Facility: Davis-Besse Scenario No.: 2 Op Test No.: DB NRC 2016

Examiners: _____ Operators: _____ SRO

_____ _____ ATC

_____ _____ BOP

Initial Conditions:
- 70% Power
- RCP 1-1 OOS (Upper bearing issue)
- ULD is in manual (will not go into auto due to issue with 3 RCP operation)

Turnover: Maintain 70% Power

Planned: Normal shift routines

Critical tasks: 1. ATWS (CT24)

2. Isolate overcooling SG (CT-17)

Event No.	Malf. No.	Event Type*	Event Description
1		I-ATC/BOP/SRO (TS)	Power range (NI5) high failure
2		C-ATC/SRO	Makeup Filter high differential pressure
3		I-BOP/SRO	MFW control valve d/p instrument fails low
4		R-ATC/SRO (TS)	Dropped rod
5		N-BOP/SRO	Remove MFP from service
6		M-All	MFP trip – Loss of Main Feedwater/ATWS
7		C-BOP/SRO	Stuck Open Main Steam Safety Valve

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

DAVIS-BESSE 2016 NRC SCENARIO 2

The Crew will take the watch with power at 70% with 1-1 RCP out of service due to a maintenance issue with the upper bearing. Direction for the crew is to maintain 70% power. Following turnover the lead evaluator will cue the failure high of Power Range Nuclear Instrument NI-5, which will cause rods to insert due to the ICS system responding to the failed high signal. The crew will take actions to stabilize the plant per abnormal procedure DB-OP-02505, Nuclear Instrument Failures. The Unit Supervisor will direct placing RPS Channel 2 in Manual Bypass and the Power Range Test Module in Test Operate. The Unit Supervisor will enter applicable Technical Specification (T.S. 3.3.1) for RPS Channel 2 in Manual Bypass (TS).

At the Lead Evaluators cue event 2 will be inserted and annunciator 2-4-A, Letdown or MU Filter Differential Pressure Hi, will alarm due to high differential pressure across the #1 Makeup Filter (PDI MU13 greater than 25 psid). The crew will implement alarm procedure actions, validate #1 Makeup Filter differential pressure is high, and swap to #2 Makeup Filter using DB-OP-06006, Makeup and Purification System.

Event 3 will be initiated at the cue from the Lead Evaluator which will fail low PDT SP5B1, MFW control valve d/p instrument. The crew will identify the failure and respond by taking manual control of HIC ICS36A/HIC ICS36B, Main Feed Pump Turbine Hand/Auto Stations, or may take actions per abnormal procedure DB-OP-02526, Primary to Secondary Plant Upset. Once the plant is stabilized the crew will select the “Y” instrument PDT SP5B2 and restore ICS stations to auto. After ICS is restored to automatic control the scenario will proceed to event 4.

Event 4 will have the crew respond to a dropped rod. Abnormal procedure DB-OP-02516, CRD Malfunctions, will be entered and power reduced to 33% power based on the three RCP configuration. The plant will be stabilized and troubleshooting of the fault will be requested, but it is not the intent of this scenario to recover the rod. The Unit Supervisor will enter applicable technical specifications 3.1.4 and 3.1.5 for the dropped rod (TS).

With power being maintained at approximately 33%, the Lead Evaluator will proceed to event 5 by providing a Shift Manager cue to remove #1 MFP from service. The BOP will remove #1 MFP from service IAW DB-OP-06224, Main Feed Pump and Turbine.

The Lead Evaluator will next cue event 6 and 7 resulting in the loss of #2 MFP and a loss of all Main Feed Water with an Anticipated Transient Without a Scram (ATWS). The ATC will perform immediate actions and trip the reactor by de-energizing simultaneously the E2 and F2 busses, and verify power is lowering in the intermediate range (**CT-24**). The crew will continue to perform actions IAW the Emergency Procedure DB-OP-02000. The crew will identify Overcooling due to a stuck open safety valve and route to section 7 of DB-OP-02000 to isolate the OTSG and terminate the overcooling (**CT-17**). The scenario will be terminated at the discretion of the Lead Evaluator.

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Event Description: Power range (NI5) high failure

Time	Position	Applicant's Actions or Behavior
		Indications Available: • **Annunciator 14-4-D, ICS FW Limited By Rx Pwr** • **Annunciator 14-6-D, ICS In Track** • **Annunciator 5-1-H, RPS Ch 2 Trip** • **Annunciator 5-2-H, RPS Hi Flux Trip** • Rods inserting
	Crew	Recognize that NI5 has failed high using indications available listed above
	SRO	Direct the implementation of DB-OP-02505, Nuclear Instrumentation Failures **NOTE: If not quickly diagnosed the crew may enter DB-OP-02526, Primary to Secondary Heat Transfer Upset**
	ATC	Place Rod Control Panel in manual and Reactor Demand Station in hand Reactor power is stabilized and held constant
	BOP	If Tave is > 2°F from setpoint then place both Feedwater Loop Demands to hand and adjust to stabilize RCS Tave
	Crew	Identify NI5 as the instrument failed high
	SRO	Enter TS 3.3.1, Condition A for function 1,7, and 8 Refer to TS 3.3.16 (only 3 ARTS Channels required)
	SRO	Notify SM to refer to reactivity management, event notifications, and Fleet Update requirements

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Event Description: Power range (NI5) high failure

Time	Position	Applicant's Actions or Behavior
	SRO	Brief contingency actions for Power Range instrument failure • RFR will not actuate • TBV Bias for reactor trip will not function • Main FW block valves will not auto close
	SM CUE	***If necessary, Role-play Shift Manager and direct placing RPS Channel 2 in manual bypass, Test Module in Test Operate, and restoring ICS controls to auto.***
	SRO	Directs placing RPS 2 in Manual Bypass per DB-OP-06403, Reactor Protective System (RPS) and Nuclear Instrumentation (NI) Operating Procedure
	BOP	• Obtain RPS Manual Bypass key and Ch2 door key • Rotate the MANUAL-BYPASS KEY SWITCH to actuate the manual bypass relay in RPS Channel 2 • Check MANUAL-BYPASS light is BRIGHT • Check SUB-SYSTEM light is DIM
	BOP	Place the Power Range Test Module for NI5 in TEST OPERATE
	SRO	Directs placing ICS in Auto per DB-OP-06401, Integrated Control System Operating Procedure
	Crew	Briefs returning ICS stations to automatic
	ATC	Depress AUTO on HC NI44, ROD CONTROL PANEL Verify Tave at setpoint Depress AUTO on HIC ICS20, REACTOR DEMAND

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Event Description: Power range (NI5) high failure

Time	Position	Applicant's Actions or Behavior
	BOP	If necessary place Feedwater Loop Demands in auto • Adjust FEEDWATER DEMAND to place measured variable on the caret • Press AUTO on FIC ICS32B (A), FEEDWATER DEMAND
On Lead Evaluator's discretion, proceed to Event 2		

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Event Description: Makeup Filter high differential pressure

Time	Position	Applicant's Actions or Behavior
Indications Available: • **PDI MU13 indicates >25 PSID** • **2-4-A LETDOWN OR MU FILT ΔP HI**		
	Crew	Recognize Makeup Filter high differential pressure for in service Makeup Filter 1 (indications available listed above)
	ATC	Implement DP-OP-02002 Letdown/Makeup Alarm Panel 2 Annunciators for 2-4-A LETDOWN OR MU FILT ΔP HI
	ATC	Validate Makeup Filter high differential pressure with PDI MU13 indicating >25 psid
	SRO	Direct placing Makeup Filter 2 in service in accordance with DB-OP-06006, Makeup and Purification System
	SRO/ATC	Verify Makeup Filter 2 is not aligned as the Purification Demin Filter (Prerequisite)
	SM CUE	***If necessary, Role-play Shift Manager and inform the SRO that Makeup Filter 2 has been verified to not be aligned as the Purification Demin***
	ATC	Swap to Makeup Filter 2
	ATC	Open MU12B, MAKEUP FILTER 2 INLET ISOLATION, using HISMU12B.
	ATC	Close MU12A, MAKEUP FILTER 1 INLET ISOLATION, using HISMU12A.
	Crew	Ensure work request initiated to have filter replaced (alarm procedure guidance)
At Lead Evaluator discretion proceed to Event 3		

