ATTACHMENT 13

Simulator Exercise Guide SE-JIT-42,
"Loss of AC, Loss of SDC and Lowering RPV Level," Rev 1

Exelon Generation®

Clinton Power Station
Licensed Operator Training
Simulator Exercise Guide

SE-JIT-42

Loss of AC, Loss of SDC and Lowering RPV Level

REVISION 001

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REVIEWED / APPROVED BY: N/A
Emergency Planning (if required) *

APPROVED BY: Richard Champley /S/ / 04/12/17
Operations Representative Date

* Emergency Planning approval required if the scenario could be used for input to the Emergency Planning Performance Indicator. Otherwise mark "N/A".

SRRS 3D.126/3D.111: Retain approved lessons for life of plant OR Life of Insurance Policy + 1 Yr for RP lesson plans. May be retained in department for two years, then forwarded to Records Management.

CPS SIMULATOR EXERCISE GUIDE

SCENARIO OUTLINE

This scenario guide is used to document Just In Time (Pre-Outage) training for performance of the level control activities needed to remove the vessel head. The scenario also contains a loss of shutdown cooling activity while at reduced inventory. In addition, a RPV bottom head leak is introduced to allow the crew to practice shifting the 'B' RHR loop into LPCI mode to restore RPV inventory in an emergency.

The unit is in Mode 4 with RAT "A","B"& "C" out of service and RPV level at ~+200 inches on the Alternate Shutdown Range instruments. RPV water level is being controlled by Reactor Water Cleanup letdown to Radwaste. RPV level is currently being lowered to ~+196 inches in preparation for entering Mode 5. Shutdown cooling loop 'B' is in operation. Removal of RPV Head piping is in progress.

A turnover to the crew will include an evolution in progress, namely, the lowering of RPV level (currently at ~200 inches to a desired level of 196 inches) using RT Reject to Radwaste. Have the crew continue the evolution until the desired RPV level is reached.

Scenario #1

After the turnover the crew will commence lowering RPV water level to a desired level of 196 inches.

When directed by the floor instructor, insert **Remote 1** to cause a sudden pressure fault on Emergency Reserve Auxiliary Transformer (ERAT)'. The fault results in ERAT Circuit Switcher B018 opening and the ERAT de-energize. The crew will send an EO to the 781 relay panels and determines the fault is on the ERAT. Personnel from the field report that the ERAT transformer casing is bulging but there is no fire. The Shift Manager will call the OCC to expedite restoration of the Reserve Auxiliary Transformers. In addition, the Division 1 Diesel Generator will trip 5 minutes after starting. The Shift Manager shall classify an Unusual Event per CU1.

Once the crew has re-established shutdown cooling flow, the Shift Manager has completed the NARS form and the crew has started to address RPV level control actions needed to restore level, the simulator will be taken to FREEZE. Have the crew perform a self-critique.

Following the above critique and discussion, reset the simulator per the specific setup; re-execute the simulator lesson plan update the crew on the initial conditions being restored prior to Scenario #1.

Scenario #2

After the crew is in role, the crew will commence lowering RPV water level to a desired level of 196 inches.

When directed by the floor instructor, insert **Remote 2** to cause a leak from the RPV bottom head region. RPV Level will begin to lower gradually. Per 4001.01, the crew should enter EOP-1 to restore RPV water level to the desired level. A start of the second Control Rod Drive pump and the securing of Reactor Water cleanup letdown will not be sufficient to reverse the trend of lowering RPV water level. A start of the LPCS pump or RHR Pump 'A' will cause an overcurrent trip of 4.16 KV Bus 1A1. If HPCS is attempted to be used, the HPCS pump will immediately trip when started. 1E12-F042C cannot be opened from the MCR or locally. The crew is expected to perform section 8.1.12 of CPS 3312.01 (RHR) to remove RHR loop 'B' from Shutdown Cooling and place it into LPCI mode to restore RPV water inventory. Note that injection from CD is not available with clearance on both FW 65A & B control switches. **Remote 3** is used to re-energize 1E12-F064B when requested during the shift to LPCI mode.

During RPV level restoration, the Alternate Shutdown Range instruments will fail downscale due to loss of power from CB MCC 1B (**Remote 4**). The crew should get assistance from the OCC and challenge any assumptions made on where RPV level really is (THU).

