



# INITIAL LICENSE EXAM

## 2007

### SCENARIO TWO

**Brunswick Steam Electric Plant, Unit No. 2**

BRUNSWICK JULY-AUG EXAM - 325, 324/2007-301  
FINAL SIMULATOR SCENARIO (2 OF 4)

*FINAL SCENARIO 2 OF 4*

Facility:	BRUNSWICK	Scenario No.:	2	Op Test No.:	2007 NRC
Examiners:	_____	Operators:	_____		(SRO)
	_____		_____		(RO)
	_____		_____		(BOP)
Initial Conditions:					
The plant is operating at maximum power, Middle of Cycle.					
Turnover:					
Several LPRMs have failed and have been bypassed.					
Circ Water Intake Pump 2C is under clearance for traveling screen maintenance.					
CRD Pump 2B is under clearance to replace oil in the speed changer and will be out of service for four hours.					
CSW Pump 2C was under clearance and is ready to be placed in service. Once it has been placed in service. CSW pump 2A is to be removed from service.					
No other equipment is out of service.					
Reduce power to 90% for upcoming turbine valve testing.					
Critical Task: See Scenario Summary					
Event No.	Malfunction No.	Event Type*	Event Description		
1	N/A	R-SRO R-RO	Power reduction with recirc flow from 100% to 90%		
2	NI048M, 28-13D	I-SRO I-RO	An LPRM fails low and must be bypassed this will make APRM # 1 inoperative for only one LPRM operable for Level B.		
3	N/A	N-SRO N-BOP	Swap CSW pumps		
4	K4B39A Auto Off CW027F	C-SRO C-BOP	After CSW Pump 2A is removed from service CSW pump 2C trips on overcurrent and CSW Pump 2A fails to auto start. (AOP)		
5	ES015F	TS-SRO	HPCI logic power failure (TS)		
6	CW015F	C-ALL	CW intake screens progressively foul resulting in high screen d/ps and eventual total loss of CW, lowering vacuum (AOP)		

**NOTES:** 1) S = Satisfactory; U - Unsatisfactory; N/O = Not Observed  
All Unsatisfactory ratings require comments; a comment sheet is attached.

2) \* = Critical Task/Step

7	RP011F SL_IASLRB BKR OFF	M-ALL C-RO	Group 1 isolation, ATWS, One SLC pump fails (EOPs)
8	RW016F	C-SRO C-RO	RWCU outboard isolation valve, G31-F004, fails to automatically isolate on SLC initiation.
9	RI_IARIUNCP	C- SRO C-BOP	Failure of RCIC turbine coupling
10	K2213A Isolate	C-SRO	Failure of SDV vent and drain valves to OPEN following the scram reset.
11	K1507A Open Off	C-SRO C-BOP	One ADS SRV fails to OPEN during Emergency depressurization (EOPs), Restoration of vessel level
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor			

- NOTES:**
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All Unsatisfactory ratings require comments; a comment sheet is attached.
  - 2) \* = Critical Task/Step

## SCENARIO DESCRIPTION

### BRUNSWICK 2007 NRC Scenario #2

The plant is operating at 100% power, Middle of Cycle with CSW Pump 2C, CRD Pump 2B, and Circ Water Intake Pump 2C under clearance. A downpower is required for upcoming turbine valve testing. While power is being reduced an LPRM will fail downscale causing a Technical Specification tracking LCO and inoperability of the #1 APRM on LPRM level inputs for the B level.

The operators will start CSW pump 2C following maintenance work. Following the pump start, CSW Pump 2A will be removed from service and placed in standby. The 2C CSW pump will then trip on overcurrent and the 2A CSW pump will fail to auto start (it will start manually). The crew will respond per AOP-19.0.

Once the CSW pump issue is addressed, a HPCI logic power failure will occur resulting in a HPCI inoperability/unavailability and requiring a technical specification entry.

The Circulating Water Intake Pumps (CWIPs) intake screens will progressively plug with river silt resulting in CWP pump trips. Condenser vacuum will initially slowly lower. The crew will enter AOP-37.1, Intake Structure Blockage. The RO will lower reactor power and the BOP operator will attempt to recover CWIPs. Eventually all CWIPs will trip and condenser vacuum will be lost causing a Group 1 isolation. If the Reactor had not been scrammed, a scram will occur.

Most control rods will fail to insert on the scram. The crew will respond per 2-EOP-01- LPC. When SLC is initiated, SLC pump 2B will trip on overcurrent. Additionally RWCU will fail to automatically isolate. When RPS is reset, the SDV vent and drain valves will fail to open. Initiating SLC and/or inserting control rods per LEP-02 is a **(Critical Task)**

RPV level will be deliberately lowered to suppress power. When RCIC initiates on LL2, the RCIC Turbine coupling will break.

Without HPCI or RCIC, RPV level will drop below LL4 requiring Emergency Depressurization **(Critical Task)**. The crew must terminate and prevent injection prior to Emergency Depressurization per 2EOP-01-LPC **(Critical Task)**. When ADS valves are opened (ADS SRV C will fail to open. Low pressure ECCS must be overridden off to prevent uncontrolled injection during depressurization. When pressure drops below Minimum Alternate Reactor Flooding Pressure (MARFP), injection may be recommenced to restore RPV level above LL4 **(Critical Task)**. Condensate should be used for injection due to inability to throttle RHR flow for 5 minutes.

When the rods are all inserted and/or hot shutdown boron weight has been injected and level is being restored to 170-200", the scenario may be terminated.