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Event Description: MFW control valve d/p instrument fails low

Time	Position	Applicant's Actions or Behavior
Indications Available: • **14-4-E, ICS INPUT MISMATCH** • **12-5-A, SG 1 OR 2 FW VLV DELTA P LO** • **MFP speed increasing**		
	Crew	Recognize PDT SP5B1 failing low
	BOP	Place HIC ICS36A/HIC ICS36B, MAIN FEED PUMP TURBINE HAND/AUTO STATIONS, in HAND Lower MAIN FEED PUMP TURBINE speed to restore valve d/p
NOTE: Depending on how quickly the crew recognizes the failure, the SRO may implement the Pri/Sec upset procedure and take other ICS station controls to manual in addition to HIC ICS36A/HIC ICS36B and lowering Feed pump speed.		
	SRO	May direct BOP actions per DB-OP-02014, MSR/ICS Alarm Panel 14 Annunciators • Determine which instrument has caused alarm (at SASS cabinet)
	BOP	Determine which instrument has caused alarm (at SASS cabinet). May depress the SASS Annunciator RESET pushbutton for the appropriate module
	SM CUE	***If necessary Role-play Shift Manager and direct selecting good instrument and returning ICS controls to Auto***
	SRO	Verify good instrument and direct MFW Valve ΔP control transferred to the 'Y' instrument per DB-OP-06407, NNI Operating Procedure, Section 4.1.
	BOP	Select the 'Y' MFW Valve ΔP instrument SP5B2

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Event Description: MFW control valve d/p instrument fails low

Time	Position	Applicant's Actions or Behavior
	BOP	Adjust speed as needed and place HIC ICS36A/HIC ICS36B, MAIN FEED PUMP TURBINE HAND/AUTO STATIONS, in Auto
On Lead Evaluator's discretion, proceed to Event 4 and 5		

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Event Description: Dropped Rod/Remove MFP 1 From Service

Time	Position	Applicant's Actions or Behavior
Indications Available: • **Annunciator 5-1-E, CRD TRBL** • **Annunciator 5-2-E, CRD ASYMETRIC ROD** • **Control Rod 4-9 Rod Bottom light ON**		
	Crew	Recognize that a single Control Rod has inserted into the core
	SRO	Implement DB-OP-02516, CRD Malfunctions
	SRO	Direct Power reduction to 33% at 3% RTP per minute (3 RCPs)
	ATC	• Set ULD MAX LOAD LIMIT to 33% RTP • Set ULD Rate of Change to 3% RTP per minute **NOTE: Annunciator 14-5-C, ICS Hi Load Limit, will alarm when Max Load Limit is below current Unit Load Demand**
	SRO	REFER TO DB-OP-02504, Rapid Shutdown (Att.2, Power Reduction using ULD Max Load Limit)
	SRO	Direct BOP to perform Attachment 6, Balance of Plant Actions for Rapid Shutdown
	SRO	Notify Equipment Operators to commence Attachment 15, Field Actions for Rapid Shutdown
	SRO	Notify the System Control Center (SCC) Load Dispatcher of the unit load reduction
	SRO	IF only 3 RCPs are in service, THEN review Attachment 16, Three Reactor Coolant Pump Operation
	ATC	If directed by US (annunciator 4-2-E, PZR LEVEL LO alarms due to the dropped rod Tave transient) then reduce MU32 (PZR level control) set point to approximately 180 inches

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Event Description: Dropped Rod/Remove MFP 1 From Service

Time	Position	Applicant's Actions or Behavior
	SRO	Notify SM to review Reactivity Management, Event Notifications, and Fleet Reporting requirements and to Notify Duty Engineering Manager or Reactor Engineering Supervisor to review Att. 5
	Crew	Monitor Reactor Power to confirm power is being reduced at the expected rate
	SRO	IF Pressurizer Level is greater than 228 inches, then refer to Technical Specification 3.4.9 Condition A
	ATC	Monitor for Regulating Rod Insertion Limits during the Shutdown (Technical Specification 3.2.1)
	ATC	As directed by SRO, set ULD minimum load limit to 13% (guidance from Att. 16 for 3 RCP operation)
	BOP	Perform Attachment 6, Balance of Plant Actions for Rapid Shutdown: • Direct EO to perform Att. 9, Controlling MSR RSLLVs • Stop #1 MFP (performance steps below) • Stop LPFW Drain Pumps/Direct EO to close HD5/HD6 • Establish one Condensate Pump in operation if <3.5 MPPH flow
	SRO	Direct Shutdown of MFP 1
	BOP	Place HIC ICS 36B, #1 MFW PUMP SPEED, station in HAND
	BOP	Lower #1 MFPT speed to approximately 3950 RPM using HIC ICS 36B, #1 MAIN FEEDPUMP SPEED
	BOP	Adjust the MDT 20 output to indicate zero amps reading on the XFER METER

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Event Description: Dropped Rod/Remove MFP 1 From Service

Time	Position	Applicant's Actions or Behavior
	BOP	Depress MANUAL on HIS 805C2 AND check MANUAL illuminates
	BOP	Reduce MFPT 1 speed by turning HS 805D, TURBINE SPEED MDT 20 PISTOL GRIP, to DECREASE until green LSS light IL 805A is LIT
	BOP	Trip MFPT 1
	BOP	Check the following lights are LIT: • Red TRIP light • Green LP STOP VALVE closed • Green HP STOP VALVE closed
	BOP	Check FW 488, MAIN FEED PMP 1 DISCHARGE NON-RETURN, is seated as indicated by the following: • PI-473, MFP 1 DISCHG PRESS is less than MFP 2 discharge pressure • Deaerator levels approximately equal
	BOP	Direct an Equipment Operator to Complete MFP Shutdown to Turning Gear Operation
	ATC/BOP	Verify S/G Load Ratio H/A station in hand with 0 degree differential temperature demand
	SRO	Notify Reactor Engineering/Duty Engineering Manager to reference Attachment 5
	SRO	Request I&C to investigate referring to Attachment 1

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Event Description: Dropped Rod/Remove MFP 1 From Service

Time	Position	Applicant's Actions or Behavior
	SRO	Refer to DB-OP-02516 Attachment 3 to determine Tech Spec applicability: • Enter Tech Spec. 3.1.4 for the dropped rod, Condition A and D • Enter Tech Spec. 3.1.5 Cond A • Verify SDM within 1 hour
	SM CUE	***If necessary Role-play Shift Manager and inform SRO the Shift Engineer is verifying SDM***
On Lead Evaluator's discretion, proceed to Event 6 and 7		

Op Test No.: 2016 Scenario No.: 2 Event No.: 6,7 Page 13 of 17

Event Description: MFP Trip – Loss of Main Feedwater/ATWS/Stuck Open Safety

Time	Position	Applicant's Actions or Behavior
Indications Available: • Annunciator 8-4-B MFPT 2 TRIP • Annunciator 5-1-F ARTS CH TRIP • MFP 2 Control Indications indicate Tripped •		
	Crew	Recognize Loss of Feedwater/ARTS Channel Trip and the reactor has not tripped
***Critical Task (CT24)**	ATC	Perform DB-OP-02000 immediate actions • Attempt to manually trip reactor • Report failure of manual pushbuttons to trip reactor • *****De-energize E2 and F2 • Re-energize E2 and F2 • Verify power decreasing on the Intermediate Range
	ATC	Complete DB-OP-02000 immediate actions • Verify Turbine Tripped • VERIFY all Turbine Stop Valves OR Control Valves are closed
	SRO	Implement DB-OP-02000
	SRO/ATC	Verify Immediate Actions
	SRO	Implement any necessary Specific Rules Actions
	BOP	Verify SFRCS has Initiated and Isolated (reverse ΔP)
	SRO	Implement any necessary Symptom Mitigation Sections
	Crew	Recognize Overcooling Symptoms
	SRO	Route to DB-OP-02000, Section 7 for Overcooling

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Event Description: MFP Trip – Loss of Main Feedwater/ATWS/Stuck Open Safety

