

Facility: Limerick Generating Station														Date of Exam: Jan 23, 2015			
Tier	Group	RO K/A Category Points												SRO-Only Points			
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	Total	A2	G*	Total	
1. Emergency & Abnormal Plant Evolutions	1	3	5	4				3	3				2	20			7
	2	1	1	1	N/A			1	1	N/A			2	7			3
	Tier Totals	4	6	5				4	4				4	27			10
2. Plant Systems	1	4	1	4	1	3	2	3	2	2	1	3	26			6	
	2	1	1	1	1	1	1	2	1	1	1	1	12			3	
	Tier Totals	5	2	5	2	4	3	5	3	3	2	4	38			9	
3. Generic Knowledge and Abilities Categories					1		2		3		4		10	1 2 3 4 7			
					2		3		2		3						

**Note:**

- Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two).
- 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  $\pm 1$  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.
- Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; 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.
- 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.
- Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
- Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
- \* 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.
- On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (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 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.
- 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.

ES-401		BWR Examination Outline - RO Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO)						Form ES-401-1	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4				X			Ability to operate and/or monitor the following as they apply to <b>PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION</b> : AA1.07 Nuclear boiler instrumentation system	3.1	11 H
295003 Partial or Complete Loss of AC / 6			X				Knowledge of the reasons for the following responses as they apply to <b>PARTIAL OR COMPLETE LOSS OF A.C. POWER</b> : AK3.05 Reactor SCRAM	3.7	12 H
295004 Partial or Total Loss of DC Pwr / 6		X					Knowledge of the interrelations between <b>PARTIAL OR LOSS OF D.C. POWER</b> and the following: AK2.03 D.C. bus loads	3.3	35 H
295005 Main Turbine Generator Trip / 3					X		Ability to determine and/or interpret the following as they apply to <b>MAIN TURBINE GENERATOR TRIP</b> : AA2.08 Electrical distribution status	3.2	51 H
295006 SCRAM / 1		X					Knowledge of the interrelations between <b>SCRAM</b> and the following: AK2.04 Turbine trip logic; Plant-Specific	3.6	41 L
295016 Control Room Abandonment / 7					X		Ability to determine and/or interpret the following as they apply to <b>CONTROL ROOM ABANDONMENT</b> : AA2.06 Cooldown rate	3.3	13 H
295018 Partial or Total Loss of CCW / 8	X						Knowledge of the operational implications of the following concepts as they apply to <b>PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER</b> : AK1.01 Effects on component/system operations	3.5	40 L
295019 Partial or Total Loss of Inst. Air / 8		X					Knowledge of the interrelations between <b>PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR</b> and the following: AK2.03 Reactor feedwater	3.2	58 H
295021 Loss of Shutdown Cooling / 4						X	2.4.11 Knowledge of abnormal condition procedures.	4.0	52 L
295023 Refueling Acc / 8	X						Knowledge of the operational implications of the following concepts as they apply to <b>REFUELING ACCIDENTS</b> : AK1.03 Inadvertent criticality	3.7	53 L
295024 High Drywell Pressure / 5			X				Knowledge of the reasons for the following responses as they apply to <b>HIGH DRYWELL PRESSURE</b> : EK3.04 †Emergency depressurization	3.7	61 L
295025 High Reactor Pressure / 3						X	2.2.39 Knowledge of less than or equal to one hour Technical Specification action statements for systems	3.9	14 L
295026 Suppression Pool High Water Temp. / 5				X			Ability to operate and/or monitor the following as they apply to <b>SUPPRESSION POOL HIGH WATER TEMPERATURE</b> : EA1.03 Temperature monitoring	3.9	59 H
295027 High Containment Temperature / 5							Suppressed		
295028 High Drywell Temperature / 5			X				Knowledge of the reasons for the following responses as they apply to <b>HIGH DRYWELL TEMPERATURE</b> : EK3.01 Emergency depressurization	3.6	39 L
295030 Low Suppression Pool Wtr Lvl / 5					X		Ability to determine and/or interpret the following as they apply to <b>LOW SUPPRESSION POOL WATER LEVEL</b> : EA2.01 Suppression pool level	4.1	62 H
295031 Reactor Low Water Level / 2	X						Knowledge of the operational implications of the following concepts as they apply to <b>REACTOR LOW WATER LEVEL</b> : EK1.02 Natural circulation: Plant-Specific	3.8	36 L
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1		X					Knowledge of the interrelations between <b>SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN</b> and the following: EK2.03 AR1/RPT/ATWS: Plant-Specific	4.1	38 L

