Simulator Scenario
Waterford 3 Nuclear Plant
Simulator Scenario Number: E-NRC022-1

Author: rglaze **Scenario Status:** REVISION **Estimated Time:** 60

Approval: **Revision Number:** 1 12/06/2001

References Verified: rglaze 12/06/2001

Applications: Initial Exam

Initial Conditions: IC-20

Scenario Description:
Initial conditions 100% power at MOC. Crew will perform a down-power per OP-010-005 to 90% for turbine valve testing. After reactivity manipulation is satisfied, Containment Fan Cooler A trips on overload. The crew should determine the need to start the idle CFC and evaluate TS 3.6.2.2/3.4.5.1 and determine that LCOs are met. Next, charging pump B trips on overcurrent requiring implementation of OP-901-112 'Charging and Letdown Malfunction' and evaluation of TS 3.0.3, 3.1.2.4 and TRM 3.1.2.4. Next, S/G 2 safety pressure instrument fails low. This requires evaluation of TS 3.3.1, 3.3.2, 3.3.3.5 and bypassing PPS channel A S/G 2 pressure low and S/G 1 and 2 DP bistables within one hour. Next, the in-service PRZ pressure control channel fails high requiring implementation of OP-901-120, 'PRZ Press Control Malfunction' subsection E1. After transferring to the non-faulted PPCS channel, PRZ spray valve A fails open requiring implementation of OP-901-120, E3. This requires a manual reactor trip and stopping RCP 1a. The reactor trip requires entering OP-901-000, 'Standard Post Trip Actions' and then transition to OP-901-001, 'Rx Trip Recovery.' Next a main steam line 'A' break occurs in containment. The SRO must re-diagnose and enter OP-902-004, 'ESD Recovery.' EFW pump B fails to auto start on EFAS actuation. The scenario can be terminated after the crew takes action to stabilize RCS temp and press or at the lead examiner's discretion.

Scenario Notes:

Simulator setup

1. Reset simulator to required IC.
2. Insert exam disk in a: and open expert mode
3. Using EXPERT mode, load batch file SCEN2-1.BAT as follows:
   a. At COMMAND type: bat a:\scen2-1.bat
4. Verify scenario Malfunctions, Remotes and Overrides are loaded.
   a. Remotes and Overrides as follows:

SIR29 - HPSI PUMP A RACKOUT
CVR20 - CHG PP A BRKR RACKOUT
LO-08A04A4DS1-1 EFW PUMP AB TURBINE OFF
LO-08A04A4DS1-2 EFW PUMP AB TURBINE OFF
LO-08A04A4DS2-1 EFW PUMP AB TURBINE OFF
LO-08A04A4DS2-2 EFW PUMP AB TURBINE OFF
LO-08A04S11-1 MS-401A EFW PUMP AB TURB STM SUPPLY OFF
LO-08A04S11-2 MS-401A EFW PUMP AB TURB STM SUPPLY OFF
LO-08A04S11-3 MS-401A EFW PUMP AB TURB STM SUPPLY OFF
LO-08A07S11-1 MS-401B EFW PUMP AB TURB STM SUPPLY OFF
LO-08A07S11-2 MS-401B EFW PUMP AB TURB STM SUPPLY OFF
LO-08A07S11-3 MS-401B EFW PUMP AB TURB STM SUPPLY OFF
LO-08A07S11-4 MS-401B EFW PUMP AB TURB STM SUPPLY OFF
LO-08A04S30-1 MS-416 EFW PUMP TURBINE STOP VALVES OFF
LO-08A04S30-2 MS-416 EFW PUMP TURBINE STOP VALVE OFF
M_A10 - EFW Pump AB Unavailable IMF M_A10 FAIL_ON

5. Verify boron equalization in progress

6. Red tag / place to off:

a. HPSI PUMP A C/S to OFF and danger tag
a. Place CHRG pp A C/S to OFF and danger tag.
b. MS-401 A and B danger tag
c. MS-416 danger tagged

7. Ensure protected train B sign placed in SM window
8. Complete simulator checksheet

Event 1 -
Crew commences down-power to 90%.