Time	Position	Applicant's Actions or Behavior
	ATC	Implement Attachment 8, Place MU/HPI/LPI in Service • Start/Verify running both CCW Pumps • Start/Verify running both HPI Pumps • Open HP 2A, HP 2B, HP 2C and HP 2D (2 handed operation is allowed) • Start both LPI Pumps • Open DH 64 and DH 63 • Transfer Makeup Pump suctions, MU6405 & MU3971, to the BWST (depress off) • Set Pressurizer Level Controller to 100 inches • Start Standby Makeup Pump 2 • Lock MU Pump suctions, MU6405 & MU3971, on the BWST • Verify Pressurizer heaters are off (If PZR Level <40 inches) • Isolate Letdown by closing MU2B • Open MU6421 • Throttle open MU6419 as needed • Direct EO to open MU6423B
	ATC	Control MU/HPI/LPI per Specific Rule 3 and Att. 13
	Crew	Diagnose stuck open safety SG2
	Booth Cue	***If security is called inform that steam continues to issue from aux building roof steam relief exhaust pipe***
	SRO	Route to Step 7.11 due to SFRCS Isolation Trip
	SRO	Route to Step 7.20 due to unisolable steam leak (safety valve does not reseat)
	SRO	Route to Step 7.25 due to Low MS Line Pressure Trip and #2 SG identified as causing the overcooling

Op Test No.: 2016 Scenario No.: 2 Event No.: 6,7 Page 15 of 17

Event Description: MFP Trip – Loss of Main Feedwater/ATWS/Stuck Open Safety

Time	Position	Applicant's Actions or Behavior
***Critical Task (CT-17)**	BOP	Verify proper operation of AFW trains feeding OTSG 1. REFER TO Table 1, SFRCS Actuated Equipment • Identify AF3872 failed open/attempt to close • *Close AF599, AFW to SG2 Stop Vlv • *Place controller LIC6451 in manual and control flow to #1 SG, or lower AFP 2 speed to control flow (controller monitors #2 SG level with AF3872 open) **NOTE: AF3872 will fail to close**
	Crew	As the SG 2 boils dry, THEN check Reactor Coolant System Cooldown rate lowers to less than 100 °F/hr.
	BOP	Control the AVV on the non-isolated SG (SG 1) to maintain RCS temperature constant OR slightly lowering
	ATC	Begin to depressurize the RCS using Pressurizer Spray AND Heaters to maintain pressure close to the minimum adequate subcooling margin, but above the RCP NPSH limits of Figure 1.
EAL **Alert based on SA3 (*Automatic actions fail to shutdown the reactor. Manual actions from the control room area are successful.*)**		
At the discretion of the Lead Evaluator the scenario can be terminated		

Justification for Critical Tasks

A. Shutdown Reactor – ATWS (CT24)

The reactor must be shut down prior to proceeding since the Technical Bases Document accident mitigation is based on having the reactor shut down. De-energize E2 and F2 to remove electrical power from control rod drive system and shut down the reactor.

B. Isolate Overcooling Steam Generator(s) (CT-17)

AF 599, AFW to SG 2, must be closed to isolate flow to #2 SG due to AF3872 failing to close. Controller LIC6451 is placed in manual, or AFP 2 speed lowered to mitigate overcooling caused by AFW Pump 2 flow to SG1 due to the controller receiving level input from #2 SG level with AF3872 open (controller input signal switches to SG1 upon AF3872 leaving the open position indication).

SIMULATOR SETUP INFORMATION

1. Simulator Setup
    a) 70% Power
    b) RCP 1-1 OOS (Upper bearing issue)
    c) Makeup Filter 1 in service
    d) Auto Reactor trip prohibited
    e) AF3872 failed open
    f) Steam Safety on #2 OTSG fails to close once lifted

2. Procedures

    Used by the crew

    a) DB-OP-02505, Nuclear Instrument Failures
    b) DB-OP-06403, RPS and Nuclear Instrumentation
    c) DB-OP-06401, Integrated Control System Operating Procedure
    d) DB-OP-02002, Letdown/Makeup Alarm Panel 2
    e) DB-OP-06006, Makeup and Purification System
    f) DB-OP-02526, Primary to Secondary Plant Upset
    g) DB-OP-02014, MSR/ICS Alarm Panel 14
    h) DB-OP-06407, NNI Operating Procedure
    i) DB-OP-02516, CRD Malfunctions
    j) DB-OP-02504, Rapid Shutdown
    k) DB-OP-02000, RPS, SFAS, SFRCS Trip, or Steam Generator Tube Rupture

    For Simulator Instructor/Communicator

    a) DB-OP-06006, Makeup and Purification System, section 3.24
    b) DB-OP-02516, CRD Malfunctions, section 4.1
    c) DB-OP-02504, Rapid Shutdown, Attachment 6 (BOP actions)

Facility:	Davis-Besse	Scenario No.:	3	Op Test No.:	DB NRC 2016
Examiners:		Operators:			SRO
					ATC
					BOP

Initial Conditions: • 100% Power

Turnover: Maintain 100% Power

Planned: Shift routines

Critical tasks: 1. Establish MU/HPI cooling (CT-14)

2. Trip All RCPs (CT-1)

Event No.	Malf. No.	Event Type*	Event Description
1		C-ATC/BOP/SRO (TS)	RCS pressure NNI input fails low
2		C-BOP/SRO R-ATC/SRO	HPFW Heater tube leak
3		I-ATC/SRO	PZR Level Temp compensating instrument fails low
4		C-BOP/SRO (TS)	Isolable steam leak – Loss of AFP 2
5		I-ATC/SRO	Loss of ICS DC – trip reactor
6		C-BOP/SRO	Loss of AFP 1 – start MDFP
7		M- All	Loss of all Feedwater – initiate MU/HPI/PORV cooling

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

DAVIS-BESSE 2016 NRC SCENARIO 3

The crew will take the watch with power at 100% power and no activities planned. The first event will be triggered resulting in the RCS pressure instrument selected for NNI failing low. The crew will implement DB-OP-02513, Pressurizer System Abnormal Operation, for failure of pressure input to heater. Manual control of heaters will be required due to input pressure signal failed low. The pressure input to NNI will be swapped to the non-faulted signal IAW DB-OP-06403, RPS and NNI Operating Procedure. Heater controls will then be returned to automatic control. The Unit Supervisor will enter applicable Technical Specifications (3.3.1) for the pressure instrument failure and direct tripping or bypassing the RPS channel with failed instrument within one hour (TS). On the Lead Evaluators discretion the scenario will proceed to event 2.

Event 2 will result in a HPFW Heater 1-6 tube leak. The crew will diagnose in response to annunciator 13-5-E, HPFW Htr 1-5 Lvl, using alarm procedure DB-OP-02013, Condensate Feedwater Alarm Panel 13 Annunciators. Power will be lowered to 95% using DB-OP-02504, Rapid Shutdown. The #1 HPFW Heaters will be bypassed and isolated using DB-OP-06229, High Pressure Feedwater Heater System Operation . Once HPFW Heater Train 1 is bypassed/ isolated the scenario can proceed to the next event.

When event 3 is cued by the Lead Evaluator the Pressurizer Temperature Transmitter TE RC15-1 will fail low resulting in lowering pressurizer level indication (temperature compensated) and increased makeup flow as MU32, Makeup Flow Controller, responds to the failure. The crew will diagnose the failure and enter abnormal procedure DB-OP-02513, Pressurizer System Abnormal Operations, and place MU32 in hand to control pressurizer level. Alternate temperature input to pressurizer temperature (TE RC15-2) will be verified functional and selected, then MU32 can be returned to automatic control. If pressurizer level exceeds 228 inches compensated (147 inches uncompensated) during the failure then Technical Specification 3.4.9 will be entered for the Pressurizer.

Event 4 will be initiated by the Lead Evaluator resulting in an isolable steam leak and the loss of #2 AFP. The crew will respond to annunciator 12-2-A, SG 1 to AFP 2 Mn Stm Press Lo, and implement abnormal procedure DB-OP-02525, Steam Leaks. The steam leak will be determined to be in AFPT Room 2, and attachment 1 of DB-OP-02525 will be used to isolate the steam leak. The Unit Supervisor will review applicable Technical Specifications and enter 3.7.5 Condition A and B for Inoperable Steam Supply (TS).