295038 High Off-site Release Rate / 9				X			Ability to operate and/or monitor the following as they apply to <b>HIGH OFF-SITE RELEASE RATE:</b> EA1.01 Stack-gas monitoring system	3.9	63 H
600000 Plant Fire On Site / 8		X					Knowledge of the interrelations between <b>PLANT FIRE ON SITE</b> and the following: AK2.01 Sensors / detectors and valves	2.6	15 L
700000 Generator Voltage and Electric Grid Disturbances / 6			X				Knowledge of the reasons for the following responses   as they apply to <b>GENERATOR VOLTAGE AND ELECTRIC GRID DISTURBANCES:</b> AK3.02 Actions contained in abnormal operating procedure for voltage and grid disturbances	3.6	16 H
K/A Category Totals:	3	5	4	3	3	2	Group Point Total:	20	

ES-401		BWR Examination Outline - RO Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO)							Form ES-401-1	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#	
295002 Loss of Main Condenser Vac / 3										
295007 High Reactor Pressure / 3						X	2.1.31 Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup.	4.6	17 H	
295008 High Reactor Water Level / 2										
295009 Low Reactor Water Level / 2										
295010 High Drywell Pressure / 5	X						Knowledge of the operational implications of the following concepts as they apply to HIGH DRYWELL PRESSURE: AK1.03 Temperature increases	3.2	18 H	
295011 High Containment Temp / 5							Suppressed			
295012 High Drywell Temperature / 5										
295013 High Suppression Pool Temp. / 5										
295014 Inadvertent Reactivity Addition / 1										
295015 Incomplete SCRAM / 1										
295017 High Off-site Release Rate / 9										
295020 Inadvertent Cont. Isolation / 5 & 7										
295022 Loss of CRD Pumps / 1										
295029 High Suppression Pool Wtr Lvl / 5				X			Ability to operate and/or monitor the following as they apply to HIGH SUPPRESSION POOL WATER LEVEL: EA1.03 RHR/LPCI	2.9	19 H	
295032 High Secondary Containment Area Temperature / 5					X		Ability to determine and/or interpret the following as they apply to HIGH SECONDARY CONTAINMENT AREA TEMPERATURE: EA2.02 Equipment operability	3.3	20 L	
295033 High Secondary Containment Area Radiation Levels / 9										
295034 Secondary Containment Ventilation High Radiation / 9						X	2.4.1 Knowledge of EOP entry conditions and immediate action steps.	4.6	34 L	
295035 Secondary Containment High Differential Pressure / 5			X				Knowledge of the reasons for the following responses as they apply to SECONDARY CONTAINMENT HIGH DIFFERENTIAL PRESSURE: EK3.01 Blow-out panel operation: Plant-Specific	2.8	60 H	
295036 Secondary Containment High Sump/Area Water Level / 5		X					Knowledge of the interrelations between SECONDARY CONTAINMENT HIGH SUMP/AREA WATER LEVEL and the following: EK2.01 Secondary Containment equipment and floor drain system	3.1	64 L	
500000 High CTMT Hydrogen Conc. / 5										
K/A Category Point Totals:	1	1	1	1	1	2	Group Point Total:		7	

ES-401		BWR Examination Outline - RO Plant Systems - Tier 2/Group 1 (RO)											Form ES-401-1	
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
203000 RHR/LPCI: Injection Mode					X							Knowledge of the operational implications of the following concepts as they apply to RHR/LPCI: INJECTION MODE (PLANT SPECIFIC): K5.01 Testable check valve operation	2.7	28 H
											X	2.1.20 Ability to interpret and execute procedure steps.	4.6	71 H
205000 Shutdown Cooling											X	Ability to manually operate and/or monitor in the control room: A4.07 Reactor temperatures	3.7	42 H
206000 HPCI								X				Ability to (a) predict the impacts of the following on the HIGH PRESSURE COOLANT INJECTION SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: A2.17 †HPCI inadvertent initiation: BWR-2,3,4	3.9	43 H
											X	2.4.6 Knowledge of EOP mitigation strategies.	3.7	65 L
207000 Isolation (Emergency) Condenser												Suppressed		
209001 LPCS	X											Knowledge of the physical connections and/or cause-effect relationships between LOW PRESSURE CORE SPRAY SYSTEM and the following: K1.02 Torus/suppression pool	3.4	2 H
209002 HPCS												Suppressed		
211000 SLC							X					Ability to predict and/or monitor changes in parameters associated with operating the STANDBY LIQUID CONTROL SYSTEM controls including: A1.09 SBLC system lineup	4.0	3 L
212000 RPS			X									Knowledge of the effect that a loss or malfunction of the REACTOR PROTECTION SYSTEM will have on following: K3.06 Scram air header solenoid operated valves	4.0	7 H
215003 IRM									X			Ability to monitor automatic operations of the INTERMEDIATE RANGE MONITOR (IRM) SYSTEM including: A3.03 RPS status	3.7	21 L
215004 Source Range Monitor						X						Knowledge of the effect that a loss or malfunction of the following will have on the SOURCE RANGE MONITOR (SRM) SYSTEM: K6.04 Detectors	2.9	26 H
215005 APRM / LPRM									X			Ability to monitor automatic operations of the AVERAGE POWER RANGE MONITOR / LOCAL POWER RANGE MONITOR SYSTEM including: A3.03 Meters and recorders	3.3	37 H
217000 RCIC			X									Knowledge of the effect that a loss or malfunction of the REACTOR CORE ISOLATION COOLING SYSTEM (RCIC) will have on following: K3.02 Reactor vessel pressure	3.6	22 H
218000 ADS	X											Knowledge of the physical connections and/or cause-effect relationships between AUTOMATIC DEPRESSURIZATION SYSTEM and the following: K1.06 Safety/relief valves	3.9	4 H

