

Facility: <u>Limerick 20-1</u>	Date of Examination: <u>07/12/21</u>	
Examination Level: RO <input checked="" type="checkbox"/> SRO <input type="checkbox"/>	Operating Test Number: <u>1</u>	
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R, N	<u>Temperature Effects on Reactor Level Instrumentation</u> (G2.1.20 – Ability to interpret and execute procedure steps, IMP RO 4.6 SRO 4.6) (LOJPM6756)
Conduct of Operations	R, N	<u>Determine Drywell Venting Parameters</u> (G2.1.25 – Ability to interpret reference materials, such as graphs, curves, tables, etc. IMP RO 3.9 / SRO 4.2) (LOJPM6755)
Equipment Control	R, D	<u>Review Drywell Floor Drain Sump/Equipment Drain Tank Logs and Determine Compliance With TS 3.4.3.2</u> (2.2.12 – Knowledge of Surveillance Procedures, IMP RO 3.7 SRO 4.1) (LOJPM6708)
Radiation Control	R, D	<u>Area Rad Monitor(s) Fail Downscale</u> (G2.3.15 – Knowledge of Rad. Monitoring Systems such as fixed rad monitors and alarms, portable survey inst., personnel monitoring equip. etc, IMP RO 2.9 SRO 3.1)(LOJPM6718)
Emergency Plan		N/A
NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).		
* Type Codes and Criteria:		
	(C)ontrol room, (S)imulator, or Class(R)oom	2
	(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs and RO retakes)	2
	(N)ew or (M)odified from bank (≥ 1)	2
	(P)revious 2 exams (≤ 1, randomly selected)	0

Facility: <u>Limerick 20-1</u>	Date of Examination: <u>07/12/21</u>
Examination Level: RO <input type="checkbox"/> SRO <input checked="" type="checkbox"/>	Operating Test Number: <u>1</u>

  

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R, N	<u>Determination of Adequate Shift Staffing</u> (G2.1.5 – Ability to use procedures related to shift staffing, such as minimum crew complement, overtime limitations etc, IMP RO 2.9 SRO 3.9)(LOJPM6757)
Conduct of Operations	R, D	<u>Determine Acceptability Of Installing Fuel Pool Gates</u> (G2.1.40 – Knowledge of Refueling administrative requirements, IMP RO 2.8 SRO 3.9)(LOJPM6763)
Equipment Control	R, D	<u>Review Drywell Floor Drain Sump/Equipment Drain Tank Logs and Determine Compliance With TS 3.4.3.2</u> (2.2.12 – Knowledge of Surveillance Procedures, IMP RO 3.7 SRO 4.1) (LOJPM6758)
Radiation Control	R, D	<u>Area Rad Monitor(s) Fail Downscale</u> (G2.3.15 – Knowledge of Rad. Monitoring Systems such as fixed rad monitors and alarms, portable survey inst., personnel monitoring equip. etc, IMP RO 2.9 SRO 3.1)(LOJPM6759)
Emergency Plan	R, N	<u>Authorize the Use of KI</u> (G2.4.40 – Knowledge of SRO responsibilities in emergency plan implementation, IMP SRO 4.5) (LOJPM6733)

NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).

* Type Codes and Criteria:	(C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs and RO retakes)      3 (N)ew or (M)odified from bank (≥ 1)      2 (P)revious 2 exams (≤ 1, randomly selected)      0
----------------------------	---

Facility: <u>Limerick NRC 20-1</u>	Date of Examination: <u>07/12/21</u>
Exam Level: RO <input checked="" type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/>	Operating Test Number: <u>1</u>

Control Room Systems:\* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U

System/JPM Title	Type Code*	Safety Function
a. <u>Start a Recirc Pump</u> (System 202001- Recirculation System, A3.02, Imp 3.1)(LOJPM3121)	A,D,S	1
b. <u>RCIC Manual Slow Start</u> (System 217000 – Reactor Core Isolation Cooling System, A4.01, Imp 3.7) (LOJPM3015)	D, S	2
c. <u>Roll the Main Turbine</u> (System 241000 – Reactor/Turbine Pressure Regulating System, A4.19, Imp 3.5)(LOJPM3029)	A,N,S	3
d. <u>Shutdown Cooling Flow Adjustment</u> (System 205000 – Shutdown Cooling System, K1.15, Imp 3.5 )(LOJPM3515)	A, D, L, S	4
e. <u>Vent Containment Using HCVS</u> (System 223001 –Primary Containment System and Aux, A4.07, Imp 4.2) (LOJPM3070)	N, S, EN, L	5
f. <u>Scram Channel A1 and A2 Functional Test</u> (System 212000 – Reactor Protection System, K4.05, Imp 3.4) (LOJPM3031)	D,EN,S	7
g. <u>Supply RECW To The Drywell Coolers</u> (System 40000 – Component Cooling Water, A2.01, Imp 3.3)(LOJPM3028)	D, L, S	8
h. <u>Standby Gas Treatment Train Swap</u> (System 261000 – Standby Gas Treatment, A4.03, Imp 3.0)(LOJPM3531)	A,N, EN, S	9

In-Plant Systems:\* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U

i. <u>T-242 Defeat of HPCI/RCIC Test Return and Injection Valve Isolation Logic</u> (System 217000 – Reactor Core Isolation Cooling, A2.01, Imp 3.8)(LOJPM2275)	N, E, L, R	4
j. <u>Manual Isolation and Vent of the Scram Air Header</u> (System 212000 – Reactor Protection System, A4.17, Imp 4.1)(LOJPM2210)	D, E, R	7
k. <u>T-244 Diesel Driven Fire Pump Manual Start</u> (System 286000 – Fire Protection System, A2.08, Imp 3.2)(LOJPM2232)	D, E	8

\* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions, all five SRO-U systems must serve different safety functions, and in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for R /SRO-I/SRO-U
(A)lternate path	<b>4-6/4-6 /2-3</b> 4
(C)ontrol room	
(D)irect from bank	$\leq 9/\leq 8/\leq 4$ 7
(E)mergency or abnormal in-plant	$\geq 1/\geq 1/\geq 1$ 3
(EN)gineered safety feature	$\geq 1/\geq 1/\geq 1$ (control room system) 3
(L)ow-Power/Shutdown	$\geq 1/\geq 1/\geq 1$ 4
(N)ew or (M)odified from bank including 1(A)	$\geq 2/\geq 2/\geq 1$ 4/2
(P)revious 2 exams	$\leq 3/\leq 3/\leq 2$ (randomly selected) 0
(R)CA	$\geq 1/\geq 1/\geq 1$ 2
(S)imulator	8

Facility: <u>Limerick NRC 20-1</u>	Date of Examination: <u>07/12/21</u>
Exam Level: RO <input type="checkbox"/> SRO-I <input checked="" type="checkbox"/> SRO-U <input type="checkbox"/>	Operating Test Number: <u>1</u>

Control Room Systems:\* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U

System/JPM Title	Type Code*	Safety Function
a. <u>Start a Recirc Pump</u> (System 202001- Recirculation System, A3.02, Imp 3.1)(LOJPM3121)	A,D,S	1
b. <u>RCIC Manual Slow Start</u> (System 217000 – Reactor Core Isolation Cooling System, A4.01, Imp 3.7) (LOJPM3015)	D, S	2
c. <u>Roll the Main Turbine</u> (System 241000 – Reactor/Turbine Pressure Regulating System, A4.19, Imp 3.5)(LOJPM3029)	A,N,S	3
d. <u>Shutdown Cooling Flow Adjustment</u> (System 205000 – Shutdown Cooling System, K1.15, Imp 3.5 )(LOJPM3515)	A, D, L, S	4
e. <u>Vent Containment Using HCVS</u> (System 223001 –Primary Containment System and Aux, A4.07, Imp 4.2) (LOJPM3070)	N, S, EN, L	5
f. <u>Scram Channel A1 and A2 Functional Test</u> (System 221000 – Reactor Protection System, K4.05, Imp 3.4) (LOJPM3031)	D,EN,S	7
g. N/A		
h. <u>Standby Gas Treatment Train Swap</u> (System 261000 – Standby Gas Treatment, A4.03, Imp 3.0)(LOJPM3531)	A,N, EN, S	9

