

AS GIVEN FINAL OPERATING EXAMINATION
(IN ITS ENTIRETY)

As given Admin Topics Outline

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A070
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A070

Administrative Topics Outline *AS GIVEN*

| Facility: <u>Crystal River Unit 3</u> | | Date of Examination: <u>2-8-99</u> |
|--|------------------------------|---|
| Exam Level: <u>RO/SRO</u> | | Operating Test No. : |
| Administrative Topic/Subject Description | | Describe method of evaluation: 1. ONE Administrative JPM, OR 2. TWO Administrative Questions |
| A1 | Plant Parameter Verification | JPM - Perform a heat balance, SP-312A, Daily Heat Balance Power Comparison//015A1.01//3.5/3/8 |
| | Plant Parameter Verification | JPM - Perform a reactivity balance, SP-421, Reactivity Balance Calculations//001K5.72//3.1/3.6 |
| A2 | Surveillance Testing | JPM - Perform the pump seal data sheet in SP-300, Operating Daily Surveillance Log//003A4.04//3.1/3.0 |
| A3 | Radiation Hazards (Surveys) | JPM - Using survey maps determine radiation requirements and stay times//2.3.1//2.6/3.0 |
| A4 | SRO Emergency PAR | JPM - Determine Emergency Action Level and Protective Action Recommendation for a given set of conditions //2.4.41//2.3/4.1 and 2.4.44//2.1/4.0 |
| A4 | RO Emergency Dose Assessment | JPM - Perform and EM-204A, Off-Site Dose Assessments during Radiological Emergencies Initial Assessment Method//2.4.39//3.3/3.1 |

Individual Walk-through Test Outline *As Given*

| Facility: <u>Crystal River Unit 3</u> Exam Level: <u>RO/SRO</u> | | Date of Examination: <u>2-8-99</u> Operating Test No. : 1 |
|--|-----------------|---|
| System / JPM Title / Type Codes* | Safety Function | Planned Follow-up Questions: K/A/G // Importance // Description |
| Control Rod Drive (CRD)//Recover a Misaligned Rod //001A2.03//3.5/4.2// S, N | 1 | A. 001K5.07//3.3/4.0//What are the Technical Specification requirements, if any, when given the position of each rod in group 7 (2 rods will not be within the 6.5% group average)? B. 001K5.04//4.3/4.7//What are the Technical Specification requirements, if any, when given the Rod Index and % power (Rod Index will be in the restricted region)? |
| Engineered Safeguards (ES)//Manually actuate Low Pressure Injection//006A4.07//4.4/4.4//S, N, L, A | 2 | A. 006K4.05//4.3/4.4//Given a set of plant conditions, what is the status of the Decay Heat Pumps (4 psig Reactor Building pressure with a Loss of Off-Site Power)? B. 056AA2.07//4.2/4.3//Given a set of plant conditions, what is the status of the Emergency Feedwater Pumps (High Pressure Injection signal, Low Pressure Injection signal, and Loss of Off-Site Power)? |
| Reactor Building (RB)//Start an RB pressure Equalization /Mini-Purge under Non-Accident Conditions//029A2.03/2.7/3.1//S, N | 8 | A. 029K3.01//2.9/3.1//Is the average Reactor Building (RB) temperature acceptable, given a list of RB temperatures from SP-300? B. 029K4.03//3.2/3.5//While securing the RB equalization two (2) of the isolation valves do not close, what are the Technical Specification actions, if any? |

| | | |
|---|----------|---|
| <p>Reactor Coolant (RCS) //Lower water level in the Reactor Coolant Drain Tank //007A1.01 //2.9/3.1 S, A, D</p> | <p>5</p> | <p>A. 007A1.01//2.9/3.1//The Reactor Coolant Drain Tank (RCDT) high level annunciator has just come into alarm, how many gallons will have to be pumped out to clear the high level alarm and bring the low level annunciator into alarm?</p> <p>007A4.10//3.6/3.8//At full reactor power the pressure in the RCDT is increasing due to a weeping code safety, if RCDT pressure is currently 4 psig (assume no other line losses), what would the temperature and condition be of the steam space in the RCDT (prior to the cooling)?</p> |
| <p>Emergency Diesel Generator (EDG)// Synchronize in Off-Site Power and unload /shutdown EDG-1A //062A4.07//3.1/3.1//S; D</p> | <p>6</p> | <p>A. 064K1.03//3.6/4.0//While performing SP-300, Operating Daily Surveillance Log, on the "A" Emergency Diesel Generator, fuel oil level in the Day Tank is 22.5 inches on the dip stick, what is the usable volume and are any fuel oil transfer pumps operating?</p> <p>B. 064A3.01//4.1/4.0//Given a set of plant data (Reactor Coolant pressure, temperature, bus voltage etc.), are the Emergency Diesel Generators running?</p> |
| <p>Reactor Protection System (RPS)//Reset an RPS channel //012A4.04//3.3/3.3//CR, D</p> | <p>7</p> | <p>A. 012K4.02//3.9/4.3//Given a set of plant parameters (variable low pressure trip), what is the condition of the Reactor Protection System (RPS)?</p> <p>B. 003K3.04//3.9/4.2//At 60% power, given the condition of the Reactor Coolant Pump Power Monitor and a set of the Reactor Coolant Pumps' kilowatt usage, what is the condition of the RPS system?</p> |
| <p>Steam Generator System//Perform Steam Generator Isolation for TRACC Limits// 035A4.06//4.5/4.6//CR, N</p> | <p>4</p> | <p>A. 035A1.01//3.6/3.8//What is the maximum allowable Steam Generator level if Main Steam pressure is 835 psig and temperature is 550°F?</p> <p>B. 059K1.05//3.1/3.2//What is the expected Feedwater temperature at 45% thermal power?</p> |

| | | |
|---|----------|--|
| <p>Post Accident Hydrogen Sampling //Place the "A" Hydrogen Analyzer in Service//028A4.03//3.1/3.3//P, D</p> | <p>5</p> | <p>A. 028A4.03//3.1/3.3//DC Distribution Panel, DPDP-1A, is de-energized and WSV-38 is failed in the closed position, what is the flow path for both Hydrogen Analyzers?</p> <p>028A4.03//3.1/3.3//With the "A" Hydrogen Analyzer placed in service given the status of the valves associated with the analyzer and the hydrogen concentration, what is the flow path and the status of the "A" Hydrogen Analyzer?</p> |
| <p>Reactor Coolant System (RCS) //Depressurize RCS using High Pressure Auxiliary Spray //010A2.02//3.9/3.9//P, R, D</p> | <p>3</p> | <p>A. 010K5.01//3.5/4.0//During a cooldown directed in an Emergency Operating Procedure, High Pressure Auxiliary Spray is used to reduce pressure, at 530°F, what is the lowest pressure that can be achieved prior to loss of adequate subcooling margin?</p> <p>B. 010K4.03//3.8/4.1//What are the Low Temperature Over Pressure (LTOP) Technical Specification actions, if any, given a list of plant conditions (Pressurizer level will be high with the Power Operated Relief Valve, PORV, inoperable)?</p> |
| <p>Liquid Radwaste//Start an Evaporator Condensate Storage Tank (ECST) release //068A4.02//3.2/3.1//P, N, R</p> | <p>9</p> | <p>C. 068K4.01//3.4/4.1//During a release of the "A" Evaporator Condensate Storage Tank, the flow instrument, WD-101-FIT, becomes inoperable; what are the requirements, if any, regarding the release?</p> <p>D. B. 068A4.02//3.2/3.1//Given a partially filled out Enclosure 1, from OP-407A, Operation of the Evaporator Condensate Storage Tanks, what are the release rates for the associated time periods?</p> |

* - Type codes: (D)irect from bank, (M)odified from bank, (N)ew, (A)lternate path, (C)ontrol room, (S)imulator, (L)ow Power, (P)lant, (R)CA, (T)ime critical

OPERATING EXAMINATION SCENARIO OUTLINE

Facility: Crystal River Unit 3

Scenario Number: 1

Operating Test Number: 1

Examiners: _____

Operators: _____

Objectives:

1. Evaluate SRO candidates ability to manage shift resources and exercise command and control during normal and emergency conditions.
2. Evaluate SRO candidates ability to implement emergency and abnormal operating procedures.
3. Evaluate SRO candidates ability to interpret and apply Tech Specs associated with inoperable ES instrumentation and an inoperable Safety Rod.
4. Evaluate RO candidates ability to diagnose faulty ES pressure signal and place ES channel in a tripped condition IAW OP-507.
5. Evaluate RO/SRO candidates ability to diagnose and respond to a circulating water pump shaft failure.
6. Evaluate RO/SRO candidates ability to diagnose and respond to a dropped control rod and ICS runback failure. Actions IAW AP-545.
7. Evaluate RO/SRO candidates ability to diagnose and respond to a Pressurizer level instrument failure.
8. Evaluate RO/SRO candidates ability to diagnose and respond to a Pressurizer steam space leak (Small Break re-pressurizing LOCA) with an HPI pump failure.
9. Evaluate RO/SRO candidates ability to diagnose and respond to a loss of ASCM with both SPDS displays failed. Action IAW EOP-03 and Rule #1.
10. Evaluate RO/SRO candidates ability to diagnose and respond to a leak down stream of an HPI injection valve. Action IAW EOP-03.
11. Evaluate RO/SRO candidates ability to diagnose and respond to a loss of all HPI.

Initial Condition: 100% power, ICS in full automatic

Turnover Information: Demin water transfer pump WTP-6B is out of service for motor/pump realignment. WTP-6B is scheduled for return to service in 10 hours. EFP-2 is OOS and red tagged to mechanical maintenance for governor replacement. The plant is six hours into a 72 hour action statement based on TS 3.7.5(D). EFP-2 is scheduled to be released for post maintenance testing in 4 hours. MUP-1A is tagged to electrical maintenance to replace fuses in the DC start circuits. MUP-1A will be released from maintenance in two hours. SWP-1A is running while engineering performs an analysis of anomalous vibration readings taken during the last SP.

During the previous shift Breaker 1661 tripped - cause unknown. A line crew is in the 500 KV switchyard troubleshooting the breaker. Breaker 1661, MOS 1661N, and MOS 1661S are currently OPEN and red tagged to the dispatcher.

Severe thunder storms and extremely high winds are expected over the next 24 hours.

| Event No. | Event type | Malf. No. | Event Description |
|--------------------------|---|------------------------|--|
| 1 | (I)-BOP/SRO | | ES channel 2 pressure transmitter (RC-3A-PT4) fails mid scale (MALF) . SRO evaluates and applies TS 3.3.5(A). ES Channel 2 is placed in "Tripped" condition IAW OP-507. |
| 2 | (C) - BOP/SRO (N)- OAC/SRO | | CWP-1B degradation/Shaft failure (MALF). Respond IAW AR-601 and OP-604. Shutdown faulty CWP Motor and reduce power to <85% IAW AP-510 or OP-204. |
| 3 | (C) - OAC/SRO (R) -OAC | | Control rod GP-1/Rod 2 drops (MALF). ICS fails to runback (MALF). SRO directs RO response IAW AP-545. SRO directs manual power reduction in response to ICS failure. SRO evaluates and applies TS 3.1.4(A) and 3.1.5(A). |
| 4 | (I) - BOP/SRO | | Pressurizer level transmitter RC-1-LT1 fails high (MALF). OAC establishes manual control of Pressurizer level. BOP selects operable instrument IAW OP-501. |
| 5 | (C) - OAC/SRO | | Small Pressurizer steam space leak develops at Pressurizer level tap (MALF). RCS pressure control cannot be maintained. SRO enters AP-520 and directs RO response. SRO should direct a manual reactor trip based on inability to maintain RCS pressure IAW AP-520. |
| 6 | (MT) - ALL | | (ATWS) When SRO directs a manual trip, the Manual Reactor Trip Push - Button does not work. In addition RPS Channels A, B, and C will fail to actuate on "Low" and "Variable Low" RCS pressure (MALF). RO diagnose failure of Rx Trip Push - Button and inform the SRO. SRO directs manual reactor trip using breakers 3305 and 3312 (CT#1). Action IAW EOP-02. |
| 7 | (MT) - cont. (C)- BOP/SRO (I) - OAC or BOP | | When the reactor is tripped, both SPDS displays go blank (MALF). OAC/BOP will have to use the digital SCM monitor displays to determine when ASCM is lost. The SRO enters EOP-03 and directs RCP's shutdown within 2 minutes (CT#2). HPI actuates and MUP-1C fails to auto start and can not be started manually (MALF). Once all HPI valves are open, flow for MUV-25 line reads 75 GPM higher than remain lines due to a passive leak down steam of valve (MALF). SRO directs BOP to bypass/reset ES and close MUV-25 IAW EOP-03. (CT#3) |
| 8 | (C) - All | | MUP-1B shaft seizes (MALF). SRO directs RO's IAW EOP-03 guidance for loss of all HPI capability (CT#4) |
| Scenario Duration | | 120 minutes | Exercise Termination: Plant is stable with cooling established by primary to secondary heat transfer. HPI recovery actions underway. |

*(N)ormal evolution, (R)eactivity manipulation, (I)instrument failure, (C)omponent failure, (M)ajor transient

Narrative Summary:

About 3 minutes after shift turnover, RCS pressure transmitter RCA-3A-PT4 fails mid scale. RO's diagnose the failure and notify the SRO. The SRO evaluates and applies TS 3.3.5(A). SRO directs the BOP to place ES channel 2 in TRIP condition IAW OP-507, Section 4.1.2(C).

After ES channel 2 has been tripped, the crew will receive several alarms indicating problems with CWP-1B. The RO's should dispatch the SPO to evaluate. After about 2 minutes CWP-1B shaft fails. The SRO should direct the BOP to stop CWP-1B motor to minimize damage, and direct the OAC to reduce reactor power to <85% IAW AP-510 or OP-204.

When the plant is stable, Safety Rod 1-2 falls into the core. The OAC will diagnose the condition and the SRO will enter AP-545. ICS will fail to runback. OAC should diagnose the ICS failure. The SRO directs the OAC to manually reduce power. When the plant is <60% power the SRO evaluates and applies TS Actions 3.1.4(A) and 3.1.5(A).

Following the manual runback, Pressurizer level transmitter (RC-1-LT1) slowly fails high. The RO's diagnose the failure and notify the SRO. OAC will manually control Pressurizer level until operable instrument is selected. SRO directs BOP to select and operable instrument IAW OP-501.

When the alternate Pressurizer level instrument has been selected, a Pressurizer steam space leak slowly develops to the point where RCS pressure begins to degrade. The SRO enters AP-520 and directs RO response. The SRO should direct a manual reactor trip when RCS pressure reduction cannot be controlled IAW AP-520. The RPS "Low" and "Variable Low" pressure trips will fail to actuate in 3 of 4 RPS channels, preventing an automatic reactor trip on low pressure. The Manual Rx Trip Push-Button does not work. The SRO should direct the OAC to trip the reactor by opening Breakers 3305 and 3312. **(CT#1)**.

Following the reactor trip, both SPDS displays go blank, RCS pressure continues to degrade, ASCM is lost, and HPI actuates. The RO's/SRO have to use the digital SCM monitors to determine when ASCM has been lost. RCP's are shutdown within 2 minutes IAW EOP-13 Rule 1 and EOP-03 **(CT#2)**. HPI and RBI&C are manually actuated IAW EOP-13 Rule 1. MUP-1C fails to start and the HPI flow for MUV-25 reads 75 GPM higher than the other lines. The SRO directs the BOP to attempt to manually start MUP-1C. The SRO directs the BOP to Bypass/Reset ES, close MUV-25 **(CT#3)**, and have MUV-25 power removed IAW EOP-03 guidance.

After MUV-25 has been closed and de-powered, the running HPI pump will suffer a shaft seizure. The SRO will recognize a total loss of HPI capability, cycles back to beginning of EOP-03, and direct the RO's to establish a maximum rate cooldown IAW with the EOP-03 guidance for total loss of HPI capability **(CT#4)**.

The exercise may be terminated when maximum primary to secondary heat transfer has been established and actions are in progress for recovering HPI flow capability.

Procedures to be used during this scenario:

| | | | |
|--------|--------|--------|--------|
| OP-501 | OP-507 | OP-604 | OP-204 |
| AP-510 | AP-520 | AP-545 | |
| EOP-02 | EOP-03 | | |
| Rule 1 | Rule 2 | Rule 3 | Rule 4 |

| Target Quantitative Attributes - Scenario 1 | Actual Attributes |
|--|--------------------------|
| 1. Total Malfunctions (5-8) | 11 |
| 2. Malfunctions after EOP entry (1-2) | 4 |
| 3. Abnormal Events (2-4) | 3 |
| 4. Major Transients (1-2) | 1 |
| 5. EOP's entered requiring substantive actions (1-2) | 2 |
| 6. EOP contingencies requiring substantive actions (0-2) | 3 |
| 7. Critical Tasks (2-3) | 4 |

Initiation Cue: Examiner Initiated

Annunciator Alarms: A-1-2 and D-1-2

Termination Cue: ES Channel 2 tripped IAW OP-507

Event Description: RC-3A-PT4 (wide range pressure to ES Channel 2 pressure) fails mid scale (MALF). ES Channel RC2 (HPI) actuates but RC5 (LPI) does not actuate. RO's verify a spurious actuation and diagnose instrument failure. The SRO evaluates and enters TS 3.3.5(A). SRO directs RO's to place ES Channel 2 in tripped condition IAW OP-507, section 4.2.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | <p>Diagnose spurious actuation/RC-3A-PT4 failure</p> <ul style="list-style-type: none"> • Ann Alarms <ul style="list-style-type: none"> ◆ A-1-2 "LOAD SEQUENCE BLOCK 2 ACTUATION A ◆ D-1-2 "LOAD SEQUENCE BLOCK 2 ACTUATION B ◆ A-1-3 "LOAD SEQUENCE BLOCK 3 ACTUATION A ◆ D-1-3 "LOAD SEQUENCE BLOCK 3 ACTUATION B ◆ A-1-4 "LOAD SEQUENCE BLOCK 4 ACTUATION A ◆ D-1-4 "LOAD SEQUENCE BLOCK 4 ACTUATION B ◆ A-1-5 "LOAD SEQUENCE BLOCK 5 ACTUATION A ◆ D-1-5 "LOAD SEQUENCE BLOCK 5 ACTUATION B ◆ A-1-6 "LOAD SEQUENCE BLOCK 6 ACTUATION A ◆ D-1-6 "LOAD SEQUENCE BLOCK 6 ACTUATION B • ES Channel 2 (RC2) Trip "A" & "B" Blue lamp Lit • HPI Channel 2, Blocks 1-6, "A" & "B" Blue Lamps Lit <ul style="list-style-type: none"> ◆ RC2 GP#1 BL#1 ◆ RC2 GP#2 BL#1 ◆ RC2 GP#3 BL#2 ◆ RC2 GP#3 BL#3 ◆ RC2 GP#3 BL#4 ◆ RC2 GP#3 BL#5 ◆ RC2 GP#3 BL#6 • RCS pressure stable • ES Channel 2 pressure buffer amp. failed mid-scale <p>Verify ES components not responding to spurious Channel 2 actuation. Checks AR-301, AR-303, and AR-304 for alarms.</p> |

Initiation Cue: Examiner Initiated

Annunciator Alarms: A-1-2 and D-1-2

Termination Cue: ES Channel 2 tripped IAW OP-507

Event Description: RC-3A-PT4 (wide range pressure to ES Channel 2 pressure) fails mid scale (**MALF**). ES Channel RC2 (HPI) actuates but RC5 (LPI) does not actuate. RO's verify a spurious actuation and diagnose instrument failure. The SRO evaluates and enters TS 3.3.5(A). SRO directs RO's to place ES Channel 2 in tripped condition IAW OP-507, section 4.2.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>Verify spurious ES channel actuation.</p> <p>Ensure the RO's verify RCS pressure stable and that ES equipment is not responding to failure.</p> <p>Assist the RO's in diagnostics of ES Channel 2 pressure buffer amp. failure.</p> <p>Reviews Tech Specifications 3.3.5 (A) and declares ES Channel 2 in-operable.</p> <ul style="list-style-type: none"> • Directs the BOP to place ES Channel 2 in "Tripped" condition per OP-507 for RC2 and RC5. <p>Provides PEER check of BOP actions</p> |

Initiation Cue: Examiner Initiated

Annunciator Alarms: A-1-2 and D-1-2

Termination Cue: ES Channel 2 tripped IAW OP-507

Event Description: RC-3A-PT4 (wide range pressure to ES Channel 2 pressure) fails mid scale (MALF). ES Channel RC2 (HPI) actuates but RC5 (LPI) does not actuate. RO's verify a spurious actuation and diagnose instrument failure. The SRO evaluates and enters TS 3.3.5(A). SRO directs RO's to place ES Channel 2 in tripped condition IAW OP-507, section 4.2.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP | <p>When directed by SRO, places ES Channel 2 (RC2/RC5) in tripped condition IAW OP-507, section 4.1.2</p> <ul style="list-style-type: none"> • Category 1 evolution • Select Channel 2 pressure test module to "Test-Operate" Position. • Verify proper ANN Alarm event points are in for ES Channel 2 tripped. <ul style="list-style-type: none"> ◆ 1020 LOADING SEQUENCE BLOCK 2 ACTUATION "A" ◆ 1023 LOADING SEQUENCE BLOCK 2 ACTUATION "B" ◆ 1021 LOADING SEQUENCE BLOCK 3 ACTUATION "A" ◆ 1025 LOADING SEQUENCE BLOCK 3 ACTUATION "B" ◆ 1022 LOADING SEQUENCE BLOCK 4 ACTUATION "A" ◆ 1026 LOADING SEQUENCE BLOCK 4 ACTUATION "B" ◆ 1029 LOADING SEQUENCE BLOCK EFP-1 ACTUATION "A" ◆ 0851 LOADING SEQUENCE BLOCK 5 ACTUATION "A" ◆ 0853 LOADING SEQUENCE BLOCK 5 ACTUATION "B" ◆ 0852 LOADING SEQUENCE BLOCK 6 ACTUATION "A" ◆ 1019 LOADING SEQUENCE BLOCK 6 ACTUATION "B" • Verify proper MCB status lights for ES Channel 2 RC2 & RC5 tripped on "A" and "B" sides. <ul style="list-style-type: none"> ◆ RC2 GP#1 BL#1 ◆ RC2 GP#2 BL#1 ◆ RC2 GP#3 BL#2 ◆ RC2 GP#3 BL#3 ◆ RC2 GP#3 BL#4 ◆ RC2 GP#3 BL#5 ◆ RC2 GP#3 BL#6 ◆ RC5 GP1 ◆ RC5 GP2 |
| | OAC | Monitor Reactor and RCS during OP-507 actions. |

Initiation Cue: Examiner Initiated

Annunciator Alarm: M-3-3

Termination Cue: Plant power stabilized at \leq 85%.

Event Description: CWP-1B lube water flow degradation/Shaft failure (**MALF**). Annunciator Alarm M-3-3 "CWP Low Lube Flow" (Event Point 0128 for CWP-1B) followed by Annunciator Alarm M-1-3 "CWP Vibration High" 1 minute later. If CWP-1B is not shutdown by the crew it's shaft will shear 45 seconds later. If the CWP-1B shaft shear occurs, ANN Alarm M-2-3 "CWP Discharge Pressure High/Low" will alarm. The RO's diagnose the failure and notify the SRO. SRO directs CWP-1B be shutdown. SRO directs power reduction to less than \leq 85% IAW OP-604. AP-510 or OP-204 can be used for the power reduction.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP/OAC | <p>Diagnose CWP-1B lube water flow / Shaft failure.</p> <ul style="list-style-type: none"> • ANN Alarm M-3-3 "CWP Lube Flow Low" alarm <ul style="list-style-type: none"> ◆ Event Point 0128 "CWP-1B Lube Water Flow Low" • ANN Alarm M-1-3 "CWP Vibrations High" alarm (1 min. after M-3-3) • Low current reading CWP-1B (1 min. 45 sec after M-3-3) • ANN Alarm M-2-3 "CWP Discharge Pressure High/Low" alarm (2 min. after M-3-3) <ul style="list-style-type: none"> ◆ Event Point 0127 "CWP-1B Discharge Pressure Low" <p>Check AR-601 for alarms</p> <p>Notify SRO of CWP-1B lube water problems</p> <p>Direct SPO to check out CWP-1B</p> |

Initiation Cue: Examiner Initiated

Annunciator Alarm: M-3-3

Termination Cue: Plant power stabilized at $\leq 85\%$.