At the Lead Evaluator cue event 5 will be initiated which will trigger events 6 and 7. A loss of ICS DC power will occur requiring the crew to implement immediate actions of DB-OP-02532 and trip the reactor and manually initiate and isolate SFRCS. The crew will then implement the Emergency Procedure DB-OP-02000. AFP 1 will not come up to proper speed due to a governor problem and the BOP will start the MDFP per Specific Rule 4 of DB-OP-02000. The MDFP will trip after two minutes resulting in a loss of all feedwater. The ATC will attempt to start the standby makeup pump but it will fail to start. With only one makeup pump in service the crew will commence aligning for MU/HPI/PORV cooling per attachment 4 (**CT-14, Establish MU/HPI Cooling**). When the PORV is opened Adequate Subcooling Margin (SCM) will be lost and all Reactor Coolant Pumps will be tripped (**CT-1, Trip All RCPs**). At the Lead Evaluator discretion the scenario will be terminated.

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Event Description: RCS pressure NNI input fails low

Time	Position	Applicant's Actions or Behavior
		Indications Available: • **4-4-C HOT LEG PRESS LO** • **5-1-G RPS CH 1 TRIP** • **5-3-G RPS RC LO PRESS TRIP** • **5-3-J RPS RC PRESS-TEMP TRIP** • **All Pressurizer Heater Banks are on** • **RCS Wide Range (actual) Pressure is rising**
	Crew	Recognize failure low of RPS pressure input to PZR heaters with indications available listed above
	SRO	Implement DB-OP-02513, Pressurizer System Abnormal Operation, for failure of pressure input to heaters
	ATC	Manually control Pressurizer Heaters and Spray to maintain required RCS Pressure (2105 to 2205) – Heaters will be ON in auto
	ATC	Place the following Pressurizer Heaters in OFF • HIS RC2-2, Bank 2 • HIS RC2-3, Bank 3 • HIS RC2-4, Bank 4 • HIS RC2A, Essen Bank 1 • HIS RC2B, Essen Bank 2 Place PIC RC2 Bank 1 in MANUAL and maintain RCS pressure by adjusting the output. Manually energize other heater banks if needed to maintain pressure band
	SRO	Refer to TS 3.4.1, RCS Pressure, Temperature and Flow DNB Limits – entry into Tech Spec is not required for this failure.
	SM CUE	***IF necessary, Role-play SM and direct crew to leave RPS channel in the tripped condition while I&C evaluates as found conditions.***

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Event Description: RCS pressure NNI input fails low

Time	Position	Applicant's Actions or Behavior
	BOP	Exchange RCS pressure input to NNI from RPS, REFER TO DB-OP-06403, RPS and NI Operating procedure
	BOP	Obtains Key 33 from SM key locker and Opens RPS Channel 2 cabinet. Remove the cap on the selection panel for the alternate RC PRESSURE NNI receptacle in RPS Channel 2. Disconnect the amphenol connector from the RC PRESSURE NNI subassembly and reconnect the amphenol connector to the alternate RC PRESSURE NNI Receptacle. Cap the open RC PRESSURE NNI receptacle.
	ATC	Return PZR heaters to Auto Control • HIS RC2-2, Bank 2, in AUTO + BASE • HIS RC2-3, Bank 3, in AUTO • HIS RC2-4, Bank 4, in AUTO • HIS RC2A, Essen Bank 1, in AUTO • HIS RC2B, Essen Bank 2, in AUTO Place PIC RC2 Bank 1 in AUTO
	BOP	Circle the RPS Channel now supplying the input signal to the NNI. RPS Channel 2 is now supplying.
	SRO	REFER to TS 3.3.1. Declare RPS Channel 1 Inoperable, Functions 3, 4, and 5. Enter TS 3.3.1 Condition A Trip or Bypass within 1 hour **NOTE: RPS Channel 1 is already tripped**
On Lead Evaluator's discretion, proceed to Event 2		

Op Test No.: 2016 Scenario No.: 3 Event No.: 2 Page 5 of 17

Event Description: HPFW Heater tube leak

Time	Position	Applicant's Actions or Behavior
Indications Available: • **13-6-E, HP FW HTR 1-4 LVL** • **L454, HP HEATER 1-4 HIGH LEVEL ALARM (Computer Point)** • **14-5-C, ICS HI LOAD LIMIT** • **14-6 D, ICS IN TRACK**		
	Crew	Implement DB-OP-02013, Condensate Feedwater Alarm Panel 13 Annunciators for annunciator 13-6-E
	ATC	Maintain Power at or below 100%
NOTE: Crew may enter DB-OP-02526 Primary to Secondary Heat Transfer Upsets to stabilize the plant.		
	Crew	Check the computer point alarm list to determine whether a high or low level exists: • L454, HP HEATER 1-4 HIGH LEVEL ALARM Determine level is high.
	BOP	Direct EO to locally verify HD 291A, FW HEATER 1-4 EMERGENCY DRAIN CONTROL VALVE, is throttled. Direct EO to locally verify HD 291B, FW HEATER 1-4 NORMAL DRAIN CONTROL VALVE, is open.
	BOOTH CUE	***After 2 minutes role-play EO and report:*** ***HD 291A, FW HEATER 1-4 EMERGENCY DRAIN CONTROL VALVE, is throttled OPEN*** ***HD 291B, FW HEATER 1-4 NORMAL DRAIN CONTROL VALVE, is FULL OPEN*** ***Level in 1-4 HTR is 11.8"*** ***Level in 1-5 HTR is 11.4"*** ***Level in 1-6 HTR is 10.5"***

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Event Description: HPFW Heater tube leak

Time	Position	Applicant's Actions or Behavior
NOTE: Comparison of normal drain flows may help determine if heater drain flow is abnormal. Normal drain flows at 100% power are approximately 1400 KPPH.		
	Crew	Crew may confirm tube leak in heater by monitoring for abnormally high or excessive heater draining. a. Compare normal drain flow computer points. • F450, HP FW HTR 1-5 NORM DRN FLOW (KPPH) ***~1,700 KPPH*** • F457, HP FW HTR 2-5 NORM DRN FLOW (KPPH) ***~1,400 KPPH***
	Crew	Determine HPFW Heater Train 1 has a tube leak
	SRO	Refer to DB-OP-06229, High Pressure Feedwater Heater System Operation. Routes to Section 5.1, HPFW Heater Tube Rupture Train 1
NOTE: Bypassing HPFW Heaters will result in Feedwater Flow and Temperature transients including Deaerator levels. Minimizing plant power levels prior to bypassing will reduce the potential for a plant trip.		
	SRO	Directs a plant power reduction to 95 percent – A single HPFW Train will be removed from service. DB-OP-02504, Rapid Shutdown, may be entered but is not referenced by the alarm procedure
	ATC	Begin plant shutdown using US provided setpoints: • Set rate of change • Select target Power • Monitor Power
	Crew	Monitor plant shutdown to 95%

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Event Description: HPFW Heater tube leak

Time	Position	Applicant's Actions or Behavior
	BOP	Isolate feedwater to HPFW Heater Train 1 by simultaneously performing the following: • Dispatch Equipment Operator to local stop pushbutton for FW448 • Throttle open FW 460, HP HTR TRAINS BYPASS, using HIS 460 to maintain Train 2 flow, as read on FI 581, HPFW HTR GROUP 2 FW FLOW, approximately one half the total Feedwater flow. FI 581 flow equals either 428 or 438 flow MFP 1/MFP 2 flow indicators • Close FW 448, HP HEATER TRAINS ISOLATION 1-4 INLET, using HIS 448. • Close FW 440, HP HEATER TRAINS ISOLATION 1-6 OUTLET, using HIS 440.
	BOOTH CUE	***Report EO on station at FW448*** ***If necessary, role play EO and stop motion of FW448 as directed.***
	BOP	Close ES 2014, EXT STM TO HP HTRS ISO TRAIN 1, using HIS 2014.
	BOP	Verify ES 252, FEEDWATER HEATER – EXT STM LINE DRAINS TRAIN 1, 1-6, is open, using HIS 252.
	BOP	Direct EO to locally isolate HPFW Heater Train 1 per DB-OP-06229, Step 5.1.7.
	BOOTH CUE	***Locally isolate HPFW Heater Train 1 or remove malfunction and isolate the MSRs.***