In-Plant Systems:\* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U

i. <u>T-242 Defeat of HPCI/RCIC Test Return and Injection Valve Isolation Logic</u> (System 217000 – Reactor Core Isolation Cooling, A2.01, Imp 3.8)(LOJPM2275)	N, E, L, R	4
j. <u>Manual Isolation and Vent of the Scram Air Header</u> (System 212000 – Reactor Protection System, A4.17, Imp 4.1)(LOJPM2210)	D, E, R	7
k. <u>T-244 Diesel Driven Fire Pump Manual Start</u> (System 286000 – Fire Protection System, A2.08, Imp 3.2)(LOJPM2232)	D, E	8

\* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions, all five SRO-U systems must serve different safety functions, and in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for R /SRO-I/SRO-U
(A)lternate path	4–6/ <del>4</del> –6 /2–3
(C)ontrol room	4
(D)irect from bank	≤ 9/≤ 8/≤ 4
(E)mergency or abnormal in-plant	≥ 1/≥ 1/≥ 1
(EN)gineered safety feature	≥ 1/≥ 1/≥ 1 (control room system)
(L)ow-Power/Shutdown	≥ 1/≥ 1/≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2/≥ 2/≥ 1
(P)revious 2 exams	≤ 3/≤ 3/≤ 2 (randomly selected)
(R)CA	≥ 1/≥ 1/≥ 1
(S)imulator	7

Facility: <u>Limerick NRC 20-1</u>	Date of Examination: <u>07/12/21</u>
Exam Level: RO <input type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input checked="" type="checkbox"/>	Operating Test Number: <u>1</u>

Control Room Systems:\* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U

System/JPM Title	Type Code*	Safety Function
a. N/A		
b. N/A		
c. <u>Roll the Main Turbine</u> (System 241000 – Reactor/Turbine Pressure Regulating System, A4.19, Imp 3.5)(LOJPM3029)	A,N,S	3
d. N/A		
e. <u>Vent Containment Using HCVS</u> (System 223001 –Primary Containment System and Aux, A4.07, Imp 4.2) (LOJPM3070)	N, S, EN, L	5
f. N/A		
g. N/A		
h. <u>Standby Gas Treatment Train Swap</u> (System 261000 – Standby Gas Treatment, A4.03, Imp 3.0)(LOJPM3531)	A,N, EN, S	9

In-Plant Systems:\* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U

i. <u>T-242 Defeat of HPCI/RCIC Test Return and Injection Valve Isolation Logic</u> (System 217000 – Reactor Core Isolation Cooling, A2.01, Imp 3.8)(LOJPM2275)	N, E, L, R	4
j. <u>Manual Isolation and Vent of the Scram Air Header</u> (System 212000 – Reactor Protection System, A4.17, Imp 4.1)(LOJPM2210)	D, E, R	7
k. N/A		

\* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions, all five SRO-U systems must serve different safety functions, and in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for R /SRO-I/SRO-U
(A)lternate path	4–6/4–6 /2–3 <span style="float:right">2</span>
(C)ontrol room	
(D)irect from bank	≤ 9/≤ 8/≤ 4 <span style="float:right">2</span>
(E)mergency or abnormal in-plant	≥ 1/≥ 1/≥ 1 <span style="float:right">2</span>
(EN)gineered safety feature	≥ 1/≥ 1/≥ 1 (control room system) <span style="float:right">2</span>
(L)ow-Power/Shutdown	≥ 1/≥ 1/≥ 1 <span style="float:right">2</span>
(N)ew or (M)odified from bank including 1(A)	≥ 2/≥ 2/≥ 1 <span style="float:right">3/2</span>
(P)revious 2 exams	≤ 3/≤ 3/≤ 2 (randomly selected) <span style="float:right">0</span>
(R)CA	≥ 1/≥ 1/≥ 1 <span style="float:right">2</span>
(S)imulator	<span style="float:right">3</span>

Facility: Limerick 1 & 2      Scenario No.: SEG-2158E      Rev 2      Op-Test No.: 2021-301

Examiners: \_\_\_\_\_ Operators: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Initial Conditions:**

Unit 1 is at 5.0 % power and RPV pressure is 900 psig with a GP-2, "Normal Plant Startup" in progress.

Unit 2 is at 100% power.

**Turnover:**

GP-2 is complete up to step 3.4.31 ready to raise Rx press from 900 to 960 psig using DEHC, and withdraw control rods to maintain Main Turbine BPVs controlling reactor pressure.

**Critical Tasks:**

OT-200.1      Insert Control Rods with Alternate Rod Insertion (ARI)

T-102.9      Conduct an Emergency Blowdown due to High Drywell Press

Per NUREG-1021, App. D, If an operator or crew significantly deviates from or fails to follow procedures that affect the maintenance of basic safety functions, those actions may form the basis for a CT identified in the post scenario review.

Event No.	Malfunction Number	Event Type*	Event Description
1	N/A	R-ATC N-BOP N-SRO	Continue raising reactor power and RPV pressure
2	MRD016D	C-ATC C-SRO	Control Rod (42-43) fails stuck
3	MPC257	C-BOP C-SRO TS	'1D' RHR Pump suction leak
4	MED282A	C-BOP C-SRO TS	Loss of Div 1 DC
5	MRR441	C-BOP C-SRO TS	Small coolant leak in Drywell
6	MRP029C	C-ATC C-SRO	RPS 'A' fails to scram (ARI successful) <b>(CT-1)</b>
7	MMS067	M-ALL	Steam leak in the Drywell
8	MPC476	C-BOP C-SRO	Downcomer break results in Suppression Pool pressure equalizing with Drywell pressure requiring blowdown on Pressure Suppression Curve <b>(CT-2)</b>
9	MRH600B	C-BOP C-SRO	'1B' RHR Pump trips on overcurrent

**QUANTITATIVE ATTRIBUTES**

**A. ILT**

<b>Target Quantitative Attributes (Per Scenario; See ES-301 Section D.5.d)</b>		
1.	Malfunctions after EOP entry (1-2): Downcomer break; 1B RHR PP trips on overcurrent	2
2.	Abnormal events (2-4): Stuck Control Rod, 1D RHR PP Suction Leak, Loss of Div 1 DC, Small Coolant Leak in DW	4
3.	Major transients (1–2): Steam Leak in DW	1
4.	EOPs entered/requiring substantive actions (1–2): T-101, T-102	2
5.	EOP contingencies requiring substantive actions (0-2): T-112	1
6.	Critical tasks (2–3): Manually Scram Reactor; Perform Emergency Blowdown.	2

# Simulator Scenario Summary

## SEG-2158E

### **Initial Conditions:**

Unit 1 is at 5.0 % power and RPV pressure is 900 psig with a GP-2, "Normal Plant Startup" in progress.

Unit 2 is at 100% power.

### **Turnover:**

GP-2 is complete up to the point to raise RPV pressure from 900 psig to 960 psig using Digital Electro-Hydraulic Control (DEHC), and withdraw control rods to maintain Main Turbine Bypass Valves (BPVs) controlling reactor pressure.

Event 1: When the crew takes the shift, the BOP will raise RPV pressure using DEHC, and continue raising power by withdrawing control rods.

Evaluation: The BOP will use GP-2 to raise RPV Pressure to 960 psig by raising DEHC Target Pressure in accordance with GP-2 Attachment 15, "Adjusting Reactor Pressure". The SRO should direct further rod withdrawal to continue power ascension.

Event 2: As the ATC withdraws control rods, one of the control rods will fail stuck.

Evaluation: During the rod withdrawal the ATC will determine that control rod 42-43 is not moving on demand. The crew will use normal operating procedure S73.1.A, "Normal Operation of the Reactor Manual Control System", section 4.4, "Failure of Control Rod to Withdraw", to attempt to move the stuck control rod. The crew should adjust drive water pressure to free the struck rod and put it in its proper position.

Event 3: Following the stuck control rod event, a leak will develop in the suction line for the '1D' RHR Pump (Tech Spec 3.5.1 LCO entered).