Event Description: CWP-1B lube water flow degradation/Shaft failure (**MALF**). Annunciator Alarm M-3-3 "CWP Low Lube Flow" (Event Point 0128 for CWP-1B) followed by Annunciator Alarm M-1-3 "CWP Vibration High" 1 minute later. If CWP-1B is not shutdown by the crew it's shaft will shear 45 seconds later. If the CWP-1B shaft shear occurs, ANN Alarm M-2-3 "CWP Discharge Pressure High/Low" will alarm. The RO's diagnose the failure and notify the SRO. SRO directs CWP-1B be shutdown. SRO directs power reduction to less than $\leq 85\%$ IAW OP-604. AP-510 or OP-204 can be used for the power reduction.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>Ensures RO's check AR-601 for alarm guidance</p> <p>Direct BOP to shutdown CWP-1B</p> <p>Directs OAC to reduce power to $\leq 85\%$ IAW OP-604.</p> <ul style="list-style-type: none"> • Direct use of OP-204 or AP-510 (Probably AP-510) <ul style="list-style-type: none"> ◆ Direct OAC to set ICS rate ◆ Direct OAC to reduce ULD ◆ Specify power level to reduce to <p>Should direct BOP to ensure actions of OP-604 for CWP shutdown are completed (May have BOP perform procedure while SRO / OAC work through AP-510) .</p> <ul style="list-style-type: none"> • BOP directs SPO to place Hotwell Level control in manual • Align SCHE's for single SCHE operation <ul style="list-style-type: none"> ◆ Place SCHE-1B in service <ul style="list-style-type: none"> □ Open CWV-6 (CWP-1C) Open CWV-8 (CWP-1C) <p style="text-align: center;"><u>AND/OR</u></p> <ul style="list-style-type: none"> □ Open CWV-5 (CWP-1D) Open CWV-7 (CWP-1D) □ Direct SPO to open SCV-7 & 8 ◆ Remove SCHE-1A from service <ul style="list-style-type: none"> □ Direct SPO to close SCV-6 □ Close CWV-1 (CWP-1A) Close CWV-3 (CWP-1A) □ Ensure closed CWV-2 (CWP-1B) Ensure closed CWV-4 (CWP-1B) ◆ Notify Units 1 & 2 of shutdown of CWP ◆ Direct SPO to close ARV-46 ◆ Direct SPO to secure associated debris filter (CWCP-7) ◆ Direct SPO to close CWV-197 & secure CWP-6 |

Initiation Cue: Examiner Initiated

Annunciator Alarm: M-3-3

Termination Cue: Plant power stabilized at < 85% .

Event Description: CWP-1B lube water flow degradation/Shaft failure (**MALF**). Annunciator Alarm M-3-3 "CWP Low Lube Flow" (Event Point 0128 for CWP-1B) followed by Annunciator Alarm M-1-3 "CWP Vibration High" 1 minute later. If CWP-1B is not shutdown by the crew it's shaft will shear 45 seconds later. If the CWP-1B shaft shear occurs, ANN Alarm M-2-3 "CWP Discharge Pressure High/Low" will alarm. The RO's diagnose the failure and notify the SRO. SRO directs CWP-1B be shutdown. SRO directs power reduction to less than ≤85% IAW OP-604. AP-510 or OP-204 can be used for the power reduction.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | Provide PEER check of BOP actions Reduce power IAW SRO directions <ul style="list-style-type: none"> • AP-510 or OP-204 (Probably AP-510) • Set ICS rate to SRO direction • Reduce ULD to SRO direction Notify SRO when power <u> ≤ 85% </u> |

Initiation Cue: Examiner Initiated

Annunciator Alarm: M-3-3

Termination Cue: Plant power stabilized at $\leq 85\%$.

Event Description: CWP-1B lube water flow degradation/Shaft failure (**MALF**). Annunciator Alarm M-3-3 "CWP Low Lube Flow" (Event Point 0128 for CWP-1B) followed by Annunciator Alarm M-1-3 "CWP Vibration High" 1 minute later. If CWP-1B is not shutdown by the crew it's shaft will shear 45 seconds later. If the CWP-1B shaft shear occurs, ANN Alarm M-2-3 "CWP Discharge Pressure High/Low" will alarm. The RO's diagnose the failure and notify the SRO. SRO directs CWP-1B be shutdown. SRO directs power reduction to less than $\leq 85\%$ IAW OP-604. AP-510 or OP-204 can be used for the power reduction.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | <p>Shuts down CWP-1B</p> <p>Respond to ANN Alarms</p> <p>Notifies Dispatcher of power reduction</p> <p>Perform action of OP-604 for shutdown of CWP-1B</p> <ul style="list-style-type: none"> • Directs SPO to place Hotwell Level control in manual • Align SCHE's for single SCHE operation <ul style="list-style-type: none"> ◆ Place SCHE-1B in service <ul style="list-style-type: none"> □ Open CWV-6 (CWP-1C) Open CWV-8 (CWV-1C) <u>AND/OR</u> □ Open CWV-5 (CWP-1D) Open CWV-7 (CWP-1D) □ Direct SPO to open SCV-7 & 8 ◆ Remove SCHE-1A from service <ul style="list-style-type: none"> □ Direct SPO to close SCV-6 □ Close CWV-1 (CWP-1A) Close CWV-3 (CWP-1A) □ Ensure closed CWV-2 (CWP-1B) Ensure closed CWV-4 (CWP-1B) ◆ Notify Units 1 & 2 of shutdown of CWP ◆ Direct SPO to close ARV-46 ◆ Direct SPO to secure associated debris filter (CWCP-7) ◆ Direct SPO to close CWV-197 and secure CWP-6 |

Initiation Cue: Examiner Initiated

Annunciator Alarms: J-2-4, K-4-2, K-6-2

Termination Cue: Plant Runback to $\leq 60\%$ and Technical Specification Evaluated

Event Description: Safety Rod 1-2 drops into the core (**MALF**) and ICS fails to automatically runback to $\leq 60\%$ (**MALF**). OAC does the immediate actions of AP-545 and diagnoses ICS is not running the plant back. OAC notifies the SRO of dropped rod and failure of ICS. SRO enters AP-545 and directs OAC to take SG/RX Bailey station to hand and perform plant runback to $\leq 60\%$ IAW AP-545. Once the plant is $\leq 60\%$ power, SRO evaluates and applies TS 3.1.4(A) and 3.1.5(A).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | <p>Diagnose symptoms associated with a dropped rod.</p> <ul style="list-style-type: none"> • ANN Alarm J-2-4 "CRD Asymmetric Alarm" • ANN Alarm K-4-2 "Asymmetric Rod Runback" • ANN Alarm K-6-2 "Unit Master In Track" • Group 1, Rod 2 position indication • Assy Rod lights on rod position panel and Diamond panel • Green In-limit Lamp for Rod 1-2 lit on PI Panel • Group 1 In-limit Lamp lit on Diamond Panel • Step decrease in reactor power • ICS FW cross-limit from reactor (K-3-3) <p>Notifies SRO of dropped control rod</p> |
| | SRO | <p>Enters AP-545 and directs the OAC response to assy rod runback.</p> <p>Directs BOP to notify plant personnel</p> <p>Direct OAC to reduce reactor power to $\leq 60\%$ IAW AP-545.</p> <ul style="list-style-type: none"> • Place SG/RX Bailey in hand and reduce reactor power to $\leq 60\%$ <p>Monitor RCS pressure and Tave</p> <p>Monitors OAC actions during manual power reduction.</p> <p>When power is $\leq 60\%$, verify:</p> <ul style="list-style-type: none"> • Plant stable • QPT within limits • Imbalance within limits • Rod index within limits • Thermal power $\leq 60\%$ <p>Refers to and enters TS 3.1.4(A) and 3.1.5 (A)</p> |

Initiation Cue: Examiner Initiated

Annunciator Alarms: J-2-4, K-4-2, K-6-2

Termination Cue: Plant Runback to $\leq 60\%$ and Technical Specification Evaluated

Event Description: Safety Rod 1-2 drops into the core (**MALF**) and ICS fails to automatically runback to $\leq 60\%$ (**MALF**). OAC does the immediate actions of AP-545 and diagnoses ICS is not running the plant back. OAC notifies the SRO of dropped rod and failure of ICS. SRO enters AP-545 and directs OAC to take SG/RX Bailey station to hand and perform plant runback to $\leq 60\%$ IAW AP-545. Once the plant is $\leq 60\%$ power, SRO evaluates and applies TS 3.1.4(A) and 3.1.5(A).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | <p>Performs immediate actions of AP-545</p> <ul style="list-style-type: none"> • Diagnoses failure of ICS to run back <p>Notifies SRO of ICS failure and need to manually reduce power.</p> <p>Establish manual control of ICS and reduces reactor power IAW SRO direction.</p> <ul style="list-style-type: none"> • SG/RX Bailey to hand • Slowly lower SG/RX Bailey while monitoring <ul style="list-style-type: none"> ◆ RCS pressure ◆ RCS Tave ◆ Power Imbalance |
| | BOP | <p>Monitors balance of plant during runback.</p> <p>Provide PEER checks of OAC actions.</p> <p>Respond to balance of plant ANN Alarms.</p> |

Initiation Cue: Examiner Initiated

Annunciator Alarms: K-3-2

Termination Cue: Alternate Pressurizer level instrument selected and Pressurizer Level control is back in AUTO.

Event Description: Pressurizer level instrument RC-1-LT1 fails high (**MALF**) The controlling Pressurizer level slowly fail high. Annunciator Alarm K-3-2 "SASS Mismatch" comes in but failure rate is too slow for SASS to auto transfer. OAC notifies the SRO of the failure. SRO directs alternate signal source selection IAW OP-501. SRO evaluates TS and enters 3.3.17(A) for Post Accident Monitoring.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC/BOP | <p>Diagnose RC-1-LT1 instrument failure</p> <ul style="list-style-type: none"> • ANN Alarm K-3-2 "SASS Mismatch" <ul style="list-style-type: none"> ◆ Event Point 0785 "Pressurizer Level Mismatch" • RC-1-LIR1 recorder indicates increasing level • RC-1-LIR3 recorder indicates stable level • ANN Alarm I-7-1 "Pressurizer Level High" <ul style="list-style-type: none"> ◆ Event Point 1372 "Reactor Coolant Pressurizer Level High" ◆ Event Point 1371 "Reactor Coolant Pressurizer Level High-High" <p>Reviews AR-501 and AR-503 for alarms</p> <p>Notifies the SRO of Controlling Pressurizer level instrument failure.</p> |
| | SRO | <p>Ensures RO's check AR-501 and AR-501 for alarm guidance.</p> <p>Direct OAC to control Pressurizer level in hand.</p> <p>Directs BOP to review OP-501 and select alternate instrument for Pressurizer level control.</p> <p>Reviews and enters TS 3.3.17(A) for PAM (If time permits).</p> |
| | BOP | <p>Select alternate instrument IAW OP-501</p> <ul style="list-style-type: none"> • Checks RC-1-LIR3 reading • Select RC-1-MS to LT3-Y position |
| | OAC | <p>Acknowledges following alarms clearing:</p> <ul style="list-style-type: none"> • I-7-1 "Pressurizer Level High" <ul style="list-style-type: none"> ◆ Event Point 1371 "Reactor Coolant Pressurizer Level High-High" ◆ Event Point 1372 "Reactor Coolant Pressurizer Level High" |

Initiation Cue: Examiner Initiated

Annunciator Alarms: K-3-2

Termination Cue: Alternate Pressurizer level instrument selected and Pressurizer Level control is back in AUTO.

Event Description: Pressurizer level instrument RC-1-LT1 fails high (**MALF**) The controlling Pressurizer level slowly fail high. Annunciator Alarm K-3-2 "SASS Mismatch" comes in but failure rate is too slow for SASS to auto transfer. OAC notifies the SRO of the failure. SRO directs alternate signal source selection IAW OP-501. SRO evaluates TS and enters 3.3.17(A) for Post Accident Monitoring.

| Time | Position | Applicant's Actions or Behavior |
|------|------------|--|
| | SRO | Directs OAC or BOP to return Pressurizer level control to auto. |
| | OAC or BOP | Returns Pressurizer level control to auto <ul style="list-style-type: none"> • Selects M/V on MUV-31 • Adjust MUV-31 setpoint to put M/V on "Carrot" • Selects Position on MUV-31 • Selects MUV-31 to "Auto" |

Initiation Cue: Examiner Initiated

Annunciator Alarm: J-4-2 (≈ 3 min.)

Termination Cue: SRO has directed that the Rx be tripped IAW AP-520.

Event Description: Small Pressurizer steam space leak develops on Pressurizer level tap (**MALF**). RCS pressure begins to slowly degrade. RO's diagnose uncontrolled pressure reduction and notify the SRO. SRO enters AP-520 and directs RO's response to uncontrolled pressure reduction. After taking action of AP-520 to isolate possible leak locations, the SRO should direct Reactor Trip IAW AP-520.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC/BOP | <p>Diagnose uncontrolled pressure reduction.</p> <ul style="list-style-type: none"> • RCS pressure low and decreasing • Pressurizer heaters indicate full demand • ANN Alarm J-4-2 "RCS Pressure Low" (2055#) • Reviews AR-502 for direction and may carry out following action in accordance with AR-502: <ul style="list-style-type: none"> ◆ Close Pressurizer Spray Valve RCV-14 ◆ Close Spray Block Valve RCV-13 ◆ Close PORV Block Valve RCV-11 • RCS temperatures stable • Pressurizer level decreasing slightly <p>Notifies the SRO of uncontrolled pressure reduction.</p> |
| | SRO | <p>Enters AP-520 and provides direction for uncontrolled pressure reduction</p> <ul style="list-style-type: none"> • BOP sent to check Pressurizer heater amp meters on back of panel. • OAC directed to isolate spray line <ul style="list-style-type: none"> ◆ Close RCV-13 ◆ Close RCV-14 • OAC directed to Isolate PORV <ul style="list-style-type: none"> ◆ Close RCV-11 ◆ Select "Closed on PORV (RCV-10) <p>Directs OAC/BOP to monitor pressure trend following isolation</p> <p>When RCS pressure continues to decrease, directs OAC to trip Rx. (<i>Entry condition of next event.</i>)</p> |

Initiation Cue: Examiner Initiated

Annunciator Alarm: J-4-2 (≈ 3 min.)

Termination Cue: SRO has directed that the Rx be tripped IAW AP-520.

Event Description: Small Pressurizer steam space leak develops on Pressurizer level tap (**MALF**). RCS pressure begins to slowly degrade. RO's diagnose uncontrolled pressure reduction and notify the SRO. SRO enters AP-520 and directs RO's response to uncontrolled pressure reduction. After taking action of AP-520 to isolate possible leak locations, the SRO should direct Reactor Trip IAW AP-520.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP | Checks the Pressurizer amp meters on rear of panel. Report meter reading to SRO Assist OAC in monitoring RCS pressure Monitor for increased RCS leakage Provide PEER checking of OAC actions |
| | OAC | Isolates Spray line IAW SRO direction. (May have been done IAW AR-502.) <ul style="list-style-type: none"> • Close RCV-13 • Close RCV-14 Isolate PORV IAW SRO direction. (May have been done IAW AR-502) <ul style="list-style-type: none"> • Close RCV-11 • Select Closed PORV Monitor RCS pressure following isolation. Notify SRO of continued pressure reduction. Depress Rx trip push-button when directed by SRO. (Button doesn't work. ENTRY CONDITION FOR NEXT EVENT.) |

Initiation Cue: Rx Trip Push-Button fail to trip Rx.

Termination Cue: Rx Tripped and EOP-02 immediate actions completed.

Event Description: (ATWS) The Rx Trip Push-Button is failed. Channels "A", "B", and "C" setpoints are miss-calibrated so they do not trip on low pressure (MALF). OAC diagnoses failure of Rx Trip Push-Button and informs the SRO. SRO directs OAC to manually trip the reactor by opening bkrs 3305/3312 (CT#1) and perform immediate actions of EOP-02.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC | Diagnoses Rx Trip Push-Button failure Informs SRO of failure. |
| | SRO | Directs OAC to open breakers 3305 and 3312 (CT#1). Enters EOP-02 and performs verification of EOP-02 immediate actions by directing the OAC to do the following: <ul style="list-style-type: none"> • Depress Rx Trip Push Button • Verify Groups 1 thru 7 in core • Verify NI's indicate Rx is shutdown • Depress Turbine Trip Push Button • Verify TV's and GV's verified closed |
| | OAC | Trips the reactor by opening breaker 3305 and 3312 (CT#1). Performs and verbalizes immediate actions of EOP-02 <ul style="list-style-type: none"> • Rx Trip Push Button Depressed • Groups 1 thru 7 verified in core • NI's indicate Rx is shutdown • Turbine Trip Push Button Depressed • TV's and GV's verified closed Notifies SRO of completion of EOP-02 immediate actions. Re-perform immediate actions of EOP-02 under SRO direction. <ul style="list-style-type: none"> • Rx Trip Push Button Depressed • Groups 1 thru 7 verified in core • NI's indicate Rx is shutdown • Turbine Trip Push Button Depressed • TV's and GV's verified closed Should note failure of SPDS displays and inform the SRO. |

Initiation Cue: Rx Trip Push-Button fail to trip Rx.

Termination Cue: Rx Tripped and EOP-02 immediate actions completed.

Event Description: (ATWS) The Rx Trip Push-Button is failed. Channels "A", "B", and "C" setpoints are miss-calibrated so they do not trip on low pressure (**MALF**). OAC diagnoses failure of Rx Trip Push-Button and informs the SRO. SRO directs OAC to manually trip the reactor by opening bkrs 3305/3312 (**CT#1**) and perform immediate actions of EOP-02.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | Scans panel for alarms Should note the failure of both SPDS displays. Monitors EFW if EFIC actuates on low level <ul style="list-style-type: none"> • EOP-13, Rule 3 |

Initiation Cue: RCS Pressure <1500 and ASCM lost

Cue: HPI actuation and SCM <50

Termination Cue: MUV-25 closed and de-powered.

Event Description: Following reactor trip, both SPDS displays go blank. RCS pressure continues to decrease and ASCM is lost. OAC/BOP diagnose the loss of ASCM using the digital SCM monitors and carry out action of EOP-13, Rule 1. SRO enters EOP-03 upon loss of ASCM and directs RCPs shutdown within 2 minutes (CT#2). HPI actuates and MUP-1C fails to auto start (MALF). HPI low range flow indications for MUV-25 read 75 gpm higher than the other three lines due to a passive leak down steam of the valve (MALF). SRO directs BOP to Bypass/Reset ES and close MUV-25 IAW EOP-03. (CT#3)

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC/BOP | <p>Report failure of SPDS to SRO</p> <p>Diagnoses a loss of ASCM.</p> <ul style="list-style-type: none"> • SCM monitors indicate < 50° with RCS pressure < 1500# <p>Notifies the SRO of loss of ASCM</p> <p>Perform action of EOP-13, Rule 1</p> <ul style="list-style-type: none"> • Stop all RCP's within 2 minutes of loss of ASCM (CT#2) • Depress yellow "HPI MAN ACT" push button on Train "A" and "B". • Depress yellow "RB ISO MAN ACTUATION" push button on Train "A" and "B". <p>Reports failure of MUP-1C to the SRO</p> <p>May report abnormal flow indication on MUV-25 narrow range flow.</p> <p>Notify SRO of EFIC actuation. (May have actuated earlier on OTSG low level but will be actuated be loss of all RCP's)</p> |

Initiation Cue: RCS Pressure <1500 and ASCM lost

Cue: HPI actuation and SCM <50

Termination Cue: MUV-25 closed and de-powered.

Event Description: Following reactor trip, both SPDS displays go blank. RCS pressure continues to decrease and ASCM is lost. OAC/BOP diagnose the loss of ASCM using the digital SCM monitors and carry out action of EOP-13, Rule 1. SRO enters EOP-03 upon loss of ASCM and directs RCPs shutdown within 2 minutes (CT#2). HPI actuates and MUP-1C fails to auto start (MALF). HPI low range flow indications for MUV-25 read 75 gpm higher than the other three lines due to a passive leak down steam of the valve (MALF). SRO directs BOP to Bypass/Reset ES and close MUV-25 IAW EOP-03. (CT#3)

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>Transitions to EOP-03</p> <p>Ensures RCP's are shutdown within 2 minutes of loss of ASCM (CT#2).</p> <p>Directs RO's actions IAW EOP-03.</p> <ul style="list-style-type: none"> • PPO directed to perform EOP-14 enclosure #2 • Verify all HPI valves are open (MUV-23, 24, 25, & 26) • Ensure full HPI <ul style="list-style-type: none"> • BWST to MUP valves open (MUV-73 & 58) • ES selected MUPs and required cooling (MUP-1B, MUP-1C, SWP-1A/1B, RWP-2A/2B, RWP-3B) (MUP-1C FAILED) <ul style="list-style-type: none"> • Should direct BOP to attempt start MUP-1C but does not get bogged down in MUP-1C recovery attempts. Should continue to progress through first 19 follow-up steps of EOP-03. • MUP recirc to MUT valves closed (MUV-53 & 257) • HPI recirc to sump valves closed (MUV-543, 544, 545, 546) • Letdown isolation valves closed (MUV-49 & 567) • Verify MUV-27 closed • Ensure HPI flow properly directed <ul style="list-style-type: none"> • Record flow for all HPI lines and determines that flow on MUV-25 line is too high. • Directs BOP to Bypass Auto ES actuations (HPI) • Directs BOP to reset Manual ES actuations (HPI & RBIC) • Directs BOP to close MUV-25 (CT#3) • Directs BOP to have power removed from MUV-25. (May have BOP turn power off to MUV-25/26 on MCP until PPO has opened MUV-25 breaker). <p>Directs OAC to control EFW IAW EOP-13, Rule-3</p> |

Initiation Cue: RCS Pressure <1500 and ASCM lost

Cue: HPI actuation and SCM <50

Termination Cue: MUV-25 closed and de-powered.

Event Description: Following reactor trip, both SPDS displays go blank. RCS pressure continues to decrease and ASCM is lost. OAC/BOP diagnose the loss of ASCM using the digital SCM monitors and carry out action of EOP-13, Rule 1. SRO enters EOP-03 upon loss of ASCM and directs RCPs shutdown within 2 minutes (CT#2). HPI actuates and MUP-1C fails to auto start (MALF). HPI low range flow indications for MUV-25 reads 75 gpm higher than the other three lines due to a leak down steam of the valve (MALF). SRO directs BOP to Bypass/Reset ES and close MUV-25 IAW EOP-03 (CT#3)

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP | <p>May attempt to start MUP-1C when it fails to auto start.</p> <p>Notifies SRO of MUP-1C failed start attempt.</p> <p>Carry out actions of EOP-13, Rule #1</p> <ul style="list-style-type: none"> • Trip all RCPs within two minutes of loss of ASCM. • Depress "HPI MAN ACT" push buttons (Trains A & B) • Depress "RB ISO MAN ACTUATION" push buttons (Trains A & B) <p>Carry out EOP-03 actions as directed by SRO</p> <ul style="list-style-type: none"> • PPO directed to perform EOP-14 enclosure #2 • Verify all HPI valves are open (MUV-23, 24, 25, & 26) • Ensure full HPI <ul style="list-style-type: none"> ◆ BWST to MUP valves open (MUV-73 & 58) ◆ ES selected MUPs and required cooling (MUP-1B, MUP-1C, SWP-1A/1B, RWP-2A/2B, RWP-3B) (MUP-1C FAILED) <ul style="list-style-type: none"> □ Should attempt start MUP-1C. ◆ MUP recirc to MUT valves closed (MUV-53 & 257) ◆ HPI recirc to sump valves closed (MUV-543, 544, 545, 546) ◆ Letdown isolation valves closed (MUV-49 & 567) ◆ Verify MUV-27 closed ◆ Ensure HPI flow properly directed (CT#3) <ul style="list-style-type: none"> □ Report flow for all HPI lines and determines that flow on MUV-25 line is too high. □ Bypass Auto ES actuations (HPI) □ Reset Manual ES actuations (HPI & RBIC) □ Close MUV-25 (CT#3) □ Directs PPO to remove power from MUV-25. (May turn power off to MUV-25/26 on MCP until PPO has opened MUV-25 breaker). |

Initiation Cue: RCS Pressure <1500 and ASCM lost

Cue: HPI actuation and SCM <50

Termination Cue: MUV-25 closed and de-powered.

Event Description: Following reactor trip, both SPDS displays go blank. RCS pressure continues to decrease and ASCM is lost. OAC/BOP diagnose the loss of ASCM using the digital SCM monitors and carry out action of EOP-13, Rule 1. SRO enters EOP-03 upon loss of ASCM and directs RCPs shutdown within 2 minutes (CT#2). HPI actuates and MUP-1C fails to auto start (MALF). HPI low range flow indications for MUV-25 reads 75 gpm higher than the other three lines due to a leak down steam of the valve (MALF). SRO directs BOP to Bypass/Reset ES and close MUV-25 IAW EOP-03 (CT#3)

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC | Control EFIC IAW EOP-13, Rule-3 <ul style="list-style-type: none"> • IF OTSG level are <u>NOT</u> progressing towards the "ISCM" setpoint, <u>THEN</u> take manual control. <ul style="list-style-type: none"> ◆ EFW flow required for manual control: <ul style="list-style-type: none"> □ <u>></u>280 gpm in 1 line to each OTSG. |

Initiation Cue: Examiner Initiated

Annunciator Alarm: B-6-1

Termination Cue: Max Rate Cooldown Started IAW EOP-03.

