will control pressure in manual.
	US/RO	Verify Redundant Channel Bistables NOT TRIPPED and Verify Technical Specification Compliance: TS 3.3.1 table 3.3-1, items 7,9, and 10 Reactor Trip System Instrumentation. TS 3.3.2 table 3.3-3 items 1.d and 10.a ESFAS Instrumentation. TS 3.2.5 DNB Parameters (if pressure drops below 2185psig). Ensures I&C is informed.
	NOTE	Because the controller failed vice a pressure channel, no TS actions required in 3.3.1 and 3.2.2. TS 3.2.5: with pressure below 2185psig, restore pressure to its normal limits within 2 hours or reduce thermal power to less than 5% RTP within the next 4 hours.

After the crew regains pressure control and evaluates technical specifications, centrifugal charging pump CS-P-2B trips on overcurrent. Letdown will be manually isolated and CS-P-2A will have to be started. The operators will manually restore letdown.

Event Description:		**TRIP OF CENTRIFUGAL CHARGING PUMP CS-P-2B**
Time	Position	Applicant's Actions or Behavior
	CUE	After the operators regain control of RCS pressure and the US resolves any TS issues, the lead examiner will cue the failure of the 'B' CCP. The trip results in VAS alarm D4652 CTRFGL CHG PUMP BKR TRIP & L/O and the RCP SEAL INJECTION FLOW LO annunciator.
	RO	Verifies pump trip and informs US.
	US	Enters and directs actions of OS1202.02 , "Charging System Failure" or OS1202.02, "Loss of Letdown"
	RO	Isolates letdown due to rapidly rising temperatures and flashing in the regenerative HX. CLOSE CS-V145.
	RO	Place CS-FK-121 in manual and minimum output.
	RO	Start CS-P-2A.
	RO	Slowly increase output on CS-FK-121 to establish charging flow.
	RO	Adjust CS-HCV-182 as necessary to restore RCP seal flow.
	RO	Establish normal letdown: OPEN CC-V341, place CS-TK-130 in AUTO, CLOSE CS-HCV-189, CLOSE CS-HCV-190, OPEN RC-LCV-459, OPEN RC-LCV-460, OPEN CS-V145, establish letdown flow using letdown flow control valves. Flow is restored by slowly opening CS-PK-131, CS-HCV-189, and CS-HCV-190.
	US	Verify TS Compliance. TS 3.1.2.2, Boration Systems Flow Paths – Operating, TS 3.1.2.4, Boration Systems Charging Pumps – Operating, TS 3.5.2 ECCS Subsystems – Tavg Greater than 350F.
	NOTE	TS 3.1.2.2 is met and thus N/A. TS 3.1.2.4 with only one charging pump OPERABLE, restore at least two charging pumps to OPERABLE status within 72 hours. TS 3.4.2 with one ECCS subsystem inoperable, restore the inoperable subsystem to operable status within 7 days.

Once letdown is restored and the US evaluates TS compliance, the 11A DC BUS de-energizes on fault. S/G water levels decrease rapidly resulting in a plant trip. The turbine output breaker will not automatically open on plant trip. The BOP operator must open the breaker manually. Following the plant trip is a loss of offsite power. EDG 'B' will fail to start. The loss of DC bus 11A will prevent EDG 'A from starting resulting in a loss of all AC power. A 90 gpm small break LOCA develops as a result of RCP seal failure. Note: Once ECA-0.0 is entered, NO transitions to FRPs should be made until the crew transitions to ECA-0.2, "Loss of All AC Power Recovery with SI Required".