Event 2 - Trigger 1
CFC A fails off

1. Once the downpower reactivity manipulation has been satisfied, initiate Event Trigger 1.
   a. If asked - RAB watch finds no abnormal indications at the breaker
   b. If asked - electricians meggar motor and find it bad

Event 3 - Trigger 2
Chrg pump B trips off

1. RAB finds O/C flags picked up at Brkr on all 3 phases.
2. RCA finds burned insulation smell at motor but no fire.

Event 4 - Trigger 3
MS line IPT-1023A pressure transmitter fails low

Event 5 - Trigger 4
Prz pressure control Chan X fails open and PRZ spray valve RC-301A fails open

Event 6 - Trigger 5
MS line A break inside Cont.

Event 7 -
EFW pump B fails to Auto Start

For all events, if maintenance support is requested inform the control room that you will get a troubleshooting package together and come to the control room.

Scenario Timeline:

Item	Malfunction		Time	Severity	Ramp	TUA	TRA	Trigger	Event
1	FW07	C	LOAD	TRUE					
	EMERGENCY FEEDWATER PUMP FAILS TO AUTO START								
2	FW07	B	LOAD	TRUE					N1000
	EMERGENCY FEEDWATER PUMP FAILS TO AUTO START								
3	CH01	A	10	TRUE				1	T3622
	CONTAINMENT FAN COOLER FAILS OFF								
4	CV01	B	20	TRUE				2	A112.E
	CHARGING PUMP TRIP								
5	SG04	A	30	0.0				3	T331
	SG PRESSURE SAFETY CHANNEL FAILS								
6	RX14	A	40	100.00				4	A120.E
	PRESSURIZER PRESSURE CONTROL INSTRUMENT FAILURE HIGH								
7	RC14	A1	40	TRUE				4	E000
	PZR SPRAY VALVE FAILS OPEN/CLOSED								
8	MS11	A	50	5.0				5	E004
	MS LINE BREAK INSIDE CNTMT (0-100%, 100% = 40								

Manip # **Manipulation Description**

Scenario Critical Tasks
Event Number E004 **EXCESS STEAM DEMAND**

1	Stop all RCPs	The task is identified by at least one member of the crew. The PNPO takes action to secure all RCPs within 3 minutes of a loss of CCW due to the CSAS.
2	Establish RCS temp control	The task is identified by at least one member of the crew. The PNPO takes actions to stabilize RCS temperature within the limits of the PT curve following blowdown of the affected S/G.
3	Establish RCS press control	The task is identified by at least one member of the crew. The PNPO takes actions to stabilize RCS pressure within the limits of the PT curve following blowdown of the affected S/G.
4	Manually start EFW pump B	The task is identified by at least one member of the crew. The EFW pump B is started prior to S/G levels lowering to 50% WR.

Event	Reference	Rev	Chng	Event	Reference	Rev	Chng
A112.E1	TS 3.1.2			A112.E1	OP-901-112	02	03
A120.E1	TS 3.2.8			A120.E1	OP-901-120	02	02
E000	OP-902-000	09	00	E004	OP-902-004	09	00
E004	EP-001-001	19	00	N10005a	OP-010-005	00	05
N10005a	TS 4.4.7			N10005a	TS 3.2.7		
N10005a	TS 3.2.1			N10005a	TS 3.1.2		
T331	TS 3.3.2			T331	TS 3.3.1		
T331	OP-009-007	05	01				

Scenario Objectives

The ABILITY to:

1 Communicate as a team, prioritize actions, demonstrate attention to detail.

2 Analyze plant parameters in abnormal / emergency conditions to diagnose and determine which emergency / off-normal operating procedure should be entered, if appropriate.

3 Verify automatic actions, and perform procedural immediate operator actions from memory.

4 Identify all LCO conditions in Technical Specifications and interpret / apply required actions.

5 Classify emergencies, make notifications and apply required actions of EP-001-001 "Recognition and Classification of Emergency Conditions".