Event Description: MUP-1B shaft seizure (MALF). BOP diagnoses loss of MUP-1B, total loss of HPI capability. SRO cycles to start of EOP-03 and provides guidance for loss of all HPI capability. SRO directs OAC to establish and maintain maximum rate cooldown (CT#4).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | Diagnoses loss of all HPI capability. <ul style="list-style-type: none"> • ANN Alarm B-6-1 "MU PP B TRIP" • HPI flows drop to 0 • RCS pressure decreasing • SCM decreasing Notifies SRO of MUP-1B failure and no HPI flow |
| | SRO | Cycles to start of EOP-03 IAW EOP-03 step 3.4 directs OAC to establish and maintain maximum possible cooldown rate (CT#4). <ul style="list-style-type: none"> • Full open all ADV's and TBV's Direct BOP to bypass " EFIC OTSG ISOL" when OTSG pressure < 725 |
| | OAC | Establish and maintain maximum possible cooldown rate. <ul style="list-style-type: none"> • Full open all ADV's and TBV's (CT#4) |
| | BOP | Bypass EFIC OTSG ISOL when OTSG pressure < 725 <ul style="list-style-type: none"> • Depress "<725 PSI STM GEN PRESS ACT BYPASS" push buttons for all 4 EFIC channels. |
| | SRO | Classify emergency IAW EOP-202 after the simulator if frozen. |

Examination Setup/Execution
Scenario 1

Scenario Setup

1. [] Initialize the simulator to 100% power and UNFREEZE the simulator.
2. [] In the "NRCEXAM" directory of LESSON PLAN, start lesson plan # 1
3. [] Trigger Lesson Plan Setup Step
4. Perform the following actions.
 - [] Place WTP-6B in Pull-To-Lock
 - [] Start SWP-1A and Shutdown SWP-1C
 - [] Open Output Breaker 1661
 - [] Open MOS 1661N
 - [] Open MOS 1661S
 - [] Unplug the SPDS SPEAKERS from the Sound Card so that SubCooling Margin loss will not have audible alarm.
5. Place the following Red Tags on the main control panel:
 - [] ASV-5
 - [] ASV-204
 - [] MSV-55
 - [] MSV-56
 - [] WTP-6B
 - [] BKR 1661
 - [] MOS 1661N
 - [] MOS 1661S
 - [] MUP-1A
6. Ensure clean copies of the following "consumable" procedures are in the control room procedure books.
 - [] EOP-02
 - [] EOP-03
 - [] AP-520
 - [] AP-545
 - [] OP-501
 - [] OP-604
 - [] OP-507
7. [] Advance all MCB recorders and remove line printer printouts and ensure ON-LINE.
8. [] Ensure all grease pencil marks on indicators and recorders are removed.
9. [] Ensure Batch Controller is Reset.
10. [] Ensure SPDS screens are Reset.
11. [] Review Turnover Sheet and ensure the simulator setup agrees with Turnover.
12. [] FREEZE the simulator and notify the lead examiner that simulator is ready to begin.

Scenario Execute

1 When notified by the lead examiner, UNFREEZE the simulator.

2 ES CHANNEL 2 PRESSURE FAILS TO 1250#

When notified by the lead examiner, TRIGGER Lesson Plan Step #1 "Event 1 - ES Channel 2 Press Fails Mid-Scale (RC-3A-PT4)"

3 CWP-1B FLUSH WATER PROBLEM/SHAFT SHEAR

When notified by the lead examiner, TRIGGER Lesson Plan Step #2 "Event 2 - CWP-1B Shaft Failure"

3.1 If TBO sent to check CWP-1B, wait five (5) minutes then report that there is steam coming out of upper packing area on the pump shaft.

3.2 If TBO sent to put SCHX-1B in service, TRIGGER Lesson Plan Step #11 "Open SCHX-1B Inlet and Outlet Valves (SCV-7 & 8)"

3.3 If TBO directed to take SCHX-1A out of service, TRIGGER Lesson Plan Step #12 "Close SCV-6 on SCHX-1A"

3.4 If TBO directed to close ARV-46, TRIGGER Lesson Plan Step #13 "Close ARV-46"

4 DROPPED ROD 1-2 NO ICS RUNBACK

When notified by the lead examiner, TRIGGER Lesson Plan Step #3 "Event 3 - Dropped Rod 1-2 No ICS Runback"

4.1 If TBO sent to check on ASV-27 operation when <80%, wait 2 minutes then report AS swap to MS has occurred and ASV-27 controlling normally.

5 PZR LEVEL INST FAILS HIGH (RC-1-LT1)

When notified by the lead examiner, TRIGGER Lesson Plan Step #4 "Event 4 - PZR Level Inst Fails High (RC-1-LT1)"

6 PZR STEAM SPACE LEAK

When notified by the lead examiner, TRIGGER Lesson Plan Step #5 "Event 5 - PZR Steam Space Leak"

6.1 When TBO directed to do EOP-14 enclosure #1, TRIGGER Lesson Plan Step #14 "EOP-14 enclosure #1 actions"

Do not report completion of actions for at least 5 minutes.

6.2 RCS pressure will continue to decrease post trip and result in a loss of ASCM.

6.3 When PPO directed to perform EOP-14 enclosure #2, TRIGGER Lesson Plan Step #15 "EOP-14 enclosure #2 actions"

When 15 minutes have passed, call the control room as the PPO and ask which H₂ analyzer to line up and which sample point is to be used.

7 MUP-1B SHAFT SEIZURE

When notified by the lead examiner, TRIGGER Lesson Plan Step #8 "Event 8 - MUP-1B Shaft Seizure"

EXAM N-1
TURNOVER

- A. Initial conditions:
1. Time in core life - 247 EFPD
 2. Rx power and power history - 100% for > 7 days
 3. Boron concentration - 1025 PPMB
 4. Xenon - Equilibrium
 5. RCS Activity - Fuel 0.0005 uCi/ml
- B. Tech. Spec. action requirement(s) in effect: 3.7.5(D) EFP-2 red tagged to mechanical maintenance for governor replacement. 6 hours into 72 hour action statement. EFP-2 is scheduled to be released for post maintenance testing in 4 hours.
- C. Clearances in effect:
1. EFP-2 for governor replacement
 2. WTP-6B (Demin Water Transfer Pump) for motor/pump realignment. Scheduled to be returned in 10 hours
 3. MUP-1A to electrical maintenance to replace control power fuses. MUP-1A will be returned to service in two hours.
 4. Breaker 1661, MOS 1661S, and MOS 1661N to Dispatcher. Breaker 1661 tripped on previous shift (cause unknown). Line crew in 500 KV switchyard trouble shooting the breaker.
- D. Significant problems/abnormalities:
1. SWP-1A is running while engineering performs an analysis of anomalous vibration reading taken during last SP. Vibrations were within allowable limits but had increased from previous SP.
 2. Severe thunderstorms and extremely high wind expected over next 24 hours.
- E. Evolution's/maintenance for the on-coming shift: Perform post maintenance test of EFP-2 and MUP-1A when released from maintenance.
- F. Units 1 and 2 status: On-Line
- G. Units 4 and 5 status: On-Line
- H. NSS - Instruct the RO's to walk down the main control board and provide you with the following data:
1. RCS Average Temperature _____
 2. RCS Pressure _____
 3. Pressurizer Level _____
 4. Make-up Tank Level _____
 5. Turbine Load _____
 6. Turbine Reference _____

NOTE: Should need arise, full implementation of the emergency plan is not required during this exam. However, SRO should be prepared to address possible Emergency Plan involvement following the exam.

OPERATING EXAMINATION SCENARIO OUTLINE

Facility: Crystal River Unit 3

Scenario Number: 2

Operating Test Number: 1

Examiners: _____

Operators: _____

Objectives:

1. Evaluate SRO candidates ability to manage shift resources and exercise command and control during normal and emergency conditions.
2. Evaluate SRO candidates ability to implement emergency and abnormal operating procedures.
3. Evaluate SRO candidates ability to interpret and apply Tech Specs associated with an inoperable EFIC channel and an inoperable SWP.
4. Evaluate RO candidates ability to place a main feedwater pump to automatic control. Actions IAW OP-504.
5. Evaluate RO/SRO candidates ability to perform a Turbine Generator Sync. To the grid. Actions IAW OP-203.
6. Evaluate RO candidates ability to diagnose and respond to a RCP seal injection total flow instrument failure. Actions IAW SRO direction.
7. Evaluate RO/SRO candidates response to a "B" ES 4160 bus undervoltage and "B" EDG failing to re-energize the bus due to EDG low frequency. Actions IAW AP-770.
8. Evaluate RO candidates response to a loss of SWP-1A. Actions IAW AR-303.
9. Evaluate RO/SRO candidates response to a SG Tube rupture. Actions IAW EOP-06.
10. Evaluate RO/SRO candidates ability to diagnose and respond to a post trip over cooling transient.

Initial Condition: Plant startup in progress. Reactor power at 21%, Turbine at 1800 RPM.

Turnover Information: Demin. water transfer pump WTP-6B is out of service for motor/pump realignment. WTP-6B is scheduled for return to service in 10 hours. EFP-2 is OOS and red tagged to mechanical maintenance for governor repair. EFP-2 was taken OOS after entry to Mode 1. The plant is one hour into a 72 hour action statement based on TS 3.7.5. (D) for EFP-2. EFP-2 is scheduled to be released for post maintenance testing in 4 hours. MUP-1A is tagged to electrical maintenance to replace fuses in the DC start circuits. MUP-1A will be returned to service in two hours. SWP-1A is running while engineering performs an analysis of anomalous vibration readings taken during the last SP.

During the previous shift, Breaker 1661 developed a quench gas leak. A line crew is in the 500 KV switchyard trouble shooting the breaker. Breaker 1661, MOS 1661N, and MOS 1661S are currently OPEN and red tagged to Dispatcher.

During the power escalation, FWP-2A was selected to manual due to minor speed oscillations. I&C identified a noisy DP signal as the source of the oscillation. Repairs and post maintenance testing are complete. FWP-2A ready to be restored to automatic.

Severe thunderstorms and extremely high winds expected over the next 24 hours.

| Event No. | Event Type* | Malf. No. | Event Description |
|--------------------------|------------------------|-------------|--|
| 1 | (N) - OAC/SRO | | Transfer FWP-2A H/A station to ICS Auto control IAW OP-504 |
| 2 | (N) -BOP/SRO | | Sync. the main generator to the grid IAW OP-203, Sections 4.2. |
| 3 | (I) - OAC/SRO | | EFIC OTSG "B" Pressure transmitter fail high (MALF). "B" OTSG ADV (MSV-26) opens in response to the failed signal. SRO directs OAC to manually close MSV-26 (CT#1). SRO evaluates and applies TS 3.3.11(A) and 3.3.11(C). |
| 4 | (I) - BOP/SRO | | RCP Seal injection total flow transmitter fails high (MALF). |
| 5 | (C) - BOP/SRO | | Breaker 3206 trips (MALF). "B" ES 4160 Bus dead. "B" EDG starts but due to a low frequency condition on the "B" EDG, does not re-energize the bus (MALF). Response IAW AP-770. |
| 6 | (C) - BOP/SRO | | SWP-1A shaft shear (MALF). SWP-1B fails to auto start (MALF). Letdown isolates on high temperature due to loss of SW flow. SRO directs the BOP to start SWP-1B (CT#2). SRO evaluates and applies TS 3.3.7(A). SRO directs BOP in recovery of Letdown IAW EOP-14 enclosure 4 or OP-402. |
| 7 | (C) - ALL (R) - OAC | | "B" OTSG 60 GPM tube leak (MALF). Actions IAW EOP-06 and AP-510. |
| 8 | (MT) - ALL | | When reactor is tripped per EOP-06 "A" TBV H/A station transfers to Hand resulting in an post trip overcooling event (MALF). The "A" TBVs will not respond to operator actions. SRO directs actions to terminate overcooling event (CT#3). Actions IAW EOP-05. |
| Scenario Duration | | 120 minutes | Exercise Termination: Terminate at examiner discretion once overcooling event terminated. |

*(N)ormal evolution, (R)eactivity manipulation, (I)instrument failure, (C)omponent failure, (M)ajor transient

Narrative Summary:

The crew reviews L&P associated with the plant startup. The SRO directs the OAC to transfer FWP-2A to ICS automatic control. The OAC places FWP-2A in auto IAW OP-504, section 4.7. The SRO then directs the crew to continue the plant startup IAW with OP-203. The BOP performs the Main Generator sync. to grid IAW OP-203 and SRO direction.

When Main Generator is sync. to the grid, "B" EFIC Channel OTSG pressure transmitter for "B" OTSG (MS-111-PT) fails high. "B" OTSG ADV (MSV-26) opens in response to the failed signal. RO's diagnose instrument failure and improper "B" ADV response. OAC selects "B" ADV to manual and closed (CT#1). SRO evaluates and applies TS 3.3.11(A) and 3.3.14(A) and directs the RO's to have EFIC channel "B" placed in a "Bypassed" condition IAW OP-450. (TS require channel be "Bypassed" or "Tripped" within one hour. It is expected that the crew will "Bypass" the channel).

When the EFIC channel has been "Bypassed" the RCP seal injection total flow transmitter (MU-27-DPT) slowly fails high. Indicated RCP total seal injection flow increases, individual RCP seal flows decrease as control system responds to failed instrument. RO's diagnose failure and establish manual control of seal injection.

When seal injection flow control has been stabilized, breaker 3206 trips and the "B" ES 4160 bus and 480 busses loses power. EDG-1B auto starts but does not re-energizes the ES bus due to a low frequency condition on the "B" EDG. SRO enters AP-770 and directs BOP/OAC response to the transient. RO's verify vital equipment operation, establish RB cooling, re-energize the "B" ES 4160 bus using "B" EDG. IAW AP-770 and SRO direction.

Before the 4160 bus is transferred to an off-site power source, SWP-1A shaft shears. SWP-1B fails to auto start resulting in a loss of SW system flows. Crew receives numerous SW related alarms. Letdown high temperature interlock actuates isolating letdown flow to the MUT. RO's diagnose the SWP-1A shaft failure and manually start SWP-1B (CT#2) following EOP-13, Rule 5 guidance for large pump starts with EDG on line. Crew verifies SW cooling restored and BOP restores letdown flow IAW EOP-14 enclosure 4 and SRO direction. SRO should evaluate and enter TS 3.7.7(A) if time permits.

When the plant is stable, a 60 GPM tube leak develops on the "B" OTSG. RO's diagnose leak, identify the affected OTSG and notify SRO that leak rate is > 1 GPM. SRO enters EOP-06 and directs RO response to the tube leak transient. When the reactor is tripped IAW EOP-06 the "A" OTSG TBV H/A station transfers to hand resulting in a post trip overcooling transient. RO's may diagnose TBV in manual and attempt to close the TBVs in manual. The "A" TBV's do not respond to operator actions. The SRO will transition to EOP-05 and direct RO's response. RO's will isolate "A" OTSG IAW EOP-05 and terminate the overcooling (CT#3). When the overcooling is terminated the SRO will work through EOP-05 and transition back to EOP-06.

Procedures to be used during this scenario:

OP-203 OP-504 OP-501 OP-450
AP-510 AP-770
EOP-06 EOP-05
Rule 5
EOP-14, enc.4

| Target Quantitative Attributes - Scenario 1 | Actual Attributes |
|--|--------------------------|
| 1. Total Malfunctions (5-8) | 7 |
| 2. Malfunctions after EOP entry (1-2) | 1 |
| 3. Abnormal Events (2-4) | 2 |
| 4. Major Transients (1-2) | 1 |
| 5. EOP's entered requiring substantive actions (1-2) | 2 |
| 6. EOP contingencies requiring substantive actions (0-2) | 0 |
| 7. Critical Tasks (2-3) | 3 |

Initiation Cue: Turnover Sheet

Termination Cue: FWP-2A H/A station in Auto.

Event Description: Transfer FWP-2A H/A station to ICS Auto control IAW OP-504

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>Direct the OAC to place the "A" FWP in "Auto" IAW OP-504</p> <ul style="list-style-type: none"> • Reads the 2 notes at the beginning of section 4.7 <ul style="list-style-type: none"> ◆ Main FW pumps should not be transferred to AUTO simultaneously. ◆ Tripping of Main FW pump will inhibit AUTO operation. • Select M/V on both "A" and "B" FW pump Bailey stations. • Adjust pressure to 80 psid using raise/lower toggle • Monitor OTSG levels, FW flows, and FW control valves. • Select position on "A" FW pump Bailey station. • Select "A" FW pump Bailey station to auto. • Monitor FW flow and FW pump speed and go back to Hand if large change occurs. |
| | OAC | <p>Places the "A" FW pump Bailey control station in "Auto" IAW OP-504.</p> <ul style="list-style-type: none"> • Select M/V on both "A" and "B" FW pump Bailey stations. • Adjust pressure to 80 psid using raise/lower toggle • Monitor OTSG levels, FW flows, and FW control valves. • Select position on "A" FW pump Bailey station. • Select "A" FW pump Bailey station to auto. • Monitor FW flow and FW pump speed and go back to Hand if large change occurs. |
| | BOP | <p>Monitors balance of plant systems and alarms.</p> <p>Provides PEER checks for OAC actions</p> |

Initiation Cue: Turnover Sheet

Termination Cue: Rx power about 21% and Main Generator sync. to grid

Event Description: Sync. Main Generator to the grid IAW OP-203, Sections 4.2.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>Direct BOP actions of OP-203 to sync the Main Generator to the grid.</p> <ul style="list-style-type: none"> • Notify dispatcher to prepare for sync to grid • Ensure voltage regulator off • Energize the voltage regulator <ul style="list-style-type: none"> ◆ Close Exciter Field Breaker ◆ Monitor exciter voltage, exciter amp, and gen voltage for increase • Adjust "Generator Volts" <ul style="list-style-type: none"> ◆ Use "Base Adjust" to adjust generator volts to 22 KV. ◆ Verify exciter amps ≈37 amps at output voltage of 22 KV. • Place voltage regulator in TEST <ul style="list-style-type: none"> ◆ Select voltage regulator to "TEST" position ◆ Balance regulator to read "0" on "Voltage Reg Balance" meter using "Volt Adjust" • Place the Auto Voltage Regulator in service <ul style="list-style-type: none"> ◆ Select Voltage Regulator to "RUN" position ◆ Ensure "Generator Volts" indicates 22 KV ◆ Ensure "Excire Amps" indicates ≈37 amps • Determine and record mode of Generator Breaker Closure (AUTO to be used IAW turnover sheet. • Select synchroscope for 1662 in "Manual" position • Adjust synchroscope in fast direction <ul style="list-style-type: none"> ◆ Adjust speed/load setter to slow clockwise rotation of synchroscope • Ensure Generator Incoming and System Running Volts are ≈ equal <ul style="list-style-type: none"> ◆ Adjust "Volt Adjust" to match • Select synchroscope switch to "AUTO" position <ul style="list-style-type: none"> ◆ Ensure proper closure of selected breaker • Load generator to clear "Turbine Steam Flow Low" alarm <ul style="list-style-type: none"> ◆ Manually load generator at 15% rate OR take turbine to manual and load manually • Select synchroscope to OFF |

Initiation Cue: Turnover Sheet

Termination Cue: Rx power about 21% and Main Generator sync. to grid

Event Description: Sync. Main Generator to the grid IAW OP-203, Sections 4.2.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP | <p>Performs actions of OP-203 to sync the Main Generator to the grid.</p> <ul style="list-style-type: none"> • Ensure voltage regulator off • Energize the voltage regulator <ul style="list-style-type: none"> ◆ Close Exciter Field Breaker ◆ Monitor exciter voltage, exciter amp, and gen voltage for increase • Adjust "Generator Volts" <ul style="list-style-type: none"> ◆ Use "Base Adjust" to adjust generator volts to 22 KV. ◆ Verify exciter amps ≈37 amps at output voltage of 22 KV. • Place voltage regulator in TEST <ul style="list-style-type: none"> ◆ Select voltage regulator to "TEST" position ◆ Balance regulator to read "0" on "Voltage Reg Balance" meter using "Volt Adjust" • Place the Auto Voltage Regulator in service <ul style="list-style-type: none"> ◆ Select Voltage Regulator to "RUN" position ◆ Ensure "Generator Volts" indicates 22 KV ◆ Ensure "Excire Amps" indicates ≈37 amps • Determine and record mode of Generator Breaker Closure (AUTO to be used IAW turnover sheet. • Select synchroscope for 1662 in "Manual" position • Adjust synchroscope in fast direction <ul style="list-style-type: none"> ◆ Adjust speed/load setter to slow clockwise rotation of synchroscope • Ensure Generator Incoming and System Running Volts are ≈ equal <ul style="list-style-type: none"> ◆ Adjust "Volt Adjust" to match • Select synchroscope switch to "AUTO" position <ul style="list-style-type: none"> ◆ Ensure proper closure of selected breaker • Load generator to clear "Turbine Steam Flow Low" alarm <ul style="list-style-type: none"> ◆ Manually load generator at 15% rate OR take turbine to manual and load manually • Select synchroscope to OFF |

Initiation Cue: Turnover Sheet

Termination Cue: Rx power about 21% and Main Generator sync. to grid

Event Description: Sync. Main Generator to the grid IAW OP-203, Sections 4.2.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | Monitor Rx power during the sync. of the Main Generator to the grid. |

Initiation Cue: Examiner Initiated

Annunciator Alarm: K-6-6

Termination Cue: EFIC Channel "B" Bypassed IAW OP-450

Event Description: EFIC OTSG "B" pressure transmitter (MS-111-PT) fails high (**MALF**). Annunciator Alarm K-6-6 "Atmospheric Dump Valve Not Full Closed" comes in. The RO's diagnose the failure and notify the SRO. SRO directs the BOP to close MSV-26 (**CT#1**). SRO reviews and enters TS 3.3.11(A) and 3.3.11(C) when informed of MS-111-PT failure.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC/BOP | Diagnose EFIC pressure transmitter failure. <ul style="list-style-type: none"> • ANN Alarm K-6-6 "Atmospheric Dump Valve Not Full Closed" • MSV-26 controller increasing demand • MS Safety Valve monitor shows steam escaping from MSV-26 • MS-11-PI1 on PSA panel pegged high • MS-107-PIR in ICS panel pegged high • SP-10A-PIR1 on TGF panel shows actual MS header decreasing • RCS shows indication in increase cooling |
| | SRO | Directs the BOP to take manual control of MSV-26 and close MSV-26 (CT#1). Directs the OAC to monitor Rx power. When informed of MS-111-PT failure, reviews and enters TS 3.3.11(A) and 3.3.11(C) Directs the BOP to have the "B" EFIC channel Bypassed or Tripped IAW OP-450. Should insure OAC/BOP realize the EFIC functions from "B" EFIC are now affected. (FOGG, Low Pressure actuation, etc.) |
| | OAC | Monitors Rx power during overcooling event. |
| | BOP | Selects MSV-26 to hand position and closes MSV-26 (CT#1). Calls the PPO to Bypass or Trip EFIC channel "B" IAW OP-450. |
| | SRO | Calls NSM to have repair activities started for EFIC pressure transmitter. |

Initiation Cue: Examiner Initiated

Annunciator Alarm: H-5-7

Termination Cue: Seal Injection Flow controlled manually and RCS leak ruled out.