OPEX - OE29988 REACTOR VESSEL DRAIN DOWN THROUGH HCU'S
OPEX - LER-2011-008, Reactor Protection System Actuation Causes Loss of Shutdown Cooling

Duration: 1.5 to 2.5 hours

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CPS SIMULATOR EXERCISE GUIDE

LESSON PLAN HISTORY PAGE	
REV.	**DESCRIPTION**
0	New simulator exercise
1	Modified simulator lesson plan to keep simulator from crashing due to a negative pressure. Negative pressure occurs when a reactor coolant leak is inserted. C1R17 has a RAT outage, so changed loss of ERAT vice RAT.

REFERENCES

CPS 3007.01, Preparation and Recovery From Refueling Operations
CPS 3303.01, Reactor Water Cleanup (RT)
CPS 3304.01, Control Rod Hydraulic and Control (RD)
CPS 3312.01, Residual Heat Removal (RH)
CPS 3312.03, RHR – Shutdown Cooling (SDC) & Fuel Pool Cooling Assist (FPC&A)
CPS 3317.01, Fuel Pool Cooling and Cleanup (FC)
CPS 4001.02, Automatic Isolation
CPS 4006.01, Loss of Shutdown Cooling
CPS 4200.01D002, RAT Trip Data Sheet
CPS 9000.06, Reactor Coolant and Vessel Metal/Pressure/Temperature Limit Logs
CPS 9000.06D003, Shutdown Cooling Temperature Data Sheet
CPS 9082.01, Offsite Source Power Verification
ITS 3.8.2, AC Sources - Shutdown
ITS 3.4.10, RHR Shutdown Cooling System – Cold Shutdown
OP-CL-101-111-1001, Strategies for Successful Transient Mitigation
Shutdown Safety Contingency Plan for loss of SDC (per OU-AA-103)
EP-AA-1003, Radiological Emergency Plan Annex For Clinton Station
EP-AA-112-100-F-01, Shift Emergency Director Checklist
OP-CL-108-101-1003-F-05, Shift Manager (SED) – EAL Guide
CM-1 CA 539389-11 Graph key parameters during validation
INPO 15-004, Operations Fundamentals
SOER 10-02, Engaged, Thinking Organizations
OPEX - OE29988 REACTOR VESSEL DRAIN DOWN THROUGH HCU'S
OPEX - LER-2011-008, Reactor Protection System Actuation Causes Loss of Shutdown Cooling

Simulator Performance Objectives

Evolution	Objective #	Position	Requirement Met
From the MCR, respond to Reactor Coolant Leakage IAW CPS No. 4001.01.	400101.01	CRS A RO B RO	
From the MCR, using CPS No. 4006.01, Loss of Shutdown Cooling, respond to a Loss of Shutdown Cooling.	400601.01	CRS	
From the MCR, respond to a partial Loss of AC Power IAW CPS No. 4200.01.	420001.02	CRS B RO	
From the MCR, perform a DC Load Shed IAW CPS No. 4201.01.	420001.03	CRS B RO	
From the MCR, respond to a Reactor Pressure Vessel Control Emergency IAW EOP-1.	440101.01	CRS	
From the MCR, perform injection/flooding operations IAW CPS 4411.03.	441103.01	CRS A RO	
From the MCR, using CPS No. 3303.01, REACTOR WATER CLEANUP (RT), perform Reject Mode (Condenser or Radwaste) for the RT System.	330301.06	A-RO	
From the MCR, using CPS No. 3312.01, shift one loop of RHR from SDC to LPCI mode.	331201.13	B-RO	
From the MCR, using CPS No. 3312.03, recover from a loss of RHR Shutdown Cooling flow.	331203.24	B-RO	
From the MCR, assist in the classification of Emergency Action Levels.	996666.08	STA/IA	
From the MCR, verify adequate accident mitigation during an accident situation and recommend corrective actions to mitigate or terminate the event.	996666.09	STA/IA	
From the MCR, evaluate plant transients to determine that events are occurring in the expected sequence.	996666.12	STA/IA	
From the MCR, classify Emergency Action Level.	997777.01	SM	
From the MCR, complete Emergency Plan Activities performed by an SRO.	997777.03	SM	

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Human Performance Improvement

During the course of this scenario, evaluators should watch for the following and discuss during the critique.