- NOTES:**
- 1) S = Satisfactory; U - Unsatisfactory; N/O = Not Observed  
All Unsatisfactory ratings require comments; a comment sheet is attached.
  - 2) \* = Critical Task/Step

**PROGRESS ENERGY CAROLINAS  
BRUNSWICK TRAINING SECTION**

**2007 NRC EXAM SCENARIO # 2**

## SCENARIO DESCRIPTION

### BRUNSWICK 2007 NRC Scenario #2

The plant is operating at 100% power, Middle of Cycle with 2C CWIP and CRD Pump 2B under clearance. 2C CSW pump has just been placed in standby following maintenance and needs to be placed in service. A downpower is required for upcoming turbine valve testing. While power is being reduced an LPRM will fail downscale causing a Technical Specification tracking LCO and inoperability of the #1 APRM on LPRM level inputs for the B level.

The operators will start CSW pump 2C following maintenance work. Following the pump start, CSW Pump 2A will be removed from service and placed in standby. The 2C CSW pump will then trip on overcurrent and the 2A CSW pump will fail to auto start (it will start manually). The crew will respond per AOP-19.0. Once the CSW pump issue is addressed, a HPCI logic power failure will occur requiring a technical specification entry.

The Circulating Water Intake Pumps (CWIPs) traveling screens will progressively plug with river silt resulting in CWIP trips. Condenser vacuum will initially slowly lower. The crew will enter AOP-37.1, Intake Structure Blockage. The RO will lower reactor power and the BOP operator will attempt to recover CWIPs. Eventually all CWIPs will trip and condenser vacuum will be lost causing a Group 1 isolation. If the Reactor had not been scrammed, a scram will occur.

Most control rods will fail to insert on the scram. The crew will respond per 2-EOP-01-LPC. When SLC is initiated, SLC pump 2B will trip on overcurrent. Additionally RWCU will fail to automatically isolate. When RPS is reset, the SDV vent and drain valves will fail to open. Initiating SLC and/or inserting control rods per LEP-02 is a **Critical Task**

RPV level will be deliberately lowered to suppress power. When RCIC initiates on LL2, the RCIC Turbine coupling will break.

Without HPCI or RCIC, RPV level will drop below LL4 requiring Emergency Depressurization (**Critical Task**). Terminate and Prevent injection must occur prior to ED (**Critical Task**). When ADS valves are opened, ADS SRV C fails to open. Low pressure ECCS must be overridden off to prevent uncontrolled injection during depressurization. When pressure drops below MARFP, injection may be recommenced to restore RPV level above LL4 (**Critical Task**). Condensate should be used for injection due to inability to throttle RHR flow for 5 minutes.

When the rods are all inserted and/or hot shutdown boron weight has been injected and level is being restored to 170-200", the scenario may be terminated.

## SIMULATOR SETUP

### Initial Conditions

IC 181  
ENP 24 for IC 13  
Rx Pwr 100%  
Core Age MOC  
Red Cap on 2B CRD Pump  
Red Cap on 2C CWIP

### EVENTS

Event Number	Trigger	Trigger Description	
1	NA	NA	Lower Reactor Power from 100% to 90%
2	1	Manual	LPRM fails downscale on APRM #1
3	NA	NA	Start 2C CSW Pump, secure 2A CSW Pump
4	4	Manual	2C CSW Pump trip, 2A CSW Pump fails to Auto-Start
5	2	Manual	HPCI Logic Power Failure
6	3	Manual	Circ Water Intake Screen fouling, lowering vacuum
7	NA	NA	Reactor Scram Signal/ATWS/RWCU G31-F004 auto close failure/SLC Pump 2B failure
8	NA	NA	RCIC coupling failure
9	NA	NA	SDV Vent & Drain valve failure/Emergency Depressurize – LL-4/ 1 ADS valve fails to open
10	NA	NA	Recommence injection (Condensate)/restore level when all rods are in and/or Hot Shutdown Boron Weight injected

## SIMULATOR SETUP

Interventions Summary  
(Shaded entries = Active)

Malfunctions Summary

Malf ID	Mult ID	Description	Current Value	Target Value	Rmptime	Actime	Dactime	Trig
N1048M	28-13-4D	LPRM AMPLIFIER FAILS LOW	FALSE	TRUE				1
ES015F		HPCI POWER SUPPLY FAILURE	FALSE	TRUE				2
CW015F		C SCREEN HI DELTA P	0.00	70.00000				3
RP011F		ATWS4	TRUE	TRUE				
RW016F		G31-F004 FAILURE TO AUTO CLOSE	TRUE	TRUE				
CW027F	C	CONV SW PUMP MOTOR WINDING FAULT	FALSE	TRUE				4
RP005F		AUTO SCRAM DEFEAT	FALSE	TRUE		00:05:00		6

Remotes Summary

Remf ID	Mult ID	Description	Current Value	Target Value	Rmptime	Actime	Trig
ED_IABKCF08		BKR CTL DC FUSES CRD PUMP 2B	OUT	OUT			
SL_IASLRB		2B SLC PUMP MOTOR BKR	CLOSE	OPEN			5
RI_IARIUNCP		UNCOUPLE RCIC TURBINE FROM PUMP	YES	YES			
CW_ZVCW003M		2CW-V3 PUMP C DISCHG	OFF	OFF			
EL_IASCW2A		MECH TRIP CIRC WATER PUMP 2A	NORMAL	TRIP			7
EL_IASCW2B		MECH TRIP CIRC WATER PUMP 2B	NORMAL	TRIP			7
EL_IASCW2D		MECH TRIP CIRC WATER PUMP 2D	NORMAL	TRIP			7