Evaluation: The crew should react to the indications and dispatch a floor operator the location. Upon confirmation of the active leak into the RHR pump room, the crew should enter AOP SE-4, "Flooding", and take action to mitigate/isolate the condition and the degradation of secondary containment.

Event 4: After the RHR leak has been isolated and Tech Spec 3.5.1 LCO entered, a loss of Division 1 DC will occur (TS LCO 3.0.3 entered).

Evaluation: The crew is expected to diagnose a loss of Division 1 DC from the indications in the MCR. Once diagnosed the crew should enter AOP E-1FA, "Loss of Division 1 Safeguard 125V/250V DC Bus 1FA", and take actions as prescribed in the procedure, including placing the MCR HVAC into a Chlorine Isolation, Verify Unit Secondary Containment integrity, hold a crew brief on plant condition and contingencies.



## **SEG-2158E (continued)**

Event 5: After the crew responds to the loss of DC, a small coolant leak will occur in the Drywell. This will require the SRO to evaluate TS 3.4.3.2..

Evaluation: The crew will recognize rising Drywell pressure and enter AOP OT-101, "High Drywell Pressure". The crew will then determine that the Drywell pressure increase is the result of an unidentified coolant leak and the crew will scram the reactor.

Event 6: After the BOP isolates RWCU in response to the increase in Drywell pressure, the ATC will perform a manual scram but 'A' RPS will fail to de-energize.

Evaluation: The ATC will take the reactor mode switch to the shutdown position but 'A' RPS will fail to de-energize. The ATC will use OT-200 Appendix 1, "RO Reactor Scram Hard Card", and manually activate RRCS (Alternate Rod Insertion), which will succeed in inserting the control rods. The crew will continue with post scram actions to stabilize the plant using EOP T-101, "RPV Control".

Event 7: When the Reactor Mode Switch has been placed in Shutdown, the steam leak in the Drywell will increase requiring actions directed by EOP T-102, "Primary Containment Control".

Evaluation: As Drywell pressure begins to rise rapidly, the SRO will enter EOP T-102 at 1.68 psig Drywell pressure and direct actions to initiate suppression pool spray. HPCI will initiate and the ATC and BOP will coordinate securing this injection source. The SRO will evaluate/direct Drywell Sprays when Suppression Pool pressure exceeds 7.5 psig.

Event 8: As the operators attempt to place Drywell Spray in service per T-225, "Startup and Shutdown of Suppression Pool and Drywell Spray Operation", a downcomer break will occur resulting in Suppression Pool pressure rising faster and exceeding the Pressure Suppression Curve.

Evaluation: The SRO will monitor T-102, Pressure Suppression Curve and once it is evident that the unsafe side of the curve cannot be avoided, enter EOP T-112, "Emergency Depressurization", and direct an emergency blowdown of the RPV.

Event 9: When Drywell pressure exceeds 10 psig, the '1B' RHR Pump will trip.

Evaluation: With '1A' RHR not available without DIV 1 DC power, the crew will utilize RHRSW to spray containment using the '1B' loop of RHR per T-225.

Termination: The scenario may be terminated when the reactor level stabilized within required band, emergency RPV depressurization has been completed and Containment Spray is in service per T-225.

## Simulator Scenario Critical Tasks

<b>OT-200.1</b>		<b>Insert Control Rods with Alternate Rod Insertion (ARI)</b>					
K/A information obtained from NUREG-1123 Revision 3							
<u>Identifier</u>			<u>K/A</u>		<u>Importance</u>		<u>Safety Function (for Systems)</u>
System/EPE/APE	Number	Title	Number	Ability	RO	SRO	
EPE	295037	Redundant Reactivity Control System	EA1.02	Operate the Redundant Reactivity Control System	3.8	4.0	7
<b>Safety Significance</b>	Correct performance of this action prevents a significant reduction of safety margin beyond that irreparably introduced by the scenario. Failure to perform this task correctly also represents a degradation of a fission product barrier.						
<b>Initiating Cue</b>	The Reactor Protection System is activated either automatically by exceeding an RPS setpoint, or manually, and the reactor control rods fail to insert to ensure reactor shutdown under all conditions.						
<b>Measurable Performance Standard</b>	<b>Expected action</b>	Initiate manual RRCS activation.					
	<b>Safety-significant boundary condition</b>	Prior to requirement for emergency blowdown of RPV.					
<b>Performance Feedback</b>	The scram air header is depressurized, and control rods insert to ensure the reactor is shutdown under all conditions.						
<b>Evaluation</b>	<b>SAT / UNSAT</b>						

<b>T-102.9</b>	<b>Conduct an Emergency Blowdown due to High Drywell Press</b>						
K/A information obtained from NUREG-1123 Revision 3							
<u>Identifier</u>			<u>K/A</u>		<u>Importance</u>		<u>Safety Function (for Systems)</u>
System/EPE/APE	Number	Title	Number	Ability	RO	SRO	
System	223001	PCS Primary Containment System and Auxiliaries	A2.07	High drywell pressure	4.4	4.3	5. Containment Integrity
EPE	295024	High Drywell Pressure	EA2.01	Drywell Pressure	4.4	4.4	N/A
<b>Safety Significance</b>	Correct performance of this action prevents a significant reduction of safety margin beyond that irreparably introduced by the scenario. Failure to perform this task correctly also represents a degradation of a fission product barrier.						
<b>Initiating Cue</b>	Pri Cont pressure and Supp Pool level cannot be maintained on the safe side of the Pressure Suppression Pressure (PSP) curve limit						
<b>Measurable Performance Standard</b>	<b>Expected action</b>		Commence an emergency blowdown in accordance with the RPV Control contingency in effect. If no RPV Control contingency is in effect, commence an Emergency Blowdown in accordance with T-112				
	<b>Safety-significant boundary condition</b>		Prior to exceeding Pressure Suppression Pressure (PSP) Curve.				
<b>Performance Feedback</b>	Lowering RPV pressure.						
<b>Evaluation</b>	<b>SAT / UNSAT</b>						

Facility: Limerick 1 & 2      Scenario No.: SEG-5006E      Rev 2      Op-Test No.: 2021-301

Examiners: \_\_\_\_\_ Operators: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Initial Conditions:**

Unit 1 is at 100 % power.

Unit 2 is at 100 % power.

**Turnover:**

- Maintain 100% Reactor power
- Perform ST-6-077-310-1, "Drywell Unit Cooler Hydrogen Mixing System Operability Test Run."

**Critical Tasks:**

T-101.2      Inhibit Auto ADS due to Low RPV Level

T-101.5      Conduct an Emergency Blowdown due to Low RPV Level

Per NUREG-1021, App. D, If an operator or crew significantly deviates from or fails to follow procedures that affect the maintenance of basic safety functions, those actions may form the basis for a CT identified in the post scenario review

Event No.	Malfunction Number	Event Type*	Event Description
1.	N/A	N-BOP N-SRO	Perform Drywell Mixing Fan ST-6-077-310-1, '1A1' ASD coolant pump trip
2.	HS26-190A/C	TS	Containment Leak Detector Inadvertent Isolation
3.	MPR020C	I-ATC I-SRO	#3 APRM fails upscale
4.	MFH563C	R-ATC C-SRO	Low Pressure FWH Level Transient
5.	MRR209A1 MRR209A2	C-ATC C-BOP C-SRO TS	'1A' Loss of ASD Cooling
6.	MRR430B	C-ATC C-SRO	'1B' Reactor Recirc Pump Trip
7.	MFW252A MRR440A	M-ALL	Loss of High Pressure Injection / LOCA Inside Containment <b>(CT-T101.2, CT-T101.5)</b>
8.	MRC460	<del>C-BOP</del> C-ATC C-SRO	RCIC discharge valve fails to Auto Open
9.	MAD151M	C-ATC C-SRO	'1M' Tailpipe break with 50% flow into SP airspace <b>(CT-T101.5 continued)</b>

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

## QUANTITATIVE ATTRIBUTES

### A. ILT

<b>Target Quantitative Attributes (Per Scenario; See ES-301 Section D.5.d)</b>	
1. Malfunctions after EOP entry (1-2): RCIC discharge valve fails to Auto Open; '1M' Tailpipe break with 50% flow into SP airspace	2
2. Abnormal events (2-4): Low Pressure FWH Level Transient; Loss of '1A' ASD Cooling pumps; APRM #3 failure; '1B' Reactor Recirc Pump Trip	4
3. Major transients (1-2): Loss of High Pressure Injection / LOCA Inside Containment	1
4. EOPs entered/requiring substantive actions (1-2): T-101, T-102	2
5. EOP contingencies requiring substantive actions (0-2): T-112	1
6. Critical tasks (2-3): Inhibit ADS, Perform Emergency Blowdown	2

# Simulator Scenario Summaries

## SEG-5006E

### **Initial Conditions:**

Unit 1 is at 100% power.