HUMAN PERFORMANCE ERROR PREVENTION TOOLS

- Briefs
- Use of STAR when manipulating controls
- First Check
- Peer checks when appropriate
- Proper use of procedures
- Place keeping
- Robust barriers when appropriate
- Proper directed three part communications

OPERATIONS STANDARDS AND FUNDAMENTALS

Operator Rounds – OP-AA-102-102
Log Keeping – OP-AA-111-101
Shift Turnover – OP-AA-112-101
Clearance & Tagging – OP-AA-109-101
Human Error Prevention – HU-AA-101
Self-Assessment/Continuous Improvement – PI-AA-126
Teamwork – OP-AA-101-111-1001
Briefs HU-AA-1211
Procedural Adherence – HU-AA-104-101
Control Board Awareness – OP-AA-103-102
Industrial Safety – SA-AA-0301
Reactor Safety – OP-AA-101-111-1001
Reactivity Management – OP-AA-300
Work Management – WC-AA-101, OU-AA-101
Security – SY-AA-101-130
Regulatory Compliance – OP-AA-101-111
Condition Reporting and Resolution – PI-AA-125
Radiological Safety – OP-AA-101-111-1001
Personal Responsibility and Accountability OP-AA-101-111/112
Training and Qualification OP-AA-101-111
Intolerance for Unexpected Equipment Failure ER-AA-10
Technical Human Performance HU-AA-102
Strategies for Successful Transient Mitigation, OP-CL-101-111-1001
Operations Fundamentals, INPO 15-004

COMPETENCIES

Reactivity Management
Understand/Interpret Annunciator and Alarm Signals
Diagnose Events/Conditions Based on Signals/Readings
Understand Plant and System Response
Compliance With and Use of Procedures and Technical Specifications
Operate the Control Boards
Communicate and Interact With the Crew and Other Personnel
Direct Shift Operations (SRO ONLY)
Emergency Plan (If applicable)
Lessons learned captured for retention

LESSON PLAN SPECIFIC SIMULATOR SETUP

- Generic Simulator Setup is complete
- Initialize to IC-81 (if available). If not available, establish a Mode 4 IC with the following major conditions/lineups:
  - SDC Loop 'B' in operation (with RPV temperature stable at ~95F)
  - FW 65A & B valves are tagged out and are not available
  - RPV Level at ~200 inches rejecting to Radwaste
  - VP Chillers, Chill Water & Fans secured (with two Supp Cooling Fans running)
  - CCP in service (if CCP does not run, may have to shoot IC to override lights to indicate CCP is running)
  - Lineup Generator to backfeed through UATs and place BOP busses on UAT & Vital busses on ERAT.
- Place XL-3 Alarm switch in the "UP" position
- Verify/Place FC Pump "B" in service
- Place the simulator in RUN
- Load and execute lesson plan SE-JIT-42
- (CM-1) If this is an examination scenario or being run for validation, start a CHART to plot the critical parameters
- Open RAT Circuit Switcher 4538 and place Info Tag on it
- Place OOS Covers/Tags on FW65A & B Control Switches
- Place protective equipment signs on:
  - Emergency Reserve Auxiliary Transformer
- Per 3006.01, place Info tag on SM004 per step 8.11.2
- Per 3007.01, place Info tag on:
  - SM-001A & SM001B
  - E12-F024B
  - 1B21-F022A-D and 1B21-F016
  - E12-F006A
  - E12-F004B
  - Division 1 and 2 Mixing Compressors
- Per 3312.03, place Info tag on:
  - E12-F042B
  - E12-F064B
- Have copies of the following for each student (as needed) for the training session:
  - CPS 3007.01, Preparation and Recovery From Refueling Operations, marked up through step 8.1.27 (step 8.1.28 is currently in progress).
  - CPS 4006.01, Loss of Shutdown Cooling
  - CPS 4306.01P017, ELAP During Modes 4 and 5
  - CPS 9000.06, Reactor Coolant and Vessel Metal/Pressure/Temperature Limit Logs
  - CPS 9000.06D003, Shutdown Cooling Temperature Data Sheet
  - Current Shutdown Safety Contingency Plan for loss of SDC (per OU-AA-103)
  - Current Shutdown Safety Contingency Plan for loss of ERAT during RAT outage (per OU-AA-103)
  - Current Time to Boil Curves

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CPS SIMULATOR EXERCISE GUIDE

Lowering Reactor Vessel Level (~20 minutes)