Event Description:		**LOSS OF DC BUS 11A AND LOSS OF ALL AC**
Time	Position	Applicant's Actions or Behavior
	CUE	After letdown is restored and the US evaluates if there are TS compliance issues, the lead examiner will cue the DC bus failure. DC BUS 11A de-energizes on fault. Several alarms come in including the DC BUS 11A VOLTS LO annunciator and VAS alarm D6094 DC BUS 11A VOLT LO-LO
	US	Should enter and direct actions of OS1248.01, "Loss of a Vital DC Bus". The plant will trip before any realistic action can be taken by the crew.
	US	Will transition and direct actions of E-0, "Reactor Trip or Safety Injection" after the reactor trips.
	CUE	As soon as the plant trips, a loss of all AC power will occur when offsite power is lost and neither EDG starts. 'A' EDG will not start because bus 11A is de-energized and 'B' EDG is faulted. An 84 gpm leak develops to simulate RCP seal failure.
	BOP	Identifies that the main generator output breaker failed to open on reactor trip. Opens the breaker manually.
	US	Should dispatch a NSO to investigate breaker 11A.
	US	Immediately transitions to ECA-0.0, "Loss of All AC Power". Contacts load dispatcher to investigate loss of offsite power.
	BOP	May attempt to emergency start EDG as skill of the trade after the loss of all AC. The EDGs will not start.
	CREW	The crew will attempt to start 'B' EDG with no success in accordance with step 5.c of ECA-0.0. The step 5 RNO column will direct them to step 6. The US/RO will direct the NSO to attempt a local start.
	RO/BOP	Step 6 of ECA-0.0 has the crew place several loads in pull to lock.
	CUE	During performance of step 6 of ECA-0.0, or immediately after, the SM will contact US and say, **"I have talked with maintenance and we believe the loss of bus 11A was due to a spurious breaker trip. I am directing you to restore bus 11A."** Bus 11A will be restored. This implies that EDG 'A' is now available to power bus E5. The crew will return to step 5, "Try to Restore Power to Any AC Emergency Bus". Step 6 MUST be completed once started.
	RO	Place the following loads in PTL: • UAT and RAT breakers • Containment air compressors – OFF • Circ water pumps

		• SCCW pumps • Heater drain pumps • Condensate pumps • Mechanical vacuum pumps • SUFP • Motor driven EFW pump • Charging pumps • RCPs • Thermal barrier cooling pumps – STOP • PCCW pumps • Containment spray pumps • RHR pumps • SI pumps
	US	Directs NSO to shut breaker from 11A to battery charger and battery.
	RO/BOP	Direct NSO to shut EDG breaker locally. Verify EDG output breaker shuts and EPS is sequencing.
	US	Directs crew to step 23 of ECA-0.0 when bus E5 is restored.
	BOP	Operate S/G ASDVs to stabilize S/G pressure.
	RO/BOP	Verifies vital loads are running on bus E5 and verifies proper service water system operation. Orders NSO to verify loads in the field.
	US	Transition guideline: if SI has actuated, the crew will transition to ECA-0.2, "Loss Off All AC Power Recovery With SI Required" else go to ECA-0.1, "Loss of All AC Power Recovery without SI Required".

Event Description:		**ECA-0.1, "LOSS OF ALL AC POWER RECOVERY WITHOUT SI REQUIRED"**
Time	Position	Applicant's Actions or Behavior
	RO	Check containment isolation phase A – NOT ACTUATED – if yes, then reset CIS phase A and phase B (T signal reset and P signal reset)
	BOP	Reset EPS-RMO
	BOP/RO	Open IA-V530 to establish containment instrument air.
	RO	Start one PCCW pump on each energized bus.
	RO	Open CS-LCV-112B. Open CS-LCV-112C.
	RO	CLOSE CS-V142 or CLOSE CS-V143
	RO	CLOSE CS-FK-121, charging flow control valve.
	RO	OPEN CS-V196
	RO	CLOSE SI-V138. CLOSE SI-V139.
	RO	START one charging pump (CS-P-2A). Note: critical step includes lineup, i.e., the charging pump must get water into the RCS.
	RO	START five containment cooling fans.
	RO	START both containment air compressors: SA-C-4A and SA-C-4B When either air compressor is started, close IA-V530.
	RO	OPEN CS-V142. OPEN CS-V143. Establish 60 gpm charging flow using CS-FCV-121 and CS-HCV-182.
	CUE	The lead examiner may terminate the scenario after charging flow is established.

Event Description:		**ECA-0.2, "LOSS OF ALL AC POWER RECOVERY WITH SI REQUIRED"**
Time	Position	Applicant's Actions or Behavior
	RO	Reset SI.
	RO/BOP	Manually align valves to establish ECCS injection alignment per attachment B of ECA-0.2.
	BOP	Reset EPS-RMO
	BOP/RO	Start one PCCW pump on E5.
	BOP/RO	Start ECCS pumps on train with an operating PCCW pump: RHR pump, SI pump. Restoring ECCS is defined as a critical task in accordance with NUREG 1021 App D.
	BOP/RO	Verify RCP seal injection throttle valves CLOSED then start 'A' CCP.
	CUE	The lead examiner may terminate the scenario after ECCS flow has been established and is injecting to the RCS.