223002 PCIS/Nuclear Steam Supply Shutoff	X																		Knowledge of the physical connections and/or cause-effect relationships between PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF and the following: K1.12 Standby gas treatment system	3.1	8 H
239002 SRVs			X																Knowledge of the effect that a loss or malfunction of the RELIEF/SAFETY VALVES will have on following: K3.02 Reactor over pressurization	4.2	25 L
259002 Reactor Water Level Control				X															Knowledge of REACTOR WATER LEVEL CONTROL SYSTEM design feature(s) and/or interlocks which provide for the following: K4.06 Control signal failure	3.1	29 L
261000 SGTS														X					2.2.12 Knowledge of surveillance procedures.	3.7	24 L
262001 AC Electrical Distribution					X														Knowledge of the operational implications of the following concepts as they apply to A.C. ELECTRICAL DISTRIBUTION: K5.01 Principle involved with paralleling two A.C. sources	3.1	23 H
262002 UPS (AC/DC)	X																		Knowledge of the physical connections and/or cause-effect relationships between UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.) and the following: K1.14 Main steam line radiation monitors	2.8	27 H
						X													Knowledge of the effect that a loss or malfunction of the following will have on the UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.): K6.02 D.C. electrical power	2.8	72 L
263000 DC Electrical Distribution					X														Knowledge of the operational implications of the following concepts as they apply to D.C. ELECTRICAL DISTRIBUTION: K5.01 Hydrogen generation during battery charging	2.6	9 L
								X											Ability to (a) predict the impacts of the following on the D.C. ELECTRICAL DISTRIBUTION; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: A2.01 Grounds	2.8	44 H
264000 EDGs							X												Ability to predict and/or monitor changes in parameters associated with operating the EMERGENCY GENERATORS (DIESEL/JET) controls including: A1.09 Maintaining minimum load on emergency generator (to prevent reverse power).	3.0	6 L
300000 Instrument Air		X																	Knowledge of electrical power supplies to the following: K2.01 Instrument air compressor	2.8	1 L
			X																Knowledge of the effect that a loss or malfunction of the (INSTRUMENT AIR SYSTEM) will have on the following: K3.02 Systems having pneumatic valves and controls	3.3	45 H
400000 Component Cooling Water							X												Ability to predict and / or monitor changes in parameters associated with operating the CCWS controls including: A1.01 CCW flow rate	2.8	66 H
K/A Category Point Totals:	4	1	4	1	3	2	3	2	2	1	3								Group Point Total:		26



ES-401		BWR Examination Outline - RO Plant Systems - Tier 2/Group 2 (RO)										Form ES-401-1		
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
201001 CRD Hydraulic		X										Knowledge of electrical power supplies to the following: K2.05 Alternate rod insertion valve solenoids: Plant-Specific	4.5	46 H
201002 RMCS											X	2.4.11 Knowledge of abnormal condition procedures.	4.0	5 L
201003 Control Rod and Drive Mechanism														
201004 RSCS												Suppressed		
201005 RCIS												Suppressed		
201006 RWM								X				Ability to (a) predict the impacts of the following on the ROD WORTH MINIMIZER SYSTEM (RWH) (PLANT SPECIFIC); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: A2.05 Out of sequence rod movement	3.1	70 H
202001 Recirculation														
202002 Recirculation Flow Control									X			Ability to monitor automatic operations of the RECIRCULATION FLOW CONTROL SYSTEM including: A3.02 Lights and alarms	3.4	47 L
204000 RWCU														
214000 RPIS					X							Knowledge of the operational implications of the following concepts as they apply to ROD POSITION INFORMATION SYSTEM: K5.01 Reed switches	2.7	67 H
215001 Traversing In-core Probe														
215002 RBM														
216000 Nuclear Boiler Inst.														
219000 RHR/LPCI: Torus/Pool Cooling Mode				X								219000 RHR/LPCI: Torus/Pool Cooling Knowledge of RHR/LPCI: TORUS / SUPPRESSION POOL COOLING MODE design feature(s) and/or interlocks which provide for the following: K4.05 Pump minimum flow protection	3.0	68 H
223001 Primary CTMT and Aux.														
226001 RHR/LPCI: CTMT Spray Mode														
230000 RHR/LPCI: Torus/Pool Spray Mode														
233000 Fuel Pool Cooling/Cleanup			X									Knowledge of the effect that a loss or malfunction of the FUEL POOL COOLING AND CLEAN-UP will have on following: K3.03 Fuel pool water clarity	2.6	48 H
234000 Fuel Handling Equipment							X					Ability to predict and/or monitor changes in parameters associated with operating the FUEL HANDLING EQUIPMENT controls including: A1.03 core reactivity level	3.4	10 H