6 Locate and utilize pertinent plant reference material available in the control room, including electrical and mechanical drawings.

7 Make clear, accurate, and concise verbal reports, writtten logs, and in-plant communications.

Event Number A112.E1 CHARGING PUMP MALFUNCTION

1 Determine the cause of charging malfunction and realign system as necessary to restore charging capability.

2 Properly perform subsequent operator actions in accordance with offnormal operating procedure OP-901-112, Charging and Letdown Malfunctions.

Event Number A120.E1 PRESSURIZER CONTROL PRESSURE TRANSMITTER FAILURE

1 Stabilize pressurizer pressure on alternate control channel according to off-normal operator procedure OP-901-120, Pressurizer Pressure Control Malfunction.

Event Number E000 STANDARD POST TRIP ACTIONS (IMMEDIATE OPERATOR ACTIONS)

1 Carry out all operator actions, including necessary contingency actions in accordance with OP-902-000, Standard Post Trip Actions, in the event of a reactor trip.

2 Properly diagnose event in progress and transition to appropriate EOP recovery procedure.

Event Number E004 EXCESS STEAM DEMAND

1 Verify the existence/location of an excess steam demand.

2 Ensure the reactor is maintained in a shutdown condition.

3 Ensure the conditions for pressurized thermal shock are minimized.

4 Mitigate the consequences of an excess steam demand by properly utilizing OP-902-004, Excess Steam Demand Recovery Procedure.

Event Number N10005a PLANT SHUTDOWN 100% TO 90%

1 Reduce reactor power and/or remove the unit from service by operating securing, or realigning plant equipment as directed by precautions, limitations, and procedural guidance of General Operating Procedure, OP-010-005.

Event Number T331 SAFETY CHANNEL INSTRUMENTATION FAILURES

1 Recognize failed instrument and verify RPS/CPC bistable functions as expected.

2 Bypass affected bistable channel.

Number:	Position:	Action
	Event Number	**N10005a** **PLANT SHUTDOWN 100% TO 90%**
1	SS/CRS	IF NECESSARY, ENSURE IPTE REQUIREMENTS ARE MET AND SENIOR LINE MANAGER ON SITE
2	CRS	NOTIFY LOAD DISPATCHER PRIOR TO POWER REDUCTION AND ANNOUNCES POWER REDUCTION OVER PLANT PAGING SYSTEM
3	PNPO/CRS	MAINTAIN TCOLD 541-558 DURING DOWNPOWER. PERFORM BORATION EQUALIZATION. BORATE PER OP-002-005 TO REDUCE REACTOR POWER AT RATE DETERMINED BY THE CRS.
4	PNPO/CRS	MAINTAIN ASI USING GROUP 5, 6 OR PART LENGTH CONTROL RODS
5	SNPO/CRS	REDUCE GENERATOR LOAD AS REQUIRED ONCE TAVE STARTS TO DROP TO MATCH REFERENCE TEMPERATURE AND TAVE
6	SNPO/CRS	WHEN POWER BELOW 95% VERIFY MSBSCAL NO LONGER IN SERVICE
7	PNPO/CRS	REEVALUATE CEA SUBGROUPS SELECTED TO DROP ON RPC BETWEEN 90% AND 80% POWER.
8	TERM	TERMINATE EVENT AT 90% POWER OR AT LEAD EXAMINER'S DISCRETION
	Event Number	**A112.E1** **CHARGING PUMP MALFUNCTION**
1	PNPO/CRS	RECOGNIZE AND REPORT CHARGING PUMP TRIP (ALARMS AND INDICATION)
2	SNPO/CRS	STOP TURBINE LOAD CHANGES (IF APPLICABLE) AND SECURE BORATION
3	PNPO/CRS	IF CHARGING PUMPS HAVE TRIPPED: VERIFY CHARGING PUMP SUCTION PATH (EITHER CVC-183 OR CVC-507 OPEN)
4	PNPO/CRS	IF LETDOWN IS NOT ISOLATED ATTEMPT TO RESTART CHARGING PUMPS
5	PNPO/CRS	CLOSE LETDOWN STOP VALVE (CVC-101) IF CHARGING PUMPS CANNOT BE RESTARTED
6	CRS/SS	CHECK TECHNICAL SPECIFICATIONS
7	PNPO/CRS	IF THE REASON FOR THE CHARGING PUMP TRIP IS CORRECTED AND PRESSURIZER LEVEL IS NORMAL, THEN PLACE CHARGING AND LETDOWN IN SERVICE