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Event Description: HPFW Heater tube leak

Time	Position	Applicant's Actions or Behavior
NOTE: The reliefs for the HPFW Heaters relieve to the TPCW Low Level Tank. This may result in elevated TPCW temperatures and levels.		
	Crew	Monitor TPCW System performance. REFER TO DB-OP-06263, Turbine Plant Cooling Water System, as necessary.
	SM CUE	***If necessary, Role-play the SM and report Alignment of the 50# header is NOT required***
On Lead Evaluator's discretion, proceed to Event 3		

Op Test No.: 2016	Scenario No.: 3	Event No.: 3	Page 9 of 17
Event Description:	PZR Level Temp compensating instrument fails low		

Time	Position	Applicant's Actions or Behavior
Indications Available: • **2-4-C, MU FLOW HI TRN 2** • **4-2-E, PZR LVL LO**		
	ATC	Respond to annunciator 4-2-E, identify PZR temperature indication is failed low
	SRO	Implement DB-OP-02513, Pressurizer System Abnormal Operation, Section 4.6, Failure of Selected Pressurizer Level or Temperature Instruments.
	ATC	Place MU32, RCS Makeup valve, in HAND using LICRC14
	ATC	Adjust MU32 to obtain desired Makeup flow or PZR level – Discuss with SRO and determine level band for manual control
	SRO	Set Pressurizer level control band based on uncompensated level (~135-145 inches).
	ATC	Compare PZR Temperature Instruments, identify selected TE has failed (TTRC15-1/TTRC15-2)
	SRO	Refer to DB-OP-06407, Non Nuclear Instrument Operating Procedure, for transferring input
	ATC	Select good input to HSRC15 • Place HIS RC 15 to the TT RC 15-2 position
	ATC	Place MU32 in AUTO
	SRO	Review TS 3.4.9, Pressurizer, Condition A for high level, if Pressurizer level reached 228 inches or uncompensated level greater than 147 inches.
On Lead Evaluator's discretion, proceed to Event 4		

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Event Description: Isolable steam leak – Loss of AFP 2

Time	Position	Applicant's Actions or Behavior
Indications Available: • **12-2-A SG 1 TO AFPT 2 MN STM PRESS LO** • **P012 AFPT 2 STM IN LOW PRESS** • **Fire alarms**		
	Crew	Recognize a steam leak in AFPT Room 2 • 12-2-A SG 1 TO AFPT 2 MN STM PRESS LO • Fire alarms
	SRO	Implement DB-OP-02525, Steam Leaks
	ATC	Monitor reactor power • Lower power as needed to maintain ≤ 100% (limit of 95% not once HPFW Train 1 is isolated and bypassed, though crew may maintain ≤ 95% unless told otherwise)
	SRO	Direct Shift Manager to refer to RA-EP-01500, Emergency Classification
	BOP	Determine the leak location is in AFPT Room 2 based on annunciator 12-2-A, P012, and/or fire alarms
	SRO	Direct BOP to perform Attachment 1, Isolation of Main Steam Line 1 to AFPT 2 Leak
	BOP	Attempt to isolate the leak as follows: • Close MS 107A • Verify MS 107 is closed • Verify MS 106 is closed
	BOP	Recognize annunciator 12-2-A is extinguished - Notify the US that the leak is isolated and to GO TO Attachment 8 for continued operation
	SRO	Go to Attachment 8, Evaluation for Continued Operation

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Event Description: Isolable steam leak – Loss of AFP 2

Time	Position	Applicant's Actions or Behavior
	SRO	Request Equipment Operator(s) open breakers for MS107 (BF1124) and MS107A (BF1188) per Attachment 9
	SRO	Direct Maintenance/Engineering to investigate the area for extent of damage
	SRO	Review Technical Specification for AFP 2 inoperable - Declare AFP 2 Inoperable. Enter TS 3.7.5, Condition B and direct energize blue TS Operability light
	SRO	Request Radiation Protection survey the area
	SRO	Direct Shift Manager to review for Notification requirements, and review for Classification per RA-EP-01500, Emergency Classification:
On Lead Evaluator's discretion, proceed to Event 5, 6, and 7		

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Event Description: Loss of ICS DC – trip reactor/Loss of AFP1/Loss of All Feedwater

Time	Position	Applicant's Actions or Behavior
		Indications Available: • **ICS IN TRACK (14-6-D)** • **ICS 24 VDC BUS TRIP (14-1-C)** • **ICS H/A Station Lights OFF** • **MDFP Trip (10-1-H)**
	Crew	Recognize a loss of ICS DC Power • ICS IN TRACK (14-6-D) • ICS 24 VDC BUS TRIP (14-1-C) ICS H/A Station Lights OFF
	ATC	Perform immediate actions • Trip the Reactor • Verify power decreasing • Trip the turbine
	ATC	Manually actuate initiate & isolation of SFRCS
	SRO	Implement DB-OP-02000
	SRO/ATC	Verify immediate actions: • Trip the Reactor • Verify power decreasing • Trip the turbine • Verify all Turbine Stop Valves OR Control Valves are closed
	Crew	Check for Specific Rule or Symptom Direction
	BOP	Implement Specific Rule 4 for a loss of both AFPs (AFP 1 does not reach sufficient speed/discharge pressure to provide flow)
	BOP	Enable MDFP Discharge Valves • HIS 6459 • HIS6460

Op Test No.: 2016 Scenario No.: 3 Event No.: 5,6,7 Page 13 of 17

Event Description: Loss of ICS DC – trip reactor/Loss of AFP1/Loss of All Feedwater

Time	Position	Applicant's Actions or Behavior
	BOP	Close both MDFP discharge valves • LIC 6459 • LIC 6460
	BOP	Start the MDFP **NOTE: (After 2 minutes the MDFP will trip)**
	Crew	Recognize the MDFP trips
	ATC	Attempt to start the standby Makeup Pump 1 (fails to start)
	SRO	Go to Attachment 4 for aligning MU/HPI/PORV Cooling
	BOP	Use Attachment 5 to attempt to restore a source of feedwater
*Critical Task (CT-14)	ATC	*Trip all but one RCP **NOTE: RCP 2-2 left running to maximize spray flow**
	ATC	Implement Attachment 8, Place MU/HPI/LPI in Service • *Start/Verify running both CCW Pumps • *Start both HPI Pumps • *Open HP 2A, HP 2B, HP 2C and HP 2D • *Start both LPI Pumps • *Open DH 64 • *Open DH 63 • Transfer MU Pump 1 suction to the BWST- MU6405 - not critical since MUP 1 is not running • *Transfer MU Pump 2 Suction to the BWST- MU3971 • *Set Pressurizer Level Controller to 100 inches
	ATC	*Place all PZR Heaters in OFF

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Event Description: Loss of ICS DC – trip reactor/Loss of AFP1/Loss of All Feedwater

Time	Position	Applicant's Actions or Behavior
	ATC	Lock MU Pump suctions on the BWST • MU 6405 - not critical since MUP 1 is not running • *MU 3971
	ATC	*Close MU6409
	ATC	*Open MU6420
	ATC	Verify Open MU6422
	ATC	Close MU6407 - not critical since MUP 1 is not running
	ATC	*Close MU6406
	ATC	Verify RC11 is open
	ATC	*Lock open the PORV
	SRO/ATC	Specific Rule 6 check for EDGs running on SFAS initiate: • Check for EDGs running and proper cooling
*Critical Task (CT-1)	ATC/BOP	When Adequate SCM is lost (<20ºF): • *Trip the remaining running RCP • Select Incores on the PAM Panel
	ATC	Open Loop 1 High Point Vents • *RC4608B • *RC4608A

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Event Description: Loss of ICS DC – trip reactor/Loss of AFP1/Loss of All Feedwater

Time	Position	Applicant's Actions or Behavior
	ATC	Open Loop 2 High Point Vents • *RC4610B • *RC4610A
	ATC	Open PZR High Point Vents • *RC200 • *RC239A
	Crew	Check for entry into PTS Criteria
EAL **Alert FA1 based on Loss of RCS Barrier (SCM <20)**		
When MU/HPI/PORV cooling is in progress and at Lead Evaluator discretion the scenario can be terminated		

Justification for Critical Tasks

A. Establish MU/HPI Cooling (CT-14)

MU/HPI cooling is required to be established immediately when only one makeup pump is available during a loss of all feedwater. Establishing MU/HPI cooling will prevent the RCS pressure from exceeding the shut off head of the HPI pump.