239001 Main and Reheat Steam								X										Ability to predict and/or monitor changes in parameters associated with operating the MAIN AND REHEAT STEAM SYSTEM controls including: A1.10 Reactor power	3.8	49 H
239003 MSIV Leakage Control	Suppressed																			
241000 Reactor/Turbine Pressure Regulator	X																	Knowledge of the physical connections and/or cause-effect relationships between REACTOR/TURBINE PRESSURE REGULATING SYSTEM and the following: K1.06 Bypass valves	3.8	73 H
245000 Main Turbine Gen. / Aux.																				
256000 Reactor Condensate																				
259001 Reactor Feedwater								X										Knowledge of the effect that a loss or malfunction of the following will have on the REACTOR FEEDWATER SYSTEM: K6.07 Reactor water level control system	3.8	69 H
268000 Radwaste																				
271000 Offgas																				
272000 Radiation Monitoring																				
286000 Fire Protection																				
288000 Plant Ventilation																				
290001 Secondary CTMT																				
290003 Control Room HVAC																X		Ability to manually operate and/or monitor in the control room: A4.01 Initiate/reset system	3.2	50 L
290002 Reactor Vessel Internals																				
K/A Category Point Totals:	1	1	1	1	1	1	1	2	1	1	1	1						Group Point Total:		12



Facility: Limerick Generating Station			Date of Exam: 01/23/15			
Category	K/A #	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.7	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.	4.4	30 H		
	2.1.21	Ability to verify the controlled procedure copy.	3.5	54 L		
	Subtotal			2		
2. Equipment Control	2.2.22	Knowledge of limiting conditions for operations and safety limits.	4.0	31 L		
	2.2.13	Knowledge of tagging and clearance procedures.	4.1	55 H		
	2.2.14	Knowledge of the process for controlling equipment configuration or status.	3.9	74 L		
	Subtotal			3		
3. Radiation Control	2.3.11	Ability to control radiation releases.	3.8	32 H		
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.	3.4	56 H		
	Subtotal			2		
4. Emergency Procedures / Plan	2.4.27	Knowledge of "fire in the plant" procedures.	3.4	33 L		
	2.4.8	Knowledge of how abnormal operating procedures are used in conjunction with EOPs.	3.8	57 L		
	2.4.11	Knowledge of abnormal condition procedures.	4.0	75 L		
	Subtotal			3		
Tier 3 Point Total				10		

Facility: Limerick Generating Station			Date of Exam: 01/23/15	
Category	K/A #	Topic	RO	
			IR	#
1. Conduct of Operations	2.1.7	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.	4.4	30 H
	2.1.21	Ability to verify the controlled procedure copy.	3.5	54 L
	Subtotal			2
2. Equipment Control	2.2.22	Knowledge of limiting conditions for operations and safety limits.	4.0	31 L
	2.2.13	Knowledge of tagging and clearance procedures.	4.1	55 H
	2.2.14	Knowledge of the process for controlling equipment configuration or status.	3.9	74 L
	Subtotal			3
3. Radiation Control	2.3.11	Ability to control radiation releases.	3.8	32 H
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.	3.4	56 H
	Subtotal			2
4. Emergency Procedures / Plan	2.4.27	Knowledge of "fire in the plant" procedures.	3.4	33 L
	2.4.8	Knowledge of how abnormal operating procedures are used in conjunction with EOPs.	3.8	57 L
	2.4.11	Knowledge of abnormal condition procedures.	4.0	75 L
	Subtotal			3
Tier 3 Point Total				10

Tier / Group	Randomly Selected K/A	Reason for Rejection
2 / 1	264000 A1.01	Cannot write an RO question with sufficient LOD. Randomly re-selected within 264000 A1; replaced with A1.09.
1 / 2	295010 2.4.49	With the latest revision of OT-101 (High Drywell Pressure), there are no “immediate operator actions”, nor any “subsequent” (follow-up) actions that are of an immediate nature. Therefore, KA 2.4.49 is not operationally valid. Randomly re-selected within 2.4 Generics; replaced with 2.4.11.
1 / 1	295028 EK3.04	For LGS, this KA lacks sufficient operational validity for the following reason: At rated power the “normal” drywell temperature is such that it demands that drywell cooling be maximized at all times; in other words, upon entry into the T-102 (PC Control) DW/T leg, LGS operators take no specific action to “operate all available drywell cooling” (as directed by step DW/T-2). Randomly re-selected within 295028 EK3; replaced with EK3.01.
3	2.2.39	This KA is inappropriate for Tier 3. The KA necessarily requires a connection to a Tech Spec “system”, which is <u>not</u> permitted by ES-401, Section D.2.a, first paragraph. Randomly re-selected among all Generics; replaced with 2.2.14.