## SIMULATOR SETUP

### Override Summary

Tag ID	Description	Position/ Target	Actual Value	Override Value	Rmptime	Actime	Dactime	Trig
K2213A	DISCH VOL TEST	NORMAL	ON	OFF		00:05:00		6
K2213A	DISCH VOL TEST	ISOLATE	OFF	ON		00:05:00		6
K1507A	AUTO DEPRESS VLV B21- F013C	AUTO	ON	ON				
K1507A	AUTO DEPRESS VLV B21- F013C	OPEN	OFF	OFF				
K4839A	CONV HDR SW PMP A DISCH VLVS	AUTO	OFF	OFF				
K4B12A	CW PMP C DISCH VLV	NORMAL	ON	OFF				
K4B12A	CW PMP C DISCH VLV	START	OFF	OFF				
K4B12A	CW PMP C DISCH VLV	STOP	OFF	ON				
Q4B12EG5	CW PMP C PMP OFF G	ON/OFF	ON	OFF				

### Annunciator Summary

Window	Description	Tagname	Override Type	OVal	AVal	Actime	Dactime	Trig
	NONE							

### Batch Files

File	Trigger	Description
		NONE

### Special Instructions

**Load scenario file 2007 NRC Scenario 2.scn**

Ensure ENP-24 for IC-14 @ P603.

Red Cap on 2B CRD pump

Red Cap on 2 C CWIP



## SHIFT BRIEFING

### Plant Status

The plant is operating at maximum power, Middle of Cycle.

### Equipment Out of Service

Several LPRMs have failed and are bypassed


CRD Pump 2B is under clearance to replace oil in the speed changer and will be out of service for four hours.

CWIP 2C is under clearance for traveling screen maintenance.

No other equipment is out of service

### Plan of the Day

Following shift turnover, reduce power to 90% for turbine valve testing. The NE has provided guidance to lower power using recirc flow. If needed insert control rods per 0ENP-24 to maintain power below the MELL line on the power to flow map.



CSW Pump 2C was under clearance for maintenance and is ready to be placed in service. Following the downpower, place 2C CSW pump in service and remove 2A CSW pump from service.



## SCENARIO INFORMATION

### Examiner Notes

#### Procedures Used in Scenarios:

##### EVENT 1

- OGP-12 (power reduction)

##### EVENT 2

- Annunciator A-5 2-2 (Rod Out Block)
- Annunciator A-6 1-7 (LPRM downscale)
- Annunciator A-6 3-7 (APRM Trouble – Directs actions to bypass APRM)
- Technical Specifications 3.3.1.1.A
- TRM 3.3

##### EVENT 3

- 2OP-43 section 8.23 (Shifting Conventional Service Water Pumps)



##### EVENT 4

- Annunciator UA-15 6-1 (Bus E1 4KV OVLD)
- Annunciator UA-1 1-9 (Conv Hdr Serv Water Press Low)
- Annunciator UA-1 4-9 (Conv Hdr SW Pump C trip)
- 0AOP-19 Conventional Service Water Failure
- 0OI-01.02 section 5.10.7 Conduct of Operations

##### Event 5

- Annunciator 2-A-1, Window 2-5 (HPCI FIC Power Loss)
- Technical Specification 3.5.1.D



#### Procedures Used in Scenarios:



## Procedures Used in Scenarios:

### EVENT 6

- Annunciators
  - UA-1 1-5 (CW Scrn A Diff-Hi or Stopped)
  - UA-1 2-5 (CW Scrn B Diff-Hi or Stopped)
  - UA-1 4-5 (CW Scrn D Diff-Hi or Stopped)
  - UA-1 1-4 (CW Scrn Diff Hi-HI)
  - UA-1 1-7 (CW Pump A Trip)
  - UA-1 2-7 (CW Pump B Trip)
  - UA-1 4-7 (CW Pump D Trip)
- 0AOP-37.1 Intake Structure Blockage

### EVENT 7

- 2EOP-01-RSP (REACTOR SCRAM PROCEDURE)
- 2EOP-01-LPC (LEVEL POWER CONTROL PROCEDURE)



### EVENT 8

- None

### EVENT 9

- 2EOP-01-LPC

### EVENT 10

- 2EOP-01-LPC



## Critical Tasks

Control Rods must be inserted manually per LEP-02 and/or SLC initiated to shutdown the reactor.

Terminate and Prevent injection prior to ED such that there is no un-controlled injection resulting in a power excursion of greater than 10%.

Perform emergency depressurization when determination is made that level cannot be restored and maintained above LL4.

When reactor pressure drops below the Minimum Alternate Reactor Flooding Pressure (MARFP) recommence injection to restore reactor water level above LL4

## EVENT 1 SHIFT TURNOVER, LOWER REACTOR POWER TO 90%

The crew lowers reactor power to 90% per SCO direction

Malfunctions required – None

Objectives:

SCO – Directs RO to lower reactor power to 90% per GP-12 using Recirc Flow.

RO – Lowers reactor power to 90% using Recirc flow per GP-12.

Success Path:

Reactor power is lowered and stabilized at 90%

**Simulator Operator Activities:**

- IF requested, as NE, advise that control rods should be inserted per ENP 24 to restore power below the MELLL line.