B. Trip All Reactor Coolant Pumps (CT-1)

Subcooling Margin will be lost due opening the PORV for MU/HPI cooling. Specific Rule 2 actions will be taken to stop the remaining RCP in service. Continued RCP operation could lead to fuel clad failure.

SIMULATOR SETUP INFORMATION

1. Simulator Setup
    a) 100% Power
    b) AFP 1 does not obtain proper speed on start (governor problem)
    c) MDFP trips 2 minutes after starting
    d) Makeup Pump 1 fails to start

2. Procedures

    Used by the crew

    a) DB-OP-02513, PZR System Abnormal Operation
    b) DB-OP-06403, RPS and Nuclear Instrumentation Systems
    c) DB-OP-02013, Condensate/Feedwater Alarm Panel 13
    d) DB-OP-02526, Primary to Secondary Heat Transfer Upset
    e) DB-OP-06229, High Pressure Feedwater Heater System
    f) DB-OP-06407, Non Nuclear Instrument Operating Procedure
    g) DB-OP-02525, Steam Leaks
    h) DB-OP- 02532, Loss of NNI/ICS Power
    i) DB-OP-02000, RPS, SFAS, SFRCS Trip, or Steam Generator Tube Rupture

    For Simulator Instructor/Communicator

    a) DB-OP-06229, High Pressure Feedwater Heater System, sect. 5.1
    b) DB-OP-06229, High Pressure Feedwater Heater System, Att. 10
    c) DB-OP-02525, Steam Leaks, Att. 8

Facility:	Davis-Besse	Scenario No.:	4	Op Test No.:	DB NRC 2016
Examiners:		Operators:			SRO
					ATC
					BOP

Initial Conditions:
- 100% power
- Makeup Pump 2 in service

Turnover:
- Maintain 100% power

Planned:
- Shift Routines

Critical tasks: 1. Control SG Pressure (CT-11)

2. Control HPI (CT-5)

Event No.	Malf. No.	Event Type*	Event Description
1		C-BOP/SRO	Condensate Pump high bearing temperature
2		C-ATC/SRO (TS)	Makeup Pump trip
3		C-BOP/SRO	Rising condenser pressure – Mechanical Hogger failure
4		C-ATC/SRO	Purification Demin isolates
5		R-ATC/SRO (TS)	SG 2 tube leak
6		M-ALL	SG 2 tube rupture/Turbine Trip/Rx Trip
7		C-BOP/SRO	MSR 2nd Stage Reheat valves fail to auto close

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

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The scenario begins with the plant in Mode 1 and the crew maintaining 100% power. Condensate Pump 1 will develop a high bearing temperature. Condensate Pump 1 will be shut down and reactor power will be reduced as needed until within the capacity of two condensate pumps.

At the Lead Evaluator cue event 2 will be triggered resulting in the trip of the running Makeup Pump. The SRO will implement DB-OP-02512, Loss of RCS Makeup. The ATC will close MU2B, RCS Letdown isolation, close MU19, Seal Injection isolation, and close MU32, PZR level control valve. The SRO will enter the applicable TS for the Inoperable Makeup Pump (TRM8.1.1). The ATC will start the standby Makeup pump, restore MU and Seal Injection flow, and reestablish Letdown.

When Makeup is restored and Letdown reestablished the Lead Evaluator will cue event 3 resulting in rising condenser pressure. The crew will identify rising pressure from trend recorder data or from receipt of annunciator alarms 15-1-F and/or 15-2-F, Hi/Lo Condenser pressure Hi. The Unit Supervisor will enter abnormal procedure DB-OP-02518, High Condenser Pressure. The Mechanical Hogger will fail to auto start and the BOP will manually start the Mechanical Hogger. Condenser pressure will stabilize at less than 5.0 inches HgA and reactor power reduction to maintain less than or equal to 5.0 HgA will not be required. At Lead Evaluator discretion the scenario will proceed to the 4th event.

Event 4 will result in MU10B, Mixed Bed 2 Letdown Inlet, failing closed isolating the Letdown flow path. The crew will diagnose the loss of Letdown using indication of no Letdown flow and annunciator 2-2-A, Letdown Pressure High. The crew will refer to alarm procedure DB-OP-02002 and verify close MU4, Pressure Reducing Valve, and MU6, Letdown Flow Control Valve. Proper lineup will be checked and MU10B identified as being closed. MU10B will fail to open if attempted and Letdown will be reestablished by placing #1 demineralizer in service. The Unit Supervisor may elect to enter abnormal procedure DB-OP-02512, Makeup and Purification System Malfunctions, for the loss of Letdown flow path if not diagnosed and corrected in a timely manner using the alarm procedure.

When Letdown is restored the Lead Evaluator will cue event 5 resulting in indications of a tube leak in #2 Steam Generator (approximately 25 gpm). The crew will respond to annunciator 12-1-B, MN STM LINE 2 RAD HI, in accordance with DB-OP-06012, STM GEN/SFRCS Alarm Panel 12 Annunciator and then enter DB-OP-02531, STEAM GENERATOR TUBE LEAK. The crew will evaluate the SG leakage and determine the leak rate is in excess of T.S. 3.4.13 and start a rapid shutdown (TS).

When a rapid shutdown is in progress event 6 will be triggered which will increase the tube leak to a tube rupture at approximately 300 gpm. The crew will identify with calculations/indications that the tube leak has degraded to a tube rupture at greater than 50 gpm. The Unit Supervisor will implement the Emergency Procedure by routing to section 8 for Steam Generator Tube Rupture. Attachment 8, Place MU/HPI/LPI in Service, will be performed (**CT-5, Control HPI**). The reactor will trip at approximately 65% power when the turbine will trip due to an electrical fault.

Event 7 will be automatically triggered with the MSR Second Stage Reheat Valves failing to auto close. The crew will identify indications of Overcooling and the Unit Supervisor will route to section 7 for Overcooling. Implementation of attachment 20, Isolate or Control Potential Source of Overcooling, should identify the MSR Second Stage Reheat Valves failing to auto close. MS314 and 199, MSR Second Stage Reheat Valves, will close if attempt to manually close is initiated. The crew may manually initiate and isolate SFRCS to terminate the overcooling. The crew will control steam generator pressure to commence a cooldown and maintain minimize subcooling margin to minimize stresses on the faulted generator tubes (**CT-11, Control SG Pressures**). At the Lead Evaluator discretion the scenario will be terminated.

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Event Description: Condensate Pump high bearing temperature

Time	Position	Applicant's Actions or Behavior
Indications Available: • **T176, CNDS PMP 1 MTR UPR BRG (computer point)**		
	Crew	Recognize Condensate Pump 1 has high bearing temperature
	ATC/BOP	Dispatch operator to Condensate Pump 1
	Booth Cue	***After 2 minutes - Role play as operator and report Motor Bearing feels hotter than usual***
	ATC/BOP	Monitor Condensate Pump 1 bearing temperature (T176) and refer to Motor Temperature Limit aid
	SRO	SRO may refer to DB-OP-06221, Condensate System – Limit and Precaution 2.2.1- pump trip guidance is also provided on Motor Temperature Limit aid
	Crew	Recognize trip criteria is 212°F– Identify to be above 212°F
	SRO	Direct trip of Condensate Pump 1
	BOP	Stop Condensate Pump 1 using control switch HIS558
	ATC	Reduce Reactor Power to within the capacity of two condensate pumps (7.0 MPPH) as necessary • Input target power into ULD • Rate of change may be increased **NOTE: Slight reduction of power needed to reduce condensate flow to less than 7.0 MPPH. DB-OP-02504, Rapid Shutdown may be used to direct shutdown.**
On Lead Evaluator's discretion, proceed to Event 2		

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Event Description: Makeup Pump trip