Unit 2 is at 100% power.

### **Turnover:**

- Maintain 100% Reactor power
- Perform ST-6-077-310-1, "Drywell Unit Cooler Hydrogen Mixing System Operability Test Run."

Event 1: When the crew has assumed responsibility, they will perform ST-6-077-310-1, "Drywell Unit Cooler Hydrogen Mixing System Operability Test Run." While the crew is performing the ST, the #1 cooling pump on the 1A ASD will trip. The standby pump will start.

Evaluation: The crew executes the ST procedure. When the cooling pump trips, crew should take ARC actions and discuss actions for total loss of cooling water.

Event 2: Shortly after the Drywell Cooler ST has been performed, an inadvertent isolation of the Unit 1 Containment Leak Detector occurs.

Evaluation: The crew determines that the Unit 1 Containment Leak Detector is isolated and after referencing the Alarm Response Card (ARC), will dispatch floor operators to investigate. The SRO will evaluate Tech Specs and enter LCO 3.4.3.1, Containment Leak, and direct Chemistry to sample.

Event 3: Following the isolation of the Containment Leak Detector, APRM #3 fails upscale.

Evaluation: The ATC determines a failure of the APRM #3. After referencing the Alarm Response Card (ARC), and Tech Specs, the Crew places APRM #3 in bypass.

Event 4: After the crew takes action to bypass the #3 APRM, an isolation of one LP Feedwater Heater String occurs forcing the crew to reduce Rx Power.

Evaluation: The crew identifies the isolation of the '1C' LP Feedwater Heater String and enters AOP OT-104, "Reactivity Addition". The ATC reduces Reactor power to maintain less than 100%. The crew further reduces power to meet feedwater inlet temperature constraints.

## **SEG-5006E (continued)**

Event 5: As the crew is recovering from the low pressure FWH level transient, the remaining '1A' ASD cooling pump will trip requiring trip of the ASD and entry into single loop operations.

Evaluation: The crew identifies the loss of cooling to the '1A' ASD. The crew will reference S43.1.F, "Responding to Alarms at ASD HMI" which will direct a trip of the ASD when both coolant pumps trip. If the crew delays, cell temperature alarms will occur on the '1A' ASD, and the crew will trip the ASD and enter AOP OT-112, "Unexpected/Unexplained Change in Core Flow". The SRO enters GP-15, "Single Recirc Loop Operation" and directs actions for single loop operations. The SRO then evaluates and enters Tech Spec 3.4.1.1.a.1 for single loop operation.

Event 6: When the actions for the tripped ASD are completed, the 1B Rx Recirc Pump (RRP) ASD will trip on overcurrent. This will place the plant in a loss of both Recirc pumps and AOP OT-112 will direct a unit scram

Evaluation: The Crew diagnosis a trip of the second ASD and the ATC will insert a scram based on previous direction from the SRO. The SRO enters EOP T-101, "RPV Control", and the ATC and BOP perform their scram actions using OT-200 Appendix 1, "RO Reactor Scram Hard Card", and OT-200 Appendix 12 "PRO Reactor Scram Hard Card" respectively.

Event 7: Following the reactor shutdown, a Feedwater line break inside primary containment occurs resulting in a loss of all feedwater to the RPV followed by a progressively worsening RPV coolant leak into the drywell.

Evaluation: The crew identifies rising DW pressure and enters EOP T-102 "Primary Containment Control". The ATC recognizes the feedwater line break and actions are taken to isolate the feedwater. The crew then takes action to identify HP injection sources and primary containment controls (Drywell and Suppression pool sprays).

Event 8: When RCIC is initiated, the pump discharge valve (PCIV) will fail to open automatically.

Evaluation: The BOP determines that RCIC is not injecting due to the closed PCIV valve and manually opens the valve from the handswitch.

Event 9: As RPV level decreases, prior to level dropping below -186", the crew performs an Emergency Depressurization per T-112, "Emergency Blowdown", allowing low pressure ECCS systems to restore and maintain RPV level.

Evaluation: During the emergency depressurization the '1M' SRV is identified as having a broken tailpipe. The operator closes the '1M' SRV and opens an additional SRV to satisfy the RPV T-112 depressurization requirements.

Termination: The scenario may be terminated when the Emergency Blowdown is complete, RPV level is restored to normal band with ECCS systems and Containment Spray is in service.



## Simulator Scenario Critical Tasks

<b>T-101.2</b>		<b>Inhibit Auto ADS due to Low RPV Level</b>					
K/A information obtained from NUREG-1123 Revision 3							
<b>Identifier</b>			<b>K/A</b>		<b>Importance</b>		<b>Safety Function (for Systems)</b>
<b>System/EPE/APE</b>	<b>Number</b>	<b>Title</b>	<b>Number</b>	<b>Ability</b>	<b>RO</b>	<b>SRO</b>	
System	218000	ADS Automatic Depressurization System	A2.06	ADS initiation signals present	4.5	4.3	3. Reactor Pressure Control
EPE	295031	Reactor Low Water Level	EA2.01	Reactor water level	4.7	4.6	N/A
<b>Safety Significance</b>	Correct performance of this action prevents a significant reduction of safety margin beyond that irreparably introduced by the scenario.						
<b>Initiating Cue</b>	Mode switch in shutdown and: <ol style="list-style-type: none"> <li>1. RPV level cannot be maintained above -129"</li> </ol>						
<b>Measurable Performance Standard</b>	<b>Expected action</b>		Inhibit auto ADS by placing ADS Auto Inhibit switches B21C-S15A and B21C-S15C in the inhibit position				
	<b>Safety-significant boundary condition</b>		Prior to automatic ADS initiation (5 open SRVs)				
<b>Performance Feedback</b>	ADS Auto Inhibit switches B21C-S15A and B21C-S15C in the inhibit position						
<b>Evaluation</b>	<b>SAT / UNSAT</b>						

T-101.5		Conduct an Emergency Blowdown due to Low RPV Level					
K/A information obtained from NUREG-1123 Revision 3							
Identifier			K/A		Importance		Safety Function (for Systems)
System/EPE/APE	Number	Title	Number	Ability	RO	SRO	
System	218000	ADS Automatic Depressurization System	A2.02	Loss of coolant accident	4.2	4.1	3. Reactor Pressure Control
EPE	295031	Reactor Low Water Level	EA2.03	Reactor pressure	4.2	4.0	N/A
<b>Safety Significance</b>	Correct performance of this action prevents a significant reduction of safety margin beyond that irreparably introduced by the scenario. Failure to perform this task correctly also represents a degradation of a fission product barrier.						
<b>Initiating Cue</b>	Mode switch in shutdown with RPV level unable to be restored and maintained above -161"						
<b>Measurable Performance Standard</b>	<b>Expected action</b>		1. Commence an emergency blowdown per T-112 to restore core cooling 2. Open an additional non-ADS SRV due to tailpipe failure of 1M SRV				
	<b>Safety-significant boundary condition</b>		Before RPV level reaches Minimum Steam Cooling RPV Water Level (MSCRWL) (-186")				
<b>Performance Feedback</b>	Lowering RPV pressure.						
<b>Evaluation</b>	<b>SAT / UNSAT</b>						

Facility: Limerick 1 & 2      Scenario No.: SEG-6215E      Rev 2      Op-Test No.: 2021-301

Examiners: \_\_\_\_\_ Operators: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Initial Conditions:**

Unit 1 is at 94% power for rod recovery following on-line HCU maintenance.