INSTRUCTOR INFORMATION/ACTIVITY	EXPECTED OPERATOR RESPONSE
• Hand out copies (as needed) per the Specific Simulator Setup. • Provide turnover to the crew per the Turnover sheet. • Discuss which reactor vessel level gages are valved out and are not available to be used during reactor vessel floodup. 1B21-R009A and B – These are locally mounted narrow range level gages mounted on the 1H22-P004 and P027 instrument racks on 755' Containment. Since these gages are purely mechanical, they should not be over-ranged during floodup and are valved out per step 8.11.3 of 3006.01, Unit Shutdown. • Per M05-1071, sheets 1 & 2, discuss when the permanent reference leg is removed (for the removal of the RPV head) the normal Shutdown Range instrument will read approximately 127 inches higher than the Alternate Shutdown Ranges. This condition will exist until the temporary standpipe is installed and filled. The simulator cannot model the removal of the reference leg for Shutdown Range instrumentation (SWR # 16818). • Allow the crew to conduct pre-evolution briefing. Briefing paperwork should be provided by Ops. • Watch to ensure the crew is Controlling Plant Evolutions Precisely during the lowering of RPV water level. Watch for the proper use of Human Performance (HU) error prevention tools to include self-checks, peer checks, proper three part communications, and procedural compliance. (INPO 15-004)	Crew: ❑ Accepts the shift. A RO: ❑ At the direction of the CRS, raises letdown and/or reduces RD flow to lower level to ~194 to ~198 inches Alternate Shutdown Range per CPS 3303.01 or CPS 3304.01. ❑ Verifies with the crew that vessel level is stable. B RO/Extra RO ❑ Ensures that reactor coolant temperature is stable at ~95 degrees. CRS: ❑ Directs the A RO to lower reactor vessel level to ~194 to ~198 inches Alternate Shutdown Range per CPS 3303.01 or CPS 3304.01.

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CPS SIMULATOR EXERCISE GUIDE

Loss of ERAT and Division 1 Diesel Generator (Scenario #1)

INSTRUCTOR INFORMATION/ACTIVITY	EXPECTED OPERATOR RESPONSE
• When the crew has assumed the shift, insert **REMOTE 1** to create a sudden pressure lockout of the ERAT. The fault will open ERAT Circuit Switcher B018 and the ERAT will de-energize. • The crew will determine the trip was due to a Sudden Pressure Fault of ERAT. . When the crew directs the C to perform the ERAT Trip Data Sheet, fill out the data sheet with the 86F-RT1 relay tripped. All other relays are NOT tripped. • When an EO is sent to investigate the trip of Division 1 Diesel Generator, wait 3 minutes and report "***There is a very strong electrical acrid odor around the Division 1 Diesel Generator. There is no fire or smoke.***" • When an EO is sent to investigate the status of the ERAT transformer, wait 3 minutes and report: "***ERAT is deluging and has a pane that has a bulge that is about 4 feet in diameter and is about 4 inches outward. There is no fire, smoke or leaking oil.***" • After the deluge has been stopped, and the E EO will report "***The deluge is secured. ERAT tripped on sudden pressure***". Note the indication to determine the trip was due to sudden pressure is located in the local ERAT cabinet. After the crew takes required actions for a loss of AC and the loss of Shutdown Cooling (SDC), freeze the simulator and conduct a critique. Include in the discussion of OPEX OE29988 or LER 2011-008.	**A RO:** ❑ Monitors for rod drifts until IA to the Containment is restored **Extra/B RO** ❑ Dispatches an EOs to investigate trip of ERAT & Division 1 Diesel Generator ❑ Dispatches an EO to perform 4200.01D003, ERAT Trip Data Sheet ❑ Directs an EO to secure the deluge to ERAT ❑ When directed performs 9082.01, Offsite Source Power Verification ❑ When directed by CRS: o Restore RHR 'B' in Shutdown Cooling per 3312.03 o Isolates the Upper Containments pools per 3317.01 (due to FC tripped) o Starts Division 2 of Standby Gas Treatment per 3319.01 o Restore Division 2 Drywell Cooling per 3320.01 o Restore or secure Fission Product Monitor per 3315.02 o Directs EO to perform a DC Load Shed of Division 1 and non-essential DC loads per 4200.01C002

CPS SIMULATOR EXERCISE GUIDE

Loss of ERAT and Division 1 Diesel Generator (Scenario #1) (continued)

INSTRUCTOR INFORMATION/ACTIVITY	EXPECTED OPERATOR RESPONSE
	CRS: ❑ Enters 4200.01 Loss of AC Power and performs sections 4.1, 4.2 and 4.3which includes directing: o Restoration of Shutdown Cooling o Isolating the Upper Containments pools due to FC tripping o Starting Division 2 of Standby Gas Treatment o Restoration of Division 2 Drywell Cooling o Restoration or securing Fission Product Monitor ❑ Enters ITS 3.8.2, action and directs the B RO to perform 9082.01 within one hour ❑ Enters ITS 3.4.10, actions A.1, B.1 & B.2 ❑ Notifies MISO an AmerenIP within 30 minutes of the event ❑ Risk Condition Orange on Electric Power Key Safety Function **SM:** ❑ Notifies the OCC ❑ Declares an Unusual Event per CU1 (Loss of off-site power & Division 1 DG) ❑ Perform actions per Section 1.1 of EP-AA-112-100-F-01 ❑ Perform EAL Choreography per OP-CL-108-101-1003-F-05 **STA/IA:** ❑ Stations the IA ❑ Assists the SM in classification of Emergency Action Levels ❑ Perform EAL Choreography per OP-CL-108-101-1003-F-05