Time	Position	Applicant's Actions or Behavior
Indications Available: • **Annunciator 6-5-C SEAL INJ FLOW LO** • **Annunciator 6-6-C SEAL INJ TOTAL FLOW** • **Makeup Pump red RUN light OFF** • **Zero Makeup flow** • **MU32, Pressurizer Level Control Opening** • **MU19, RCP Seal Injection Flow Control Opening**		
	Crew	Recognize a loss of running RCS Makeup Pump using indication available listed above
	SRO	Implement DB-OP-02512, Makeup and Purification System Malfunctions, for a loss of RCS Makeup Pump
	ATC	Isolate Letdown using MU 2B • Depress CLOSE on HISMU2B
	ATC/BOP	Dispatch operators to investigate pump trip
	ATC/BOP	Verify CCW is being supplied to the RCPs using Attachment 1, Verification Of CCW Flow To Reactor Coolant Pumps • Verify a CCW Pump in service • Verify Open CC5095, Supply • Verify Open CC5097, CTMT BLDG Return Open • Verify Open CC1411A • Verify Open CC1411B • Verify Open CC1407A • Verify Open CC1407B Verify Seal Cooling CCW Return flow path is available • RCP 1-1 CC4100 Open • RCP 1-2 CC4200 Open • RCP 2-1 CC4300 Open • RCP 2-2 CC4400 Open Check Annunciator Alarm 6-5-B, SEAL CCW FLOW LOW is extinguished Notify SRO CCW flow is available to the Reactor Coolant pumps

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Event Description: Makeup Pump trip

Time	Position	Applicant's Actions or Behavior
	ATC	Monitor Pressurizer level and compare to curve CC 4.3 - Anytime Pressurizer Level is less than 160 inches, trip the reactor and go to DB-OP-02000
	ATC	Isolate RCP Seal Injection by closing MU19 using FICMU19
	ATC	Place MU32 in Hand AND close MU32 using LICMU14 to isolate the normal Makeup flowpath
	SRO	Refer to DB-OP-02515, Reactor Coolant Pump and Motor Abnormal Operation
	Crew	Monitor RCP Seal parameters
	BOP/ATC	Maintain Tave constant
	SRO	Refer to TRM 8.1.1, Boration Systems – Operating Enter TRM 8.1.1, Nonconformance A
	SRO	Notify the Shift Manager to perform event notifications and Fleet Reporting updates
	Booth Cue	***Role play if asked to investigate Makeup Pump 2 trip – report 50/51 relay target on MUP 2 breaker AD105*** ***Role play if asked no local pump problems observed***
	ATC	Verify Makeup Pump did not indicate cavitation • No erratic amps, No erratic flow • No erratic discharge pressure • Makeup pump did not empty
	Crew	Verify operator on station to monitor standby makeup pump start

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Event Description: Makeup Pump trip

Time	Position	Applicant's Actions or Behavior
	ATC	Start Makeup Pump 1 • Start Makeup Pump 1 oil pumps • Start Makeup Pump 1
	Booth Cue	***Role play as equipment Operator and report when stationed at MUP and proper operation of MUP 1***
	ATC	Restore Makeup flow using Attachment 4 • Verify MU6421 Closed • Verify MU6422 Open • Throttle as needed and place MU32 in Automatic **NOTE: Attachments 4 and 5 can be performed in either order or in parallel**
	ATC	Restore Seal Injection flow using Attachment 5 • Verify MU19 closed • Verify MU66A through D open • Verify MU6408 Open • Verify MU6409 Open • Gradually over 2 minutes open MU19 to establish 12-15 gpm seal inject flow (minimum 3 gpm to any RCP)
	ATC	Restore letdown – Open MU2B Depress OPEN on HISMU2B
	ATC	When 10 minutes has elapsed raise seal injection flow to 20-25 gpm **NOTE: Not necessary to complete to proceed to next event**
	ATC	When 10 minutes has elapsed raise seal injection flow to 32-36 gpm and place FICMU19 in Auto **NOTE: Not necessary to complete to proceed to next event**
On Lead Evaluator's discretion, proceed to Event 3		

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Event Description: Rising condenser pressure – Mechanical Hogger failure

Time	Position	Applicant's Actions or Behavior
Indications Available: • **Annunciator 15-1-F HP CNDSR HI** • **Annunciator 15-2-F LP CNDSR HI** • **Annunciator 14-2-F ICS ULD TRBL** • **HP PR 530 rising (trend recorder)** • **LP-PR 541 rising (trend recorder)** • **Lowering MW**		
	Crew	Recognize indications of slowly increasing condenser pressure (available indications listed above)
	SRO	Implement DB-OP-02518, High Condenser Pressure
	ATC	Reduce Power as needed to maintain less than or equal to 7.0 MPPH condensate flow (limit for two Cond Pumps in service)
	BOP	Verify the Mechanical Hogger Starts at 4.5 inches HgA LP Condenser (Auto start is failed) • Position switch HIS1005 to START (Condenser pressure will stop increasing and slowly improve)
	ATC	Reduce Reactor Power as needed to maintain Condenser pressure less than or equal to 5.0 inches HgA **NOTE: Should not be needed unless slow to start hogger**
	BOP	Verify proper Circ Water Pump operation
	BOP	Verify Condenser Vacuum Breakers are Closed (HIS634)
	BOP	Check proper operation of Gland Sealing Steam system
	SRO	Request assistance to determine the cause (Attachment 1)
	SRO	Notify the Shift Manager to refer to Notification requirements
On Lead Evaluator's discretion, proceed to Event 4		

Op Test No.: 2016	Scenario No.: 4	Event No.: 4	Page 9 of 18
Event Description:	Purification Demin isolates		

Time	Position	Applicant's Actions or Behavior
Indications Available: • **Zero Letdown flow or identification of relief lifting to RCDT** • **Annunciator 2-2-A LETDOWN PRESS HI**		
	Crew	Recognize a loss of the Letdown flowpath: • Zero Letdown flow/identify relief lifting to RCDT • 2-2-A LETDOWN PRESS HI
	ATC	Refer to DB-OP-02002, Letdown/Makeup Alarm Panel 2 Annunciators
NOTE: If diagnosis is slow the SRO may implement abnormal procedure DB-OP-02512, Makeup and Purification System Malfunctions, for the loss of Letdown flowpath		
	ATC	Verify MU 4, Pressure Reducing Valve, is closed
	ATC	Verify MU 6, Letdown Flow Control Valve, is closed using HCMU6
	ATC	Check for correct valve lineup in the Letdown line Recognize MU10B is closed
	SRO	Direct attempting to open MU10B
	ATC	Attempt to Open MU10B using HISMU10B (will remain failed)
	SRO	Direct placing another demin in service or bypassing demins
	CUE	***If necessary - Shift Manager directs placing #1 Demin in service and restore Letdown***
	ATC	Depress Open on HISMU10A

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Event Description: Purification Demin isolates

Time	Position	Applicant's Actions or Behavior
	ATC	Throttle open MU6 using HCMU6 to restore flow to 70 gpm
	ATC/BOP	Verify PSV1890 is not lifting/leaking by observing RCDT level (LI1721 or trend pen) – Alarm procedure action
	SRO	If Pressurizer level reaches 228 inches then TS 3.4.9 will need to be entered and restored within 1 hour.
When Letdown has been restored proceed to Event 5		

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Event Description: SG 2 tube leak

Time	Position	Applicant's Actions or Behavior
Indications Available: • **Annunciator 9-4-A VAC SYS DISCH RAD HI** • **Annunciator 12-1-B MN STM LINE 2 RAD HI** • **Increasing Makeup flow**		
	Crew	Recognize indications of a SG tube leak • Annunciator 9-4-A VAC SYS DISCH RAD HI • Annunciator 12-1-B MN STM LINE 2 RAD HI • Increasing Makeup flow
	SRO	Route to DB-OP-02531, Steam Generator Tube Leak
	ATC	Calculate a leak rate (~25 gpm). REFER to Attachment 1, Steam Generator Tube Leak Calculation
	Crew	Determine SG 2 has the tube leak (~25 gpm) **Note: If >50 gpm is calculated the crew will route to OP2000**
	SRO	Notify SM to refer to EP Classification, Offsite Dose assessment, and notification requirements
	SRO	Refer to TS 3.4.13, RCS Operational Leakage. Enter Condition B for primary to secondary leakage
	SM CUE	***IF needed, Role-play SM and direct to lower power at 5%/min.***
	SRO	Direct a plant shutdown per DB-OP-02504, Rapid Shutdown, Attachment 1, Power Reduction Actions ICS Full Automatic
	ATC	Begin plant shutdown • Set rate of change as directed • Select target Power – 20% RTP for Low level limits • Monitor Power
	SRO	Direct BOP to perform Attachment 6, BOP Actions