Unit 2 is at 100% power

Reactor Services personnel are loading spent fuel into shipping casks.

Refuel Floor Secondary Containment is established.

**Turnover:**

Withdraw the 2 maintenance rods per the ReMA (Reactivity Maneuver Approval) and restore power to 100% with Recirc flow as required.

**Critical Tasks:**

T-117.1      Inhibit Auto ADS due to Low RPV Level.

T-117.3      Control Reactor Power by Controlling RPV Injection.

T-117.6      Insert Control Rods.

Per NUREG-1021, App. D, If an operator or crew significantly deviates from or fails to follow procedures that affect the maintenance of basic safety functions, those actions may form the basis for a CT identified in the post scenario review

Event No.	Malfunction Number	Event Type*	Event Description
1	N/A	R-ATC	Withdraw control rods and restore power to 100%
2	MPR011B	I-ATC I-SRO	'1B' RBM fails INOP
3	MED014 MED015H MDG420D	C-BOP C-SRO TS	Loss of D14 Bus
4	MCR547 MRC016C	C-ATC C-SRO TS	CRD pump trip due to clogged suction strainer with multiple HCU accumulator trouble alarms.
5	MVI232F MRP029A	C-ATC C-SRO TS	"1C" RPS Rx Level Transmitter Fails Low with a Failure to Half Scram / OT-117
6	MRD556 MSL559	M-ALL	Hydraulic ATWS and SLC Line rupture ( <b>CT- T117.1, CT- T117.3, CT- T117.6</b> )
7	MRSW601B MRSW601D	C-BOP C-SRO	B Loop RHRSW pump trips
8	MMT100 MEH108	C-BOP C-SRO	Turbine high vibration requiring manual turbine trip / Bypass Valves fail closed

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

## QUANTITATIVE ATTRIBUTES

### A. ILT

<b>Target Quantitative Attributes (Per Scenario; See ES-301 Section D.5.d)</b>	
1. Malfunctions after EOP entry (1-2): Turbine high vibration requiring manual turbine trip / Bypass Valves fail closed; B Loop RHRSW pump trips	2
2. Abnormal events (2-4): Rob Block Monitor INOP, Loss of D14 Bus; CRD pump trip due to clogged suction strainer; Failure to scram	4
3. Major transients (1–2): Hydraulic ATWS and SLC Line rupture	1
4. EOPs entered/requiring substantive actions (1–2): T-101, T-102	2
5. EOP contingencies requiring substantive actions (0-2): T-117	1
6. Critical tasks (2–3): Inhibit ADS, Control Power by Controlling Injection, Insert Control Rods	3

## **SEG-6215E**

### **Initial Conditions:**

Unit 1 is at 94% power for rod recovery following on-line HCU maintenance.

Unit 2 is at 100% power.

Reactor Services personnel are loading spent fuel into shipping casks.

Refuel Floor Secondary Containment is established.

### **Turnover:**

The crew is expected to withdraw the 2 maintenance rods per the ReMA (Reactivity Maneuver Approval) and restore power to 100% with Recirc flow as required.

Event 1: When the crew takes responsibility, the ATC is directed to withdraw control rods per the provided ReMA and restore power to 100% with Recirc flow.

Evaluation: The crew takes action to withdraw the control rods using the ReMA and normal operating procedure S73.1.A, "Normal Operation of the Rx Manual Control System", while monitoring control rod drive parameters and Reactor Power. A coupling check is performed for each control rod withdrawn.

Event 2: When the 2<sup>nd</sup> control rod is selected, the '1B' RBM fails INOP and generates a control rod block requiring a Tech Spec evaluation.

Evaluation: The ATC will determine the rod block condition and the crew will determine that the '1B' Rod Block Monitor has failed. After referencing Tech Specs, and thermal limits the crew determines that it is permissible to bypass the RBM and continue with recovering the control rod.

Event 3: Once both maintenance rods have been withdrawn and Reactor power has been restored to 100% with Recirc, the safeguard Division 4 AC D14 Bus trips.

Evaluation: Using the indication in the MCR, the crew determines the trip of D14 Bus and enters AOP E-D14, "Loss of D14 Safeguard Switchgear". From the procedure the crew makes various callouts to the field. The crew restores power to the bus by either manually starting the D14 DG or closing in the alternate offsite source both of which failed to actuate automatically. The crew also recognizes a loss of Drywell cooling and enters AOP OT-101, "High Drywell Pressure". The crew addresses the loss of Drywell cooling by starting the standby Drywell Chiller to restore Drywell cooling.

Event 4: After the D14 Bus trip has been addressed, the running control rod drive (CRD) pump trips due to a clogged common suction strainer causing multiple HCU accumulators to alarm below TS minimum pressure.

Evaluation: The crew enters AOP ON-107, "Control Rod Drive System Problems". During execution of the procedure the crew bypasses the strainer, and starts a CRD pump. SRO determines TS implications of multiple HCU accumulator alarms.

## **SEG-6215E (continued)**

Event 5: After the crew has restarted a CRD pump, the "1C" RPS RPV Level transmitter will fail downscale causing a RPV Water Low, Level 3 Trip alarm. A RPS half scram is not received requiring the crew to enter OT-117, "RPS Failures".

Evaluation: The SRO directs the performance of OT-117 to insert a half scram on channel A1(2). When this fails, a full scram is inserted by placing the mode switch to shutdown and 10 rods insert.

Event 6: When the mode switch is placed in shutdown, a hydraulic ATWS occurs with 175 control rods failing to scram. Complicating the event, the SLC injection line ruptures inside the Drywell.

Evaluation: The SRO enters EOP T-101, "RPV Control". The ATC and BOP execute OT-200 appendices 1, "RO Rx Scram Hard Card" and 12, "PRO Rx Scram Hard Card", respectively. The ATC performs the first RPV lowering below -50 inches. The failure of SLC is identified and procedure T-209, "Inject SLC from RCIC", is called out to be performed. Two RHRSW pumps are then started in preparation for placing two loops of suppression pool cooling in service. The SRO directs performance of T-221, "MSIV Isolation Bypass, To Keep the MSIVs Open", and T-217, "RPS/ARI Reset", to insert control rods.

Event 7: Complicating the event, when the BOP places RHRSW in service, the B Loop pump will trip on Overcurrent several minutes later.

Evaluation: The BOP recognizes the trip of the running pump and starts the other B loop pump.

Event 8: After Reactor level has been lowered to less than -50", the Main Turbine experiences high vibration which requires a turbine trip. When Bypass valves are controlling pressure, the Turbine Bypass Valves will fail to control pressure, forcing pressure control with SRVs and heat addition to containment. Additionally, the Rod Worth Minimizer will fail to bypass preventing Rod insertion by the ATC when power is less than 14%.

Evaluation: The crew identifies that the Main Turbine vibrations are rising and briefs a pressure control contingency to trip it. Once the Main Turbine is tripped, the crew recognizes the DEHC Bypass Valve malfunction and establishes pressure control with SRVs. The crew must enter T-102, "Primary Containment Control" at 95°F and when Suppression Pool temperature reaches 110°F, the crew performs a controlled lowering to below top of active fuel (-161"). At this point the rods will be inserted and the crew slowly recovers level to the normal band (+12.5" to +54") to mitigate RPV cooldown.

Termination: The scenario may be terminated when all control rods have been inserted and RPV level has been stabilized above top of active fuel.