Event Description: RCP total flow transmitter (MU-27-DPT) fails high slowly. ANN Alarm H-5-07 "RC PUMP SEAL FLOWS HIGH/LOW" actuates. The RO's diagnose the failure and inform the SRO. SRO directs the BOP to take manual control of the seal injection control valve and adjust seal flows using the individual seal flow indications.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC/BOP | <p>Diagnose RCP total flow transmitter (MU-27-DPT) failure.</p> <ul style="list-style-type: none"> • ANN Alarm H-5-7 "RC PUMP SEAL FLOWS HIGH/LOW" <ul style="list-style-type: none"> ◆ Event Point 1079 "Total seal flow > 42 gpm" ◆ Event Point 1084 "RCP-1A seal flow < 3 gpm" ◆ Event Point 1085 "RCP-1B seal flow < 3 gpm" ◆ Event Point 1086 "RCP-1C seal flow < 3 gpm" ◆ Event Point 1087 "RCP-1D seal flow < 3 gpm" • Total seal flow on MU-27-FI increasing • Individual RCP seal flow decreasing • Seal controlled demand decreasing • Checks done for possible RCS leak • Rad Monitors checked for increasing trends <p>Informs the SRO of the failure.</p> |
| | SRO | <p>Directs the OAC to ensure RCS leakage has not increased.</p> <p>Directs the BOP to take manual control of seal injection controller and maintain RCP seal injection using the individual seal flow indications</p> |
| | OAC | <p>Monitors RCS for possible increase RCS leakage.</p> <p>Should report no increase in RCS leakage to SRO</p> |
| | BOP | <p>Takes manual control of MUV-16 by placing MU-15-FIC into "Hand"</p> <p>Adjust MU-15-FIC controller to maintain seal injection flow on individual RCP seal flow meters</p> |
| | SRO | <p>Calls NSM to have repair activities started for seal injection controller.</p> |

Initiation: Examiner Initiated

Cue: Control room lighting reduced

Termination: "B" ES 4160 volt bus energized by the "B" EDG

Event Description: Power supply breaker to "B" 4160 Volt ES bus (BKR 3206) trips open (**MALF**). The "B" ES buses go dead and the "B" EDG starts. "B" EDG does not energize the bus due to a low frequency problem (58 - 58.5 htz) on the "B" EDG. The SRO enters AP-770 and directs the BOP actions. SRO may review and enter TS 3.8.1(A) if time permits.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC/BOP | <p>Diagnose loss of power to B" 4160 ES Bus and EDG "B" start</p> <ul style="list-style-type: none"> • Control room lighting reduced • "B" ES bus voltage meters indicate) volts • "B" EDG "Crank" light ON, followed by the "Run" light when the EDG loads on the bus • "B" ES bus voltage meters return to normal readings once EDG energizes the "B" bus. <p>Informs the SRO of AP-770 entry conditions met.</p> |
| | SRO | <p>Directs the OAC to continue to monitor Rx power while directing BOP through AP-770.</p> <p>Enters AP-770 and directs BOP actions.</p> <ul style="list-style-type: none"> • Ensures at least one ES bus energized and goes to step 3.12. • Verifies Letdown flow • Verifies SW, MUP, and SW RW pumps operating • Verifies ES MCC 3AB energized • Verifies no ES 480 UV lockouts • Verifies IA pressure • Ensures RB cooling <ul style="list-style-type: none"> ◆ Should stay on CI cooling ◆ Stops AHF-1A in Fast ◆ Starts AHF-1A in Slow ◆ Starts AHF-1B in slow (Must verify EOP-13 Rule 5 used) • Verifies 2 groups Pressurizer heaters energized • Verifies both ES buses energized <ul style="list-style-type: none"> ◆ Has BOP check "B" EDG voltage ≈ 4150 volts ◆ Directs BOP to increase "B" EDG frequency to 60 htz • Verifies CC ventilation running • Verifies CC Chillier running • Verifies Non-1E battery charge not needed • Directs BOP to have PPO restore heat tracing • Notify NSM may need to order EDG fuel • Verify SF cooling |

Initiation: Examiner Initiated

Cue: Control room lighting reduced

Termination: "B" ES 4160 volt bus energized by the "B" EDG

Event Description: Power supply breaker to the 4160 V "B" ES bus (BKR 3206) trips open (**MALF**). The "B" ES buses go dead and the "B" EDG starts. "B" EDG does not energize the bus due to a low frequency problem (58.5 htz) on the "B" EDG. The SRO enters AP-770 and directs the BOP actions. SRO may review and enter TS 3.8.1(A) if time permits.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | Monitors Rx power |
| | BOP | <p>Under direction of SRO perform AP-770 actions</p> <ul style="list-style-type: none"> • Ensures at least one ES bus energized. (Both energized) • Verifies Letdown flow. • Verifies SW, MUP, and SW RW pumps operating. • Verifies ES MCC 3AB energized. • Verifies no ES 480 UV lockouts. • Verifies IA pressure > 90 psig. • Ensures RB cooling. <ul style="list-style-type: none"> ◆ Ensures CI cooling ◆ Stops AHF-1A in Fast ◆ Starts AHF-1A in Slow • Verifies 2 groups Pressurizer heaters energized (all groups energized) • Verifies both ES buses energized <ul style="list-style-type: none"> ◆ Verifies "B" EDG volts ≈ 4150 ◆ Verifies "B" EDG at 60 htz <ul style="list-style-type: none"> □ Uses the "B" EDG speed adjust to increase frequency □ Ensures "B" EDG energizes bus • Verifies CC ventilation running (Behind ES panel on ventilation panel) • Verifies CC Chillier running (Behind ES panel on ventilation panel) • Verifies Non-1E battery charge not needed • Directs PPO to restore heat tracing • Verify SF cooling |
| | SRO | <p>Calls NSM to have repair activities started for breaker 3206.</p> <p>May review and enter TS 3.8.1(A)</p> |

Initiation: Examiner Initiated

Annunciator Alarms: I-1-3, I-2-3, I-3-3, I-4-3

Termination: Letdown Recovered

Event Description: SWP-1A shaft shear (**MALF**) and SWP-1B fails to auto start on low pressure (**MALF**). OAC/BOP diagnose the loss of SW flow. ANN Alarms I-1-3, I-2-3, I-3-3, and I-4-3 (Low cooling water flow to RCP's) actuate. Letdown will isolate on high temperature. OAC/BOP diagnose failure of SWP-1A shaft and failure of SWP-1B to auto start and notify SRO. SRO directs BOP to start SWP-1B after checking EDG loading IAW EOP-13, Rule 5. SRO directs recover of Letdown using EOP-14, enclosure 4.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC/BOP | <p>Diagnose a loss of SW flow.</p> <ul style="list-style-type: none"> • ANN Alarm I-1-3 "RC PUMP A CLG WTR FLOW LOW" • ANN Alarm I-2-3 "RC PUMP B CLG WTR FLOW LOW" • ANN Alarm I-3-3 "RC PUMP C CLG WTR FLOW LOW" • ANN Alarm I-4-3 "RC PUMP D CLG WTR FLOW LOW" • ANN Alarm C-2-5 "SW SYSTEM PRESSURE LOW" • ANN Alarm C-1-4 "SW BP A/B FLOW LOW" • ANN Alarm C-1-6 "SW BP AUTO START" • SWP-1A low amp reading • ANN Alarm H-4-4 "LETDOWN TEMP HIGH" • Letdown isolated (MUV-49 closed) <p>Notify the SRO of loss of SW flow</p> |

Initiation: Examiner Initiated

Annunciator Alarms: I-1-3, I-2-3, I-3-3, I-4-3

Termination: Letdown Recovered

Event Description: SWP-1A shaft shear (**MALF**) and SWP-1B fails to auto start on low pressure (**MALF**). OAC/BOP diagnose the loss of SW flow. ANN Alarms I-1-3, I-2-3, I-3-3, and I-4-3 (Low cooling water flow to RCP's) actuate. Letdown will isolate on high temperature. OAC/BOP diagnose failure of SWP-1A shaft and failure of SWP-1B to auto start and notify SRO. SRO directs BOP to start SWP-1B after checking EDG loading IAW EOP-13, Rule 5. SRO directs recover of Letdown using EOP-14, enclosure 4.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>May enter AP-330 but probably will just direct BOP to attempt to start SWP-1B (CT#1) following EOP-13 Rule 5 guidance.</p> <p>Should direct BOP to shutdown SWP-1A and have PPO check it out.</p> <p>Directs BOP action for Letdown recovery IAW EOP-14 enclosure 4 or may direct BOP to perform enclosure 2.</p> <ul style="list-style-type: none"> • Ensures MUV-49 closed • Directs closure of MUV-50 • Directs closure of MUV-51 • Ensures SW valves for Letdown coolers are open • Ensures Letdown cooler inlet and outlet valves open • Directs Bypassing of Demins <ul style="list-style-type: none"> ◆ Ensures MUV-124 open ◆ Directs opening of MUV-200 ◆ Ensures MUV-117 open ◆ Directs closure of MUV-116 ◆ Ensure MUV-133 closed • Ensures pre-filter and post-filter in service • Directs Letdown flow be established <ul style="list-style-type: none"> ◆ Directs MUV-49 High Temp Bypass switch placed in Bypass ◆ Directs MUV-49 be opened ◆ Directs BOP to establish desired flow with MUV-51 ◆ Directs MUV-50 be opened ◆ Directs MUV-51 be throttled to desired flow. • Directs MUV-49 High Temp Bypass switch returned to normal when Letdown temperature < 130°. • Directs demin placed into service <ul style="list-style-type: none"> ◆ Ensures MUV-124 open ◆ Ensures MUV-116 open ◆ Directs closure of MUV-200 ◆ Ensures MUV-201 closed ◆ Directs closure of MUV-117 |

Initiation: Examiner Initiated

Annunciator Alarms: I-1-3, I-2-3, I-3-3, I-4-3

Termination: Letdown Recovered

Event Description: SWP-1A shaft shear (**MALF**) and SWP-1B fails to auto start on low pressure (**MALF**). OAC/BOP diagnose the loss of SW flow. ANN Alarms I-1-3, I-2-3, I-3-3, and I-4-3 (Low cooling water flow to RCP's) actuate. Letdown will isolate on high temperature. OAC/BOP diagnose failure of SWP-1A shaft and failure of SWP-1B to auto start and notify SRO. SRO directs BOP to start SWP-1B after checking EDG loading IAW EOP-13, Rule 5. SRO directs recover of Letdown using EOP-14, enclosure 4.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP | <p>Start SWP-1B (CT#1) after ensuring EDG loading margin per EOP-13, Rule 5. Recovers Letdown IAW EOP-14 enclosure 4.</p> <ul style="list-style-type: none"> • Ensures MUV-49 closed • Closes of MUV-50 • closes of MUV-51 • Ensures SW valves for Letdown coolers are open • Ensures Letdown cooler inlet and outlet valves open • Bypasses of Demins <ul style="list-style-type: none"> ◆ Ensures MUV-124 open ◆ Open of MUV-200 ◆ Ensures MUV-117 open ◆ Closes of MUV-116 ◆ Ensures MUV-133 closed • Ensures pre-filter and post-filter in service • Establishes Letdown flow <ul style="list-style-type: none"> ◆ Selects MUV-49 High Temp Bypass switch to Bypass ◆ Opens MUV-49 ◆ Establishes desired flow with MUV-51 ◆ Opens MUV-50 ◆ Throttles MUV-51 to desired flow. • Selects MUV-49 High Temp Bypass switch to normal when Letdown temperature < 130°. • Places demin into service <ul style="list-style-type: none"> ◆ Ensures MUV-124 open ◆ Ensures MUV-116 open ◆ Closes of MUV-200 ◆ Ensures MUV-201 closed ◆ Closes of MUV-117 |
| | SRO | <p>Calls NSM to have repair activities started for SWP-1A. If allowed time, reviews TS and enter 3.8.1(A)</p> |

Initiation: Examiner Initiated

Annunciator Alarms: H-1-5, H-2-2, H-2-1

Termination: Rx Tripped

Event Description: "B" OTSG develops a 60 GPM tube leak. ANN Alarms H-1-5 "MN STM LINE A/B HIGH RAD MONITOR FAIL", H-2-2 "ATMOSPHERIC MONITOR WARNING", and H-2-1 "ATMOSPHERIC RADIATION HIGH" actuates. OAC/BOP diagnose OTSG tube leak and inform SRO of EOP-6 entry conditions. SRO enters EOP-06 and directs plant shutdown and cooldown.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC/BOP | <p>Diagnose "B" OTSG tube leak</p> <ul style="list-style-type: none"> • ANN Alarm H-1-5 "MN STM LINE A/B HIGH RAD MONITOR FAIL" • ANN Alarm H-2-2 "ATMOSPHERIC MONITOR WARNING" <ul style="list-style-type: none"> ◆ Event point 1739 "RM-A12 Condenser Vacuum Pump Exhaust Warning/Fail" • ANN Alarm H-2-1 "ATMOSPHERIC RADIATION HIGH" <ul style="list-style-type: none"> ◆ Event point 1738 " RM-A12 Condenser Vacuum Pump Exhaust Level High" • Makeup flow increase • MUT level decrease • Steam line monitor pegged at 100 gpd <p>Determines a leak rate</p> <p>Notifies SRO EOP-06 entry conditions met.</p> |

Initiation: Examiner Initiated

Annunciator Alarms: H-1-5, H-2-2, H-2-1

Termination: Rx Tripped

Event Description: "B" OTSG develops a 60 GPM tube leak. ANN Alarms H-1-5 "MN STM LINE A/B HIGH RAD MONITOR FAIL", H-2-2 "ATMOSPHERIC MONITOR WARNING", and H-2-1 "ATMOSPHERIC RADIATION HIGH" actuates. OAC/BOP diagnose OTSG tube leak and inform SRO of EOP-6 entry conditions. SRO enters EOP-06 and directs plant shutdown and cooldown.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>Directs the OAC/BOP to quantify the leak rate if not already done by OAC/BOP.</p> <p>Enters EOP-06 and directs OAC/BOP actions</p> <ul style="list-style-type: none"> • Direct SPO to perform EOP-14, enclosure #6 (OTSG Blowdown Lineup) • Provide direction to Ros to maintain MUT level ≥ 55" by cycling MUV-73 as necessary. • Begin determining affected OTSG <ul style="list-style-type: none"> ◆ Directs BOP to check MS line rad monitors (RM-G26 and RM-G27) ◆ Directs BOP to check MSV-25 and 26 rad monitors (RM-G25 and RM-G28) ◆ Notify Chemistry of perform CH-266 (OTSG leak rate monitoring. ◆ Notify HP to perform MS line surveys • Perform AP-510 <ul style="list-style-type: none"> ◆ Adjust ICS "Load Rate" to desired setpoint. (Probably not applicable, since OTSG will probably still be LL limited.) ◆ Adjust "Unit Load Master" to demand "10". (Probably not applicable, since OTSG will probably still be LL limited.) ◆ Maintain DFT level between 10 to 13 ft. ◆ Ensures MBV closed and in manual ◆ When both OTSG are LL limited, then align ICS for shutdown <ul style="list-style-type: none"> □ Rx Diamond to "Manual" □ "Reactor Demand" to "Hand" □ "SG/RX Demand" to "Hand" and demand at "0" □ Both FW Loop Demands to "Hand" and demand at "0" ◆ Direct RO to maintain PZR level IAW OP-103A, Curve #5 <p>ACTIONS CONTINUED NEXT PAGE</p> |

Initiation: Examiner Initiated

Annunciator Alarms: H-1-5, H-2-2, H-2-1

Termination: Rx Tripped

Event Description: "B" OTSG develops a 60 GPM tube leak. ANN Alarms H-1-5 "MN STM LINE A/B HIGH RAD MONITOR FAIL", H-2-2 "ATMOSPHERIC MONITOR WARNING", and H-2-1 "ATMOSPHERIC RADIATION HIGH" actuates. OAC/BOP diagnose OTSG tube leak and inform SRO of EOP-6 entry conditions. SRO enters EOP-06 and directs plant shutdown and cooldown.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | SRO | <ul style="list-style-type: none"> ◆ Direct OAC to commence RCS cooldown <ul style="list-style-type: none"> □ Direct RO to perform EOP-14 Enclosure 15, EOP Temperature Log. □ Provide Reactivity management for OAC □ Cooldown rate ≤ 50 °F/1/2 hour ◆ Direct SPO to perform EOP-14, enclosure #1 (SPO post trip actions) ◆ When Rx power is < 12%, directs BOP to trip Turbine <ul style="list-style-type: none"> □ Establish turbine manual control (EHC Auto or Manual mode) □ Establish 45 to 55 Mwe □ Ensure TBV's controlling □ Depress Main Turbine trip push button □ Verify TVs and GVs are closed ◆ Ensure breakers 1661 and 1662 open ◆ Shutdown Main Generator <ul style="list-style-type: none"> □ Open field breaker □ Select voltage regulator to "Off" ◆ Ensure TBP-8 and 2 running ◆ Ensure all Main Turbine drain valves are open <ul style="list-style-type: none"> □ TDV-1, 2, 3, 4, 5, 6, 7, 8, 9, & 10 ◆ Go back to EOP-06 • When Main Turbine is tripped and Tave is < 565 °F THEN trip Rx <ul style="list-style-type: none"> ◆ Adjust MS Hdr Pressure setpoint to "46" ◆ Depress Rx Trip push button (OAC) ◆ Remain in EOP-06 • Verify CRD groups 1 through 7 fully inserted • Verify Nis indicate Rx is shutdown |

Initiation: Examiner Initiated

Annunciator Alarms: H-1-5, H-2-2, H-2-1

Termination: Rx Tripped

Event Description: "B" OTSG develops a 60 GPM tube leak. ANN Alarms H-1-5 "MN STM LINE A/B HIGH RAD MONITOR FAIL", H-2-2 "ATMOSPHERIC MONITOR WARNING", and H-2-1 "ATMOSPHERIC RADIATION HIGH" actuates. OAC/BOP diagnose OTSG tube leak and inform SRO of EOP-6 entry conditions. SRO enters EOP-06 and directs plant shutdown and cooldown.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | <p>Determine leak rate .</p> <p>Ensure SRO enters EOP-06</p> <p>Carry out EOP-06 and AP-510 actions as directed by SRO</p> <ul style="list-style-type: none"> • AP-510 Actions <ul style="list-style-type: none"> ◆ Adjust ICS "Load Rate" to desired setpoint. (Probably not applicable, since OTSG will probably still be LL limited.) ◆ Adjust "Unit Load Master" to demand "10". (Probably not applicable, since OTSG will probably still be LL limited.) ◆ Maintain DFT level between 10 to 13 ft. ◆ Ensures MBV closed and in manual ◆ When both OTSG are LL limited, then align ICS for shutdown <ul style="list-style-type: none"> □ Rx Diamond to "Manual" □ "Reactor Demand" to "Hand" □ "SG/RX Demand" to "Hand" and demand at "0" □ Both FW Loop Demands to "Hand" and demand at "0" ◆ Direct RO to maintain PZR level IAW OP-103A, Curve #5 <p>When directed to commence cooldown:</p> <ul style="list-style-type: none"> • Performs EOP-14, enclosure #15 (EOP temperature log) • Begins inserting control rod while maintaining proper OI-01 reactivity control <ul style="list-style-type: none"> ◆ Announces intent to insert rods and gets SRO concurrence before beginning each insertion ◆ Announces completion of each insertion • Maintains cooldown ≤ 50 °F/1/2 hour <p>ACTION CONTINUED NEXT PAGE</p> |

Initiation: Examiner Initiated

Annunciator Alarms: H-1-5, H-2-2, H-2-1

Termination: Rx Tripped

Event Description: "B" OTSG develops a 60 GPM tube leak. ANN Alarms H-1-5 "MN STM LINE A/B HIGH RAD MONITOR FAIL", H-2-2 "ATMOSPHERIC MONITOR WARNING", and H-2-1 "ATMOSPHERIC RADIATION HIGH" actuates. OAC/BOP diagnose OTSG tube leak and inform SRO of EOP-6 entry conditions. SRO enters EOP-06 and directs plant shutdown and cooldown.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC | When Main Turbine is tripped and Tave is < 565 °F THEN trip Rx <ul style="list-style-type: none"> ◆ Adjust MS Hdr Pressure setpoint to "46" ◆ Depress Rx Trip push button (OAC) ◆ Remain in EOP-06 • Verify CRD groups 1 through 7 fully inserted • Verify Nis indicate Rx is shutdown |

Initiation: Examiner Initiated

Annunciator Alarms: H-1-5, H-2-2, H-2-1

Termination: Rx Tripped

Event Description: "B" OTSG develops a 60 GPM tube leak. ANN Alarms H-1-5 "MN STM LINE A/B HIGH RAD MONITOR FAIL", H-2-2 "ATMOSPHERIC MONITOR WARNING", and H-2-1 "ATMOSPHERIC RADIATION HIGH" actuates. OAC/BOP diagnose OTSG tube leak and inform SRO of EOP-6 entry conditions. SRO enters EOP-06 and directs plant shutdown and cooldown.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP | <p>Determines leak rate.</p> <p>Ensures SRO enters EOP-06</p> <p>Carry out EOP-06 actions directed by SRO</p> <ul style="list-style-type: none"> • Direct SPO to perform EOP-14, enclosure #6 (OTSG Blowdown Lineup) • Maintain MUT level ≥ 55" by cycling MUV-73 as necessary. • Begin determining affected OTSG <ul style="list-style-type: none"> ◆ Check MS line rad monitors (RM-G26 and RM-G27) ◆ Check MSV-25 and 26 rad monitors (RM-G25 and RM-G28) • AP-510 Actions <ul style="list-style-type: none"> ◆ Direct SPO to perform EOP-14, enclosure #1 (SPO post trip actions) ◆ When Rx power is < 12%, directs BOP to trip Turbine <ul style="list-style-type: none"> □ Establish turbine manual control (EHC Auto or Manual mode) □ Establish 45 to 55 Mwe □ Ensure TBV's controlling □ Depress Main Turbine trip push button □ Verify TVs and GVs are closed ◆ Ensure breakers 1661 and 1662 open ◆ Shutdown Main Generator <ul style="list-style-type: none"> □ Open field breaker □ Select voltage regulator to "Off" ◆ Ensure TBP-8 and 2 running ◆ Ensure all Main Turbine drain valves are open <ul style="list-style-type: none"> □ TDV-1, 2, 3, 4, 5, 6, 7, 8, 9, & 10 |

Initiation: Rx Tripped

Cue: Rx Tripped

Termination: Termination at examiner discretion once the overcooling event is terminated.

Event Description: When the reactor is tripped, the "A" TBVs controller shifts to "Hand" and remains at it's pre-trip position. The OAC diagnoses overcooling event and informs the SRO. The OAC may take control of the "A" TBVs and attempt to terminate the event by running the demand to 0% however, the "A" TBV's are failed as is. The SRO should enter EOP-05 and terminate the overcooling by isolating the "A" OTSG (CT#3). Once the overcooling event is terminated, the SRO works through EOP-05 until directed to transition back to EOP-06.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | <p>Diagnoses RCS overcooling</p> <ul style="list-style-type: none"> • Tave decreasing • "A" MS header pressure decreasing <p>Diagnose "A" TBV's causing the overcooling.</p> <ul style="list-style-type: none"> • "A" TBV's "Hand" lamp lit • "A" TBV's demanded same as pre-trip status <p>Should attempt to terminate the overcooling by manually reducing demand to "A" TBV's to 0%.</p> <p>Informs the SRO of the "A" TBVs failure</p> <p>Informs SRO of continued overcooling event</p> |

Initiation: Rx Tripped

Cue: Rx Tripped

Termination: Termination at examiner discretion once the overcooling event is terminated.

Event Description: When the reactor is tripped, the "A" TBVs controller shifts to "Hand" and remains at it's pre-trip position. The OAC diagnoses overcooling event and informs the SRO. The OAC may take control of the "A" TBVs and attempt to terminate the event by running the demand to 0% however, the "A" TBV's are failed as is. The SRO should enter EOP-05 and terminate the overcooling by isolating the "A" OTSG (CT#3). Once the overcooling event is terminated, the SRO works through EOP-05 until directed to transition back to EOP-06.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | SRO | <p>If informed of "A" TBV's controller failure, directs OAC to manually control "A" TBV's to stabilize the plant.</p> <p>When 0% demand on "A" TBV's does not terminate the overcooling, transitions to EOP-05 and directs the isolation of "A" OTSG to terminate overcooling (CT#3).</p> <ul style="list-style-type: none"> • Direct OAC to depress MS Isolation for "A" OTSG on both trains of EFIC • Direct OAC to depress FW Isolation for "A" OTSG on both trains of EFIC • Direct OAC to close EFV-58 and EFV-56 • Direct OAC to ensure MSV-25 ("A" Atmo. Dump) closed • Direct OAC to ensure MSV-130 ("A" OTSG Blowdown) closed <p>Works through EOP-05 to transition step which directs crew back to EOP-06.</p> <ul style="list-style-type: none"> • When Pressurizer level ≤ 50, provides direction to BOP to increase makeup. <ul style="list-style-type: none"> ◆ Close MUV-49 ◆ Open MUV-24 ◆ Open MUV-73 ◆ Start second MUP and required cooling water <ul style="list-style-type: none"> □ DCP-1B started □ RWP-3B started □ MUP-1C started ◆ Open additional HPI valves as necessary <ul style="list-style-type: none"> □ MUV-23 □ MUV-25 □ MUV-26 <p>ACTIONS CONTINUED ON NEXT PAGE</p> |

Initiation: Rx Tripped

Cue: Rx Tripped

Termination: Termination at examiner discretion once the overcooling event is terminated.

Event Description: When the reactor is tripped, the "A" TBVs controller shifts to "Hand" and remains at it's pre-trip position. The OAC diagnoses overcooling event and informs the SRO. The OAC may take control of the "A" TBVs and attempt to terminate the event by running the demand to 0% however, the "A" TBV's are failed as is. The SRO should enter EOP-05 and terminate the overcooling by isolating the "A" OTSG (CT#3). Once the overcooling event is terminated, the SRO works through EOP-05 until directed to transition back to EOP-06.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <ul style="list-style-type: none"> • Once overcooling event is terminated, directs OAC to stabilize RCS temperature using the "A" Atmo. Dump valve and the "B" TBVs. • Provide direction to OAC to check all "A" OTSG isolation actions <ul style="list-style-type: none"> ◆ MSV-412 Closed & selected closed ◆ MSV-411 Closed & selected closed ◆ FWV-31 Closed & selected closed ◆ FWV-30 Closed, selected closed and toggle in Manual ◆ FWV-36 Closed & selected closed ◆ FWV-28 Closed & selected closed ◆ FWV-14 Closed & selected closed ◆ Both Main FW pumps tripped since FWV-28 was open before actuation |

Initiation: Rx Tripped

Cue: Rx Tripped

Termination: Termination at examiner discretion once the overcooling event is terminated.

