Facility:	Limerick – NRC 17-1	Date of Examination:	11/26/18
Examination Level: RO ☒ SRO ☐		Operating Test Number:	1

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	N, R	G2.1.20, (Ability to Interpret and Execute Procedure Steps (CFR 41.10 / 43.5 / 45.12) 4.6 / 4.6) RCIC VALVE STROKE TIME EVALUATION (LOJPM6762)
Conduct of Operations	M, R	G2.1.25 (Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 43.5 / 45.12) 3.9 / 4.2) DETERMINE MAXIMUM GENERATOR VARS (LOJPM6729)
Equipment Control	D, R	G2.2.12 (Knowledge of surveillance procedures (CFR 41.10 / 45.13) 3.7 / 4.1) EVALUATE ST-6-047-370-1, PRE-CONTROL ROD WITHDRAWAL CHECK (LOJPM6752)
Radiation Control	D, R	G2.3.11, (Ability to Control Rad Releases, (CFR 41.11 / 43.4 / 45.10) 3.8 / 4.3) GASEOUS EFFLUENT DOSE RATE DETERMINATION (LOJPM6706)
Emergency Plan		

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)
(N)ew or (M)odified from bank (≥ 1)
(P)revious 2 exams (≤ 1, randomly selected)

Facility:	Limerick – NRC 17-1	Date of Examination:	11/26/18
Examination Level: RO ☐ SRO ☒		Operating Test Number:	1

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	D, R	G2.1.25, (Ability to Interpret Reference Materials such as Graphs, Curves, Tables etc.(CFR 41.10 / 43.5 / 45.12) 3.9 / 4.2) EVALUATE VALVE STROKE DATA (SRO)(LOJPM6766)
Conduct of Operations	N, R	G2.1.3, (Knowledge of Shift or Short Term Relief Turnover Practices (CFR41.10 / 45.13) 3.7 / 3.9) PERFORM A SHIFT TURNOVER (SRO)(LOJPM6754)
Equipment Control	D, R	G2.2.12 (Knowledge of surveillance procedures (CFR 41.10 / 45.13) 3.7 / 4.1) Review ST-6-047-370-1, PRE-CONTROL ROD WITHDRAWAL CHECK (LOJPM6753)
Radiation Control	D, R	G2.3.11, (Ability to Control Rad Releases, (CFR 41.11 / 43.4 / 45.10) 3.8 / 4.3) REVIEW AND APPROVE RELEASE FROM EQUIP. DRAIN TO C.T. BLOWDOWN LINE (LOJPM6726)
Emergency Plan	N, R	G2.4.41 (Knowledge of the emergency action level thresholds and classifications, (CFR 41.10/ 43.5/ 45.11) 2.9 / 4.6) ERP CLASSIFICATION AND REPORTING (Time Critical) (LOJPM3153)

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)
(N)ew or (M)odified from bank (≥ 1)
(P)revious 2 exams (≤ 1, randomly selected)

Facility: Limerick – NRC 17-1 Date of Examination: 11/26/18

Exam Level: RO ☒ SRO-I ☐ SRO-U ☐ Operating Test Number: 1

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. Align 1C SLC Pump for Automatic Operation (System 211000 – Standby Liquid Control, A1.09; 4.0/4.1) (LOJPM3767)	N, S	1 – Reactivity Control
b. Manually Place 3rd Reactor Feed Pump in Service (System 259001 – Reactor Feedwater System, A4.02; 3.9 / 3.7) (LOJPM3007)	D, S	2 – Rx Water Inventory Control
c. Response to EHC Leaks - ISV (System 241000 – Reactor/Turbine Pressure Regulating System, A4.09 3.2 / 3.1) (LOJPM3149)	N, S	3 – Reactor Pressure Control
d. Transfer HPCI from Pressure Control to Level Control (206000 – High Pressure Coolant Injection System, A4.04, 3.7 / 3.7) (LOJPM3756)	A, D, S	4 – Heat Removal From Core
e. Vent the Drywell (System 223001 – Primary Containment System and Auxiliaries, A4.07, 4.2 / 4.1) (LOJPM3106)	A, D, S	5 – Containment Integrity
f. Transfer D14 from 201 to 101 (264000 – Emergency Generators, A4.04, 3.7 / 3.7) (LOJPM3532)	A, EN, N, S	6 – Electrical
g. Scram Channel A1 and A2 Functional Test (System 212000 – Reactor Protection System, A4.02; 3.6 / 3.7) (LOJPM3006)	A, D, S	7 – Instrumentation
h. Align ESW to Unit 1 TECW Heat Exchanger (400000 – Component Cooling Water System, A2.01; 3.3 / 3.4) (LOJPM3053)	EN, L, N, S	8 – Plant Service Systems
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. T-214, Manual Initiation of ARI (295037 – Emergency, EA1.03; 4.1 / 4.1) (LOJPM2208)	D, E, R	1 – Reactivity Control
j. Maximize CRD Flow after Shutdown During Emergency Conditions (295031 – Emergency, EA1.10; 3.6 / 3.7) (LOJPM2269)	D, E, L, R	2 – Rx Water Inventory Control
k. Install Air Jumper to Provide Long Term ADS Operation from D*1 D/G Air Compressor (218000 – Automatic Depressurization, A2.03, 3.4 / 3.6) (LOJPM2231)	D, E, L	3 – Reactor Pressure Control

* 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	4
(C)ontrol room		
(D)irect from bank	**≤ 9**/≤ 8/≤ 4	7
(E)mergency or abnormal in-plant	**≥ 1**/≥ 1/≥ 1	3
(EN)gineered safety feature	**≥ 1**/≥ 1/≥ 1 (control room system)	2
(L)ow-Power/Shutdown	**≥ 1**/≥ 1/≥ 1	3
(N)ew or (M)odified from bank including 1(A)	**≥ 2**/≥ 2/≥ 1	4
(P)revious 2 exams	**≤ 3**/≤ 3/≤ 2 (randomly selected)	0
(R)CA	**≥ 1**/≥ 1/≥ 1	2
(S)imulator		8