**Required Operator Actions**

**Normal Operation – Lower Reactor Power to 90%**

**SRO**

- Direct RO to lower reactor power to 90% per OGP-12 using Recirc Flow.
- If advised by NE, Directs RO to insert control rods to restore power below the MELLL line.

**RO**

- Lower Reactor Power to 90% per OGP-12 using Recirc Flow.
- As directed by SRO, inserts rods to restore power below the MELLL line.



## EVENT 2 LPRM Failure

The crew responds to an LPRM failure

### Malfunctions required:

- LPRM 28-13-4D fails, resulting in various annunciators associated with APRM #1

### Objectives:

SCO Correctly recognizes LPRM failure and specific location

Recognizes and evaluates impact on APRM #1 (too few inputs on a specific level – APRM #1 inoperable and still determines that only a tracking LCO is required- 3.3.1.1 condition A, table 3.3.1.1-1)

Evaluates Technical Specifications for 1 APRM channel inoperable

RO Refers to annunciator procedures and identifies/reports indications of LPRM failure and APRM#1 indications/alarms

-2-A-6 1-7, LPRM Downscale  
-2-A-6 3-7, APRM Trouble  
-2-A-5 2-2, Rod Out Block

Bypasses APRM #1 using the joystick

BOP Accesses APRM #1 and determines downscale LPRM

### Success Path:

Recognize APRM #1 is inoperable. Bypasses APRM #1. Determination is made that Technical Specification requirements are being met for the minimum number of Operable APRMs. (TS 3.3.1.1 – RPS, TRM 3.3 Rod Block)

### Simulator Operator Activities:

- **WHEN** directed by lead examiner, activate **TRIGGER 1** (LPRM Downscale on APRM #1).
- **WHEN** asked, as I&C, to assist in the investigation of the failure, acknowledge the request.





## EVENT 2 LPRM Failure


### Required Operator Actions

Annunciator Response – LPRM downscale

#### SRO

- Obtain information from RO/BOP regarding failed LPRM (APRM assignment, associated LPRM status; i.e., total counts and LPRMs per level).
- Direct BOP to bypass the affected APRM per 2APP-A-6 3-7
- Evaluates Technical Specifications and declares APRM #1 inoperable
- Determines Tracking LCO is required per TS 3.3.1.1 Condition – A, tracking LCO- no actions required. Also, TRM 3.3 Rod Block

#### RO

- 
- Refers to annunciator procedures and identifies/reports indications of LPRM failure and APRM#1 indications/alarms

2-A-6 1-7, LPRM Downscale

2-A-6 3-7, APRM Trouble

2-A-5 2-2, Rod Out Block

- Bypasses APRM #1 using the joystick.

#### RO/BOP

- Accesses APRM #1 drawer (in the backpanels) and determines LPRM location (28-13 D) and impact on the APRM (too-few-inputs on level).  
NOTE: This information is also available on Panel 603 in the main control room.



### EVENT 3 SHIFTING CONVENTIONAL SERVICE WATER PUMPS

The crew will swap operating Conventional Service Water Pumps in support of scheduled Maintenance.

#### Malfunction required:

- None

#### Objectives:

SCO Directs BOP to start 2C Conventional Service Water Pump and place 2A Conventional Service Water Pump in standby per 2OP-43.

BOP Place 2C Conventional Service Water Pump in service and secure 2A Conventional Service Water Pump and place it in standby per 2OP-43, Section 8.23.

#### Success Path:

Conventional Service Water Pump 2C will be started and Conventional Service Water Pump 2A will be secured and placed in AUTO per 2OP-43, section 8.23.

#### Simulator Operator Activities:

- **WHEN** asked, report that pre-start checks on 2C Conventional Service Water Pump have been completed and all parameters/conditions are normal.
- **WHEN** asked, report that 2C Conventional Service Water Pump is running normally.

#### Required Operator Actions

##### **Normal Plant Operation – Shifting of Conventional Service Water Pumps**

#### **SRO**

- Direct BOP to shift Conventional Service Water Pumps per 2OP-43, Section 8.23

#### **BOP**

- Shift Conventional Service Water Pumps per 2OP-43, Section 8.23.



## EVENT 4 CONVENTIONAL SERVICE WATER PUMP FAILURE

The crew will respond to the failure of an operating Conventional Service Water Pump failure per 0AOP-19.0 and take action to restore Conventional Service Water to within normal operating limits.

### Malfunctions required:

2C Conventional Service Water Pump will trip on electrical fault, and the 2A Conventional Service Water Pump will fail to start on a low pressure demand signal.

### Objectives:

SCO Enters/References 0AOP-19.0 and directs the actions of the BOP to facilitate restoration of The Conventional Service Water System to within normal limits

BOP Enters/References 0AOP-19 and manually starts the 2A Conventional Service Water Pump to restore Conventional Service Water parameters within normal limits.

### Success Path:

Conventional Service Water header is restored to operating within normal ranges with the 2A and 2B Conventional Service Water Pumps operating.

### Simulator Operator Activities:

- **WHEN** directed by the lead examiner, activate **TRIGGER 4** (2C CSW Pump trip/2A CSW Pump fails to auto start)
- **IF** asked, as AO, to investigate in the Service Water Building, wait 3 minutes and then report an acrid smell in the vicinity of the 2C Conventional Service Water Pump motor, but that there are no signs of smoke and/or fire.
- **IF** asked, as AO, to investigate in the Diesel Generator Building, wait 3 minutes and report that there are overcurrent trips on all three phases of the 2C Conventional Service Water Pump 4KV Breaker.
- **IF** asked, as I&C, to investigate the trip of the 2C CSW Pump, acknowledge request.