Simulator Instructor Instructions for Scenario 4

RESET simulator to IC 101, 75% power.
Align CS-P-2B for charging, place CS-P-2A in STANDBY.

Please track the following parameters along with the standard set (if any):

SR, IR, and PR power level
Loop 2 Tave
Loop2 Tc
RCS pressure
PZR level
RVLIS (all level channels)
Core thermocouples (2 channels acceptable)
CCP, RHR, SI flow rates into the RCS
Bus E5 voltage

Initial Setup:
Prevent Main Turbine Automatic Trip

MALFUNCTIONS	REACTOR PROTECTION
MFED0036 MAIN GENERATOR BKR AUTOTRIP FAILS TO FUNCTION.	

Prevent EDG 'B' from starting

MALFUNCTIONS ELECTRICAL DISTRIBUTION		
MFED033	DG1B AUTO START FAILURE	INSERT
PANEL PHF10		
INSERT OVERRIDE DG1B EMERGENCY STOP PB'o		STOP
INSERT OVERRIDE DG1B EMERGENCY START PB'o		RELEASE

After the crew assumes the watch and performs an adequate reactivity addition, the lead examiner will prompt the PT-507 failure.

PT-507 Fails HIGH

COMPONENT MALFUNCTIONS MAIN STEAM			
ptMSPT507	FAILHIGH	INSERT	

When the crew restores normal feed flow to the S/Gs and at the examiners discretion, insert the malfunction for the PK-455A setpoint failure.

PZR Master Pressure Controller Setpoint Fails High

PANEL PDF10A	
INSERT OVERRIDE	
SELECT SETPT POT ON RC-PK-455A FINAL VALUE 2350	
RAMP OVER 120 SECS	INSERT

When the crew stabilizes RCS pressure, and TS compliance has been resolved, the lead examiner will cue the trip of CS-P-2B.

CS-P-2B Trip

MALFUNCTIONS CHEMICAL AND VOLUME CONTROL COMPONENT		
MFCS017	CS-P-2B OCTRIP	INSERT

After the crew restores charging and letdown and the US resolves TS compliance issues, the lead examiner will cue the loss of bus 11A.

DC BUS 11A Failure

MALFUNCTIONS ELECTRICAL DISTRIBUTION		
MFED019	125VDC BUS 11A GROUND FAULT	INSERT

After the BOP opens the main turbine output breaker (or output breakers 11 and 163 open), insert the malfunction for loss of offsite power and the RCS leak below.

Loss of Offsite Power

MALFUNCTIONS ELECTRICAL DISTRIBUTION		
MFED038	LOSS OF OFFSITE POWER	INSERT

90gpm RCS Leak

MALFUNCTIONS REACTOR COOLANT			
MFRC018	RCS LEAK	SELECT 90GPM	INSERT

RCP Seal Failures

MALFUNCTIONS REACTOR COOLANT			
MFRC016	'D' RCP #1 SEAL FAILURE	FINAL VALUE = 1	INSERT
MFRC017	'D' RCP #2 SEAL FAILURE	FINAL VALUE = 1	INSERT

Use Sim Diagram CS4 to close the following seal injection throttle valves:

CLOSE CS-V153		
CLOSE CS-V157		
CLOSE CS-V161		
CLOSE CS-V165		
Click on VALVE	FINAL VALUE = 0	INSERT

When crew completes step 6 of ECA-0.0, call the control room as the Shift Manager: **"I have talked with maintenance and we believe the loss of bus 11A was due to a spurious breaker trip. I am directing you to restore bus 11A."**

Restore Bus 11A and EDG 'A'

DELETE MALFUNCTION MFED019

Respond to control room orders to start the EDG locally as NSO. Take local control of DG1A if directed. DG1A should AUTO START – if it does not auto start then start via PB overrides.

Scenario is complete when crew restores ECCS flow to reactor in either ECA-0.1 or ECA-0.2.

Scenario 4 Briefing Sheet

The reactor is at 75% power. The crew will continue with a power ascension in accordance with OS1000.05, "Power Increase" to raise power to 100%.