## Simulator Scenario Critical Tasks

<b>T-117.1</b>		<b>Inhibit Auto ADS due to Low RPV Level</b>					
K/A information obtained from NUREG-1123 Revision 3							
System/EPE/APE	<u>Identifier</u>		<u>K/A</u>		<u>Importance</u>		<u>Safety Function (for Systems)</u>
	Number	Title	Number	Ability	RO	SRO	
System	218000	ADS Automatic Depressurization System	A2.06	ADS initiation signals present	4.5	4.3	3. Reactor Pressure Control
EPE	295031	Reactor Low Water Level	EA2.01	Reactor water level	4.7	4.6	N/A
<b>Safety Significance</b>	Correct performance of this action prevents a significant reduction of safety margin beyond that irreparably introduced by the scenario.						
<b>Initiating Cue</b>	ATWS condition						
<b>Measurable Performance Standard</b>	<b>Expected action</b>		Inhibit auto ADS by placing ADS Auto Inhibit switches B21C-S15A and B21C-S15C in the inhibit position				
	<b>Safety-significant boundary condition</b>		Prior to automatic ADS initiation (5 open SRVs)				
<b>Performance Feedback</b>	ADS Auto Inhibit switches B21C-S15A and B21C-S15C in the inhibit position						
<b>Evaluation</b>	<b>SAT / UNSAT</b>						

<b>T-117.3</b>		<b>Control Reactor Power by Controlling RPV Injection</b>					
K/A information obtained from NUREG-1123 Revision 3							
<u>Identifier</u>			<u>K/A</u>		<u>Importance</u>		<u>Safety Function (for Systems)</u>
<b>System/EPE/APE</b>	Number	Title	Number	Ability	RO	SRO	
EPE	295037	SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown	EA2.01	Reactor power	4.3	4.7	N/A
EPE	295037	SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown	EA2.02	Reactor Water Level	4.3	4.4	N/A
<b>Safety Significance</b>	Correct performance of this action prevents a significant reduction of safety margin beyond that irreparably introduced by the scenario. Failure to perform this task correctly also represents a degradation of a fission product barrier and incorrect reactivity control.						
<b>Initiating Cue</b>	With mode switch in shutdown, Reactor power above 4%, RPV level between TAF (-161") and -50", Supp Pool temperature above 110°F, and either an SRV open or drywell pressure above 1.68 psig						
<b>Measurable Performance Standard</b>	Expected action		Control RPV injection to lower RPV level until reactor power is <4%, RPV level reaches TAF (-161"), or all SRVs are closed with drywell pressure less than 1.68 psig.				
	Safety-significant boundary condition		Prior to exceeding Heat Capacity Temperature Limit (HCTL)				
<b>Performance Feedback</b>	RPV level restored and maintained in a band between -186" and the level to which it was lowered.						
<b>Evaluation</b>	SAT / UNSAT						



<b>T-117.6</b>		<b>Insert Control Rods</b>					
K/A information obtained from NUREG-1123 Revision 3							
<u>Identifier</u>			<u>K/A</u>		<u>Importance</u>		<u>Safety Function (for Systems)</u>
System/EPE/APE	Number	Title	Number	Ability	RO	SRO	
System	201001	CRDH Control Rod Drive Hydraulic System	A2.04	SCRAM conditions	4.7	4.2	1. Reactivity Control
EPE	295037	SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown	EA2.05	Control rod position	4.2	4.5	N/A
<b>Safety Significance</b>	Correct performance of this action prevents a significant reduction of safety margin beyond that irreparably introduced by the scenario. Failure to perform this task correctly is also representative of incorrect reactivity control.						
<b>Initiating Cue</b>	ATWS condition						
<b>Measurable Performance Standard</b>	<b>Expected action</b>		Insert control rods with a strategy appropriate to conditions, using T-210, T-214, T-215, T-216, T-213, T-219, T-217, or T-218 based on ATWS conditions.				
	<b>Safety-significant boundary condition</b>		Prior to exceeding Heat Capacity Temperature Limit (HCTL)				
<b>Performance Feedback</b>	All rods inserted to or beyond Maximum Subcritical Bank Withdrawal Position (MSBWP), or all rods fully inserted except one.						
<b>Evaluation</b>	<b>SAT / UNSAT</b>						

Facility: Limerick		Date of Exam: 07/12/2021															
Tier	Group	RO K/A Category Points												SRO-Only Points			
		K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	Total	A2	G*	Total	
1. Emergency and Abnormal Plant Evolutions	1	4	3	3	N/A			4	3	N/A			3	20	4	3	7
	2	1	1	1	N/A			2	1	N/A			1	7	2	1	3
	Tier Totals	5	4	4	N/A			6	4	N/A			4	27	6	4	10
2. Plant Systems	1	3	1	3	3	2	2	3	3	3	2	1	26	3	2	5	
	2	1	1	1	1	1	2	1	1	1	1	1	12	0	1	2	3
	Tier Totals	4	2	4	4	3	4	4	4	4	3	2	38	4	4	8	
3. Generic Knowledge and Abilities Categories					1	2	3	4	10				1	2	3	4	7
					2	3	2	3					2	2	1	2	

- Note: 1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outline sections (i.e., except for one category in Tier 3 of the SRO-only section, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 radiation control K/A is allowed if it is replaced by a K/A from another Tier 3 category.)
2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ±1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points, and the SRO-only exam must total 25 points.
3. Systems/evolutions within each group are identified on the outline. Systems or evolutions that do not apply at the facility should be deleted with justification. Operationally important, site-specific systems/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 for guidance regarding the elimination of inappropriate K/A statements.
4. Select topics from as many systems and evolutions as possible. Sample every system or evolution in the group before selecting a second topic for any system or evolution.
5. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
7. The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' IRs for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above. If fuel-handling equipment is sampled in a category other than Category A2 or G\* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2. (Note 1 does not apply.) Use duplicate pages for RO and SRO-only exams.
9. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

G\* Generic K/As

- \* These systems/evolutions must be included as part of the sample (as applicable to the facility) when Revision 3 of the K/A catalog is used to develop the sample plan. They are not required to be included when using earlier revisions of the K/A catalog.
- \*\* These systems/evolutions may be eliminated from the sample (as applicable to the facility) when Revision 3 of the K/A catalog is used to develop the sample plan.

ES-401		BWR Examination Outline Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (RO)						Form ES-401-1	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
295001 (APE 1) Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4			05				AK3.05 - Knowledge of the reasons for the following responses as they apply to PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION: Reduced loop operating requirements: Plant-Specific. (CFR: 41.5 / 45.6)	3.2	1
295003 (APE 3) Partial or Complete Loss of AC Power / 6	06						AK1.06 - Knowledge of the operational implications of the following concepts as they apply to PARTIAL OR COMPLETE LOSS OF A.C. POWER: Station blackout: Plant-Specific. (CFR: 41.8 to 41.10)	3.8	2
295004 (APE 4) Partial or Total Loss of DC Power / 6		03					AK2.03 - Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF D.C. POWER and the following: D.C. bus loads. (CFR: 41.7 / 45.8)	3.3	3
295005 (APE 5) Main Turbine Generator Trip / 3						04.31	Generic 2.4.31 - Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.2	4
295006 (APE 6) Scram / 1	02						AK1.02 - Knowledge of the operational implications of the following concepts as they apply to SCRAM: Shutdown margin. (CFR: 41.8 to 41.10)	3.4	5
295016 (APE 16) Control Room Abandonment / 7						01.30	Generic 2.1.30 – Ability to locate and operate components, including local controls. (CFR: 41.7 / 45.7)	4.4	6
295018 (APE 18) Partial or Complete Loss of CCW / 8					01		AA2.01 - Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER: Component temperatures. (CFR: 41.10 / 43.5 / 45.13)	3.3	7
295019 (APE 19) Partial or Complete Loss of Instrument Air / 8						04.04	Generic 2.4.4 – Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.5	8
295021 (APE 21) Loss of Shutdown Cooling / 4				04			AA1.04 - Ability to operate and/or monitor the following as they apply to LOSS OF SHUTDOWN COOLING: Alternate heat removal methods. (CFR: 41.7 / 45.6)	3.7	9
295023 (APE 23) Refueling Accidents / 8			02				AK3.02 - Knowledge of the reasons for the following responses as they apply to REFUELING ACCIDENTS: Interlocks associated with fuel handling equipment. (CFR: 41.5 / 45.6)	3.4	10
295024 High Drywell Pressure / 5	01						EK1.01 - Knowledge of the operational implications of the following concepts as they apply to HIGH DRYWELL PRESSURE: Drywell integrity: Plant-Specific. (CFR: 41.8 to 41.10)	4.1	11
295025 (EPE 2) High Reactor Pressure / 3			03				EK3.03 - Knowledge of the reasons for the following responses as they apply to HIGH REACTOR PRESSURE: HPCI operation: Plant-Specific. (CFR: 41.5 / 45.6)	3.8	12