## EVENT 4 CONVENTIONAL SERVICE WATER PUMP FAILURE

### Required Operator Actions

#### Abnormal Operating Procedures – Conventional Service Water Failure

#### SRO

- Enter/Reference 0AOP-19 and directs BOP to execute applicable steps to restore the system to normal parameters
- Reviews Technical Specifications for impact of a loss of two Conventional Service Water Pumps (one electrical fault and one that did not start on a low header pressure demand). TS 3.7.2 – Ultimate Heat Sink – Tracking LCO-i.e. LCO conditions are still met))

#### BOP

- Enter/Reference and executes applicable steps of 0AOP-19 and restores Conventional Service Water header pressure to within normal parameter ranges.
- Starts 2A CSW pump manually
- Refers to Annunciator responses

2-UA-15 6-1, Bus E1 4KV OVLD  
2-UA-1 1-9, CONV HDR SERV WATER PRESS-LOW  
2-UA-1 4-9, CONV HDR SW PUMP C TRIP



## EVENT 5 HPCI FIC POWER FAILURE

The crew will observe and respond to a HPCI FIC power failure annunciator and diagnose that the condition has resulted in HPCI being inoperable and unavailable. The SCO will evaluate the impact to plant operation, including Technical Specification action statement(s).

### Malfunctions required:

- Power to the HPCI FIC (Flow Indicating Controller) will be interrupted, resulting in HPCI inoperability and unavailability.

### Objectives:

SCO

Evaluate plant conditions and diagnose the failure of HPCI and determine HPCI is Inoperable and Unavailable.

Evaluate the impact of the HPCI inoperability with respect to Technical Specifications. (3.5.1.D.1 – Verify RCIC Operable – immediately, 3.5.1.D.2 – HPCI operable 14 days )

RO

Review the Annunciator Procedure for A-1 2-5, "HPCI FIC POWER LOSS

Dispatch auxiliary operator to investigate the logic power supply source

Secure HPCI as directed by the annunciator procedure for window A-1 2-5, "HPCI FIC POWER LOSS

### Success Path:

The crew correctly diagnoses that HPCI is inoperable and unavailable, properly secures the system per 2OP-19, and evaluates the condition with respect to Technical Specifications.



## EVENT 5 HPCI LOGIC POWER FAILURE

### Simulator Operator Activities:

- **WHEN** directed by the lead examiner, activate **TRIGGER 2** (HPCI FIC Logic Power Loss).
- **WHEN** asked as an auxiliary operator, report that panel 4A circuit 2 breaker for the HPCI logic power is tripped and, if directed to attempt a reset, report that the breaker immediately tripped, again.
- **WHEN** asked as I&C to come to the control room to help with the investigation, acknowledge the request.

### Required Operator Actions:

#### SCO

- Evaluate the plant impact and Technical Specification requirements for the HPCI inoperability. (3.5.1.D.1 – Verify RCIC Operable – immediately, 3.5.1.D.2 – HPCI operable -14 days)
- Direct the RO to carry out the actions necessary to secure HPCI, as required by the annunciator procedure

#### RO

- Inform the SCO of the annunciator related to 2-A-1 2-5, HPCI FIC POWER LOSS
- When directed by the SCO, secure HPCI as directed by the applicable procedure.
- Places HPCI Aux Oil Pump in Pull-To-Lock



**EVENT 5 HPCI LOGIC POWER FAILURE**

**APPLICANT'S ACTIONS OR BEHAVIOR:**

A series of approximately 30 horizontal lines provided for the applicant to describe their actions or behavior in response to the event.



## EVENT 6 CIRC WATER INTAKE SCREEN FOULING WITH LOWERING CONDENSER VACUUM

The crew will respond to an insurge of vegetative debris on the Circ Water intake screens accompanied by a lowering condenser vacuum.

### Malfunctions required:

- Circ Water Intake screen differential pressure will begin to rise due to vegetative fouling, followed by Circ Water Intake Pumps tripping on a high differential pressure signal. Impacted by this, main condenser vacuum will begin to lower due to heat sink availability (lower circ water flow due to pump trips).

### Objectives:

SCO Enter and direct actions associated with 0AOP-37.1.

Directs the RO to lower reactor power using the 0ENP-24 rapid power reduction directions

Directs the BOP to take appropriate actions contained in 0AOP-37.1 to maintain the main condenser available as a heat sink.

Establishes and communicates a value for condenser vacuum at which time the crew will scram the reactor (line-in-the-sand)

RO Lowers reactor power as directed by the unit SCO in an effort to maintain main condenser vacuum

BOP Enters and executes 0AOP-37.1 for intake structure blockage. Restarts Circ Water Intake Pumps, as permitted.

### Success Path:

Crew recognizes the indications for fouling of Circ Water Intake Screens, enters and executes 0AOP-37.1 and, when the condition is recognized as unrecoverable, makes the decision/takes the actions to scram the reactor.

## EVENT 6 CIRC WATER INTAKE SCREEN FOULING WITH LOWERING CONDENSER VACUUM

### Simulator Operator Activities

- **WHEN** directed by lead examiner, activate **TRIGGER 3** (Circ Water Intake Screen fouling/lowering vacuum).
- **WHEN** scram occurs, **TRIGGER 7** automatically initiates to trip all Circ Water Intake Pumps.
- **WHEN** contacted, report that there is significant vegetative debris on the Circ Water trash racks and that more can be seen coming down the intake canal.
- **WHEN** contacted, report that the screens have heavy debris on them, but are continuing to rotate.
- **IF** directed as the AO to place screenwash in high vulnerability lineup, acknowledge the request.