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RPV Bottom Head Leak & Shift from SDC to LPCI Mode (Scenario #2)

- Before proceeding, reset the simulator to the same IC. Inform the crew that the initial conditions have been re-established (SDC in operation and ERO is not activated).
- When directed, insert **Remote 2** to cause a leak from the RPV bottom head region. RPV Level will begin to lower gradually. After the crew identify the RPV lowering water level, call the MCR emergency line (x3329) and report: **"This is RP Technician, Jack Smith. There is a severe leak on the Reactor Water Cleanup Suction piping in the bottom head region. It appears the leak is un-isolable."**
- When an EO is sent to bypass CRD Suction Filters, wait 3 minutes, insert **Remote 5** and report "***The CRD Suction Filters have been bypassed.***"
- When an EO/IMD Tech is sent to defeat E12-F042B seal-in circuit, insert **Remote 6** and inform the Floor Instructor when the seal-in circuit is defeated.
- When an EO is sent to investigate the trip of HPCS pump, wait 3 minutes and report "***The HPCS pump has tripped on overcurrent.***"
- When an EO is sent to investigate the trip of 4.16 KV Bus 1A1, wait 3 minutes and report "***4.16 KV Bus 1A1 has tripped on overcurrent.***"
- When an EO is sent to investigate the breaker for E12-F042C, wait 3 minutes and report "**The breaker for E12-F042C appears to be normal.**"
- When an EO is sent to manually open E12-F042C, wait 3 minutes and report "**E12-F042C handwheel will not engage.**"
- When an EO is sent to re-energize 1E12-F064B, wait 3 minutes, insert **Remote 3** and report: **"The breaker for E12-F064B is closed."**

A RO:

- ☐ Evacuates the containment
- ☐ When directed, minimizes RT reject flow
- ☐ Monitors Alternate Shutdown Range level instrumentation and reactor coolant temperature

B RO/Extra RO:

- ☐ Directs EO to bypass RD suction filters
- ☐ Starts second Control Rod Drive Pump
- ☐ Reports HPCS pump tripped when started
- ☐ Reports 4.16 KV Bus 1A1 has tripped on overcurrent
- ☐ Reports E12-F042C cannot be opened
- ☐ When directed, shifts RHR Loop 'B' into LPCI mode per CPS 3312.01, section 8.1.12
- ☐ Coordinates with A-RO in restoring RPV level

CRS:

- ☐ Enters the 4001.01, Reactor Coolant Leakage off-normal and EOP-1
- ☐ Directs the A RO to minimize RT reject flow
- ☐ Directs RO to restore RPV Water Level using the following systems per 4411.03:
  - CRD
  - HPCS
  - LPCS or RHR 'A'
  - RHR 'C'
  - Directs the B-RO to shift RHR Loop from SDC to LPCI mode to restore RPV level

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RPV Bottom Head Leak & Shift from SDC to LPCI Mode (Scenario #2) (continued)

- Just before the RHR Loop 'B' lineup is complete for injection using LPCI mode, insert **Remote 4** to cause a loss of the Alternate Shutdown Range instruments. Cause will be a faulty (tripped open) circuit breaker (circuit #35) powered by MCC 1B (which is powered from Unit Sub 1M).

  The only instrument reading on scale at this point will be the Shutdown Range but it will still indicate ~127 inches higher than actual level with no reference leg currently installed (Rx Services having problems)

  The crew should get assistance from the OCC and challenge any assumptions made on where RPV level really is (THU). Refer to CPS OPEX LER 2011-008 event to stimulate discussion and how we are going to learn from it going into the next refuel outage. Relate to SOER 10-02.