Event Description: When the reactor is tripped, the "A" TBVs controller shifts to "Hand" and remains at it's pre-trip position. The OAC diagnoses overcooling event and informs the SRO. The OAC may take control of the "A" TBVs and attempt to terminate the event by running the demand to 0% however, the "A" TBV's are failed as is. The SRO should enter EOP-05 and terminate the overcooling by isolating the "A" OTSG (CT#3). Once the overcooling event is terminated, the SRO works through EOP-05 until directed to transition back to EOP-06.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC | <p>Takes manual control of "A" TBV's and attempts to terminate overcooling by reducing "A" TBVs demand to 0%.</p> <p>When directed by SRO to isolate MS and MFW to "A" OTSG (CT#3)..</p> <ul style="list-style-type: none"> • Depress the "A" OTSG MS isolation buttons on EFIC panel for both trains of EFIC <ul style="list-style-type: none"> ◆ Verifies "A" OTSG MSIV's closed <ul style="list-style-type: none"> □ MSV-412 □ MSV-411 • Depress the "A" OTSG MFW isolation buttons on the EFIC panel for both trains of EFIC <ul style="list-style-type: none"> ◆ Verifies "A" Feedwater block valves closed <ul style="list-style-type: none"> □ "A" MBV (FWV-30) □ "A" LLBV (FWV-31) □ "A" SUBV (FWV-36) ◆ Verifies FWV-28 (Cross-Tie) closed ◆ Verifies FWV-14 ("A" FWP suction valve) closed ◆ Verifies both MFWP's tripped • Close EFV-58 & 56 (EFW supplies to "A" OTSG) • Check MSV-25 ("A" Atmo. Dump) closed • Check MSV-130 ("A" OTSG Blowdown) closed <p>ACTIONS CONTINUED ON NEXT PAGE</p> |

Initiation: Rx Tripped

Cue: Rx Tripped

Termination: Termination at examiner discretion once the overcooling event is terminated.

Event Description: When the reactor is tripped, the "A" TBVs controller shifts to "Hand" and remains at it's pre-trip position. The OAC diagnoses overcooling event and informs the SRO. The OAC may take control of the "A" TBVs and attempt to terminate the event by running the demand to 0% however, the "A" TBV's are failed as is. The SRO should enter EOP-05 and terminate the overcooling by isolating the "A" OTSG (CT#3). Once the overcooling event is terminated, the SRO works through EOP-05 until directed to transition back to EOP-06.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | <p>When overcooling event terminated, stabilize RCS temperature using the "A" Atmo. Dump valve and the "B" TBVs.</p> <p>Check all "A" OTSG isolation actions as directed by SRO</p> <ul style="list-style-type: none"> • MSV-412 Closed & selected closed • MSV-411 Closed & selected closed • FWV-31 Closed & selected closed • FWV-30 Closed, selected closed and toggle in Manual • FWV-36 Closed & selected closed • FWV-28 Closed & selected closed • FWV-14 Closed & selected closed <p>Check both Main FW pumps tripped since FWV-28 was open before actuation</p> |

Initiation: Rx Tripped

Cue: Rx Tripped

Termination: Termination at examiner discretion once the overcooling event is terminated.

Event Description: When the reactor is tripped, the "A" TBVs controller shifts to "Hand" and remains at it's pre-trip position. The OAC diagnoses overcooling event and informs the SRO. The OAC may take control of the "A" TBVs and attempt to terminate the event by running the demand to 0% however, the "A" TBV's are failed as is. The SRO should enter EOP-05 and terminate the overcooling by isolating the "A" OTSG (CT#3). Once the overcooling event is terminated, the SRO works through EOP-05 until directed to transition back to EOP-06.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP | <p>When Pressurizer level ≤ 50, inform the SRO and request direction of EOP-05.</p> <ul style="list-style-type: none"> • Close MUV-49 • Open MUV-24 • Open MUV-73 • Start second MUP and required cooling water <ul style="list-style-type: none"> ◆ DCP-1B started ◆ RWP-3B started ◆ MUP-1C started • Open additional HPI valves as necessary <ul style="list-style-type: none"> ◆ MUV-23 ◆ MUV-25 ◆ MUV-26 <p>Once overcooling event terminated and Pressurizer level is >50", inform the SRO and control makeup flow</p> <ul style="list-style-type: none"> • Close MUV-23, 24, 25, and 26 • Close MUV-73 • Shutdown MUP-1C <p>May request permission to reestablish letdown in accordance with EOP-14, enclosure #4</p> |
| | SRO | Classify the Emergency IAW EM-202 after the simulator frozen. |

Scenario Setup

1. [] Initialize the simulator to 21% power with turbine ready to sync to grid.
2. [] Unfreeze the simulator
3. [] In the "NRCEXAM" directory of LESSON PLAN, start lesson plan for exam N-2.
4. [] Trigger SETUP step
5. Perform the following setup actions:
 - [] Start SWP-1A
 - [] Stop SWP-1C
 - [] Place WTP-6B in Pull-To-Lock
 - [] Open MOS 1661N
 - [] Open MOS 1661S
 - [] Adjust "A" FWP to establish 40-50 psid across control valves
 - [] Take "B" EDG speed control to lower for ten seconds. (High speed light is overridden on by setup step.)
6. Place the following Red Tags on the main control panel:
 - [] MSV-55
 - [] MSV-56
 - [] ASV-5
 - [] ASV-204
 - [] Breaker 1661
 - [] MOS 1661N
 - [] MOS 1661S
 - [] MUP-1A
7. Ensure clean copies of the following "consumable" procedures are in the control room procedure books.
 - [] OP-501
 - [] OP-504
 - [] OP-450
 - [] EOP-06
 - [] EOP-05
 - [] AP-510
 - [] AP-330
 - [] Signed off copy of OP-203. (Signed off to step 4.2.25)
8. [] Ensure marked up copy of OP-203 signed off to step 4.2.25 for turnover
9. [] Advance all MCB recorders and remove line printer printouts.
10. [] Ensure all grease pencil marks on indicators and recorders are removed.
11. [] Ensure SPDS screens are acknowledged and on proper screens with history trace reset.
12. [] FREEZE the simulator and notify the lead examiner that simulator is ready to begin.

Scenario Execute

1. When notified by the lead examiner, UNFREEZE the simulator.
2. MAIN TURBINE SYNC TO GRID
 - 2.1. Crew will sync the turbine generator to the grid using OP-203 starting at step 4.2.25.
 - 2.2. If the crew calls asking about the auto sync relays, the sync check relays are good to be used.
3. "B" OTSG PRESSURE TO "B" EFIC FAILS HIGH

When notified by the lead examiner, TRIGGER Lesson Plan Step #1 ("B" OTSG pressure to "B" EFIC channel fails high)

 - 3.1. If TBO called to check on MSV-26 status, wait about 1 minute then report valve Status. (I/F page MS_B)
 - 3.2. TBO sees no problems with MSV-26 operation.
 - 3.3. BYPASS/TRIP EFIC
 - 3.3.1. IF CNO directed to "Bypass" "B" EFIC IAW OP-450, TRIGGER Lesson Plan Step #13 (INSTRUCTOR ACTION: BYPASS "B" EFIC CHANNEL).

Report the "B" EFIC channel Bypassed on the PHONE to the control room (Radio use not allowed in EFIC rooms).
 - 3.3.2. IF CNO directed to "TRIP" "B" EFIC IAW OP-450, TRIGGER Lesson Plan Step #12 (INSTRUCTOR ACTION: TRIP "B" EFIC CHANNEL).

Report the "B" EFIC channel Tripped on the PHONE to the control room (Radio use not allowed in EFIC rooms).
4. RCP TOTAL SEAL FLOW TRANSMITTER SLOW FAILS HIGH

When notified by the lead examiner, TRIGGER Lesson Plan Step #2 (MU-27-DPT slowly fails high)

 - 4.1. IF PPO called to check for leaks in area of seal injection, wait a 2.5 minutes then report that you do not see any leaks.

5. BREAKER 3206 TRIPS OPEN/EDG-1B STARTS BUT FAILS TO ENERGIZES "B" ES BUS

When notified by the lead examiner, TRIGGER Lesson Plan Step #3 (Breaker 3206 fails open) ("B" EDG will be at about 58-58.5 hts)

- 5.1. PPO should check out EDG-1B operation. Report all conditions "Sat" on the "B" EDG.
- 5.2. If anyone sent to check breaker 3206 locally, report breaker indicates open locally and no visible problems.

6. SWP-1A SHAFT SHEAR AND FAILURE OF SWP-1B AUTO START ON LOW PRESSURE

When notified by the lead examiner, TRIGGER Lesson Plan Step #4 (SWP-1A shaft shear)

- 6.1. If PPO sent to check SWP-1A locally

If pump is running, report that SWP-1A is vibrating badly and make loud noise

If pump is not running, report addition seal leakage on pump seals but no other observed problems.

7. "B" OTSG 60 GPM TUBE LEAK

When notified by the lead examiner, TRIGGER Lesson Plan Step #6 ("B" OTSG 60 gpm tube leak).

- 7.1. When HP for surveys of MS lines, wait about 5 minutes then report there is in increase in radiation level around the "B" MS lines. Contact readings on "B" MS lines is 145-150 mrem/hour.
- 7.2. When Chemistry called to check for OTSG leakage, wait 25 minutes and report "B" OTSG appears to be leaking.
- 7.3. When called to do enclosures of EOP-14, use the time line guides supplied by EOP group for these actions.

8. "A" TBV's GO TO HAND AND FAIL AS-IS WHEN REACTOR TRIPPED (OVERCOOLING EVENT)

When Rx is tripped, the "A" TBV's will go to hand automatically and will fail AS-IS.

- 8.1. IF TBO sent to check "A" TBV's, wait 1 minute then report that both "A" TBVs are partially open (20 to 25%).

EXAM N-2
TURNOVER

- A. Initial conditions:
1. Time in core life - 247 EFPD
 2. Rx power and power history - 21% for \approx 1/2 hour
 3. Boron concentration - 1450 PPMB
 4. Xenon - Equilibrium
 5. RCS Activity - Fuel 0.0005 uCi/ml
- B. Tech. Spec. action requirement(s) in effect: 3.7.5(D) EFP-2 red tagged to mechanical maintenance for governor replacement after Mode 1 was entered. 1 hour into 72 hour action statement. EFP-2 is scheduled to be released for post maintenance testing in 4 hours.
- C. Clearances in effect:
1. EFP-2 for governor replacement
 2. WTP-6B (Demin Water Transfer Pump) for motor/pump realignment
 3. MUP-1A to electrical maintenance to replace control power fuses. MUP-1A will be returned to service in two hours.
 4. Breaker 1661, MOS 1661S, and MOS 1661N to Dispatcher. Breaker 1661 developed quench gas leak on previous shift. Line crew in 500 KV switchyard trouble shooting the breaker.
- D. Significant problems/abnormalities:
1. SWP-1A is running while engineering performs an analysis of anomalous vibration reading taken during last SP. Vibrations were within allowable limits but had increased from previous SP.
 2. During the power escalation, FWP-2A was selected to manual due to minor speed oscillations. I&C identified a noisy DP signal as source of the oscillation. Repairs and post maintenance testing are complete. FWP-2A ready to be restored to automatic.
 3. Severe thunderstorms and extremely high wind expected over the next 24 hours.
- E. Evolution's/maintenance for the on-coming shift:
1. Perform post maintenance test of EFP-2 and MUP-1A when released from maintenance.
 2. Return FWP-2A to automatic operation.
 4. Continue with plant startup starting at step 4.2.25 of OP-203. All steps to step 4.2.25 completed. Initial HP turbine first stage temp was 247°F.
 5. Auto breaker closure to be used at step 4.2.31. Approved by plant management and system engineer.
- F. Units 1 and 2 status: On-Line
- G. Units 4 and 5 status: On-Line

**EXAM N-2
TURNOVER**

H. NSS - Instruct the RO's to walk down the main control board and provide you with the following data:

1. RCS Average Temperature _____
2. RCS Pressure _____
3. Pressurizer Level _____
4. Make-up Tank Level _____
5. Turbine Load _____
6. Turbine Reference _____

NOTE: Should need arise, full implementation of the emergency plan is not required during this exam. However, SRO should be prepared to address possible Emergency Plan involvement following the exam.

OPERATING EXAMINATION SCENARIO OUTLINE

Facility: Crystal River Unit 3

Scenario Number: 3

Operating Test Number: 1

Examiners: _____

Operators: _____

Objectives:

1. Evaluate SRO candidates ability to manage shift resources and exercise command and control during normal and emergency conditions.
2. Evaluate SRO candidates ability to implement emergency and abnormal operating procedures.
3. Evaluate SRO candidates ability to interpret and apply Tech Specs associated with RPS channel instrumentation.
4. Evaluate RO/SRO candidates ability to perform a plant power reduction. Actions IAW AP-510.
5. Evaluate RO candidates ability to diagnose faulty RPS pressure signal and place an RPS channel in "Bypassed" IAW OP-507.
6. Evaluate RO/SRO ability to diagnose and respond to a main feedwater pump failure while in 3 RCP mode of operation. Actions IAW AP-545.
7. Evaluate RO/SRO ability to diagnose and respond to an ICS instrument failure (neutron error).
8. Evaluate RO/SRO ability to diagnose and respond to loss of the plant startup transformer/loss of all main feedwater and failure of EFP-1 to auto start.
9. Evaluate RO/SRO ability to diagnose and respond to a loss of all EFW.
10. Evaluate RO/SRO ability to diagnose and respond to a loss of ALL feedwater.
11. Evaluate RO/SRO ability to swap in service Makeup and Purification Demins.

Initial Condition: 75% Power, 3 RCP operating, ICS in automatic.

Turnover Information: RCP-1C developed a ground fault 4 days ago. Demin water transfer pump WTP-6B is out of service for motor/pump realignment. WTP-6B is scheduled for return to service in 10 hours. EFP-2 is OOS and red tagged to mechanical maintenance for governor replacement. The plant is six hours into 72 hour actions statement based on TS 3.7.5(D). EFP-2 is scheduled to be released for post maintenance testing in 4 hours. MUP-1A is tagged to electrical maintenance to replace fuses in the DC control power circuits. MUP-1A will be release in two hours. SWP-1A is running while engineering performs an analysis of anomalous vibration readings taken during the last SP.

During the previous shift Breaker 1661 tripped - cause unknown. A line crew is in the 500 KV switchyard troubleshooting the breaker. Breaker 1661, MOS 1661N, and MOS 1661S are currently OPEN and red tagged to Dispatcher.

Severe thunderstorms and extremely high winds are expected over the next 24 hours.

| Event No. | Event Type* | Malf. No. | Description | Event |
|--------------------------|----------------------------|-------------|---|-------|
| 1. | (N) - BOP/SRO | | Swap makeup demins IAW OP-402 | |
| 2 | (I) - BOP/SRO | | CDP-1B demand fails to 0% (Malf) | |
| 3 | (N) -OAC/SRO | | Reduce reactor power to 60% IAW AP-510. | |
| 4 | (I) - ALL (C) - OAC/SRO | | RPS Channel "B" Pressure (RC-3B-PT1) fails high (Malf). RPS channel trips on high pressure. PZR spray and PORV actuate. PZR Spray Valve fails open (Malf). SRO directs OAC to close PZR spray isolation valve. SRO evaluates and enters TS 3.3.1(A). Place RPS Channel "B" in "Bypassed" IAW OP-507. Alternate pressure channel selected for pressure control IAW OP-501. | |
| 5 | (C) - ALL (R) - OAC | | "A" Main Feed Pump oil system failure, Feedwater pump trip (Malf), and ICS automatic runback to 55% power. The "A" MBV does not close automatically but will close when the operator selects it to manual and closed. The crew will have to reduce power to \leq 45% power IAW AP-545. | |
| 6 | (I) - OAC/SRO | | ICS Neutron Error fails to +9 (Malf). SRO directs OAC to take manual control of Rx and Main FW to stabilize the plant. | |
| 7 | (MT) - ALL (C) - BOP | | Loss of Startup Transformer (Malf) which results in loss of all RCPs, loss of main feedwater, and loss of most secondary equipment. EFIC actuates but EFP-1 does not auto start due to a relay failure (Malf). SRO directs BOP to start EFP-1 (CT#1). | |
| 8 | (C) - BOP/SRO | | EFP-1 Shaft Seizure (Malf) - Loss of all EFW flow. | |
| 9 | (N) -All | | SRO directs 4160 Rx Aux. bus energized by dedicated EDG and FWP-7 place into service IAW EOP-04. (CT#2) | |
| 10 | (C) - ALL | | Loss of FWP-7 (Malf) - Loss of all feedwater - SRO directs the establishment of HPI/PORV cooling IAW EOP-04 (CT#3) | |
| Scenario Duration | | 120 minutes | Exercise Termination: When PORV / HPI cooling established. | |

*(N)ormal evolution, (R)eactivity manipulation, (I)instrument failure, (C)omponent failure, (M)ajor transient

Narrative Summary:

After shift turnover, the crew will place the "B" Makeup Demin into service and remove the "A" Makeup Demin from service IAW OP-402.

After Makeup Demins have been transferred, CDP-1B's coupling demand fails to 0% and will not respond in manual or automatic. This causes CD flow reduction below amount needed for power operation > 60%. RO's diagnoses the failure and notify the SRO. RO's should direct the SPO to check out CDP-1B operation. SRO enters AP-510 and directs the OAC to reduce power to \leq 60%.

After the power reduction is completed, RPS Channel "B" Pressure (RC-3B-PT1) fails high slowly. The rate of failure is less than that needed for SASS to transfer automatically. The increasing pressure causes the PZR heaters to go to minimum, the spray valve will open (and fail open), the "B" RPS Channel will trip, and the PORV will open. The RO's should diagnose the failure and notify the SRO. The SRO should direct the OAC to close the PORV (RCV-10) and close the Spray Block Valve (RCV-13). SRO directs the OAC to use alternate instruments to control RCS pressure. SRO directs the BOP to select alternate instrument IAW OP-501. SRO directs the OAC to return Pressurizer Heaters and PORV to Auto. SRO evaluates TS and applies 3.3.1(A) for "B" RPS Channel. The SRO directs the BOP to place the "B" RPS Channel in "Bypass" IAW OP-507. (TS requires channel "Tripped" or "Bypassed". The crew should "Bypass" the channel).

When Pressurizer heaters in auto, PORV in auto, and "B" RPS Channel "Bypassed", the oil system for the "A" MFWP begins to degrade. The "A" MFWP will eventually trip if not shutdown by the crew. When "A" MFWP is tripped, the "A" MBV does not automatically close. When selected to manual and closed, the "A" MBV will close. The RO's diagnose the problem, inform the SRO, and send the SPO to investigate the oil system for the "A" MFWP. The SRO enters AP-545 and ensures the plant is running back to <45%. The OAC performs the immediate actions of AP-545 (Select "A" MBV to manual and closed) and monitors the runback. The SRO directs the RO's to have PPO place both the FWP trips switches into the "BOTH" position IAW AP-545.

Following the Plant Runback, ICS Neutron Error fails to +9. This causes the reactor to insert control rods while cross-limiting FW in the increase direction. The OAC diagnoses the problem and informs the SRO. The SRO directs the OAC to take manual control of the reactor and feedwater to stabilize the plant.

When the plant is stabilized from the Neutron Error failure, a Startup Transformer fault occurs. This takes out power to all the unit buses. It also removes power from the "A" ES 4160 bus until it is recovered by the "A" EDG. EFIC actuates on loss of all RCP's and all FWP's, but EFP-1 fails to auto start. The EFP-1 will start when selected to run in the control room however, the BOP should insure the "A" EDG has enough margin to allow EFP-1 start. The BOP diagnoses the failure of the only available EFP to auto start and informs the SRO. The SRO directs the BOP to start EFP-1 IAW EOP-13, Rule 3 and 5 (CT#1).

Ten minutes after EFP-1 is running, its shaft seizes and EFP-1 is lost. The BOP diagnoses the loss of all FW flow and informs the SRO. SRO will enter EOP-04 for inadequate heat transfer and direct actions for energizing the 4160 Rx Aux bus and placing FWP-7 into service. (CT#2).

When FWP-7 operation is established and feeding the OTSG's, FWP-7 breaker fails open. The SRO cycles back to the front of EOP-04 and directs actions to place the plant on HPI/PORV cooling (CT#3).

Procedures to be used during this scenario:

| | | | | |
|--------|--------|--------|--------|--------|
| OP-507 | OP-501 | OP-605 | OP-603 | OP-402 |
| AP-545 | AP-510 | AP-770 | | |
| EOP-02 | EOP-04 | | | |
| Rule 3 | Rule 5 | | | |

| Target Quantitative Attributes - Scenario 1 | Actual Attributes |
|--|--------------------------|
| 1. Total Malfunctions (5-8) | 9 |
| 2. Malfunctions after EOP entry (1-2) | 3 |
| 3. Abnormal Events (2-4) | 3 |
| 4. Major Transients (1-2) | 1 |
| 5. EOP's entered requiring substantive actions (1-2) | 2 |
| 6. EOP contingencies requiring substantive actions (0-2) | 2 |
| 7. Critical Tasks (2-3) | 3 |

Initiation: Turnover Sheet

Termination: "B" MU Demin in service and "A" MU Demin out of service.

Event Description: The BOP places "B" MU Demin into service and removes the "A" MU Demin from service IAW OP-402.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | Directs BOP to place MUDM-1B in service and remove MUDM-1A from service IAW OP-402 section 4.10 |
| | BOP | Carry out actions of step 4.10.4 of OP-402 <ul style="list-style-type: none"> • Open MUV-133 (MUDM-1B inlet valve) • Open MUV-117 (MUDM-1B outlet valve) • Close MUV-116 (MUDM-1A outlet valve) • Close MUV-124 (MUDM-1A inlet valve) • Ensure Close MUV-200 and 201 |
| | OAC | Peer check BOP actions |

Initiation: Examiner Initiated

Annunciator Alarms: N-3-1

Termination: Power reduction in progress IAW AP-510

Event Description: CDP-1B demand fails to 0% (Malf) . ANN Alarm N-3-2 "CD PUMP B UNCOUPLED".
Condensate flow decreases and DFT level begins to lower.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | Diagnoses the failure of CDP-1B <ul style="list-style-type: none"> • CD Flow Decreasing • DFT Level Decreasing • Hotwell Level Increasing • CDP-1B Controller Demand at 0% Pulls and reviews AR-602 for ANN Alarm N-3-2 Notifies the SRO of CDP-1B failure |
| | SRO | Directs BOP to take CDP-1B controller to hand and to attempt to raise demand. Directs BOP to notify TBO to check CDP-1B operation |
| | BOP | Attempts to take manual control of CDP-1B <ul style="list-style-type: none"> • Select CDP-1B Bailey control station to manual • Select raise on CDP-1B Bailey control station toggle Notifies SRO of failure of manual operation of CDP-1B Directs TBO to check out CDP-1B operation |

Initiation: Power Reduction Commenced

Cue: ULD lowered to 10% by OAC

Termination: Power stabilized within capability of one CDP (55% to 60% power).

Event Description: Reduce power to < 60% power IAW AP-510.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | <p>When CDP-1B controller fails to respond, enters AP-510 and directs power reduction to within capability of one CDP (IAW OP-603 ≤ 60%)</p> <p>OAC directed to lower power</p> <ul style="list-style-type: none"> • Set load rate to 5%/min. • Lower ULD to 10% <p>BOP directed to</p> <ul style="list-style-type: none"> • Notify SPO to check out CDP-1B operation • Notify SPO power reduction (Take Demins off as necessary) • Notify SPO to verify ASV-27 operation • Monitor Deaerator level |
| | OAC | <p>Commence power reduction IAW SRO directions</p> <ul style="list-style-type: none"> • Set load rate to 5%/min. • Lower ULD to 10% <p>Monitors plant power reduction</p> |
| | :BOP | <p>Notify SPO to check out CDP-1B operation</p> <p>Notify SPO power reduction (Take Demins off as necessary)</p> <p>Notify SPO to verify ASV-27 operation</p> <p>Monitor Deaerator level and keep crew informed of status</p> |

Initiation: Examiner Initiated

Annunciator Alarms: K-3-2

Termination: PORV closed and selected closed, Spray valve isolated, alternate pressure signal selected, Pressurizer heaters control in Auto, and Technical Specifications addressed.