### Required Operator Actions

#### SCO

- Enter and direct actions associated with 0AOP-37.1.
- Directs the RO to lower reactor power using the 0ENP-24 rapid power reduction directions
- Directs the BOP to take appropriate actions contained in 0AOP-37.1 to maintain the main condenser available as a heat sink.
- Establishes and communicates a value for condenser vacuum at which time the crew will scram the reactor (line-in-the-sand).

#### RO

- Lowers reactor power to support maintaining of vacuum, as directed by the SCO per ENP-24
  - Reduces recirc flow to 47 mlbs/hr
  - Inserts control rods per ENP-24/GP-12 guidance





## **EVENT 7 ATWS/RWCU G31-F004 AUTO CLOSE FAILURE/SLC PUMP 2B FAILURE/GROUP 1 ISOLATION**

The crew will respond to a failure of the Reactor to complete a scram, a subsequent SLC Pump failure and associated RWCU failure to isolate, and a Group 1 isolation.

### Malfunctions required:


Multiple control rods will fail to insert when a reactor scram signal is applied (hydraulic ATWS). When started the 2B SLC Pump indication will be lost at the RTGB (pump motor breaker trip). The RWCU outboard isolation valve , 2-G31-F004, will fail to automatically close when the SLC system is initiated.

### Objectives:

#### **SCO**

Enter and direct the actions of 2EOP-01-RSP (Reactor Scram Procedure)

Recognizes the conditions for an ATWS, enters and executes the actions of 2-EOP-01-LPC (Level-Power Control)



Enters and executes the actions of 0EOP-02-PCCP (Primary Containment Control Procedure)

Direct SLC initiation

Direct entry into LEP-02 to insert control rods

Directs Terminate and prevent Injection per EOPs

#### **RO**

Performs the initial scram actions and recognizes/reports the ATWS conditions

Initiates ARI,

When directed, Inhibit ADS

When directed, initiates SLC and reports the 2B SLC Pump failure

When directed, enters and carries out the actions of LEP-02.

## EVENT 7 ATWS/RWCU G31-F004 AUTO CLOSE FAILURE/SLC PUMP 2B FAILURE/GROUP 1 ISOLATION

### Objectives (continued):

#### **BOP**

Perform the actions associated with reactor level and pressure control as directed by the SCO.

Controls RPV pressure 800 to 1000 psig with SRVs

Terminates and Prevents injection as directed

#### **RO/BOP**

Recognizes and reports the failure of the 2-G31-F004 (RWCU outboard isolation valve) to isolate and takes manual action to close the valve.

### Success Path:

Following insertion of the scram signal, crew recognizes and responds to the ATWS condition and directs/carries out the actions as delineated by the EOPs. The crew also recognizes and responds to the failures associated with the SLC system (SLC Pump trip, failure of the 2-G31-F004 to automatically close).

### Simulator Operator Activities:

- **WHEN** SLC switch is taken to B Pump or A&B Pump position, **TRIGGER 5** will automatically initiate to trip 2B SLC pump.
- **WHEN** asked, report that the breaker for the 2B SLC Pump is tripped. If directed to reset the breaker, report the breaker immediately trips when closed.
- **WHEN** scram jumpers are requested, activate **TRIGGER 6** (automatically initiates five minute timer for LEP-02, Section 3 jumpers installed and disables SDV vent and drains). When trigger has occurred, notify the control room that the jumpers are installed.
- **WHEN** requested (I&C and/or Mechanical Maintenance) acknowledge assistance request to get the Scram Discharge Volume Vents and Drains open.

**EVENT 7 ATWS/RWCU G31-F004 AUTO CLOSE FAILURE/SLC PUMP 2B  
FAILURE/GROUP 1 ISOLATION**

**Required Operator Actions:**

**SCO**

- Enter and directs the actions of 2EOP-01-RSP (Reactor Scram Procedure)
- Will recognize the conditions for an ATWS, enters and executes the actions of 2-EOP-01-LPC (Level-Power Control)
- Enters and executes the actions of 0EOP-02-PCCP (Primary Containment Control Procedure)
- **\*\*\*CRITICAL TASK\*\*\*** Directs SLC initiation **AND/OR** Direct entry into LEP-02 to insert control rods
- Directs Terminate and Prevent Injection per EOPs to suppress power.

**RO**

- Performs the initial scram actions and recognizes/reports the ATWS conditions
- **\*\*Critical Task\*\*** When directed, initiates SLC
- Reports the 2B SLC Pump failure
- **\*\*Critical Task\*\*** When directed, enters and carries out the actions of LEP-02 to insert control rods.



**EVENT 7 ATWS/RWCU G31-F004 AUTO CLOSE FAILURE/SLC PUMP 2B  
FAILURE/GROUP 1 ISOLATION**

**Required Operator Actions (continued):**

**BOP**

- Perform the actions associated with reactor level and pressure control as directed by the SCO.
- Controls RPV pressure 800 to 1000 psig with SRVs
- Terminates and Prevents injection as directed to lower level for power suppression.
  - TRIPS HPCI, if running. Places HPCI Aux Oil Pump in Pull-to-lock.
  - Overrides OFF low pressure ECCS systems as they start and reactor pressure approaches pump discharge pressure.
  - TRIPS Reactor Feed Pumps
  - CLOSES FW-V6 and FW-V8 **OR** FW-V118 and FW-V119.
  - ENSURES Startup Level Control Valve in Manual and demand set at zero per cent.