8	TERM	WHEN LETDOWN IS RESTORED

Event Number T331 SAFETY CHANNEL INSTRUMENTATION FAILURES

1	PNPO	RECOGNIZE AND REPORT INDICATIONS OF FAILED CHANNEL
2	PNPO/CRS	VERIFY RPS/CPC FUNCTION BISTABLE RESPOND AS EXPECTED
3	CRS	REVIEW AND/OR IMPLEMENT ACTIONS REQUIRED BY TECHNICAL SPECIFICATION SECTION 3.3.1 OR 3.3.2 (RPS OR ESFAS) AND 3.3.3.5
4	CRS	DIRECT BISTABLE BYPASS WITH 1 HOUR OF FAILURE (FOR FIRST CHANNEL FAILURE)
4.1	CRS	NOTE: FAILURE OF A SECOND CHANNEL WILL REQUIRE THAT CHANNEL TO BE PLACED IN THE TRIP CONDITION. TO BYPASS A SECOND CHANNEL WILL REMOVE BOTH CHANNELS FROM BYPASS.
5	SNPO/PNP	BYPASS AFFECTED CHANNEL IN ACCORDANCE WITH OP-009-007 SECTION 6.2
6	TERM	BYPASS LIGHTS ILLUMINATE ON BCP AND ROM FOR THE DESIRED CHANNEL

Event Number A120.E1 PRESSURIZER CONTROL PRESSURE TRANSMITTER FAILURE

1	PNPO/CRS	VERIFIES PRESSURIZER PRESSURE INSTRUMENT FAILURE BY CHECKING X/Y RECORDER
2	PNPO/CRS	TRANSFER PRESSURIZER PRESSURE CONTROL TO OPERABLE CHANNEL USING PRESSURIZER PRESSURE CHANNEL SELECTOR CONTROL SWITCH
3	PNPO/CRS	IF PRESSURIZER PRESSURE CONTROL CHANNEL IS FAILED HIGH, THEN PERFORM THE FOLLOWING: A) TRANSFER PRESSURIZER LO LEVEL CUTOUT SELECTOR SWITCH TO THE OPERABLE PRESSURIZER PRESSURE CONTROL CHANNEL B) RESET PROPORTIONAL HEATER BANKS #1 AND #2.
4	TERM	TERMINATE WHEN FAILED SPRAY VALVE IS NOTED.

Event Number E000 STANDARD POST TRIP ACTIONS (IMMEDIATE OPERATOR ACTIONS)

1	PNPO/CRS	VERIFY REACTIVITY CONTROL. CHECK REACTOR POWER DROPPING OR PERFORM ANY OF THE FOLLOWING: MANUALLY TRIP THE REACTOR, MANUALLY INITIATE DRTS, OPEN BOTH 32 BUS BKRS FOR 5 SECONDS AND RE-CLOSE. CHECK STARTUP RATE IS NEGATIVE. CHECK LESS THAN 2 CEAS NOT FULLY INSERTED OR EMERGENCY BORATE.