Event Description: RPS Channel "B" Pressure (RC-3B-PT1) fails high (Malf). ANN Alarm K-3-2 "SASS MISMATCH" RPS channel trips on high pressure. PZR spray and PORV actuate. PZR Spray Valve fails open (Malf). SRO directs OAC to close PZR spray isolation valve. SRO evaluates and enters TS 3.3.1(A). SRO directs the BOP to select good pressure signal source IAW OP-501. SRO directs BOP to "Bypass" "B" RPS channel IAW OP-507.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | <p>Diagnoses the failure of RCS pressure input to SASS and "B" RPS Channel</p> <ul style="list-style-type: none"> • ANN Alarm K-3-2 "SASS MISMATCH" <ul style="list-style-type: none"> ◆ Event Point 0784 "RCS Narrow Range Pressure" • "B" Loop pressures increasing on recorders RC-3A-PIR1 and RC-3A-PIR2 • Spray Valve opens to 40% position if left in AUTO • ANN Alarm J-6-1 "RPS CHANNEL B TRIP" • PORV opens if left in AUTO <ul style="list-style-type: none"> ◆ PORV Ultra Sonic meter show flow ◆ ANN Alarm I-5-1 "PORV SAFETY VALVE OPEN" <ul style="list-style-type: none"> ◇ Event Point 1959 "RCV-10" ◆ ANN Alarm I-6-1 "PORV SOLENOID ENERGIZED" <p>Verifies actual RCS high pressure does not exist</p> <p>Notifies SRO of the failure</p> |
| | SRO | <p>Directs OAC to close the PORV or PORV Block valve</p> <p>Directs OAC to take manual control of the Spray Valve and close it.</p> <p>When Spray Valve fails to respond to OAC, directs OAC to close the Spray Block valve.</p> <p>Directs OAC to take manual control of Pressurizer heaters and stabilize RCS pressure.</p> <p>Evaluates and applies TS 3.3.1(A) for RPS channel</p> <p>Directs BOP to select alternate RCS pressure instrument IAW OP-501</p> <p>Directs OAC to return PORV and Pressurizer heaters to "Auto"</p> <p>Directs BOP to place "B" RPS channel in "Bypass" IAW OP-507</p> <p>Provides Peer checking of BOP OP-507 actions</p> |

Initiation: Examiner Initiated

Annunciator Alarms: K-3-2

Termination: PORV closed and selected closed, Spray valve isolated, alternate pressure signal selected, Pressurizer heaters control in Auto, and Technical Specifications addressed.

Event Description: RPS Channel "B" Pressure (RC-3B-PT1) fails high (Malf). ANN Alarm K-3-2 "SASS MISMATCH" RPS channel trips on high pressure. PZR spray and PORV actuate. PZR Spray Valve fails open (Malf). SRO directs OAC to close PZR spray isolation valve. SRO evaluates and enters TS 3.3.1(A). SRO directs the BOP to select good pressure signal source IAW OP-501. SRO directs BOP to "Bypass" "B" RPS channel IAW OP-507.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | Selects the PORV to "Closed" position and verifies PORV closed Selects Spray Valve to manual and attempts to close it. Reports failure of the Spray Valve to respond to manual control to SRO Closes Spray Block Valve Takes Pressurizer heater controls to hand and stabilizes RCS pressure Once BOP has swapped pressure input IAW OP-501 <ul style="list-style-type: none"> • Selects PORV to Auto • Selects Pressurizer heater controls to Auto |
| | BOP | Selects alternate RCS pressure instrument IAW OP-501 <ul style="list-style-type: none"> • Checks alternate instrument reading on RC-3A-PIR1 and RC-3B-PIR2 • Selects RC-3-HS toggle switch (SASS Cabinet) to RPS-A Places "B" RPS channel in "Bypass" IAW OP-507 <ul style="list-style-type: none"> • Verifies no other RPS Channels Bypassed • Verifies no EFIC Channels Bypassed • Gets RPS Bypass Key out of locker • Selects "B" RPS Channel to Bypass |

Initiation: Examiner Initiated

Annunciator Alarms: L-3-3

Termination: Power stabilized at about 40-45% power.

Event Description: "A" Main Feed Pump oil system begins to degrade (MALF). ANN Alarm L-3-3 "FWP TROUBLE". Three minutes into the failure the backup AC oil pump starts on low pressure. ANN Alarm L-1-3 "FWP A OIL PRESS LOW" and L-1-5 "FWP A EMERGENCY OIL PP AUTO START". Forty five seconds later the "A" Main Feedwater Pump will trip (Malf) and ICS automatic runback to 55% power. The "A" MBV does not close automatically and must be closed by the OAC. IAW AP-545 plant power will have to be reduced to $\leq 45\%$ power to stabilize Tave and ΔT_c . ANN ALARM L-1-1 "FWP A TRIP", L-4-1 "LOSS OF FW PP RUNBACK", and L-6-2 "UNIT MASTER IN TRACK"

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC/BOP | <p>Diagnose FWP-2A oil system problem</p> <ul style="list-style-type: none"> • ANN Alarm L-3-3 "FWP TROUBLE" <ul style="list-style-type: none"> ◆ Event Point 1494 "Feedwater PP 2A Turb Lube FLTR diff press high" • 3 Minutes later the backup AC oil pump for FWP-2A auto starts <ul style="list-style-type: none"> ◆ ANN Alarm L-1-3 "FWP A OIL PRESS LOW" (3 minutes after L-3-3) ◆ ANN Alarm L-1-5 "FWP A EMERGENCY OIL PP AUTO START" ◆ FWP-4A ("A" FWP backup AC oil pump) running <p>Notifies SRO of problem</p> <p>Monitors FWP-2A Control Oil and Lube Oil pressures</p> |
| | SRO | <p>Directs the BOP to notify the SPO of FWP-2A problems</p> <p>May decide to direct power reduction in case FWP-2A fails. If power reduction done, it should be IAW AP-510.</p> <p>May direct that FWP-2A be tripped and AP-545 actions performed</p> <p>When FWP-2A trips, enters AP-545 and directs runback actions</p> <ul style="list-style-type: none"> • Directs BOP to notify plant personnel • Directs OAC to ensure RCS pressure stabilized • Directs OAC to ensure Rx Power stabilized $\leq 45\%$ • Directs OAC to ensure imbalance within limits • Direct that the PPO or CNO to place both of the FWP trip EFIC switches into the "BOTH" position. • Calls Chemistry for > 15% power change • Directs BOP/OAC to check that Regulating Rods are within insertion limits • Directs OAC to ensure all control rods are within 6.5% of their group average |

Initiation: Examiner Initiated

Annunciator Alarms: L-3-3

Termination: Power stabilized at about 40-45% power.

Event Description: "A" Main Feed Pump oil system begins to degrade (MALF). ANN Alarm L-3-3 "FWP TROUBLE". Three minutes into the failure the backup AC oil pump starts on low pressure. ANN Alarm I-1-3 "FWP A OIL PRESS LOW" and L-1-5 "FWP A EMERGENCY OIL PP AUTO START". Forty five seconds later the "A" Main Feedwater Pump will trip (Malf), and ICS automatic runback to 55% power. Plant power will have to be reduced to 40-45% power to stabilize Tave and ΔTc. ANN ALARM L-1-1 "FWP A TRIP", L-4-1 "LOSS OF FW PP RUNBACK", and L-6-2 "UNIT MASTER IN TRACK"

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC | <p>When FWP-2A trips, performs immediate actions of AP-545.</p> <ul style="list-style-type: none"> • Ensure plant runback in progress • Ensure FWV-28 opening • Ensure FWV-29 closing • Finds FWV-30 not closing <ul style="list-style-type: none"> ◆ FWV-30 red light on ◆ "A" FW flow excessive ◆ Tave decreasing • CLOSSES FWV-30 <p>Carry out actions of AP-545 as directed by SRO</p> <ul style="list-style-type: none"> • Ensure Rx Power stabilized \leq 45% • Ensure RCS pressure stabilized • Ensure imbalance within limits • Ensure that Regulating Rods are within insertion limits • Ensure all control rods are within 6.5% of their group average |
| | BOP | <p>Notifies NSM, SPO, PPO, and STA of loss of FWP-2A.</p> <p>Monitors balance of plant during the runback.</p> <p>Checks rod insertion curves for OAC</p> <p>Notify PPO or CNO to place both of the FWP trip EFIC switches into the "BOTH" position.</p> |

Initiation: Examiner Initiated

Annunciator Alarms: K-5-3

Termination: Power stabilized Rx and FW in Hand (Manual) control.

Event Description: "ICS Neutron Error fails to +9 (Malf). ANN Alarm K-5-3 "FW LIMITED BY RX" and K-6-2 "UNIT MASTER IN TRACK" SRO directs OAC to take manual control of Rx and Main FW to stabilize the plant.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC | Diagnoses the Neutron Error Failure <ul style="list-style-type: none"> • ANN Alarm K-5-3 "FW LIMITED BY RX" • ANN Alarm K-6-2 "UNIT MASTER IN TRACK" • Neutron Error meter at +9 • Diamond Panel inserting control rods • FW flow increase to max. allowed with MBV's closed Notifies the SRO of failure |
| | SRO | Directs OAC to take Rx and FW demand stations to "Hand" and stabilize the plant. |
| | OAC | Takes Rx Diamond and Rx Demand stations to Manual/Hand Takes FW loop demand s to "Hand" Adjust FW flow to match Rx power and to stabilize the plant. |
| | BOP | Monitors balance of plant |

Initiation: Examiner Initiated

Cue: Rx Trip/Control room lighting reduced.

Termination: Plant stabilized on natural circulation with EFP-1 supplying OTSG's.

Event Description: "Loss of Startup Transformer (Malf) - This causes a loss of power to all unit buses and a loss of power to the "B" ES 4160 bus until the EDG recovers it. Control room lighting will be reduced until the "B" EDG re-energizes the "B" ES 4160 bus. EFIC actuates but fails to auto start EFP-1 (Malf). SRO directs BOP to start EFP-1 (CT#1).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC/BOP | <p>Diagnose loss of Startup Transformer</p> <ul style="list-style-type: none"> • Rx Trip • Loss of power to most secondary side equipment • Control room lighting reduced • "B" EDG starts and re-energizes "B" ES buses |
| | SRO | <p>Ensures OAC performing EOP-02 Immediate Actions</p> <p>Enters EOP-02 and re-verifies Immediate action</p> <ul style="list-style-type: none"> • Directs OAC to depress Rx trip push button • Directs OAC to verify group 1-7 fully inserted • Directs OAC to verify NI's indicate the Rx is shutdown • Directs OAC to depress Turbine trip push button • Directs OAC to verify TV's and GV's closed <p>Directs OAC/BOP to scan for symptoms</p> <p>Directs BOP to start EFP-1 (CT#1) if not already running.</p> <p>Should direct BOP to perform AP-770 while SRO and OAC work EOP-02.</p> <p>Directs BOP/OAC to control EFW IAW EOP-13 Rule #3</p> <p>Direct OAC actions for Followup Actions of EOP-02</p> <ul style="list-style-type: none"> • Direct SPO to perform EOP-14 enclosure #1 • Since CRDM position can not be verified commences emergency boration. <ul style="list-style-type: none"> ◆ Open CAV-60 ◆ Start CAP-1A or 1B • Ensure MBV's closed (FWV-29 & 30) • Ensure LLBV's closed (FWV-37 & 38) • Verify EFP-1 operating and Natural Circ setpoint selected • Ensure OTSG levels progressing to setpoint • Verify PZR level ≥ 50" <p>ACTIONS CONTINUED ON NEXT PAGE</p> |

Initiation: Examiner Initiated

Cue: Rx Trip/Control room lighting reduced.

Termination: Plant stabilized on natural circulation with EFP-1 supplying OTSG's.

Event Description: "Loss of Startup Transformer (Malf) - This causes a loss of power to all unit buses and a loss of power to the "B" ES 4160 bus until the EDG recovers it. Control room lighting will be reduced until the "B" EDG re-energizes the "B" ES 4160 bus. EFIC actuates but fails to auto start EFP-1 (Malf). SRO directs BOP to start EFP-1 (CT#1).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | SRO | <ul style="list-style-type: none"> • Verify MSSV's closed • Verify OTSG pressures about 1000 psig • Isolate MSR high pressure bundles <ul style="list-style-type: none"> ◆ Close MSV-29, 30, 31, & 32 • Verify ICS power available • Verify Main Generator breakers 1661 and 1662 open • Shutdown Main Generator <ul style="list-style-type: none"> ◆ Open Exciter breaker ◆ Select voltage regulator to off • Verify IA pressure \geq 90 psig • Verify ES busses energized • Verify ES Bus UV has occurred <ul style="list-style-type: none"> ◆ Must concurrently perform AP-770 if not already in progress by BOP • Verify ES systems have not actuated • Verify Letdown Flow <p>Perform EOP-14 enclosure #4 (Probably will lose EFP-1 before this is reached.)</p> |

Initiation: Examiner Initiated

Cue: Rx Trip/Control room lighting reduced.

Termination: Plant stabilized on natural circulation with EFP-1 supplying OTSG's.

Event Description: "Loss of Startup Transformer (Malf) - This causes a loss of power to all unit buses and a loss of power to the "B" ES 4160 bus until the EDG recovers it. Control room lighting will be reduced until the "B" EDG re-energizes the "B" ES 4160 bus. EFIC actuates but fails to auto start EFP-1 (Malf). SRO directs BOP to start EFP-1 (CT#1).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | OAC | <p>Performs Immediate actions of EOP-02</p> <ul style="list-style-type: none"> • Depress Rx trip push button • Verify group 1-7 fully inserted (Since rod position can not be verified, OAC should open Red handled breakers then re-close) <ul style="list-style-type: none"> ◆ Breaker 3305 opened ◆ Breaker 3312 opened ◆ Breaker 3305 closed ◆ Breaker 3312 closed • Verify NI's indicate the Rx is shutdown • Depress Turbine trip push button • Verify TV's and GV's closed • Announces completion of EOP-02 Immediate actions <p>Verifies EOP-02 Immediate Actions as directed by SRO</p> <p>Perform EOP-02 Followup Actions as directed SRO</p> <ul style="list-style-type: none"> • Direct SPO to perform EOP-14 enclosure #1 • Since CRDM position can not be verified commences emergency boration. <ul style="list-style-type: none"> ◆ Open CAV-60 ◆ Start CAP-1A or 1B • Ensure MBV's closed (FWV-29 & 30) • Ensure LLBV's closed (FWV-37 & 38) • Verify EFP-1 operating and Natural Circ setpoint selected • Ensure OTSG levels progressing to setpoint • Verify PZR level $\geq 50"$ • Verify MSSV's closed • Verify OTSG pressures about 1000 psig • Isolate MSR high pressure bundles <ul style="list-style-type: none"> ◆ Close MSV-29, 30, 31, & 32 <p>ACTIONS CONTINUED NEXT PAGE</p> |

Initiation: Examiner Initiated

Cue: Rx Trip/Control room lighting reduced.

Termination: Plant stabilized on natural circulation with EFP-1 supplying OTSG's.

Event Description: "Loss of Startup Transformer (Malf) - This causes a loss of power to all unit buses and a loss of power to the "B" ES 4160 bus until the EDG recovers it. Control room lighting will be reduced until the "B" EDG re-energizes the "B" ES 4160 bus. EFIC actuates but fails to auto start EFP-1 (Malf). SRO directs BOP to start EFP-1 (CT#1).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | OAC | <ul style="list-style-type: none"> • Verify ICS power available • Verify Main Generator breakers 1661 and 1662 open • Shutdown Main Generator <ul style="list-style-type: none"> ◆ Open Exciter breaker ◆ Select voltage regulator to off • Verify IA pressure \geq 90 psig • Verify ES busses energized • Verify ES Bus UV has occurred <ul style="list-style-type: none"> ◆ Must concurrently perform AP-770 if not already in progress by BOP • Verify ES systems have not actuated • Verify Letdown Flow <ul style="list-style-type: none"> ◆ Perform EOP-14 enclosure #4 (Probably will lose EFP-1 before this is reached.) |

Initiation: Examiner Initiated

Cue: Rx Trip/Control room lighting reduced.

Termination: Plant stabilized on natural circulation with EFP-1 supplying OTSG's.

Event Description: "Loss of Startup Transformer (Malf) - This causes a loss of power to all unit buses and a loss of power to the "B" ES 4160 bus until the EDG recovers it. Control room lighting will be reduced until the "B" EDG re-energizes the "B" ES 4160 bus. EFIC actuates but fails to auto start EFP-1 (Malf). SRO directs BOP to start EFP-1 (CT#1).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | <p>Checks EFW operations</p> <ul style="list-style-type: none"> • Notes EFW actuation • Notes EFP-1 not running • Carry out actions of EOP-13 Rule #3 • May start EFP-1 <p>Notifies SRO of auto start failure of EFP-1</p> <p>Perform AP-770 if directed by SRO</p> <ul style="list-style-type: none"> • Ensure at least 1 ES 4160V bus energized • Verify letdown flow exists <ul style="list-style-type: none"> ◆ Close MUV-49 (Letdown flow path stopped at MU Demins) • Check with SRO to see if Letdown flow path to be restored. (Probably will be told to wait on that.) • Verify at least 1 SWP running. • Verify at least 1 MUP running • Verify at least 1 SW RW pump running <ul style="list-style-type: none"> ◆ Start RWP-2A or 2B (If RWP-2B started, should check "B" EDG loading first. • Verify ES MCC 3AB energized • Verify 480V UV Lockouts not tripped • Verify IA pressure >90 psig • Ensure RB cooling <ul style="list-style-type: none"> ◆ Should leave cooling on SW ◆ Stop AHF-1A if running ◆ Start AHF-1A in slow ◆ Stop AHF-1B if running ◆ Start AHF-1B in slow after checking "B" EDG loading • Verify 2 PZR Htr groups energized • Verify CC Ventilation is running (EFP-1 should be lost about now) |

Initiation: 10 minutes after EFP-1 running

Annunciator Alarms: H-7-4

Termination: EOP-14 actions being taken to put FWP-7 into service.

Event Description: "Ten minutes after EFP-1 started, EFP-1 shaft seizure occurs (Malf) and EFP-1 trips. ANN Alarm H-7-4 "EF PUMP 1 TRIP". SRO enters EOP-04.

| Time | Position | Applicant's Actions or Behavior |
|------|----------|--|
| | BOP/OAC | Diagnoses failure of EFP-1 <ul style="list-style-type: none"> • EFW flow goes to 0. • ANN Alarm H-7-4 "EF PUMP 1 TRIP". • EFP-1 green light lit. Notifies SRO of loss of all EFW |
| | SRO | Transitions to EOP-04 and directs actions <ul style="list-style-type: none"> • Plant personnel notified • PPO directed to perform EOP-14 enclosure #2 • SPO directed to open FWV-222 and FWV-223 • Provides direction for the use of PORV <ul style="list-style-type: none"> ◆ If RCS pressure reaches NDT open PORV and reduce pressure to < NDT limit ◆ If RCS pressure reaches 2400 then and ASCM exist then open PORV and reduce pressure to ≈ 10°F > ASCM • Provides direction for Bypassing EFIC Isolation • At step 3.9 transitions to step 3.56 (Based upon OTSG available and FWP-7 available) |
| | OAC/BOP | Notify plant personnel of EOP-4 entry Directs PPO to perform EOP-14 enclosure #2 Direct SPO to open FWV-222 and FWV-223 |
| | OAC | Monitors RCS pressure and operates PORV IAW SRO directions <ul style="list-style-type: none"> • If RCS pressure reaches NDT open PORV and reduce pressure to < NDT limit • If RCS pressure reaches 2400 then and ASCM exist then open PORV and reduce pressure to ≈ 10°F > ASCM Monitors OTSG pressure and Bypasses EFIC Isolation IAW SRO direction |

Initiation: EOP-04 direction

Cue: EOP-14 enclosure 10 being used.

Termination: FWP-7 supplying the OTSG's.

Event Description: "SRO directs BOP to perform actions of EOP-14 enclosure #10 to place FWP-7 into service. (CT#2)

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | SRO | Directs BOP to perform EOP-14 enclosure #10 to place FWP-7 into service. (CT#2) When FWP-7 available, directs BOP/OAC to feed OTSG's |
| | BOP | Performs EOP-14 enclosure #10 <ul style="list-style-type: none"> • Open breaker 3223 • Select MTDG-1 to "RUN" • Verify "RUN/MTDG-1" light (red) is lit. • Close Bkr 3225 • Verify 4160V REACTOR AUX BUS 3 voltage is stable. • Start FWP-7 Feed OTSG as directed by SRO |
| | | |

Initiation: Examiner Initiated (OPTIONAL)

Annunciator Alarms: H-7-7

Termination: HPI/PORV cooling in progress.

Event Description: (OPTIONAL) When FWP-7 is in service and OTSG are being feed, FWP-7 breaker fails open (MALF). ANN Alarm H-7-7 "FWP-7 TRIP". SRO starts EOP-4 from beginning and directs actions to place the plant on HPI/PORV cooling (CT#3).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | <p>Diagnoses the loss of FWP-7</p> <ul style="list-style-type: none"> • ANN Alarm H-7-7 "FWP-7 TRIP". • Aux FW Flow goes to 0 • FWP-7 amp meter indicates 0. • FWP-7 green light on <p>Notifies SRO of loss of FWP-7, loss of all feed capability</p> |
| | SRO | <p>Cycles back to the beginning of EOP-04 and provides direction to establish HPI/PORV cooling (CT#3).</p> <p>Works through the first 8 steps again, but at step 3.9 should continue to step 3.10 (Loss of secondary cooling capability).</p> <ul style="list-style-type: none"> • Direct BOP to establish full HPI <ul style="list-style-type: none"> ◆ Open MUV-73 ◆ Verify MUV-58 open ◆ Start MUP-1C with its required cooling <ul style="list-style-type: none"> ◇ RWP-3B ◇ DCP-1B ◇ MUP-1C ◆ Verify MUP-1B running ◆ Open MUV-23, 24, 25, & 26 ◆ Close MUV-27 ◆ Close MUV-49 • Directs OAC to ensure RCV-11 open • Directs OAC to open PORV (RCV-10) • Directs OAC to shutdown running RCP when ASCM lost |
| | OAC | <p>Operates PORV IAW direction given be SRO.</p> <ul style="list-style-type: none"> • At 2400# open PORV • Close PORV when <ul style="list-style-type: none"> • If ASCM exist, then 10° > adequate SCM • If ASCM does not exist, then 1600# |

Initiation: Examiner Initiated (OPTIONAL)

Annunciator Alarms: P-2-3

Termination: HPI/PORV cooling in progress.

Event Description: (OPTIONAL) When FWP-7 is in service and OTSG are being feed, MTGT-1 fails due to a fuel supply problem (MALF). ANN Alarm P-2-3 "4 KV RX AUX BUS DEAD". SRO starts EOP-4 from beginning and directs actions to place the plant on HPI/PORV cooling (CT#3).

| Time | Position | Applicant's Actions or Behavior |
|------|----------|---|
| | BOP | Establishes full HPI (CT#3) <ul style="list-style-type: none"> • Open MUV-73 • Verify MUV-58 open • Start MUP-1C with its required cooling <ul style="list-style-type: none"> ◆ RWP-3B ◆ DCP-1B ◆ MUP-1C • Verify MUP-1B running • Open MUV-23, 24, 25, & 26 • Close MUV-27 • Close MUV-49 |
| | OAC | Open PORV IAW SRO direction <ul style="list-style-type: none"> • Full HPI then open PORV and leave it open (CT#3) |
| | SRO | Classify the emergency IAW EM-202 once simulator is frozen. |

Examination Setup/Execution
Scenario 1

Scenario Setup

1. [] Initialize the simulator to 75% power and UNFREEZE the simulator.
2. [] Shutdown RCP-1C and perform the following:
 - [] Select RC-5B-MS2 to TT3-Y position
 - [] Insure SASS switch RC-3-HS selected to "RPS B" position
 - [] Allow the plant to stabilize
2. [] In the "NRCEXAM" directory of LESSON PLAN, start lesson plan # 3
3. [] Trigger Lesson Plan Setup Step
4. Perform the following actions.
 - [] Place WTP-6B in Pull-To-Lock
 - [] Start SWP-1A and Shutdown SWP-1C
 - [] Open Output Breaker 1661
 - [] Open MOS 1661N
 - [] Open MOS 1661S
 - [] Place RCP-1C in Pull-To-Lock
5. Place the following Red Tags on the main control panel:
 - [] ASV-5
 - [] ASV-204
 - [] MSV-55
 - [] MSV-56
 - [] WTP-6B
 - [] BKR 1661
 - [] MOS 1661N
 - [] MOS 1661S
 - [] MUP-1A
 - [] RCP-1C
6. Ensure clean copies of the following "consumable" procedures are in the control room procedure books.
 - [] EOP-02
 - [] EOP-04
 - [] AP-510
 - [] AP-545
 - [] OP-507
7. [] Advance all MCB recorders and remove line printer printouts and ensure ON-LINE.
8. [] Ensure all grease pencil marks on indicators and recorders are removed.
9. [] Ensure Batch Controller is Reset.
10. [] Ensure SPDS screens are Reset.
11. [] Review Turnover Sheet and ensure the simulator setup agrees with Turnover.
12. [] FREEZE the simulator and notify the lead examiner that simulator is ready to begin.