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Tier	Group	RO K/A Category Points												SRO-Only Points					
		K	K	K	K	K	K	A	A	A	A	G	Total	A2	G*	Total			
		1	2	3	4	5	6	1	2	3	4	7							
1. Emergency & Abnormal Plant Evolutions	1												20		3	4	7		
	2					N/A				N/A			7		1	2	3		
	Tier Totals												27		4	6	10		
2. Plant Systems	1												26		2	3	5		
	2												12	1		2	3		
	Tier Totals												38		3	5	8		
3. Generic Knowledge and Abilities Categories		1		2		3		4		10			1	2	3	4	7		
													2	2	1	2			
<p>Note:</p> <ol style="list-style-type: none"> <li>Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two).</li> <li>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 <math>\pm 1</math> 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.</li> <li>Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; 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.</li> <li>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.</li> <li>Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.</li> <li>Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.</li> <li>* 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.</li> <li>On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (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 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.</li> <li>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.</li> </ol>																			

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E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#	
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4						X	2.2.12 Knowledge of surveillance procedures.	4.1	81 L	
295003 Partial or Complete Loss of AC / 6										
295004 Partial or Total Loss of DC Pwr / 6										
295005 Main Turbine Generator Trip / 3					X		Ability to determine and/or interpret the following as they apply to MAIN TURBINE GENERATOR TRIP: AA2.03 Turbine valve position	3.1	86 H	
295006 SCRAM / 1					X		Ability to determine and/or interpret the following as they apply to SCRAM: AA2.03 Reactor water level	4.2	87 H	
295016 Control Room Abandonment / 7										
295018 Partial or Total Loss of CCW / 8						X	2.4.30 Knowledge of events related to system operation/status that must be reported to internal organizations or external agencies, such as the State, the NRC, or the transmission system operator.	4.1	78 H	
295019 Partial or Total Loss of Inst. Air / 8										
295021 Loss of Shutdown Cooling / 4						X	2.4.21 Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc.	4.6	77 H	
295023 Refueling Acc / 8										
295024 High Drywell Pressure / 5										
295025 High Reactor Pressure / 3										
295026 Suppression Pool High Water Temp. / 5										
295027 High Containment Temperature / 5							Suppressed			
295028 High Drywell Temperature / 5										
295030 Low Suppression Pool Wtr Lvl / 5						X	2.2.40 Ability to apply Technical Specifications for a system.	4.7	79 L	
295031 Reactor Low Water Level / 2										
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1										
295038 High Off-site Release Rate / 9										
600000 Plant Fire On Site / 8										
700000 Generator Voltage and Electric Grid Disturbances / 6					X		Ability to determine and/or interpret the following as they apply to GENERATOR VOLTAGE AND ELECTRIC GRID DISTURBANCES: AA2.05 Operational status of offsite circuit	3.8	80 H	
K/A Category Totals:					3	4	Group Point Total:		7	

ES-401		BWR Examination Outline - SRO Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (SRO)							Form ES-401-1	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#	
295002 Loss of Main Condenser Vac / 3										
295007 High Reactor Pressure / 3										
295008 High Reactor Water Level / 2										
295009 Low Reactor Water Level / 2										
295010 High Drywell Pressure / 5						X	2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc.	4.2	88 H	
295011 High Containment Temp / 5							Suppressed			
295012 High Drywell Temperature / 5										
295013 High Suppression Pool Temp. / 5										
295014 Inadvertent Reactivity Addition / 1						X	2.1.37 Knowledge of procedures, guidelines, or limitations associated with reactivity management.	4.6	95 H	
295015 Incomplete SCRAM / 1										
295017 High Off-site Release Rate / 9					X		Ability to determine and/or interpret the following as they apply to HIGH OFF-SITE RELEASE RATE: AA2.01 †Off-site release rate	4.2	89 L	
295020 Inadvertent Cont. Isolation / 5 & 7										
295022 Loss of CRD Pumps / 1										
295029 High Suppression Pool Wtr Lvl / 5										
295032 High Secondary Containment Area Temperature / 5										
295033 High Secondary Containment Area Radiation Levels / 9										
295034 Secondary Containment Ventilation High Radiation / 9										
295035 Secondary Containment High Differential Pressure / 5										
295036 Secondary Containment High Sump/Area Water Level / 5										
500000 High CTMT Hydrogen Conc. / 5										
K/A Category Point Totals:					1	2	Group Point Total:		3	