295026 (EPE 3) Suppression Pool High Water Temperature / 5				03		EA1.03 - Ability to operate and/or monitor the following as they apply to SUPPRESSION POOL HIGH WATER TEMPERATURE: Temperature monitoring. (CFR: 41.7 / 45.6)	3.9	13
295027 (EPE 4) High Containment Temperature (Mark III Containment Only) / 5								
295028 (EPE 5) High Drywell Temperature (Mark I and Mark II only) / 5		03				EK2.03 - Knowledge of the interrelations between HIGH DRYWELL TEMPERATURE and the following: Reactor water level indication. (CFR: 41.7 / 45.8)	3.6	14
295030 (EPE 7) Low Suppression Pool Water Level / 5				01		EA1.01 - Ability to operate and/or monitor the following as they apply to LOW SUPPRESSION POOL WATER LEVEL: ECCS systems (NPSH considerations): Plant-Specific. (CFR: 41.7 / 45.6)	3.6	15
295031 (EPE 8) Reactor Low Water Level / 2					04	EA2.04 - Ability to determine and/or interpret the following as they apply to REACTOR LOW WATER LEVEL: Adequate core cooling. (CFR: 41.10 / 43.5 / 45.13)	4.6	16
295037 (EPE 14) Scram Condition Present and Reactor Power Above APRM Downscale or Unknown / 1		02				EK2.02 - Knowledge of the interrelations between SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN and the following: RRCS: Plant-Specific. (CFR: 41.7 / 45.8)	4.0	17
295038 (EPE 15) High Offsite Radioactivity Release Rate / 9				06		EA1.06 - Ability to operate and/or monitor the following as they apply to HIGH OFFSITE RELEASE RATE: Plant ventilation. (CFR: 41.7 / 45.6)	3.5	18
600000 (APE 24) Plant Fire On Site / 8					13	AA2.13 - Ability to determine and/or interpret the following as they apply to PLANT FIRE ON SITE: Need for emergency plant shutdown.	3.2	19
700000 (APE 25) Generator Voltage and Electric Grid Disturbances / 6		03				AK1.03 - Knowledge of the operational implications of the following concepts as they apply to GENERATOR VOLTAGE AND ELECTRIC GRID DISTURBANCES: Under-excitation. (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8)	3.3	20
K/A Category Totals:	4	3	3	4	3	3	Group Point Total:	20

ES-401		BWR Examination Outline Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (RO)						Form ES-401-1	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
295002 (APE 2) Loss of Main Condenser Vacuum / 3					02		AA2.02 - Ability to determine and/or interpret the following as they apply to LOSS OF MAIN CONDENSER VACUUM: Reactor power: Plant-Specific. (CFR: 41.10 / 43.5 / 45.13)	3.2	21
295007 (APE 7) High Reactor Pressure / 3									
295008 (APE 8) High Reactor Water Level / 2	03						AK1.03 - Knowledge of the operational implications of the following concepts as they apply to HIGH REACTOR WATER LEVEL: Feed flow/steam flow mismatch. (CFR: 41.8 to 41.10)	3.2	22
295009 (APE 9) Low Reactor Water Level / 2									
295010 (APE 10) High Drywell Pressure / 5									
295011 (APE 11) High Containment Temperature (Mark III Containment only) / 5									
295012 (APE 12) High Drywell Temperature / 5									
295013 (APE 13) High Suppression Pool Temperature. / 5									
295014 (APE 14) Inadvertent Reactivity Addition / 1									
295015 (APE 15) Incomplete Scram / 1				01			AA1.01 - Ability to operate and/or monitor the following as they apply to INCOMPLETE SCRAM: CRD hydraulics. (CFR: 41.7 / 45.6)	3.8	23
295017 (APE 17) Abnormal Offsite Release Rate / 9									
295020 (APE 20) Inadvertent Containment Isolation / 5 & 7				02			AA1.02 - Ability to operate and/or monitor the following as they apply to INADVERTENT CONTAINMENT ISOLATION: Drywell ventilation/cooling system. (CFR: 41.7 / 45.6)	3.2	24
295022 (APE 22) Loss of Control Rod Drive Pumps / 1		07					AK2.07 - Knowledge of the interrelations between LOSS OF CRD PUMPS and the following: Reactor Pressure (SCRAM assist): Plant-Specific. (CFR: 41.7 / 45.8)	3.4	25
295029 (EPE 6) High Suppression Pool Water Level / 5									
295032 (EPE 9) High Secondary Containment Area Temperature / 5						04.01	Generic 2.4.1 – Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)	4.6	26
295033 (EPE 10) High Secondary Containment Area Radiation Levels / 9									
295034 (EPE 11) Secondary Containment Ventilation High Radiation / 9									
295035 (EPE 12) Secondary Containment High Differential Pressure / 5			01				EK3.01 - Knowledge of the reasons for the following responses as they apply to SECONDARY CONTAINMENT HIGH DIFFERENTIAL PRESSURE: Blow-out panel operation: Plant-Specific. (CFR: 41.5 / 45.6)	2.8	27

295036 (EPE 13) Secondary Containment High Sump/Area Water Level / 5										
500000 (EPE 16) High Containment Hydrogen Concentration / 5										
K/A Category Point Totals:	1	1	1	2	1	1	Group Point Total:			7

ES-401	BWR Examination Outline Plant Systems—Tier 2/Group 1 (RO)											Form ES-401-1		
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
203000 (SF2, SF4 RHR/LPCI) RHR/LPCI: Injection Mode										09		A3.09 - Ability to monitor automatic operations of the RHR/LPCI: INJECTION MODE (PLANT SPECIFIC) including: Emergency generator load sequencing. (CFR: 41.7 / 45.7)	3.6	28
205000 (SF4 SCS) Shutdown Cooling			03									K3.03 - Knowledge of the effect that a loss or malfunction of the SHUTDOWN COOLING SYSTEM (RHR SHUTDOWN COOLING MODE) will have on following: Reactor temperatures (moderator, vessel, flange). (CFR: 41.7 / 45.4)	3.8	29
206000 (SF2, SF4 HPCIS) High-Pressure Coolant Injection	07											K1.07 - Knowledge of the physical connections and/or cause-effect relationships between HIGH PRESSURE COOLANT INJECTION SYSTEM and the following: D.C. power: BWR-2,3,4. (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.7	30
				14								K4.14 - Knowledge of HIGH PRESSURE COOLANT INJECTION SYSTEM design feature(s) and or interlocks which provide for the following: Control oil to turbine speed controls: BWR-2,3,4. (CFR: 41.7)	3.4	31
207000 (SF4 IC) Isolation (Emergency) Condenser														
209001 (SF2, SF4 LPCS) Low-Pressure Core Spray										03		A4.03 - Ability to manually operate and/or monitor in the control room: Injection valves. (CFR: 41.7 / 45.5 to 45.8)	3.7	32
209002 (SF2, SF4 HPCS) High-Pressure Core Spray														
211000 (SF1 SLCS) Standby Liquid Control					04							K5.04 - Knowledge of the operational implications of the following concepts as they apply to STANDBY LIQUID CONTROL SYSTEM: Explosive valve operation. (CFR: 41.5 / 45.3)	3.1	33
212000 (SF7 RPS) Reactor Protection						04						K6.04 - Knowledge of the effect that a loss or malfunction of the following will have on the REACTOR PROTECTION SYSTEM: D.C. electrical distribution. (CFR: 41.7 / 45.7)	2.8	34
					02							K5.02 - Knowledge of the operational implications of the following concepts as they apply to REACTOR PROTECTION SYSTEM: Specific logic arrangements. (CFR: 41.5 / 45.3)	3.3	35
215003 (SF7 IRM) Intermediate-Range Monitor							05					A1.05 - Ability to predict and/or monitor changes in parameters associated with operating the INTERMEDIATE RANGE MONITOR (IRM) SYSTEM controls including: SCRAM and rod block trip setpoints. (CFR: 41.5 / 45.5)	3.9	36
215004 (SF7 SRMS) Source-Range Monitor									02			A3.02 - Ability to monitor automatic operations of the SOURCE RANGE MONITOR (SRM) SYSTEM including: Annunciator and alarm signals. (CFR: 41.7 / 45.7)	3.4	37