Scenario Execute

- 1 When notified by the lead examiner, UNFREEZE the simulator.
- 2 CDP-1B CONTROLLER DEMAND FAILS TO 0
When notified by the lead examiner, TRIGGER Lesson Plan Step #1 ("B" CDP Demand Fails To 0)
 - 2.1 When TBO sent to check out CDP-1B, wait 3 minutes then report no apparent problems.
 - 2.2 Take Demins off as necessary during the power reduction to 60%.
- 3 "B" RPS PRESSURE FAILS HIGH / SPRAY VALVE FAILURE
When notified by the lead examiner, TRIGGER Lesson Plan Step #2 ("B" RPS Press Fail, Spray Valve Fail)
 - 3.1 When PPO/CNO sent to check EFIC channels not tripped, wait two (2) minutes then report via telephone that no EFIC channels are Bypassed.
- 4 FWP-2A OIL SYSTEM FAILURE
When notified by the lead examiner, TRIGGER Lesson Plan Step #3 ("A" MFWP Oil Sys Failure/Pump Trip)
 - 4.1 This failure clogs the filter enough and oil system trouble alarm.
 - 4.2 3 minutes later the auto start of backup AC oil pump occurs.
 - 4.3 45 seconds after the backup AC oil pump starts the "A" MFWP will trip on low oil pressure
- 5 ICS NEUTRON ERROR FAILS TO +9
When notified by the lead examiner, TRIGGER Lesson Plan Step #4 (ICS Neutron Error Failure +9)
- 6 STARTUP TRANSFORM FAULT, LOSS OF STARTUP and BEST TRANSFORMERS
When notified by the lead examiner, TRIGGER Lesson Plan Step #5 (Loss of S/U Transformer, EFP-1 Fails To Auto Start)
 - 6.1 When TBO directed to perform EOP-14 Enclosure 1, TRIGGER Lesson Plan Step #10. These action will take 23 minutes to be completed. Report them completed after this time period.
 - 6.2 PPO will report "A" EDG & EFP-1 properly if control room calls.
- 7 EFP-1 SHAFT SEIZURE 10 MINUTES AFTER STARTING
10 minutes after EFP-1 is started, its shaft will seize up.
 - 7.1 If called as PPO to check it out, wait 2 minutes then report pump not running, hot wiring smell in area.

- 7.2 When PPO directed to perform EOP-14 Enclosure #2, TRIGGER Lesson Plan Step #11. These actions will take 15 minutes to perform. About 10 minutes after triggering this step, call control room as PPO and request which H₂ analyzer to put in service and which sample point.
- 7.3 When SPO directed to open FWV-222 and 223, TRIGGER Lesson Plan Step #9. Wait about 3 minutes then report FWV-222 and 223 open

8 LOSS OF POWER FOR FWP-7

If notified by the lead examiner, TRIGGER Lesson Plan Step #7 (FWP-7 Failure, Loss Of All FW, PORV/HPI Cooling)

EXAM N-3
TURNOVER

- A. Initial conditions:
1. Time in core life - 247 EFPD
 2. Rx power and power history - 75% for 4 days
 3. Boron concentration - 1088 PPMB
 4. Xenon - Equilibrium
 5. RCS Activity - Fuel 0.0005 uCi/ml
- B. Tech. Spec. action requirement(s) in effect: 3.7.5(D) EFP-2 red tagged to mechanical maintenance for governor replacement. 6 hours into 72 hour action statement. EFP-2 is scheduled to be released for post maintenance testing in 4 hours.
- C. Clearances in effect:
1. EFP-2 for governor replacement
 2. WTP-6B (Demin Water Transfer Pump) for motor/pump realignment
 3. MUP-1A to electrical maintenance to replace control power fuses. MUP-1A will be returned to service in two hours.
 4. Breaker 1661, MOS 1661S, and MOS 1661N to Dispatcher. Breaker 1661 tripped open on previous shift (cause unknown). Line crew in 500 KV switchyard trouble shooting the breaker.
 5. RCP-1C due to ground fault
- D. Significant problems/abnormalities:
1. SWP-1A is running while engineering performs an analysis of anomalous vibration reading taken during last SP. Vibrations were within allowable limits but had increased from previous SP.
 2. RCP-1C tripped 4 days ago. Electrical maintenance has determined that RCP-1C has a ground fault in its stator.
 3. Severe thunderstorms and extremely high winds expected over the next 24 hours.
- E. Evolution's/maintenance for the on-coming shift:
1. Perform post maintenance test of EFP-1 and MUP-1A when released from maintenance.
 2. Place the "B" Makeup Demin (MUDM-1B) and remove MUDM-1A from service. MUDM-1B was in service two hours ago and is at the proper boron concentration.
- F. Units 1 and 2 status: On-Line
- G. Units 4 and 5 status: On-Line

**EXAM N-3
TURNOVER**

H. SSOD - Instruct the RO's to walk down the main control board and provide you with the following data:

1. RCS Average Temperature _____
2. RCS Pressure _____
3. Pressurizer Level _____
4. Make-up Tank Level _____
5. Turbine Load _____
6. Turbine Reference _____

NOTE: Should need arise, full implementation of the emergency plan is not required during this exam. However, SRO should be prepared to address possible Emergency Plan involvement following the exam.

DISTRIBUTION CODE
A070

PWR RO Examination Outline Worksheet

Revision 1

| Based on NUREG-1021 Form ES-401-4 Pg 30 of 39 Interim Rev.8, January 1997 | | | | | | | | | | | | | |
|--|--------------------|---------------------|------|------|------|----|----|----|----|----|----|---|-------------|
| | | K/A Category Points | | | | | | | | | | | |
| Tier | Group | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | Point Total |
| Tier 1 Plant Evolutions | 1 | 2 | 2 | 5 | | | | 3 | 1 | | | 3 | 16 |
| | 2 | 3 | 3 | 4 | | | | 4 | 1 | | | 2 | 17 |
| | 3 | 1 | 1 | 0 | | | | 1 | 0 | | | 0 | 3 |
| | Tier Totals | 6 | 6 | 9 | | | | 8 | 2 | | | 5 | 36 |
| Tier 2 Plant Systems | 1 | 2 | 1 | 1 | 3 | 1 | 2 | 1 | 2 | 4 | 4 | 2 | 23 |
| | 2 | 2 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 1 | 20 |
| | 3 | 1 | 0 | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 8 |
| | Tier Totals | 5 | 2 | 5 | 7 | 2 | 3 | 5 | 4 | 7 | 7 | 4 | 51 |
| Tier 3 Generic | | Cat1 | Cat2 | Cat3 | Cat4 | | | | | | | | 13 |
| | | 3 | 3 | 2 | 5 | | | | | | | | |

| | | | | | | | | | | | |
|---------------|----|---|----|---|---|---|----|---|---|---|---|
| K/A/G/ Totals | 11 | 8 | 14 | 7 | 2 | 3 | 13 | 6 | 7 | 7 | 9 |
|---------------|----|---|----|---|---|---|----|---|---|---|---|

PWR RO Examination Outline - Revision 1
Emergency and Abnormal Plant Evolutions - Tier1/Group1

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|---|------------|--------|
| 000005 Inoperable/Stuck Control Rod / I | | | | | | | | | |
| 000015/17 RCP Malfunctions / IV | | | 1 | | | | AK3.03 Knowledge of the reasons for the following responses as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow): Sequence of events for manually tripping reactor and RCP as a result of an RCP malfunction | 3.7 | |
| E09 Natural Circ. / IV | 1 | | | | | 1 | EK1.2 Knowledge of the operational implications of the following concepts as they apply to the (Natural Circulation Cooldown): Normal, abnormal and emergency operating procedures associated with (Natural Circulation Cooldown). G2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. | 3.7 3.9 | |
| 000024 Emergency Boration / I | | | 1 | | | | * AK3.02 Knowledge of the reasons for the following responses as they apply to the Emergency Boration: Actions contained in EOP for emergency boration | 4.2 | |
| 000026 Loss of Component Cooling Water / VIII | | | | | | 1 | G2.1.30 Ability to locate and operate components, including local controls. | 3.9 | |
| 000027 Pressurizer Pressure Control System Malfunction / III | | | 1 | | | | AK3.02 Knowledge of the reasons for the following responses as they apply to the Pressurizer Pressure Control Malfunctions: Verification of alternate transmitter and/or plant computer prior to shifting flow chart transmitters | 2.9 | |
| 000040 (E05) Steam Line Rupture (Excessive Heat Transfer) / IV | | 1 | | | | | E05-EK2.1 Knowledge of the interrelations between the (Excessive Heat Transfer) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. | 3.8 | |

PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|---|----------------|--------|
| 000051 Loss of Condenser Vacuum / IV | | | | | | | | | |
| 000055 Station Blackout / VI | | | 1 | | 1 | | EK3.02 Knowledge of the reasons for the following responses as they apply to the Station Blackout: Actions contained in EOP for loss of offsite and onsite power EA2.06 Ability to determine or interpret the following as they apply to a Station Blackout: Faults and lockouts that must be cleared prior to re-energizing buses | 4.3 3.7 | |
| 000057 Loss of Vital AC Elec. Inst. Bus / VI | | | | 1 | | | ** AA1.01 Ability to operate and/or monitor the following as they apply to the Loss of Vital AC Instrument Bus: Manual inverter swapping | 3.7 | |
| 000062 Loss of Nuclear Service Water / IV | | | 1 | | | | AK3.03 Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: Guidance actions contained in EOP for the Loss of Nuclear Service Water | 4.0 | |
| 000067 Plant Fire On-site / IX | | | | | | 1 | G2.4.27 Knowledge of fire in the plant procedures. | 3.0 | |
| 000068 (A06) Control Room Evac. / VIII | | | | | | | | | |
| 000069 Loss of CTMT Integrity / V | | | | | | | | | |
| 000074 Inad. Core Cooling / IV | | | | 1 | | | EA1.12 Ability to operate and monitor the following as they apply to an Inadequate Core Cooling: RCS temperature and pressure indicators | 4.1 | |
| E03 Inadequate Subcooling Margin / IV | | 1 | | | | | EK2.2 Knowledge of the interrelations between the (Inadequate Subcooling Margin) and the following: Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. | 4.3 | |
| 000076 High Reactor Coolant Activity / IX | | | | 1 | | | AA1.04 Ability to operate and/or monitor the following as they apply to High Reactor Coolant Activity: Failed fuel monitoring equipment | 3.2 | |

PWR RO Examination Outline
Emergency and Abnormal Plant Evolutions - Tier1/Group1 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|----------------------------------|----|----|----|----|----|---|---|------|--------|
| A02&A03 Loss of NNI-X/Y / VII | 1 | | | | | | AK1.3 Knowledge of the operational implications of the following concepts as they apply to the (Loss of NNI-X): Annunciators and conditions indicating signals, and remedial actions associated with the (Loss of NNI-X). | 3.8 | |
| K/A Category Totals: | 2 | 2 | 5 | 3 | 1 | 3 | Group Point Total = 16 | | |

* Selected more appropriate and higher importance factor KA subject ** Question written/selected by Melissa Gallian due to my classroom involvement with this subject

PWR RO Examination Outline - Revision 1
Emergency and Abnormal Plant Evolutions - Tier1/Group2

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|---|------|--------|
| 000001 Continuous Rod Withdrawal / I | | | | | 1 | | <i>AA2.03 Ability to determine and interpret the following as they apply to the Continuous rod Withdrawal: Proper actions to be taken if automatic safety functions have not taken place</i> | 4.5 | |
| 000003 Dropped Control Rod / I | | | 1 | | | | <i>AK3.04 Knowledge of the reasons for the following responses as they apply to the Dropped Control Rod: Actions contained in EOP for dropped rod</i> | 3.8 | |
| 000007 (E02&E10) Reactor Trip - Stabilization - Recovery / I | 1 | | | | | | E02-EK1.3 Knowledge of the operational implications of the following concepts as they apply to the (Vital System Status Verification): Annunciators and conditions indicating signals, and remedial actions associated with the (Vital System Status Verification). | 3.8 | |
| A01 Plant Runback / I | | | | 1 | | | <i>AA1.1 Ability to operate and/or monitor the following as they apply to the (Plant Runback): Components, and functions of control and safety systems, including instrumentation , signals, interlocks, failure modes, and automatic and manual features.</i> | 3.7 | |
| A04 Turbine Trip / IV | | | | | | | | | |
| 000008 Pressurizer Vapor Space Accident / III | | | | | | | | | |
| 000009 Small Break LOCA / III | | | | | | 1 | G2.4.47 Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material. | 3.4 | |

PWR RO Examination Outline
Emergency and Abnormal Plant Evolutions - Tier1/Group2 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|---|------------|--------|
| 000011 Large Break LOCA / III | 1 | 1 | | | | | EK1.01 Knowledge of the operational implications of the following concepts as they apply to the Large Break LOCA: Natural circulation and cooling, including reflux boiling EK2.02 Knowledge of the interrelations between the and the following Large Break LOCA: Pumps | 2.6 | |
| E08 LOCA Cooldown/Depress. / IV | | 1 | | | | | EK2.1 Knowledge of the interrelations between the (LOCA Cooldown) and the following: Components, and functions of control and safety systems, including instrumentation, signals interlocks, failure modes, and automatic and manual features. | 3.7 | |
| 000022 Loss of Reactor Coolant Makeup / II | | | | | | | | | |
| 000025 Loss of RHR System / IV | | 1 | | | | 1 | AK2.01 Knowledge of the interrelations between the Loss of residual Heat Removal System and the following: RHR heat exchangers G2.1.20 Ability to execute procedure steps. | 2.9 4.3 | |
| 000029 Anticipated Transient w/o Scram / I | | | 1 | | | | * EK3.01 Knowledge of the reasons for the following responses as they apply to the ATWS: Verifying a reactor trip; methods | 4.2 | |
| 000032 Loss of Source Range NI / VII | | | | | | | | | |
| 000033 Loss of Intermediate Range NI / VII | | | | | | | | | |
| 000037 Steam Generator Tube Leak / III | | | | | | | | | |
| 000038 Steam Generator Tube Rupture / III | | | 1 | | | | ** EK3.06 Knowledge of the reasons for the following responses as they apply to the SGTR: Actions contained in EOP for RCS water inventory balance, S/G tube rupture, and plant shutdown procedures | 4.2 | |
| 000054 Loss of Main Feedwater / IV | | | 1 | | | | AK3.03 Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): Manual control of AFW/EFW flow control valves | 3.8 | |

PWR RO Examination Outline
Emergency and Abnormal Plant Evolutions - Tier1/Group2 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|---|----------|----------|----------|----------|----------|----------|---|-------------------------------|--------|
| E04 Inadequate Heat Transfer - Loss of Secondary Heat Sink / IV | 1 | | | | | | EK1.3 Knowledge of the operational implications of the following concepts as they apply to the (Inadequate Heat Transfer): Annunciators and conditions indicating signals, and remedial actions associated with the (Inadequate Heat Transfer). | 4.0 | |
| 000058 Loss of DC Power / VI | | | | 1 | | | ***AA1.03 Ability to operate and/or monitor the following as they apply to the Loss of DC Power: Vital and battery bus components | 3.1 | |
| 000059 Accidental Liquid Radwaste Rel. / IX | | | | | | | | | |
| 000060 Accidental Gaseous Radwaste Rel. / IX | | | | 1 | | | AA1.02 Ability to operate and/or monitor the following as they apply to the Accidental Gaseous Radwaste: Ventilation system | 2.9 | |
| 000061 ARM System Alarms / VII | | | | 1 | | | **** AA1.01 Ability to operate and/or monitor the following as they apply to the Area Radiation Monitoring (ARM) System Alarms: Automatic actuation | 3.6 | |
| K/A Category Totals: | 3 | 3 | 4 | 4 | 1 | 2 | | Group Point Total = 17 | |

* Selected more appropriate and higher importance factor KA ** No random generated KA rated greater than 2.5 *** Question written/selected by Melissa Gallian due to my classroom involvement with the subject. **** Only one random generated KA available and is of low, if any, value

PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group3

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|--|------------------------------|--------|
| 000028 Pressurizer Level Malfunction / II | | | | | | | | | |
| 000036 (A08) Fuel Handling Accident / VIII | 1 | | | | | | 36-AK1.03 Knowledge of the operational implications of the following concepts as they apply to Fuel Handling Incidents: Indications of approaching criticality | 4.0 | |
| 000056 Loss of Off-site Power / VI | | | | | | | | | |
| 000065 Loss of Instrument Air / VIII | | | | 1 | | | AA1.02 Ability to operate and/or monitor the following as they apply to the Loss of Instrument Air: Components served by instrument air to minimize drain on system | 2.6 | |
| E13&E14 EOP Rules and Enclosures | | | | | | | | | |
| A05 Emergency Diesel Actuation / VI | | 1 | | | | | AK2.1 Knowledge of the interrelations between the (Emergency Diesel Actuation) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. | 4.0 | |
| A07 Flooding / VIII | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| K/A Category Totals: | 1 | 1 | 0 | 1 | 0 | 0 | | Group Point Total = 3 | |

PWR RO Examination Outline - Revision 1

Plant Systems - Tier2/Group1

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|--|----|----|----|----|----|----|----|----|----|----|---|--|------|--------|
| 001 Control Rod Drive | | | | | | | | | 1 | | 1 | A3.05 Ability to monitor automatic operation of the CRDS, including: Individual vs. group rod position | 3.5 | |
| | | | | | | | | | | | | G2.1.32 Ability to explain and apply all system limits and precautions. | 3.4 | |
| 003 Reactor Coolant Pump | | | | | | 1 | | | | | | K6.14 Knowledge of the effect of a loss or malfunction on the following will have on the RCPs: Starting requirements | 2.6 | |
| | | | | | | | | | | | | A4.06 Ability to manually operate and/or monitor in the control room: RCP parameters | 2.9 | |
| 004 Chemical and Volume Control | 1 | | | | | | 1 | | | | | K1.15 Knowledge of the physical connections and/or cause-effect relationships between the CVCS and the following systems: ECCS | 3.8 | |
| | | | | | | | | | | | | A1.06 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CVCS controls including: VCT level | 3.0 | |
| 013 Engineered Safety Features Actuation | | | | | | | | | | | | K2.01 Knowledge of bus power supplies to the following: ESFAS/safeguards equipment | 3.6 | |
| | | 1 | | | | | | 1 | | | 1 | A2.06 Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based on those predictions use procedures to correct, control, or mitigate the consequences of those malfunctions or operations; Inadvertent ESFAS actuation | 3.7 | |
| | | | | | | | | | | | | A4.01 Ability to manually operate and/or monitor in the control room: ESFAS-initiated equipment which fails to actuate | 4.5 | |

PWR RO Examination Outline
Plant Systems - Tier2/Group1 - Continued

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points | | | | | | | | | | | |
|-----------------------------------|----|----|----|----|----|----|----|----|----|----|---|---|------|--------|---|---|---|---|---|---|---|---|---|-------------------------------|--|
| 061 Auxiliary/Emergency Feedwater | | | | | | | | | | | | <i>K4.02 Knowledge of the AFW/EFW design feature(s) and/or interlock(s) which provide for the following: AFW/EFW automatic start upon loss of MFW pump, S/G level, blackout, or safety injection</i> | 4.5 | | | | | | | | | | | | |
| | | | | 1 | 1 | | | | 1 | | | K5.01 Knowledge of the operational implications of the following concepts as they apply to the AFW/EFW: Relationship between AFW/EFW flow and RCS heat transfer | 3.6 | | | | | | | | | | | | |
| | | | | | | | | | | | | <i>A3.04 Ability to monitor automatic operation of the AFW/EFW including: Automatic AFW/EFW isolation</i> | 4.1 | | | | | | | | | | | | |
| 068 Liquid Radwaste | | | | | | 1 | | | | | | * K6.10 Knowledge of the effect of a loss or malfunction on the following will have on the Liquid Radwaste system: Radiation Monitors | 2.5 | | | | | | | | | | | | |
| 071 Waste Gas Disposal | | | | | | | | | 1 | | | A3.03 Ability to monitor automatic operation of the Waste Gas disposal system including: Radiation monitoring system alarms and actuating signals | 3.6 | | | | | | | | | | | | |
| 072 Area Radiation Monitoring | | | | | | | | 1 | | | | A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the ARM system, and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: Detector failure | 2.8 | | | | | | | | | | | | |
| K/A Category Totals: | | | | | | | | | | | | | 2 | 1 | 1 | 3 | 1 | 2 | 1 | 2 | 4 | 4 | 2 | Group Point Total = 23 | |

* No random generated KA rated greater than 2.5

PWR RO Examination Outline - Revision 1

Plant Systems - Tier2/Group2

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|----------------------------------|----|----|----|----|----|----|----|----|----|----|---|---|------|--------|
| 002 Reactor Coolant | | | | | 1 | | | | | | | <i>K5.10 Knowledge of the operational implications of the following concepts as they apply to the RCS: Relationship between reactor power and RCS differential temperature</i> | 3.6 | |
| 006 Emergency Core Cooling | | | | | | | | | | 1 | | A4.07 Ability to manually operate and/or monitor in the control room: ECCS pumps and valves | 4.4 | |
| 010 Pressurizer Pressure Control | | 1 | | | | | | | | | | K2.01 Knowledge of bus power supplies to the following: PZR heaters | 3.0 | |
| 011 Pressurizer Level Control | | | | | | | | 1 | | | | <i>A2.10 Ability to (a) predict the impacts of the following malfunctions or operations on the PZR LCS: and (b) based on those predictions use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Failure of PZR level instrument - high</i> | 3.4 | |
| 012 Reactor Protection | | | | 1 | | 1 | | | | | | <i>K4.01 Knowledge of RPS design feature(s) and/or interlock(s) which provide for the following: Trip logic when one channel OOC or in test</i> | 3.7 | |
| | | | | | | | | | | | | <i>K6.06 Knowledge of the effect of a loss or malfunction of the following will have on the RPS: Sensors and detectors</i> | 2.7 | |
| 014 Rod Position Indication | | | | | | | 1 | | | | | A1.04 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RPIS controls, including: Axial and radial power distribution | 3.5 | |
| 016 Non-nuclear Instrumentation | | | 1 | | | | | | | | 1 | K3.03 Knowledge of the effect that a loss or malfunction of the NNIS will have on the following: SDS (Steam dump system) | 3.0 | |
| | | | | | | | | | | | | <i>A3.01 Ability to monitor automatic operation of the NNIS including: Automatic selection of NNIS inputs to control systems</i> | 2.9 | |

PWR RO Examination Outline
Plant Systems - Tier2/Group2 - Continued

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|-----------------------|----|----|----|----|----|----|----|----|----|----|---|---|------------------------|--------|
| 075 Circulating Water | | | | | | | | 1 | | | | *A2.03 Ability to (a) predict the impacts of the following malfunctions or operations on the circulating water system; and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: Safety features and relationship between condenser vacuum, turbine trip and steam dumps | 2.5 | |
| 079 Station Air | | | | | | | | | | | | | | |
| 086 Fire Protection | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| K/A Category Totals: | 2 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 1 | | Group Point Total = 20 | |

* No random generated KA rated greater than 2.5 ** Question written/selected by Melissa Gallian due to my classroom involvement with the subject.