ES-401		BWR Examination Outline - SRO Plant Systems - Tier 2/Group 1 (SRO)										Form ES-401-1		
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
203000 RHR/LPCI: Injection Mode														
205000 Shutdown Cooling														
206000 HPCI														
207000 Isolation (Emergency) Condenser												Suppressed		
209001 LPCS														
209002 HPCS												Suppressed		
211000 SLC											X	2.2.40 Ability to apply Technical Specifications for a system.	4.7	82 H
212000 RPS											X	2.2.22 Knowledge of limiting conditions for operations and safety limits.	4.7	90 H
215003 IRM														
215004 Source Range Monitor														
215005 APRM / LPRM														
217000 RCIC								X				Ability to (a) predict the impacts of the following on the REACTOR CORE ISOLATION COOLING SYSTEM (RCIC) ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: A2.10 Turbine control system failures	3.1	91 H
218000 ADS														
223002 PCIS/Nuclear Steam Supply Shutoff														
239002 SRVs														
259002 Reactor Water Level Control								X				Ability to (a) predict the impacts of the following on the REACTOR WATER LEVEL CONTROL SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: A2.03 Loss of reactor water level input	3.7	92 H
261000 SGTS														
262001 AC Electrical Distribution														
262002 UPS (AC/DC)														
263000 DC Electrical Distribution														
264000 EDGs														
300000 Instrument Air											X	2.1.20 Ability to interpret and execute procedure steps.	4.6	83 H
400000 Component Cooling Water														
K/A Category Point Totals:								2			3	Group Point Total:		5



ES-401		BWR Examination Outline - SRO Plant Systems - Tier 2/Group 2 (SRO)											Form ES-401-1	
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
201001 CRD Hydraulic														
201002 RMCS														
201003 Control Rod and Drive Mechanism											X	2.2.22 Knowledge of limiting conditions for operations and safety limits.	4.7	94 L
201004 RSCS												Suppressed		
201005 RCIS												Suppressed		
201006 RWM														
202001 Recirculation														
202002 Recirculation Flow Control														
204000 RWCU											X	2.2.38 Knowledge of conditions and limitations in the facility license.	4.5	84 L
214000 RPIS														
215001 Traversing In-core Probe														
215002 RBM														
216000 Nuclear Boiler Inst.														
219000 RHR/LPCI: Torus/Pool Cooling Mode														
223001 Primary CTMT and Aux.								X				Ability to (a) predict the impacts of the following on the PRIMARY CONTAINMENT SYSTEM AND AUXILIARIES; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: A2.10 High drywell temperature	3.8	93 H
226001 RHR/LPCI: CTMT Spray Mode														
230000 RHR/LPCI: Torus/Pool Spray Mode														
233000 Fuel Pool Cooling/Cleanup														
234000 Fuel Handling Equipment														
239001 Main and Reheat Steam														
239003 MSIV Leakage Control												Suppressed		
241000 Reactor/Turbine Pressure Regulator														
245000 Main Turbine Gen. / Aux.														
256000 Reactor Condensate														
259001 Reactor Feedwater														
268000 Radwaste														
271000 Offgas														
272000 Radiation Monitoring														
286000 Fire Protection														
288000 Plant Ventilation														
290001 Secondary CTMT														
290003 Control Room HVAC														
290002 Reactor Vessel Internals														
K/A Category Point Totals:								1			2	Group Point Total:		3

Facility: Limerick Generating Station			Date of Exam: Jan 23, 2015			
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.42	Knowledge of new and spent fuel movement procedures.			3.4	85 L
	2.1.1	Knowledge of conduct of operations requirements.			4.2	98 L
	Subtotal					2
2. Equipment Control	2.2.23	Ability to track Technical Specification limiting conditions for operations.			4.6	76 L
	2.2.17	Knowledge of the process for managing maintenance activities during power operations, such as risk assessments, work prioritization, and coordination with the transmission system operator.			3.8	99 H
	Subtotal					2
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions.			3.7	96 L
	Subtotal					1
4. Emergency Procedures / Plan	2.4.38	Ability to take actions called for in the facility emergency plan, including supporting or acting as emergency coordinator if required.			4.4	97 L
	2.4.41	Knowledge of the emergency action level thresholds and classifications.			4.6	100 L
	Subtotal					2
Tier 3 Point Total				10		7

**ES-401**

**BWR Examination Outline - NRC - SRO**

**Form ES-401-4**

Tier / Group	Randomly Selected K/A	Reason for Rejection
		<b>NONE</b>

Facility: <u>Limerick</u>		Date of Examination: <u>Jan 12-23, 2015</u>
Examination Level: RO X SRO		Operating Test Number: <u>1</u>
Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R-M	Evaluate Overtime Work Request (Generic 2.1.5)
Equipment Control	R-M	Determine Blocking Required per OP-MA-109-101, "Clearance and Tagging" (Generic 2.2.41)
Equipment Control	R-D	Temporary Change to Approved Document (Generic 2.2.11)
Radiation Control	R-D-P	Determine Offgas Effluent Activity Release Rate (Generic 2.3.11)
Emergency Procedures/Plan		
NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when 5 are required.		
* Type Codes & Criteria: (C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank ( $\leq 3$ for ROs; $\leq 4$ for SROs & RO retakes) (N)ew or (M)odified from bank ( $\geq 1$ ) (P)revious 2 exams ( $\leq 1$ ; randomly selected)		