  After the crew takes required actions to realigns RHR "B" to inject into the RPV and the Shift Manager completes the NARS form, then freeze the simulator and conduct a critique. Handout and include in the discussion CPS 4306.01P017 AND the following:
  - At this time there is no upper procedure (i.e. 4306.01) directs you to this procedure
  - Section 4.1, Mode 4 and 5 ELAP Considerations
  - Distinct Conditions (plant status at start of ELAP)
  - Strategies for Core Cooling, Containment & Spent Fuel Pool

- During diagnosis and response to system's failure, Work Effectively as a Team to restore RPV water level within the required band. (INPO 15-004)

  Discuss one or both of the attached OPEX

SM:
- ☐ Notifies the OCC
- ☐ Declares an Unusual Event per CU6 (Unplanned loss of Reactor coolant)
- ☐ Perform actions per Section 1.1 of EP-AA-112-100-F-01
- ☐ Perform EAL Choreography per OP-CL-108-101-1003-F-05

STA/IA:
- ☐ Stations the IA
- ☐ Assists the SM in classification of Emergency Action Levels
- ☐ Perform EAL Choreography per OP-CL-108-101-1003-F-05

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Turnover

1. The unit is in Mode 4. 30 hours into the outage.

2. Secondary Containment is still established. CCP is in service, vice VR/VQ due to damper issues which is currently being investigated.

3. RHR 'B' is in Shutdown Cooling mode with coolant temperature at ~ 95 degrees F. Current RPV temperature band is 92 to 98 degrees F.

4. **DO NOT** operate RHR 'B" in Shutdown Cooling mode at flowrates greater than 4400 gpm (controlled by position of E12-F053B). Flowrates of greater than 4400 gpm will cause RHR 'B' system instabilities and a complete simulator crash (SWR #16814)

5. When lowering RPV level, the RPV pressure will go negative and cause the simulator to crash (SWR # 133110). Until fixed, Drywell pressure shall be maintained high.

6. When RPV level is above the Main Steam Lines and level is lowered the RPV level stops at approximately 112 inches Alternate Shutdown RPV level indications. Depending on the rate of lowering level (i.e. coolant leak), the RPV level will remain constant for several minutes. (SWR # 133111)

7. Reactor Vessel level is at ~200 inches on Alternate Shutdown Range.

8. RPV level control is RD in with RT rejecting to Radwaste.

9. CPS 3007.01 is complete up through step 8.1.27 with step 8.1.28 to be completed by the crew.

10. Refuel floor will commence removing the RPV head piping and insulation in approximately 2 hours.

11. OCC is fully staffed.

12. Reactor Services has already commenced removing head piping per MA-CL-716-102, Reactor Disassembly. The temporary standpipe for the Shutdown range instrument has yet to be connected.

13. The FW-65A & B valves are tagged out and not available for use. The motors for both valves have been removed and are in the electrical shop for modifications.

14. Reserve Auxiliary Transformers outage commenced 8 hours ago and expected to be completed in approximately 16 hours from now. The following systems are protected:
    - Emergency Reserve Auxiliary Transformer

15. Key Safety Function risk are as follow:
    - Decay Heat Removal: Green
    - Inventory Control: Yellow
    - Containment Control: Green
    - Reactivity Control: Green
    - Electric Power: Green
    - Fuel Pool Cooling: Green

OPEX

OPEX- OE29988 REACTOR VESSEL DRAIN DOWN THROUGH HCU'S

Description:

Condition Description:
OE29988 describes an event that occurred at Cooper station on 9-29-09 while in mode 4. While attempting to raise level in the vessel, the actual water level started to drop. I was identified by the MCR crew that one of the scram discharge volumes was clearanced out to support hydrolazing. During this period of time, there were several accumulators that had their drain valves open draining. Once recognized, the CRS directed closure of the drain valves stopping the level drop. It was later identified that there was reverse flow through the hydraulic control unit inlet valve, the open scram valve and through the respective HCU drain valve.

The cause was determined to be inadequate program controls to prevent the event.

Immediate actions taken:
None- OE review that may be applicable to upcoming outage.

Recommended Actions:
Submit training request to review for incorporation into system review or
OE review for upcoming outage.

OPEX

OPEX- LER 2011-008 Reactor Protection System Actuation Causes Loss of Shutdown Cooling

Abstract:
On 12/18/11, with the plant in Cold Shutdown, following completion of refueling activities, the reactor vessel head was reinstalled and the permanent shutdown / upset level transmitter reference leg piping was re-attached for Reactor Pressure Vessel (RPV) water level indication. After the RPV pressure test, as RPV water level was being lowered, a Low RPV Water Level 3 signal was received resulting in a loss of shutdown cooling. RPV water level was restored above the Level 3 setpoint using the Control Rod Drive system. Operators reset the logic within minutes of the Low RPV Water Level 3 trip signal, and shutdown cooling was fully restored in 26 minutes. Reactor coolant temperature increased approximately three degrees Fahrenheit during this event.