PWR RO Examination Outline

Plant Systems - Tier2/Group3

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points | | | | | | | | | | | |
|---|----|----|----|----|----|----|----|----|----|----|---|--|------|--------|---|---|---|---|---|---|---|---|---|-----------------------|--|
| 005 Residual Heat Removal | | | | | | | 1 | | | | | A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RHRS controls including: Heatup/cooldown rates | 3.5 | | | | | | | | | | | | |
| 007 Pressurizer Relief/Quench Tank | | | | | | | | | | | 1 | G2.4.46 Ability to verify that alarms are consistent with the plant conditions. | 3.5 | | | | | | | | | | | | |
| 008 Component Cooling Water | | | 1 | | | | | | | | | K3.01 Knowledge of the effect that a loss or malfunction of the CCWS will have on the following: Loads cooled by CCWS | 3.4 | | | | | | | | | | | | |
| 027 Containment Iodine Removal | | | | | | | | | | | | | | | | | | | | | | | | | |
| 028 Hydrogen Recombiner and Purge Control | | | | | | | | | | | | | | | | | | | | | | | | | |
| 034 Fuel Handling Equipment | 1 | | | | | | | | | | | K1.02 Knowledge of the physical connections and/or cause-effect relationships between the Fuel Handling System and the following systems: RHRS | 2.5 | | | | | | | | | | | | |
| 041 Steam Dump/Turbine Bypass Control | | | | | | | | | | | | | | | | | | | | | | | | | |
| 045 Main Turbine Generator | | | | | | | 1 | | | | | A1.05 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the MT/G system controls including: Expected response of primary plant parameters (temperature and pressure) following a T/G trip | 3.8 | | | | | | | | | | | | |
| 076 Service Water | | | | 1 | | | | | | | | K4.02 Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: Automatic start features associated with SWS pump controls | 2.9 | | | | | | | | | | | | |
| 078 Instrument Air | | | | | | | | | | | 1 | A4.01 Ability to manually operate and/or monitor in the control room: Pressure gauges | 3.1 | | | | | | | | | | | | |
| 103 Containment | | | | 1 | | | | | | | | * K4.06 Knowledge of containment system design feature(s) and/or interlock(s) which provide for the following: Containment isolation system | 3.1 | | | | | | | | | | | | |
| K/A Category Totals: | | | | | | | | | | | | | 1 | 0 | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | Group Point Total = 8 | |

* No random generated KA rated greater than 2.5

PWR RO Examination Outline - Revision 1

Generic Knowledges and Abilities

| Category | KA # | K/A Topic | Imp. | Points |
|------------------------------------|--------------|---|------|-----------|
| Conduct of Operations | 2.1.2 | Knowledge of operator responsibilities during all modes of plant operation. | 4.0 | 1 |
| | 2.1.22 | <i>Ability to determine Mode of Operation.</i> | 2.8 | 1 |
| | 2.1.24 | Ability to obtain and interpret station electrical and mechanical drawings. | 2.8 | 1 |
| | Total Points | | | |
| Equipment Control | 2.2.2 | Ability to manipulate the console controls as required to operate the facility between shutdown and designated power levels. | 3.5 | 1 |
| | 2.2.12 | Knowledge of surveillance procedures. | 3.4 | 1 |
| | 2.2.30 | <i>Knowledge of RO duties in the control room during fuel handling such as alarms from fuel handling area, communication with fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentation.</i> | 3.5 | 1 |
| | Total Points | | | |
| Radiation Control | 2.3.9 | <i>Knowledge of the process for performing a containment purge.</i> | 2.5 | 1 |
| | 2.3.11 | Ability to control radiation releases. | 3.2 | 1 |
| | Total Points | | | |
| Emergency Procedures / Plan | 2.4.1 | Knowledge of EOP entry conditions and immediate action steps. | 4.6 | 1 |
| | 2.4.2 | Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. | 4.1 | 1 |
| | 2.4.32 | Knowledge of operator response to loss of all annunciators. | 3.5 | 1 |
| | 2.4.35 | Knowledge of local auxiliary operator tasks during emergency operations including system geography and system implications. | 3.5 | 1 |
| | 2.4.45 | Ability to prioritize and interpret the significance of each annunciator or alarm. | 3.6 | 1 |
| | Total Points | | | |
| TIER 3 Category Totals: | | | | 13 |

PWR SRO Examination Outline Worksheet

Revision 1

Based on NUREG-1021

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| | | K/A Category Points | | | | | | | | | | | |
|-------------------------------|--------------------|---------------------|------|------|------|----|----|----|----|----|----|---|-------------|
| Tier | Group | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | Point Total |
| Tier 1 Plant Evolutions | 1 | 3 | 3 | 6 | | | | 3 | 6 | | | 3 | 24 |
| | 2 | 2 | 2 | 3 | | | | 4 | 3 | | | 2 | 16 |
| | 3 | 1 | 1 | 0 | | | | 0 | 1 | | | 0 | 3 |
| | Tier Totals | 6 | 6 | 9 | | | | 7 | 10 | | | 5 | 43 |
| Tier 2 Plant Systems | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 19 |
| | 2 | 1 | 1 | 2 | 3 | 1 | 0 | 1 | 4 | 2 | 1 | 1 | 17 |
| | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 4 |
| | Tier Totals | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 8 | 4 | 4 | 4 | 40 |
| Tier 3 Generic | | Cat1 | Cat2 | Cat3 | Cat4 | | | | | | | | |
| | | 4 | 4 | 3 | 6 | | | | | | | | 17 |

| | | | | | | | | | | | |
|---------------|----|---|----|---|---|---|---|----|---|---|---|
| K/A/G/ Totals | 10 | 8 | 13 | 4 | 2 | 2 | 9 | 18 | 4 | 4 | 9 |
|---------------|----|---|----|---|---|---|---|----|---|---|---|

PWR SRO Examination Outline - Revision 1
Emergency and Abnormal Plant Evolutions - Tier1/Group1

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|---|----|----|----|----|----|---|---|----------------|--------|
| 000001 Continuous Rod Withdrawal / I | | | 1 | | | | AK3.02 Knowledge of the reasons for the following responses as they apply to the Continuous Rod Withdrawal: Tech-Spec limits on rod operability | 4.3 | |
| 000003 Dropped Control Rod / I | | | | | 1 | | AA2.03 Ability to determine and interpret the following as they apply to the Dropped Control Rod: Dropped rod, using in-core/ex-core instrumentation, in-core or loop temperature measurements | 3.8 | |
| 000005 Inoperable/Stuck Control Rod / I | | | | | 1 | | AA2.03 Ability to determine and interpret the following as they apply to the Inoperable/Stuck Control Rod: Required actions if more than one rod is stuck or inoperable | 4.4 | |
| 000011 Large Break LOCA / III | 1 | 1 | | | | | EK2.02 Knowledge of the interrelations between the and the following Large Break LOCA: Pumps EK1.01 Knowledge of the operational implications of the following concepts as they apply to the Large Break LOCA: Natural Circulation and cooling, including reflux boiling | 2.7 4.4 | |
| 000015/17 RCP Malfunctions / IV | | | 1 | | | | AK3.03 Knowledge of the reasons for the following responses as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow): Sequence of events for manually tripping reactor and RCP as a result of an RCP malfunction | 4.0 | |

PWR SRO Examination Outline
Emergency and Abnormal Plant Evolutions - Tier1/Group1 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|---|------|--------|
| E09 Natural Circ. / IV | 1 | | | | | 1 | EK1.2 Knowledge of the operational implications of the following concepts as they apply to the (Natural Circulation Cooldown): Normal, abnormal and emergency operating procedures associated with (Natural Circulation Cooldown). | 4.0 | |
| | | | | | | | G2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. | 4.0 | |
| 000024 Emergency Boration / I | | | 1 | | | | * AK3.02 Knowledge of the reasons for the following responses as they apply to the Emergency Boration: Actions contained in EOP for emergency boration | 4.4 | |
| 000026 Loss of Component Cooling Water / VIII | | | | | 1 | | AA2.01 Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: Location of a leak in the CCWS | 3.5 | |
| 000029 Anticipated Transient w/o Scram / I | | | 1 | | | | * EK3.01 Knowledge of the reasons for the following responses as they apply to the ATWS: Verifying a reactor trip; methods | 4.5 | |
| 000040 (E05) Steam Line Rupture - Excessive Heat Transfer / IV | | 1 | | | | | E05-EK2.1 Knowledge of the interrelations between the (Excessive Heat Transfer) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. | 4.0 | |
| 000051 Loss of Condenser Vacuum / IV | | | | | 1 | | AA2.02 Ability to determine and interpret the following as they apply to the Loss of Condenser Vacuum: Conditions requiring reactor and/or turbine trip | 4.1 | |

PWR SRO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|--|------|--------|
| 000055 Station Blackout / VI | | | 1 | | 1 | | EK3.02 Knowledge of the reasons for the following responses as they apply to the Station Blackout: Actions contained in EOP for loss of offsite and onsite power | 4.6 | |
| | | | | | | | EA2.06 Ability to determine or interpret the following as they apply to a Station Blackout: Faults and lockouts that must be cleared prior to re-energizing buses | 4.1 | |
| 000057 Loss of Vital AC Elec. Inst. Bus / VI | | | | 1 | | | **AA1.01 Ability to operate and/or monitor the following as they apply to the Loss of Vital AC Instrument Bus: Manual inverter swapping | 3.7 | |
| 000059 Accidental Liquid Radwaste Rel. / IX | | | | | | | | | |
| 000062 Loss of Nuclear Service Water / IV | | | 1 | | | | AK3.03 Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: Guidance actions contained in EOP for the Loss of Nuclear Service Water | 4.2 | |
| 000067 Plant Fire On-site / IX | | | | | | 1 | G2.4.27 Knowledge of fire in the plant procedures. | 3.5 | |
| 000068 (A06) Control Room Evac. / VIII | | | | | 1 | | <i>AA2.07 Ability to determine and interpret the following as they apply to the control Room Evacuation: PZR level</i> | 4.3 | |
| 000069 Loss of CTMT Integrity / V | | | | | | 1 | <i>G2.2.26 Knowledge of refueling administrative requirements.</i> | 3.7 | |
| 000074 Inad. Core Cooling / IV | | | | 1 | | | EA1.12 Ability to operate and monitor the following as they apply to an Inadequate Core Cooling: RCS temperature and pressure indicators | 4.4 | |
| E03 Inadequate Subcooling Margin / IV | | 1 | | | | | EK2.2 Knowledge of the interrelations between the (Inadequate Subcooling Margin) and the following: Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. | 4.3 | |

PWR SRO Examination Outline
Emergency and Abnormal Plant Evolutions - Tier1/Group1 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|---|----|----|----|----|----|---|---|------|--------|
| 000076 High Reactor Coolant Activity / IX | | | | 1 | | | AA1.04 Ability to operate and/or monitor the following as they apply to High Reactor Coolant Activity: Failed fuel monitoring equipment | 3.4 | |
| A02&A03 Loss of NNI-X/Y / VII | 1 | | | | | | A02 AK1.3 Knowledge of the operational implications of the following concepts as they apply to the (Loss of NNI-X): Annunciators and conditions indicating signals, and remedial actions associated with the (Loss of NNI-X). | 3.8 | |
| K/A Category Totals: | 3 | 3 | 6 | 3 | 6 | 3 | Group Point Total = 24 | | |

* Selected more appropriate and higher importance factor KA subject.

** Question written/selected by Melissa Gallian due to my classroom involvement with this

PWR SRO Examination Outline - Revision 1
Emergency and Abnormal Plant Evolutions - Tier1/Group2

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|---|------|--------|
| 000007 (E02&E10) Reactor Trip - Stabilization - Recovery / I | 1 | | | | | | E02-EK1.3 Knowledge of the operational implications of the following concepts as they apply to the (Vital System Status Verification): Annunciators and conditions indicating signals, and remedial actions associated with the (Vital System Status Verification). | 3.8 | |
| A01 Plant Runback / I | | | | | 1 | | AA2.2 Ability to determine and interpret the following as they apply to the (Plant Runback): Adherence to appropriate procedures and operation within the limitations of the facility's license and amendments. | 3.8 | |
| A04 Turbine Trip / IV | | | | | | | | | |
| 000008 Pressurizer Vapor Space Accident / III | | | | | | | | | |
| 000009 Small Break LOCA / III | | | | | | 1 | G2.4.47 Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material. | 3.7 | |
| E08 LOCA Cooldown - Depress. / IV | | 1 | | | | | EK2.1 Knowledge of the interrelations between the (LOCA Cooldown) and the following: Components, and functions of control and safety systems, including instrumentation, signals interlocks, failure modes, and automatic and manual features. | 3.9 | |
| 000022 Loss of Reactor Coolant Makeup / II | | | | | 1 | | AA2.01 Ability to determine and interpret the following as they apply to the Loss of Reactor Coolant Pump Makeup: Whether charging line leak exists | 3.8 | |

PWR SRO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group2 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|---|----|----|----|----|----|---|---|----------------|--------|
| 000025 Loss of RHR System / IV | | 1 | | | | 1 | AK2.01 Knowledge of the interrelations between the Loss of residual Heat Removal System and the following: RHR heat exchangers G2.1.20 Ability to execute procedure steps. | 2.9 4.2 | |
| 000027 Pressurizer Pressure Control System Malfunction / III | | | 1 | | | | AK3.02 Knowledge of the reasons for the following responses as they apply to the Pressurizer Pressure Control Malfunctions: Verification of alternate transmitter and/or plant computer prior to shifting flow chart transmitters | 3.0 | |
| 000032 Loss of Source Range NI / VII | | | | | | 1 | <i>AA2.04 Ability to determine and interpret the following as they apply to the Loss of Source Range Nuclear Instrumentation: Satisfactory source range/intermediate range overlap</i> | 3.5 | |
| 000033 Loss of Intermediate Range NI / VII | | | | | | | | | |
| 000037 Steam Generator Tube Leak / III | | | | | | | | | |
| 000038 Steam Generator Tube Rupture / III | | | 1 | | | | * EK3.06 Knowledge of the reasons for the following responses as they apply to the SGTR: Actions contained in EOP for RCS water inventory balance, S/G tube rupture, and plant shutdown procedures | 4.5 | |
| 000054 Loss of Main Feedwater / IV | | | 1 | | | | AK3.03 Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): Manual control of AFW/EFW flow control valves | 4.1 | |
| E04 Inadequate Heat Transfer - Loss of Secondary Heat Sink / IV | 1 | | | | | | EK1.3 Knowledge of the operational implications of the following concepts as they apply to the (Inadequate Heat Transfer): Annunciators and conditions indicating signals, and remedial actions associated with the (Inadequate Heat Transfer). | 4.0 | |

PWR SRO Examination Outline
Emergency and Abnormal Plant Evolutions - Tier1/Group2 - Continued

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|---|------|--------|
| 000058 Loss of DC Power / VI | | | | 1 | | | **AA1.03 Ability to operate and/or monitor the following as they apply to the Loss of DC Power: Vital and battery bus components | 3.3 | |
| 000060 Accidental Gaseous Radwaste Rel. / IX | | | | 1 | | | AA1.02 Ability to operate and/or monitor the following as they apply to the Accidental Gaseous Radwaste: Ventilation system | 3.1 | |
| 000061 ARM System Alarms / VII | | | | 1 | | | *** AA1.01 Ability to operate and/or monitor the following as they apply to the Area Radiation Monitoring (ARM) System Alarms: Automatic actuation | 3.6 | |
| 000065 Loss of Instrument Air / VIII | | | | 1 | | | AA1.02 Ability to operate and/or monitor the following as they apply to the Loss of Instrument Air: Components served by instrument air to minimize drain on system | 2.8 | |
| K/A Category Totals: | 2 | 2 | 3 | 4 | 3 | 2 | Group Point Total = 16 | | |

* No random generated KA rated greater than 2.5 ** Question written/selected by Melissa Gallian due to my classroom involvement with the subject.

*** Only one random generated KA available and is of low, if any, value

PWR SRO Examination Outline - Revision 1
Emergency and Abnormal Plant Evolutions - Tier1/Group3

| E/APE # / Name / Safety Function | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | Imp. | Points |
|--|----|----|----|----|----|---|--|-----------------------|--------|
| 000028 Pressurizer Level Malfunction / II | | | | | | | | | |
| 000036 (A08) Fuel Handling Accident / VIII | 1 | | | | | | 36-AK1.03 Knowledge of the operational implications of the following concepts as they apply to Fuel Handling Incidents: Indications of approaching criticality | 4.3 | |
| 000056 Loss of Off-site Power / VI | | | | | | | | | |
| E13&E14 EOP Rules and Enclosures | | | | | 1 | | E14-EA2.1 Ability to determine and interpret the following as they apply to the (EOP Enclosures): Facility conditions and selection of appropriate procedures during abnormal and emergency operations. | 4.0 | |
| A05 Emergency Diesel Actuation / VI | | 1 | | | | | AK2.1 Knowledge of the interrelations between the (Emergency Diesel Actuation) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. | 3.8 | |
| A07 Flooding / VIII | | | | | | | | | |
| | | | | | | | | | |
| K/A Category Totals: | 1 | 1 | 0 | 0 | 1 | 0 | | Group Point Total = 3 | |

PWR SRO Examination Outline - Revision 1

Plant Systems - Tier2/Group1

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|--|----|----|----|----|----|----|----|----|----|----|---|---|------|--------|
| 001 Control Rod Drive | | | | | | | | | 1 | | | A3.05 Ability to monitor automatic operation of the CRDS, including: Individual vs. group rod position | 3.5 | |
| 003 Reactor Coolant Pump | | | | | | 1 | | 1 | | | | K6.14 Knowledge of the effect of a loss or malfunction on the following will have on the RCPs: Starting requirements A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the RCPs; and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: Problems with RCP seals | 2.9 | |
| 004 Chemical and Volume Control | 1 | | | | | | | | | | | K1.15 Knowledge of the physical connections and/or cause-effect relationships between the CVCS and the following systems: ECCS | 4.0 | |
| 013 Engineered Safety Features Actuation | | 1 | | | | | | | | 1 | | K2.01 Knowledge of bus power supplies to the following: ESFAS/safeguards equipment A4.01 Ability to manually operate and/or monitor in the control room: ESFAS initiated equipment which fails to actuate | 3.8 | |
| 014 Rod Position Indication | | | | | | | 1 | | | | | A1.04 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RPIS controls, including: Axial and radial power distribution | 3.8 | |
| 015 Nuclear Instrumentation | | | | | | | | | | 1 | 1 | A4.02 Ability to manually operate and/or monitor in the control room: NIS indicators G2.1.12 Ability to apply technical specifications for a system. | 3.9 | |
| 017 In-core Temperature Monitor | | | | 1 | | | | | | | | K4.01 Knowledge of the ITM system design feature(s) and/or interlock(s) which provide for the following: Input to subcooling monitors | 3.7 | |

PWR SRO Examination Outline
Plant Systems - Tier2/Group1 - Continued

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|-----------------------------------|----|----|----|----|----|----|----|----|----|----|---|--|------|--------|
| 022 Containment Cooling | | | | | | | | 1 | | | | A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the CCS system, and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: Loss of service water | 3.2 | |
| 026 Containment Spray | 1 | | | | | | | | | | | K1.02 Knowledge of the physical connections and/or cause-effect relationships between the CSS and the following systems: Cooling water | 4.1 | |
| 056 Condensate | 1 | | | | | | | | | | | * K1.03 Knowledge of the physical connections and/or cause-effect relationships between the Condensate System and the following systems: MFW | 2.6 | |
| 059 Main Feedwater | | | | | | | | | | | 1 | G2.4.49 Ability to perform without reference to procedures those actions that require immediate operation of system components and controls. | 4.0 | |
| 061 Auxiliary/Emergency Feedwater | | | | | 1 | | | | | | | K5.01 Knowledge of the operational implications of the following concepts as they apply to the AFW/EFW: Relationship between AFW/EFW flow and RCS heat transfer | 3.9 | |
| 063 DC Electrical Distribution | | | 1 | | | | | | | | | K3.02 Knowledge of the effect that a loss or malfunction of the DC electrical system will have on the following: Components using DC control power | 3.7 | |
| 068 Liquid Radwaste | | | | | | 1 | | | | | | * K6.10 Knowledge of the effect of a loss or malfunction on the following will have on the Liquid Radwaste system: Radiation Monitors | 2.9 | |
| 071 Waste Gas Disposal | | | | | | | | | 1 | | | A3.03 Ability to monitor automatic operation of the Waste Gas disposal system including: Radiation monitoring system alarms and actuating signals | 3.8 | |

PWR SRO Examination Outline
Plant Systems - Tier2/Group1 - Continued

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|-------------------------------|----|----|----|----|----|----|----|----|----|----|---|---|------|--------|
| 072 Area Radiation Monitoring | | | | | | | | 1 | | | | A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the ARM system, and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: Detector failure | 2.9 | |
| K/A Category Totals: | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | Group Point Total = 19 | | |

* No random generated KA rated greater than 2.5

PWR SRO Examination Outline - Revision 1

Plant Systems - Tier2/Group2

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|---|----|----|----|----|----|----|----|----|----|----|---|---|------|--------|
| 002 Reactor Coolant | | | | | 1 | | | 1 | | | | <p><i>K5.08 Knowledge of the operational implications of the following concepts as they apply to the RCS: Why PZR level should be kept within the programmed band.</i></p> <p><i>A2.03 Ability to (a) predict the impacts of the following malfunctions or operations on the RCS: and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of coolant inventory</i></p> | 3.9 | |
| 006 Emergency Core Cooling | | | | | | | | | | | 1 | <p><i>A4.07 Ability to manually operate and/or monitor in the control room: ECCS pumps and valves</i></p> | 4.4 | |
| 010 Pressurizer Pressure Control | | 1 | | | | | | | | | | <p><i>K2.01 Knowledge of bus power supplies to the following: PZR heaters</i></p> | 3.4 | |
| 011 Pressurizer Level Control | | | | | | | | | | | | | | |
| 012 Reactor Protection | | | | | | | | | 1 | | | <p><i>A3.01 Ability to monitor automatic operation of the RPS, including: Individual channel</i></p> | 3.9 | |
| 016 Non-nuclear Instrumentation | | | 1 | | | | | | | | | <p><i>K3.03 Knowledge of the effect that a loss or malfunction of the NNIS will have on the following: SDS (Steam dump system)</i></p> | 3.1 | |
| 027 Containment Iodine Removal | | | | | | | | | | | | | | |
| 028 Hydrogen Recombiner and Purge Control | | | | | | | | | | | | | | |
| 029 Containment Purge | | | | | | | | | | | | | | |
| 033 Spent Fuel Pool Cooling | | | | | | | 1 | | | | | <p><i>A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with the Spent Fuel Pool Cooling System operating the controls including: Spent fuel water level</i></p> | 3.3 | |

PWR SRO Examination Outline
Plant Systems - Tier2/Group2 - Continued

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points |
|-----------------------|----|----|----|----|----|----|----|----|----|----|---|---|------------------------|--------|
| 075 Circulating Water | | | | | | | | 1 | | | | ** A2.03 Ability to (a) predict the impacts of the following malfunctions or operations on the circulating water system; and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: Safety features and relationship between condenser vacuum, turbine trip and steam dumps | 2.7 | |
| 079 Station Air | | | | | | | | | | | | | | |
| 086 Fire Protection | | | | | | | | | | | | | | |
| 103 Containment | | | | 1 | | | | | | | | ** K4.06 Knowledge of containment system design feature(s) and/or interlock(s) which provide for the following: Containment isolation system | 3.7 | |
| K/A Category Totals: | 1 | 1 | 2 | 3 | 1 | 0 | 1 | 4 | 2 | 1 | 1 | | Group Point Total = 17 | |

* Question written/selected by Melissa Gallian due to my classroom involvement with the subject. ** No random generated KA rated greater than 2.5

PWR SRO Examination Outline - Revision 1

Plant Systems - Tier2/Group3

| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic | Imp. | Points | | | | | | | | | | | |
|---------------------------------------|----|----|----|----|----|----|----|----|----|----|---|---|------|--------|---|---|---|---|---|---|---|---|---|------------------------------|--|
| 005 Residual Heat Removal | | | | | | | | 1 | | | | A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the RHRS; and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: Pressure transient protection during cold shutdown | 3.7 | | | | | | | | | | | | |
| 007 Pressurizer Relief/Quench Tank | | | | | | | | | | | 1 | G2.4.46 Ability to verify that alarms are consistent with the plant conditions. | 3.6 | | | | | | | | | | | | |
| 008 Component Cooling Water | | | 1 | | | | | | | | | K3.01 Knowledge of the effect that a loss or malfunction of the CCWS will have on the following: Loads cooled by CCWS | 3.5 | | | | | | | | | | | | |
| 041 Steam Dump/Turbine Bypass Control | | | | | | | | | | | | | | | | | | | | | | | | | |
| 045 Main Turbine Generator | | | | | | | | | | | | | | | | | | | | | | | | | |
| 076 Service Water | | | | | | | | | | | | | | | | | | | | | | | | | |
| 078 Instrument Air | | | | | | | | | | | 1 | A4.01 Ability to manually operate and/or monitor in the control room: Pressure gauges | 3.1 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| K/A Category Totals: | | | | | | | | | | | | | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | Group Point Total = 4 | |

PWR SRO Examination Outline - Revision 1

Generic Knowledges and Abilities

| Category | KA # | K/A Topic | Imp. | Points |
|------------------------------------|--------------|--|------|-----------|
| Conduct of Operations | 2.1.1 | Knowledge of conduct of operations requirements. | 3.8 | 1 |
| | 2.1.2 | Knowledge of operator responsibilities during all modes of plant operation. | 4.0 | 1 |
| | 2.1.4 | Knowledge of shift staffing requirements. | 3.4 | 1 |
| | 2.1.11 | Knowledge of less than one hour technical specification action statements for systems. | 3.8 | 1 |
| | Total Points | | | |
| Equipment Control | 2.2.2 | Ability to manipulate the console controls as required to operate the facility between shutdown and designated power levels. | 3.5 | 1 |
| | 2.2.12 | Knowledge of surveillance procedures. | 3.4 | 1 |
| | 2.2.22 | Knowledge of limiting conditions for operations and safety limits. | 4.1 | 1 |
| | 2.2.29 | Knowledge of SRO fuel handling responsibilities. | 3.8 | 1 |
| | Total Points | | | |
| Radiation Control | 2.3.4 | Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized. | 3.1 | 1 |
| | 2.3.6 | Knowledge of the requirements for reviewing and approving release permits. | 3.1 | 1 |
| | 2.3.11 | Ability to control radiation releases. | 3.2 | 1 |
| | Total Points | | | |
| Emergency Procedures / Plan | 2.4.1 | Knowledge of EOP entry conditions and immediate action steps. | 4.6 | 1 |
| | 2.4.2 | Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. | 4.1 | 1 |
| | 2.4.32 | Knowledge of operator response to loss of all annunciators. | 3.5 | 1 |
| | 2.4.35 | Knowledge of local auxiliary operator tasks during emergency operations including system geography and system implications. | 3.5 | 1 |
| | 2.4.44 | Knowledge of emergency plan protective action recommendations. | 4.0 | 1 |
| | 2.4.45 | Ability to prioritize and interpret the significance of each annunciator or alarm. | 3.6 | 1 |
| | Total Points | | | |
| TIER 3 Category Totals: | | | | 17 |