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Event Description: SG 2 tube leak

Time	Position	Applicant's Actions or Behavior
	BOP	Direct an EO to remove AFPT Main Steam minimum flow lines
	BOP	Direct an EO to coordinate control of Moisture Separator Reheat RSLLVs at ~675 MWe (refer to Attachment 9)
	SRO	Notify EOs to commence Attachment 15, Field Actions
	SRO	Notify Load Dispatcher
	SRO	Notify Chemistry to monitor polisher operation and sample for isotopic analysis of iodine per TS 3.4.16
	SRO	Notify SM to complete required notifications

With plant shutdown in progress per DB-OP-02504. Rapid Shutdown, or DB-OP-02000 at approximately 80% power proceed to event 6 (Tube Rupture) and event 7 (Generator/Reactor Trip) will auto trigger at approximately 60% power.

Op Test No.: 2016 Scenario No.: 4 Event No.: 6,7 Page 13 of 18

Event Description: SG 2 tube rupture/Turbine Trip/Rx Trip/MSR 2nd Stage Reheat valves fail to auto close

Time	Position	Applicant's Actions or Behavior
Indications Available: • **Pressurizer level decreasing** • **Increasing Makeup flow**		
	Crew	Recognize increase in leak rate indicates a SG Tube Rupture, (greater than 50 gpm), using PZR level ↓, Makeup Flow ↑, and/or computer leak rate program.
	SRO	Go to DB-OP-02000, RPS SFAS, SFRCS Trip, or SG Tube Rupture, Section 8 **NOTE: Turbine will trip due to electrical fault resulting in Rx trip at approximately 65% power**
	Crew	Recognize Reactor Trip (Turbine trip at approximately 65%)
	ATC	Perform DB-OP-02000 Immediate Actions • Manually trip the reactor • Verify power decreasing in the intermediate range • Manually trip the turbine
	SRO/ATC	Verify immediate actions • Verify Reactor is tripped • Verify power decreasing in the intermediate range • Manually trip the turbine • Verify all 4 Stop Valves or Control Valves are closed
	Crew	Check for Specific Rule implementation
	Crew	Check for Symptom Mitigation section implementation • Recognize Overcooling due to SG pressure less than 960 psig
	SRO	Route to DB-OP-02000, Section 7

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Event Description: SG 2 tube rupture/Turbine Trip/Rx Trip/MSR 2nd Stage Reheat valves fail to auto close

Time	Position	Applicant's Actions or Behavior
	ATC/BOP	Implement Attachment 8, Place MU/HPI/LPI in Service • Start/Verify running both CCW Pumps • Start/Verify running both HPI Pumps • Verify open HP 2A, HP 2B, HP 2C and HP 2D • Start both LPI Pumps • Open DH 64 and DH 63 • Transfer MU Pump suctions to the BWST Set Pressurizer level to 100 Inches **NOTE: Attachment 8 may be started when Tube Rupture is identified prior to reactor trip (OP2000 section 8)** **Two handed operation of HP2A-2D is authorized**
	ATC	If Pressurizer Level is less than 40 inches: • Lock MU Pump suctions on the BWST • Isolate Letdown Verify Pressurizer heaters are off
	BOP	Implement Attachment 20, Isolate or Control Potential Source of Overcooling
***Critical Task (CT-11)**	BOP	Terminate the overcooling: • *Close MS 314 and MS 199 OR • *Manually Initiate and Isolate SFRCS (Auto Initiate/Isolate is failed)
	BOP	If the MSR Second Stage Reheat valves were isolated: • Verify proper SG level control • Control TBVs to maintain RCS temperature constant or slowly decreasing • Check for entry into PTS
	BOP	If SFRCS was actuated: • Verify proper SFRCS actuation • Verify SG pressures are equal • Control AVVs to maintain RCS temperature constant or slowly decreasing • Verify proper SG level control

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Event Description: SG 2 tube rupture/Turbine Trip/Rx Trip/MSR 2nd Stage Reheat valves fail to auto close

Time	Position	Applicant's Actions or Behavior
		• Check for entry into PTS
	SRO	Route to Section 4.0 Supplemental Actions
	SRO	Route to Section 8.0 step 8.19
	ATC	Verify Attachment 8 is complete
	ATC	If Pressurizer Level is less than 40 inches: • Lock MU Pump suctions on the BWST • Isolate Letdown using MU2B • Verify Pressurizer heaters are off
	ATC	Verify Pressurizer level controller set at 100 inches
	SRO	Verify DB-OP-02531 Attachments are in progress • Direct Chemistry to perform Attachment 2 • Direct Radiation Protection to perform Attachment 3 • Direct an Equipment Operator/Field Supervisor to perform Attachment 4
	BOP	If the Aux Boiler is running then direct an Equipment Operator/Field Supervisor to transfer Aux Steam and Gland Steam to the Aux Boiler
	ATC	Turn off all Pressurizer heaters
	SRO	Route to step 8.40
	ATC	Use Pressurizer Spray to reduce RCS pressure to Minimize Subcooling Margin

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Event Description: SG 2 tube rupture/Turbine Trip/Rx Trip/MSR 2nd Stage Reheat valves fail to auto close

Time	Position	Applicant's Actions or Behavior
***Critical Task (CT-5)**	ATC	Throttle High Pressure Injection *Control Pressurizer level by throttling MU and HPI flows as pressure is reduced to prevent overfilling the pressurizer: • Throttle/close HP 2A, HP 2B, HP 2C and HP 2D as needed to prevent overfilling the pressurizer as RCS pressure is reduced
EAL SU7 Unusual event based on leak greater than 10 gpm or FA1 Alert based on greater than 250 gpm leak		
At Lead Evaluator discretion the scenario can be terminated		

Justification for Critical Tasks

A. Control SG Pressure (CT-11)

Control of SG Pressure lowering due to overcooling will be accomplished by recognizing the cause to be MSR Reheat Low Load Valves failing to auto close and manually closing, or Initiating and Isolating SFRCS (auto initiate/isolate is failed).

B. Control HPI (CT-5)

Due to the loss of inventory through the Steam Generator tube rupture, High Pressure Injection will be placed in service to inject water to maintain Pressurizer level. When depressurizing the RCS, control per specific rule 3 will be required and HPI 2A-2D throttled and or closed to prevent overfilling the pressurizer.

SIMULATOR SETUP INFORMATION

1. Simulator Setup
    a) 100% Power
    b) Makeup Pump 2 in service
    c) Mechanical Hogger failure to auto start
    d) MU10B fails to open when triggered closed
    e) Tube leak increases to a rupture (300 gpm) at approximately 80%
    f) SFRCS Auto Initiate/Isolate failed
    g) Reactor Trip due to Turbine Trip (generator fault) at 65% power
    h) MSR 2nd Stage Reheat Valves fail to auto close
2. Procedures

    Used by the crew

    a) DB-OP-06221, Condensate System
    b) DB-OP-02504, Rapid Shutdown
    c) DB-OP-02512, Makeup and Purification System Malfunctions
    d) DB-OP-02518, High Condenser Pressure
    e) DB-OP-02002, Letdown/Makeup Alarm Panel 2
    f) DB-OP-02531, Steam Generator Tube Leak
    g) DB-OP-02504, Rapid Shutdown
    h) DB-OP-02000, RPS, SFAS, SFRCS Trip, or Steam Generator Tube Rupture

    For Simulator Instructor/Communicator

    a) DB-OP-06221, Condensate System, sect. 3.8
    b) DB-OP-06006, MU and Purification System, section 3.2
    c) DB-OP-02504, Rapid Shutdown, Att. 6 (BOP actions)