2	SNPO/CRS	VERIFY MAINTENANCE OF VITAL AUXILIARIES CHECK THE MAIN TURBINE TRIPPED OR PERFORM ANY OF THE FOLLOWING: MANUALLY TRIP THE TURBINE OR CLOSE BOTH MSIVS. CHECK THE GENERATOR TRIPPED OR MANUALLY TRIP THE MAIN GENERATOR BY PERFORMING ANY OF THE FOLLOWING: DEPRESS BOTH GENERATOR EMERG TRIP PUSHBUTTONS OR TRANSFER BOTH ELECTRICAL TRAINS TO THE SUTS AND OPEN BOTH GENERATOR OUTPUT BKRS AND THE EXCITER FIELD BKR. CHECK TRAIN A AND B STATION LOADS ARE ENERGIZED FROM OFFSITE POWER OR VERIFY THE APPLICABLE EDG STARTS AND ITS OUTPUT BKR CLOSES.
3	PNPO/CRS	VERIFY RCS INVENTORY CONTROL BY CHECKING PZR LEVEL 7% TO 60% AND SUBCOOLING MARGIN GREATER THAN OR EQUAL TO 28 DEG. F. IF PZR LEVEL CONTROL SYSTEM IS MALFUNCTIONING THE OPERATOR TAKES MANUAL CONTROL OF THE SYSTEM OR OPERATES CHARGING AND LETDOWN COMPONENTS TO RESTORE PZR LEVEL (THIS STEP MAY BE N/A FOR ESD, LOCA, OR SGTR EVENTS)
4	PNPO/CRS	VERIFY RCS PRESSURE CONTROL BY CHECKING PZR PRESSURE BETWEEN 1750 PSIA AND 2300 PSIA OR 1) IF PZR PRESS CONTROL SYSTEM (PPCS) IS MALFUNCTIONING THE OPERATOR TAKES MANUAL OF PPCS CONTROLLERS TO RESTORE PRESSURE 2) IF PZR PRESSURE IS LESS THAN 1684 PSIA, THE OPERATOR VERIFIES THAT SIAS AND CIAS INITIATE OR PERFORMS MANUAL INITIATION 3)IF PZR PRESSURE IS LESS THAN 1621, THE OPERATOR VERIFIES NO MORE THAN TWO RCPS ARE OPERATING. 4) IF PZR PRESSURE IS LESS THAN MINIMUM RCP NPSH OF APP. 2A THE OPERATOR SECURES ALL RCPS.
5	PNPO/CRS	VERIFY CORE HEAT REMOVAL BY CHECKING AT LEAST ONE RCP OPERATING, OPERATING LOOP DELTA-T LESS THAN 13 DEG. F, AND RCS SUBCOOLING GREATER THAN OR EQUAL TO 28 DEG. F. (MAY BE N/A FOR ESD, LOCA, AND LOOP EVENTS)
6	SNPO/CRS	CHECK RCS HEAT REMOVAL BY CHECKING AT LEAST ONE S/G IS BOTH 15-80% NR AND MAIN FEEDWATER IS AVAILABLE TO RESTORE LEVEL OR VERIFY EFW IS AVAILABLE TO RESTORE LEVEL IN AT LEAST ONE S/G.
7	PNPO/SNPO/C	CHECK RCS TEMPERATURE 535-555 DEG. F OR 1) IF TC IS > 555 DEG. F VERIFY LEVEL IS BEING RESTORED TO AT LEAST ONE S/G AND VERIFY SBCS OR ADVs ARE MAINTAINING RCS TEMP 535-555 DEG. F. 2) IF TC IS < 535 DEG. F THEN VERIFY FEED FLOW IS NOT EXCESSIVE AND VERIFY SBCS OR ADVs ARE RESTORING RCS Tc 535-555 DEG. F 3) IF TC IS < 500 DEG. F VERIFY NO MORE THAN 2 RCPs OPERATING 4) IF ESD IN PROGRESS STABILIZE RCS TEMPERATURE USING LEAST AFFECTED S/G PER APP. 13.
8	SNPO/CRS	CHECK S/G PRESSURE 925-1050 PSIA OR 1) IF S/G PRESS <925 PSIA VERIFY STEAM BYPASS VALVES AND ADVs ARE CLOSED. 2) IF S/G PRESS LESS THAN OR EQUAL TO 764 PSIA VERIFY MSIS IS INITIATED. 3) IF S/G PRESS > 1050 PSIA VERIFY SBCS OR ADVs ARE RESTORING S/G PRESS TO < 1050 PSIA