**RO/BOP**

- Recognizes and reports the failure of the 2-G31-F004 (RWCU outboard isolation valve). Takes manual action to close the valve.
- When directed, Inhibits ADS.



## EVENT 8 RCIC COUPLING FAILURE

The crew will respond to indications of RCIC failure to develop adequate discharge pressure and determines it is not available for high pressure injection.

### Malfunctions Required:

RCIC will not develop discharge pressure and/or flow when the system is started to inject water into the vessel

### Objectives:

- |     |   |
|-----|---|
| SCO | Evaluates indications of RCIC performance, determines RCIC unavailability, and utilizes Level-Power Control flowpath to establish course of action. |
| BOP | Observes RCIC performance when starting and reports to the unit SCO of RCIC's inability to develop discharge head and, when directed, secures RCIC. |

### Success Path:

The crew makes the determination that a problem exists with RCIC preventing it from developing adequate discharge head for injection to the vessel, secures RCIC, and implements alternate actions in the Level-Power Control EOP for maintaining level control.

### Simulator Operator Activities:

- **WHEN** contacted, inform the control room that there is not any flow noise coming from the RCIC Pump and that the turbine end of the shaft appears to be turning and the pump end of the shaft appears to not be turning.

### **EVENT 8 RCIC COUPLING FAILURE**

#### **Required Operator Actions:**

SCO

- Correctly diagnose, based on information provided and/or observed, that RCIC is not available as an injection source and execute the Level-Power Control EOP based on the information

BOP

- Attempts to operate RCIC and informs the SCO of its inability to develop flow and/or discharge head, assisting in the diagnosis of its unavailability.
- Dispatches AO to investigate RCIC

#### **APPLICANT'S ACTIONS OR BEHAVIOR:**

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**EVENT 9 SDV VENTS & DRAINS FAIL TO OPEN, EMERGENCY DEPRESSURIZATION ON INABILITY TO MAINTAIN LEVEL WITH ONE ADS VALVE FAILING TO OPEN, RESTORATION OF LEVEL**

The crew will respond to the inability to maintain Reactor Water Level above Low Level 4 (LL4) and a subsequent failure of one ADS valve to open.

Malfunctions Required:

2-B21-F013C (ADS Valve C) will fail to open when its control switch is placed to the "Open" position.

Objectives:

SCO \*\*\*\*\***CRITICAL TASK**\*\*\*\*\* Correctly evaluates inability to maintain Reactor water level above Low Level 4 and provides direction to the crew to Terminate and Prevent prior to Emergency Depressurization.

\*\*\*\*\***CRITICAL TASK**\*\*\*\*\* Directs Emergency Depressurization due to inability restore and maintain level above LL-4.

RO Continues to insert control Rods

Informs the SCO when 32% is achieved in the SLC Tank (Hot Shutdown Boron Weight)

Recognizes SDV Vents and Drains not opening when LEP-02 jumpers are installed and scram is reset

BOP \*\*\*\*\***CRITICAL TASK**\*\*\*\*\* Terminates and prevents injection from Low Pressure and Alternate Coolant Injection Systems prior to Emergency Depressurization.

Places 7 ADS Valve Control Switches in Open Position, when directed.

Identifies that F013C ADS valve does not open and informs SCO

Opens an additional SRV when directed

When directed, commences feeding the Reactor Vessel using the Condensate system to establish the level band as directed by the SCO

**EVENT 9 SDV VENTS & DRAINS FAIL TO OPEN, EMERGENCY DEPRESSURIZATION ON INABILITY TO MAINTAIN LEVEL WITH ONE ADS VALVE FAILING TO OPEN, RESTORATION OF LEVEL**

Objectives (continued):

Success Path:

The crew terminates and prevents injection sources, Emergency Depressurizes the reactor, identifies the failure of the B21-F013C to open and opens an SRV in its place and, when reactor pressure lowers below the Minimum Alternate Flooding Pressure, commences injection with the Feed and Condensate system to restore level above Low Level 4 (LL4).

Simulator Operator Activities:

- **WHEN REACTOR PRESSURE IS 120 PSIG AND INJECTION HAS COMMENCED, THEN** when directed by the lead examiner, remove SDV vent and drain override (K2213A) and remove the ATWS malfunction.

Required Operator Actions

**EOP Action – Emergency Depressurize the reactor and restore level above LL4 with a failure of ADS Valve C to open**

SCO

- **\*\*\*\*\*CRITICAL TASK\*\*\*\*\*** Correctly evaluates inability to maintain Reactor water level above Low Level 4 and provides direction to the crew to Terminate and Prevent prior to Emergency Depressurization.
- Directs Emergency Depressurization.
- **\*\*\*\*\*CRITICAL TASK\*\*\*\*\*** Recommence injection using Table 1 systems to restore level above LL4.