Facility: LimerickDate of Examination: Jan 12-23, 2015Examination Level: RO SRO ☒ XOperating Test Number: 1

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R-D	Determination of Adequate Shift Staffing (Generic 2.1.5)
Equipment Control	R-D	Evaluate Valve Stroke Data Sheet (Generic 2.2.37)
Equipment Control	R-M	Review and Verify Blocking Required per OP-MA-109-101, "Clearance and Tagging" (Generic 2.2.41)
Radiation Control	R-D-P	Review and Approve Inventory Release from Equipment Drain Sample Tank to Cooling Tower Blowdown Line (Generic 2.3.11)
Emergency Procedures/Plan	R-D	ERP Upgrade Classification and Reporting (Time Critical) (Generic 2.4.41)

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when 5 are required.

\* Type Codes & Criteria:

- (C)ontrol room, (S)imulator, or Class(R)oom
- (D)irect from bank ( $\leq 3$  for ROs;  $\leq 4$  for SROs & RO retakes)
- (N)ew or (M)odified from bank ( $\geq 1$ )
- (P)revious 2 exams ( $\leq 1$ ; randomly selected)

Facility: Limerick Generating StationDate of Examination: Jan 12-23, 2015Exam Level: RO X    SRO-I ☐    SRO-U ☐Operating Test No.: 1Control Room Systems<sup>@</sup> (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)

System / JPM Title	Type Code*	Safety Function
a. Start a Reactor Recirc Pump (202001 A3.02)	A, D, S, P	1
b. Manually Place 3 <sup>rd</sup> Reactor Feed Pump in Service (259001 A4.02)	A, D, S, P	2
c. Open a Single Isolated MSIV (239001 A4.02)	D, S	3
d. Operating Unit 1 RCIC in Full Flow Test (217000 A2.12)	M, S	4
e. Perform a Group III NSSSS Isolation Reset (223002 A4.03)	D, S	5
f. Supplying Power to a 480 VAC Non-Safeguard Load Center from its Alternate Source (262001 A4.05)	A, D, S	6
g. Scram Reset (212000 A4.14)	A, D, S, L	7
h. Manually Isolate the Reactor Enclosure (223002 A4.02)	A, N, S, EN	9

In-Plant Systems<sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)

i. Maximizing CRD Flow After Shutdown During Emergency Conditions (295031 EA1.10)	D, R, E, L, P	2
j. Install Air Jumper to Provide Long Term ADS Operation from D*1 D/G Air Compressor (218000 A2.03)	D, R	8
k. Drywell Spray Interlock Bypass (226001 A2.15)	D, R, E	5

@ All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

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

Facility: <u>Limerick Generating Station</u>		Date of Examination: <u>Jan 12-23, 2015</u>
Exam Level: RO <input type="checkbox"/> SRO-I <input checked="" type="checkbox"/> SRO-U <input type="checkbox"/>		Operating Test No.: <u>1</u>

  

Control Room Systems <sup>@</sup> (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)		
System / JPM Title	Type Code*	Safety Function
a. Start a Reactor Recirc Pump (202001 A3.02)	A, D, S, P	1
b. Manually Place 3 <sup>rd</sup> Reactor Feed Pump in Service (259001 A4.02)	A, D, S, P	2
c. Open a Single Isolated MSIV (239001 A4.02)	D, S	3
d. Operating Unit 1 RCIC in Full Flow Test (217000 A2.12)	M, S	4
e.		
f. Supplying Power to a 480 VAC Non-Safeguard Load Center from its Alternate Source (262001 A4.05)	A, D, S	6
g. Scram Reset (212000 A4.14)	A, D, S, L	7
h. Manually Isolate the Reactor Enclosure (223002 A4.02)	A, N, S, EN	9
In-Plant Systems <sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Maximizing CRD Flow After Shutdown During Emergency Conditions (295031 EA1.10)	D, E, L, R, P,	2
j. Install Air Jumper to Provide Long Term ADS Operation from D*1 D/G Air Compressor (218000 A2.03)	D, R	8
k. Drywell Spray Interlock Bypass (226001 A2.15)	D, R, E	5
<p><sup>@</sup> All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.</p>		
* Type Codes	Criteria for RO / SRO-I / SRO-U	
(A)lternate path (C)ontrol room (D)irect from bank (E)mergency or abnormal in-plant (EN)gineered safety feature (L)ow-Power / Shutdown (N)ew or (M)odified from bank including 1(A) (P)revious 2 exams (R)CA (S)imulator	4-6 / 4-6 / 2-3  $\leq 9 / \leq 8 / \leq 4$ $\geq 1 / \geq 1 / \geq 1$ - / - / $\geq 1$ (control room system) $\geq 1 / \geq 1 / \geq 1$ $\geq 2 / \geq 2 / \geq 1$ $\leq 3 / \leq 3 / \leq 2$ (randomly selected) $\geq 1 / \geq 1 / \geq 1$	