9	SNPO/CRS	CHECK FWCS IN RTO BY CHECKING MAIN FEED REG VALVES ARE CLOSED, STARTUP FEED REG VALVES ARE 13-21% OPEN, AND OPERATING FEED PUMPS ARE 3800 TO 4000 RPM OR MANUALLY OPERATE FEEDWATER SYSTEM TO RESTORE LEVEL IN AT LEAST ONE S/G TO 50-70 NR.(N/A IF MSIS IS INITIATED)
10	SNPO/CRS	RESET MOISTURE SEPARATOR REHEATERS AND CHECK THE TEMP CONTROL VALVES CLOSED OR NOTIFY AN NAO TO FAIL CLOSE THE VALVES LOCALLY. (N/A IF MSIS IS INITIATED)
11	PNPO/CRS	VERIFY CONTAINMENT ISOLATION BY CHECKING CONTAINMENT PRESSURE < 16.4 PSIA, CHECK THAT NO CONT. AREA RAD MONITORS ARE IN ALARM OR SHOW AN UNEXPLAINED RISE IN ACTIVITY, AND CHECK THAT NO STEAM PLANT RAD MONITORS ALARM OR SHOW AN UNEXPLAINED RISE IN ACTIVITY. iF CONTAINMENT PRESSURE IS GREATER THAN OR EQUAL TO 17.1 PSIA VERIFY CIAS, SIAS, AND MSIS INITIATE.
12	SNPO/PNPO/C	VERIFY CONTAINMENT TEMPERATURE AND PRESSURE CONTROL AND CONTAINMENT COMBUSTIBLE GAS CONTROL BY VERIFYING CONTAINMENT TEMP LESS THAN OR EQUAL TO 120 DEG. F AND CONTAINMENT PRESSURE IS < 16.4 PSIA OR 1) VERIFY AT LEAST 3 CFCs OPERATING. 2) IF CONTAINMENT PRESS IS GREATER OR EQUAL TO 17.1 PSIA VERIFY ALL CFCs ARE OPERATING IN EMERGENCY MODE. 3) IF CONTAINMENT PRESS IS GREATER THAN OR EQUAL TO 17.7 VERIFY CSAS IS INITIATED, ALL AVAILABLE CS PUMPS ARE DELIVERING > 1750 GPM, AND SECURE ALL RCPs .
13	CRS	VERIFY ALL SAFETY FUNCTION ACCEPTANCE CRITERIA ARE MET
14	CRS/PNPO/SN	PERFORM DIAGNOSTICS
15	TERM	CREW DIAGNOSES AN ESD EVENT AND EXITS TO OP-902-004

Event Number E004 EXCESS STEAM DEMAND

1	CRS/STA	CONFIRM DIAGNOSIS
2	CREW	ANNOUNCE THE EVENT
3	SS/CRS	CLASSIFY THE EVENT
4	CRS	IMPLEMENT PLACEKEEPING
5	PNPO/SNPO/C	VERIFY SIAS INITIATED
6	SNPO/CRS	VERIFY SIAS ACTUATION

7	SNPO/CRS	VERIFY MSIS ACTUATION
8	PNPO/CRS	VERIFY RCP TRIP STRATEGY
9	PNPO/SNPO/C	VERIFY RCP OPERATING LIMITS
10	SNPO	PROTECT MAIN CONDENSER
11	SNPO/CRS	VERIFY PROPER CCW OPERATION
12	SNPO/CRS	DETERMINE MOST AFFECTED SG
13	SNPO/CRS	ISOLATE MOST AFFECTED SG:
14	PNPO/SNPO/C	VERIFY CORRECT SG ISOLATED
15	PNPO/SNPO/C	STABILIZE RCS TEMPERATURE
16	TERM	THE EVENT MAY BE TERMINATED WHEN ACTIONS TO STABILZE RCS TEMPERATURE AND PRESSURE HAVE BEEN PERFORMED.