The cause of this event was a lack of rigorous process controls while removing and installing the permanent reference leg pipe. Specifically, inadequate instructions existed on how to fill the reference leg and insufficient guidance on how to perform a check of the restored instrument. Additional insights include the excessive amount of time (8 hrs) before the reference leg was determined to be full, and a surveillance in progress that disabled three FW narrow range level indications in the MCR.

Event Description:
On 12/17/2011, the plant was in Mode 4 (Cold Shutdown), the upper pool was drained down after completion of refueling activities and the Reactor Pressure Vessel (RPV) [ ] head was installed and fully tensioned. The temporary standpipe used for RPV water level indication during refueling activities was being removed and replaced by the permanent reference leg for RPV water level indication. This evolution requires the Main Control Room (MCR) to stabilize RPV water level by matching Control Rod Drive (CRD) system [ ] makeup and Reactor Water Cleanup (RWCU) system [ ] reject flow rates as near as possible. At 0515 hours, just prior to disconnecting the temporary standpipe, the value from the recorder for RPV water level was 222 inches shutdown range indication. At 0629 hours, the MCR was notified that installation of the permanent reference leg piping was completed.

At 0730 hours, Maintenance was notified to fill the permanent reference leg. The Maintenance crew was briefed and the applicable sections of the procedure were marked up for the fill and vent evolution. At 0920 hours, the first fill evolution was complete and the subsequent MCR check found shutdown level was not as expected for existing plant conditions. Operations requested Maintenance to perform a second fill evolution. At about 1321 hours, Maintenance completed the second reference leg fill and vent evolution, and Operations again questioned the validity of the reactor level indication which was showing a rising trend in RPV water level. The Operations crew had believed actual water level had trended up to match the indicated water level as correlated by an increase in reactor recirculation pump [ ] seal [ ] pressures. The MCR requested assistance for restoring RPV level indication from the Outage Control Center (OCC) and the OCC responded that the indicated RPV water level seen by Operations was correct.

Following acceptance of the RPV level indication, at about 1404 hours, the Operations crew established a new RPV water level band of 265 to 275 inches per the shutdown range indication in preparation for the RPV pressure test. At about 1640 hours, the RPV pressure test commenced and the RPV was filled, however, unknown to the Operations crew, the shutdown instrument reference leg did not fill with water because the piping configuration slopes down from the condensing pot to the connection with the RPV head piping, and due to air in the reference leg pipe, the reference leg was air bound and did not allow water to flow upwards to the condensing pot, and then down into the partially empty reference leg.

Following completion of the RPV pressure testing, at about 0700 on 12/18/11, Operations set the target RPV water level to be below the Main Steam lines in accordance with procedure, at a normal Mode 4 level of between 75 inches and 95 inches shutdown range indication, and a Reactor Operator was assigned responsibility for RPV water level and was monitoring RWCU reject rate which was set to achieve an approximately one inch per minute decrease in RPV water level. Operators were monitoring RPV water level on a recorder using the shutdown range RPV water level instrument output, as well as the upset range instrument.