**EVENT 9 SDV VENTS & DRAINS FAIL TO OPEN, EMERGENCY DEPRESSURIZATION ON INABILITY TO MAINTAIN LEVEL WITH ONE ADS VALVE FAILING TO OPEN, RESTORATION OF LEVEL**

**Required Operator Actions (continued)**

RO

- Continues to insert control Rods per LEP-02
- Informs the SCO when 32% is achieved in the SLC Tank (Hot Shutdown Boron Weight)
- Recognizes SDV Vents and Drains not opening when LEP-02 jumpers are installed and scram is reset

BOP

- **\*\*\*CRITICAL TASK\*\*\*** Terminates and prevents injection to prevent uncontrolled injection during reflood following emergency depressurization.
  - TRIPS HPCI, if running. Places HPCI Aux Oil Pump in Pull-to-lock.
  - Overrides OFF low pressure ECCS systems as they start and reactor pressure approaches pump discharge pressure.
  - TRIPS Reactor Feed Pumps
  - CLOSES FW-V6 and FW-V8 **OR** FW-V118 and FW-V119.
  - ENSURES Startup Level Control Valve in Manual and demand set at zero percent.
- Places 7 ADS Valve Control Switches in Open Position, when directed.
- Identifies that F013C ADS valve does not open and informs SCO
- Opens an additional SRV when directed
- **\*\*\*\*\*CRITICAL TASK\*\*\*\*\*** When directed, recommences injection using systems from Table1 to restore level above LL4.





**EVENT 10 RECOMMENCE INJECTION/RESTORE LEVEL WITH ALL RODS IN AND/OR HOT SHUTDOWN BORON WEIGHT**

Malfunctions Required:

None

Objectives:

SCO Recognize conditions exist to allow restoring reactor water level to the normal operating band and directs BOP operator to raise water level to the normal operating band using Condensate.

If all rods in, direct RO to secure SLC and exit Level-Power Control and enter RVCP

RO If all rods in, secure SLC when directed

BOP When directed, raise reactor water level to 170" to 200" using Condensate

Success Path:

The crew has successfully achieved All Rods In or Hot Shutdown Boron Weight and restored reactor water level to a range of 170" to 200".

Simulator Operator Activities:

None

**EVENT 10 RECOMMENCE INJECTION/RESTORE LEVEL WITH ALL RODS IN AND/OR HOT SHUTDOWN BORON WEIGHT**

**Required Operator Actions:**

**EOP Action – Restore reactor vessel level to the normal operating band**

SCO

- Recognize conditions exist to allow restoring reactor water level to the normal operating band and directs BOP operator to raise water level to the normal operating band using Condensate.
- Execute the steps of 2EOP-01-RVCP to direct restoration of reactor water level to a range of 170" to 200".
- When all control rods are inserted, exit 2EOP-01-LPC and enter 2EOP-01-RVCP.

RO

- When all control rods are inserted and directed by SRO, secure SLC pumps.
- Continue to insert control rods and/or inject SLC until All Rods In or Hot Shutdown Boron Weight is achieved

BOP

- When directed, raise reactor water level to a range of 170" to 200" using Condensate in a controlled manner.

**EVENT 10 RECOMMENCE INJECTION/RESTORE LEVEL WITH ALL RODS IN AND/OR HOT SHUTDOWN BORON WEIGHT**

**APPLICANT'S ACTIONS OR BEHAVIOR:**

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**EVENT 10 RECOMMENCE INJECTION/RESTORE LEVEL WITH ALL RODS IN  
AND/OR HOT SHUTDOWN BORON WEIGHT**

**Simulator Operator Activities:**

**WHEN** directed by the lead examiner, place the simulator in **FREEZE**.

**CAUTION**

**DO NOT RESET THE SIMULATOR PRIOR TO RECEIPT  
OF CONCURRENCE TO DO SO FROM THE LEAD  
EXAMINER**

# ATTACHMENT 1

# Title -NRC Scenario 2

# Path - E:\NRC Scenarios\2007 NRC Scenario 2.scn

mfi:NI048M,True,,00:00:00,00:00:00, 1,28-13-4D  
mfi:ES015F,True,00:00:00,00:00:00, 2  
mfi:CW015F, 70,00:00:00,00:00:00,00:00:00, 3  
mfi:RP011F,True,00:00:00,00:00:00, 0  
mfi:RW016F,True,00:00:00,00:00:00, 0  
mfi:CW027F,True,,00:00:00,00:00:00, 4,C  
mfi:RP005F,True,00:05:00,00:00:00, 6  
rfi:ED\_IABKCF08,OUT,00:00:00, 0  
rfi:SL\_IASLRB,OPEN,00:00:00, 5  
rfi:RI\_IARIUNCP,YES,00:00:00, 0  
rfi:CW\_ZVCW003M,OFF,00:00:00, 0  
rfi:EL\_IALSCW2A,TRIP,00:00:00, 7  
rfi:EL\_IALSCW2B,TRIP,00:00:00, 7  
rfi:EL\_IALSCW2D,TRIP,00:00:00, 7  
tri:5, K2119E2O || K2119E3O  
tri:7, ZA751  
dii:K2213A,NORMAL,OFF,00:05:00,00:00:00, 6  
dii:K2213A,ISOLATE,ON,00:05:00,00:00:00, 6  
dii:K1507A,AUTO,ON,00:00:00,00:00:00, 0  
dii:K1507A,OPEN,OFF,00:00:00,00:00:00, 0  
dii:K4B39A,AUTO,OFF,00:00:00,00:00:00, 0  
dii:K4B12A,NORMAL,OFF,00:00:00,00:00:00, 0  
dii:K4B12A,START,OFF,00:00:00,00:00:00, 0  
dii:K4B12A,STOP,ON,00:00:00,00:00:00, 0  
doi:Q4B12EG5,ON/OFF,OFF,00:00:00,00:00:00, 0