Facility: <u>Limerick Generating Station</u>		Date of Examination: <u>Jan 12-23, 2015</u>
Exam Level: RO <input type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input checked="" type="checkbox"/>		Operating Test No.: <u>1</u>

  

Control Room Systems <sup>®</sup> (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)		
System / JPM Title	Type Code*	Safety Function
a.		
b.		
c.		
d.		
e.		
f. Supplying Power to a 480 VAC Non-Safeguard Load Center from its Alternate Source (262001 A4.05)	A, D, S	6
g. Scram Reset (212000 A4.14)	A, D, S, L	7
h. Manually Isolate the Reactor Enclosure (223002 A4.02)	A, N, EN, S	9

  

In-Plant Systems <sup>®</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Maximizing CRD Flow After Shutdown During Emergency Conditions (295031 EA1.10)	D, E, L, R, P	2
j. Install Air Jumper to Provide Long Term ADS Operation from D*1 D/G Air Compressor (218000 A2.03)	D, R	8
k.		

  

@ All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

  

* Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(EN)gineered safety feature	- / - / ≥ 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	

Facility: Limerick

Scenario No.: 2

Op-Test No.: 1

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

**Initial Conditions:**

Unit 1 is at 90% power due a cell failure on the '1A' ASD. Repairs are in progress. Unit 2 is at 100%.

**Turnover:**

Shift orders are to support the '1A' ASD repairs as necessary and to perform RT-6-019-310-1, REACTOR FEEDPUMP TURBINE LUBE OIL PUMP OPERABILITY.

Event No.	Malf. No.	Event Type*	Event Description
1	N/A	N-PRO	Perform RT-6-019-310-1 Reactor Feedpump Turbine Lube Oil Pump Operability
2	MRD016I	C-RO TS-SRO	Control Rod Drifts Out
3	MNS161B	C-PRO TS-SRO	Inadvertent NSSSS Group VIIIA Isolation
4	MFW245A	C-RO C-PRO	1B RFP Trip
5	MRR441 MRR440A MHP447B MCN001 MCN002	M	LOCA , HPCI Aux Oil Pump Failure, Loss of Condensate
6	MRD016G	C-RO	Failure of rods to scram (three)
7	MDG420B MED012 MED015D	C-PRO	D12 DG fails to auto start with failure of Dead Bus Transfer

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

Facility: Limerick

Scenario No.: 3

Op-Test No.:1

Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Operators: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Initial Conditions:

Unit 1 is at 18% power with a startup in progress per GP-2. Unit 2 is at 100% power.

## Turnover:

GP-2, Reactor Startup is in progress with the Main Generator ready for synchronization per S32.1.A. The crew is expected to synch the Main Generator and continue raising power per GP-2.

Event No.	Malfunction Number	Event Type*	Event Description
1	N/A	N-PRO	Synch the Main Generator
2	N/A	R-RO	Continue raising power
3	MRD016D	C-RO	Control Rod fails stuck
4	RCS284	TS-SRO	1C Core Spray Pump control power failure
5	V116A01	C-PRO	1A EHC Pump Vibrations
6	MED282A	C-PRO TS-SRO	Loss of Div 1 DC
7	MR441	C-PRO	Small coolant leak in Drywell
8	MRP029A	C-RO	RPS 'A' fails to scram (ARI successful)
9	MMS067	M	Steam leak in the Drywell
10	MPC476	C-PRO	Downcomer break results in Suppression Pool pressure equalizing with Drywell pressure requiring blowdown on Pressure Suppression Curve
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor			

Facility: Limerick

Scenario No.:4

Op-Test No.: 1

Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Operators: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Initial Conditions:

Unit 1 is at 95% power for rod recovery following control rod maintenance. Unit 2 is at 100%.

## Turnover:

The crew is expected to withdraw the two maintenance rods per the ReMA and restore power to 100% with Recirc flow.

Event No.	Malfunction Number	Event Type*	Event Description
1	N/A	R-RO	Withdraw control rods and restore power to 100%
2	MPR011B	C-RO TS-SRO	RBM 'B' fails upscale
3	MCW483A MCW485B	C-PRO	1A RECW Pump trips and 1B RECW Pump fails to auto start
4	MRE001A MRE311A MRE311B MRE311C	C-PRO TS-SRO	Refuel Floor isolates with failure of SGTS
5	MAD141E	C-PRO C-RO	1E SRV fails open mechanically
6	MRD556 MSL559	M	Hydraulic ATWS with SLC Line rupture
7	MRD024	C-RO	RDCS fails
8	MMT100 MEH108	C-RO C-PRO	Turbine High Vibration requiring manual trip/Bypass Valves fail closed

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