263000 (SF6 DC) DC Electrical Distribution											01	A3.01 - Ability to monitor automatic operations of the D.C. ELECTRICAL DISTRIBUTION including: Meters, dials, recorders, alarms, and indicating lights. (CFR: 41.7 / 45.7)	3.2	49
264000 (SF6 EGE) Emergency Generators (Diesel/Jet) EDG	06										07	K1.06 - Knowledge of the physical connections and/or cause-effect relationships between EMERGENCY GENERATORS (DIESEL/JET) and the following: Starting system. (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.2	50
												A2.07 - Ability to (a) predict the impacts of the following on the EMERGENCY GENERATORS (DIESEL/JET); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Loss of off-site power during full-load testing. (CFR: 41.5 / 45.6)	3.5	51
300000 (SF8 IA) Instrument Air		01										K2.01 - Knowledge of electrical power supplies to the following: Instrument air compressor. (CFR: 41.7)	2.8	52
400000 (SF8 CCS) Component Cooling Water											01	A4.01 - Ability to manually operate and/or monitor in the control room: CCW indications and control. (CFR: 41.7 / 45.5 to 45.8)	3.1	53
510000 (SF4 SWS*) Service Water (Normal and Emergency)														
K/A Category Point Totals:	3	1	3	3	2	2	3	3	3	2	1	Group Point Total:		26





ES-401		BWR Examination Outline Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (SRO)						Form ES-401-1	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
295001 (APE 1) Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4						02.25	Generic 2.2.25 – Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)	4.2	76
295003 (APE 3) Partial or Complete Loss of AC Power / 6									
295004 (APE 4) Partial or Total Loss of DC Power / 6									
295005 (APE 5) Main Turbine Generator Trip / 3									
295006 (APE 6) Scram / 1									
295016 (APE 16) Control Room Abandonment / 7									
295018 (APE 18) Partial or Complete Loss of CCW / 8									
295019 (APE 19) Partial or Complete Loss of Instrument Air / 8						02	AA2.02 - Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR: Status of safety-related instrument air system loads (see AK2.1 – AK2.19). (CFR: 41.10 / 43.5 / 45.13)	3.7	77
295021 (APE 21) Loss of Shutdown Cooling / 4									
295023 (APE 23) Refueling Accidents / 8						05	AA2.05 -Ability to determine and/or interpret the following as they apply to REFUELING ACCIDENTS: Entry conditions of emergency plan. (CFR: 41.10 / 43.5 / 45.13)	4.6	78
295024 High Drywell Pressure / 5									
295025 (EPE 2) High Reactor Pressure / 3									
295026 (EPE 3) Suppression Pool High Water Temperature / 5						03	EA2.03 -Ability to determine and/or interpret the following as they apply to SUPPRESSION POOL HIGH WATER TEMPERATURE: Reactor pressure. (CFR: 41.10 / 43.5 / 45.13)	4.0	79
295027 (EPE 4) High Containment Temperature (Mark III Containment Only) / 5									
295028 (EPE 5) High Drywell Temperature (Mark I and Mark II only) / 5									
295030 (EPE 7) Low Suppression Pool Water Level / 5									
295031 (EPE 8) Reactor Low Water Level / 2									
295037 (EPE 14) Scram Condition Present and Reactor Power Above APRM Downscale or Unknown / 1						04.18	Generic 2.4.18 – Knowledge of the specific bases for EOPs. (CFR: 41.10 / 43.1 / 45.13)	4.0	80
295038 (EPE 15) High Offsite Radioactivity Release Rate / 9									
600000 (APE 24) Plant Fire On Site / 8						04.08	Generic 2.4.8 – Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)	4.5	81

700000 (APE 25) Generator Voltage and Electric Grid Disturbances / 6					05	AA2.05 - Ability to determine and/or interpret the following as they apply to GENERATOR VOLTAGE AND ELECTRIC GRID DISTURBANCES: Operational status of offsite circuit. (CFR: 41.5 and 43.5 / 45.5, 45.7, and 45.8)	3.8	82
K/A Category Totals:	0	0	0	0	4	3	Group Point Total:	7



K/A Category Point Totals:	0	0	0	0	2	1	Group Point Total:	3
----------------------------	---	---	---	---	---	---	--------------------	---





261000 (SF9 SGTS) Standby Gas Treatment										03											A2.03 - Ability to (a) predict the impacts of the following on the STANDBY GAS TREATMENT SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: High train temperature. (CFR: 41.5 / 45.6)	3.2	90
262001 (SF6 AC) AC Electrical Distribution																							
262002 (SF6 UPS) Uninterruptable Power Supply (AC/DC)																							
263000 (SF6 DC) DC Electrical Distribution																							
264000 (SF6 EGE) Emergency Generators (Diesel/Jet) EDG																							
300000 (SF8 IA) Instrument Air																							
400000 (SF8 CCS) Component Cooling Water																							
510000 (SF4 SWS*) Service Water (Normal and Emergency)																							
K/A Category Point Totals:	0	0	0	0	0	0	0	0	3	0	0	2	Group Point Total:										5





Facility: Limerick		Date of Exam: 07/12/2021				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	G2.1.1	Knowledge of conduct of operations requirements. (CFR: 41.10 / 45.13)	3.8	66		
	G2.1.26	Knowledge of industrial safety procedures (such as rotating equipment, electrical, high temperature, high pressure, caustic, chlorine, oxygen and hydrogen). (CFR: 41.10 / 45.12)	3.4	67		
	G2.1.37	Knowledge of procedures, guidelines, or limitations associated with reactivity management. (CFR: 41.1 / 43.6 / 45.6)			4.6	94
	G2.1.40	Knowledge of refueling administrative requirements (CFR: 41.10 / 43.5 / 45.13)			3.9	95
	Subtotal			2		2
2. Equipment Control	G2.2.6	Knowledge of the process for making changes to procedures. (CFR: 41.10 / 43.3 / 45.13)	3.0	68		
	G2.2.13	Knowledge of tagging and clearance procedures. (CFR: 41.10 / 45.13)	4.1	69		
	G2.2.35	Ability to determine Technical Specification Mode of Operation. (CFR: 41.7 / 41.10 / 43.2 / 45.13)	3.6	70		
	G2.2.11	Knowledge of the process for controlling temporary design changes. (CFR: 41.10 / 43.3 / 45.13)			3.3	96
	G2.2.21	Knowledge of pre- and post-maintenance operability requirements. (CFR: 41.10 / 43.2)			4.1	97
Subtotal			3		2	
3. Radiation Control	G2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)	3.2	71		
	G2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities. (CFR: 41.12 / 43.4 / 45.10)	3.4	72		
	G2.3.13	Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 43.4 / 45.9 / 45.10)			3.8	98
	Subtotal			2		1
4. Emergency Procedures/Plan	G2.4.17	Knowledge of EOP terms and definitions. (CFR: 41.10 / 45.13)	3.9	73		
	G2.4.26	Knowledge of facility protection requirements, including fire brigade and portable fire fighting equipment usage. (CFR: 41.10 / 43.5 / 45.12)	3.1	74		
	G2.4.43	Knowledge of emergency communication systems and techniques. (CFR: 41.10 / 45.13)	3.2	75		
	G2.4.38	Ability to take actions called for in the facility emergency plan, including supporting or acting as emergency coordinator if required. (CFR: 41.10 / 43.5 / 45.11)			4.4	99
	G2.4.44	Knowledge of emergency plan protective action recommendations. (CFR: 41.10 / 41.12 / 43.5 / 45.11)			4.4	100
	Subtotal			3		2
Tier 3 Point Total				10		7