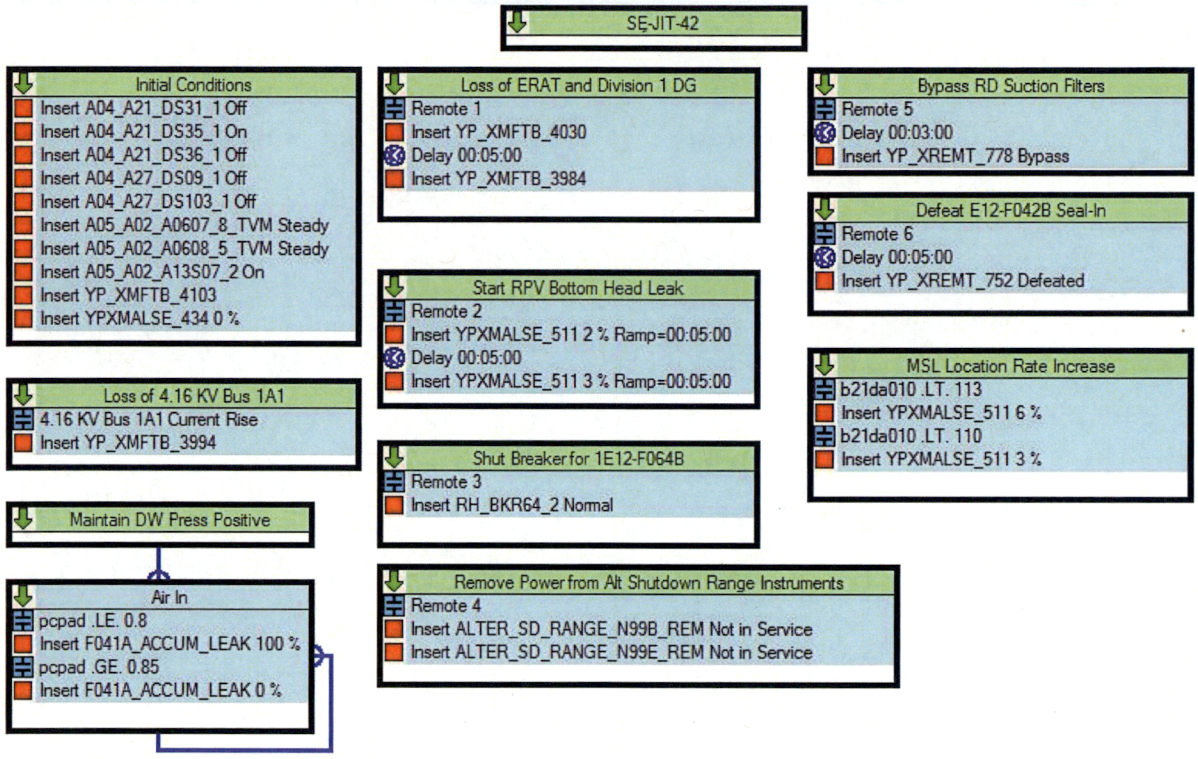
At about 0930, during the evolution to lower RPV water level, the Low Reactor Water Level 3 trip setpoint was reached which initiated a reactor protection system signal, resulting in closure of the shutdown cooling suction containment isolation valves and a loss of shutdown cooling. All control rods were already fully inserted prior to the Low RPV Water Level 3 trip signal since the reactor was in Mode 4. At the time of the Low RPV Water Level 3 trip signal, the shutdown range instrument read 116 inches and upset range instrument read 145 inches. The other available RPV water level instruments are narrow range and wide range, which all have a maximum range of 60 inches.

Review of computer points following the event found the wide range level instruments came on scale at 59 inches four minutes prior to the Low Reactor Water Level 3 trip, and the wide range instrument read 57 inches when the Low Reactor Water Level 3 trip occurred. The Low Reactor Water Level 3 trip setpoint is 8.9 inches on narrow range level indication.

Following the Low Reactor Water Level 3 trip, the MCR crew completed the immediate and subsequent actions for a reactor scram, entered off-normal procedures for reactor scram, automatic isolation, and loss of shutdown cooling, and commenced recovery of shutdown cooling. The Low Reactor Water Level 3 condition immediately cleared as the CRD system commenced injecting approximately 200 gallons of water per minute into the RPV. Operators reset the Low Reactor Water Level 3 Isolation signal, allowing operators to reopen the Shutdown Cooling containment isolation valves. Approximately five minutes after the initial Low Reactor Water Level 3 trip, Operations directed an extra Reactor Operator in the control room to obtain readings from the Analog Trip Modules for the transmitters which are used in the Low Reactor Water Level 3 trip and containment isolation logic. At that time, the readings for all four divisions of RPV water level indication were nominally 24 inches and trending up. After the Low Reactor Water Level 3 trip, Operations ordered a rising trend on Shutdown Range and shortly thereafter, provided a level band of 130-150 inches Shutdown Range. At about 0956, operators restored Train A of RHR Shutdown Cooling. During the period of time shutdown cooling was not in service, reactor coolant temperature increased approximately three degrees Fahrenheit.

Following recovery of shutdown cooling, the Operations crew recognized that the vessel indicated level was higher than vessel actual level due to an incompletely filled reference leg for the shutdown and upset range instruments. Maintenance was contacted to re-perform the fill of the shutdown level reference leg. After the permanent reference leg fill was completed at 1253 hours, RPV shutdown level indication lowered 110 inches from 195 inches to 86 inches as indicated on the shutdown instrument. This was determined to be the amount of level error due to the initial incompletely filled reference leg.

Simulator Remotes & Malfunctions
(Reference Only)



SRRS 3D.126/3D.111: Retain approved lessons for life of plant OR Life of Insurance Policy + 1 Yr for RP lesson plans. May be retained in department for two years, then forwarded to Records Management.

Attachment 1 – XL-3 Display

DEVICE 24-19 RESERVE AUXILIARY TRANSFORMER 1 ADS	ION DETECTOR	*******IN ALARM*******
DEVICE 22-24 ENGINE RUN DIESEL FIRE PUMP A		*******IN ALARM*******
DEVICE 22-15 ENGINE RUN DIESEL FIRE PUMP B		*******IN ALARM*******

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