Facility: Limerick – NRC 17-1 Date of Examination: 11/26/18

Exam Level: RO ☐ SRO-I ☒ SRO-U ☐ Operating Test Number: 1

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. Align 1C SLC Pump for Automatic Operation (System 211000 – Standby Liquid Control, A1.09; 4.0/4.1) (LOJPM3767)	N, S	1 – Reactivity Control
c. Response to EHC Leaks - ISV (System 241000 – Reactor/Turbine Pressure Regulating System, A4.09 3.2 / 3.1) (LOJPM3149)	N, S	3 – Reactor Pressure Control
d. Transfer HPCI from Pressure Control to Level Control (206000 – High Pressure Coolant Injection System, A4.04, 3.7 / 3.7) (LOJPM3756)	A, D, S	4 – Heat Removal From Core
e. Vent the Drywell (System 223001 – Primary Containment System and Auxiliaries, A4.07, 4.2 / 4.1) (LOJPM3106)	A, D, S	5 – Containment Integrity
f. Transfer D14 from 201 to 101 (264000 – Emergency Generators, A4.04, 3.7 / 3.7) (LOJPM3532)	A, EN, N, S	6 – Electrical
g. Scram Channel A1 and A2 Functional Test (System 212000 – Reactor Protection System, A4.02; 3.6 / 3.7) (LOJPM3006)	A, D, S	7 – Instrumentation
h. Align ESW to Unit 1 TECW Heat Exchanger (400000 – Component Cooling Water System, A2.01; 3.3 / 3.4) (LOJPM3053)	EN, L, N, S	8 – Plant Service Systems
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. Manual Initiation of ARI (295037 – Emergency, EA1.03; 4.1 / 4.1) (LOJPM2208)	D, E, R	1 – Reactivity Control
j. Maximize CRD Flow after Shutdown During Emergency (295031 – Emergency, EA1.10; 3.6 / 3.7) (LOJPM2269)	D, E, L, R	2 – Rx Water Inventory Control
k. Install Air Jumper to Provide Long Term ADS Operation from D*1 D/G Air Compressor (218000 – Automatic Depressurization, A2.03, 3.4 / 3.6) (LOJPM2231)	D, E, L	3 – Reactor Pressure Control

* 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	4
(C)ontrol room		
(D)irect from bank	≤ 9/**≤ 8**/≤ 4	6
(E)mergency or abnormal in-plant	≥ 1/**≥ 1**/≥ 1	3
(EN)gineered safety feature	≥ 1/**≥ 1**/≥ 1 (control room system)	2
(L)ow-Power/Shutdown	≥ 1/**≥ 1**/≥ 1	3
(N)ew or (M)odified from bank including 1(A)	≥ 2/**≥ 2**/≥ 1	4
(P)revious 2 exams	≤ 3/**≤ 3**/≤ 2 (randomly selected)	0
(R)CA	≥ 1/**≥ 1**/≥ 1	2
(S)imulator		7

Facility: Limerick – NRC 17-1	Date of Examination: 11/26/18
Exam Level: RO ☐ SRO-I ☐ SRO-U ☒	Operating Test Number: 1

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

System/JPM Title	Type Code*	Safety Function
c. Response to EHC Leaks - ISV (System 241000 – Reactor/Turbine Pressure Regulating System, A4.09 3.2 / 3.1) (LOJPM3149)	N, S	3 – Reactor Pressure Control
d. Transfer HPCI from Pressure Control to Level Control (206000 – High Pressure Coolant Injection System, A4.04, 3.7 / 3.7) (LOJPM3756)	A, D, S	4 – Heat Removal From Core
f. Transfer D14 from 201 to 101 (264000 – Emergency Generators, A4.04, 3.7 / 3.7) (LOJPM3532)	A, EN, N, S	6 – Electrical

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

i. Manual Initiation of ARI (295037 – Emergency, EA1.03; 4.1 / 4.1) (LOJPM2208)	D, E, R	1 – Reactivity Control
j. Maximize CRD Flow after Shutdown During Emergency (295031 – Emergency, EA1.10; 3.6 / 3.7) (LOJPM2269)	D, E, L, R	2 – Rx Water Inventory Control

* 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**	2
(C)ontrol room		
(D)irect from bank	≤ 9/≤ 8/**≤ 4**	3
(E)mergency or abnormal in-plant	≥ 1/≥ 1/**≥ 1**	2
(EN)gineered safety feature	≥ 1/≥ 1/**≥ 1** (control room system)	1
(L)ow-Power/Shutdown	≥ 1/≥ 1/**≥ 1**	1
(N)ew or (M)odified from bank including 1(A)	≥ 2/≥ 2/**≥ 1**	2
(P)revious 2 exams	≤ 3/≤ 3/**≤ 2** (randomly selected)	0
(R)CA	≥ 1/≥ 1/**≥ 1**	2
(S)imulator		3

Facility: Limerick 1 & 2 Scenario No.: SEG-2016E Rev 0 Op-Test No.: 1 .

Examiners: _____ Operators: _____

_____ _____

_____ _____

Initial Conditions:

Unit 1 Reactor Power is 100%
Unit 2 Reactor Power is 100%

Turnover:

Maintain 100% power

Critical Tasks:

1. Spray the Drywell
2. Perform Emergency Blowdown per T-112

Event No.	Malfunction Number	Event Type*	Event Description
1	MPC854D MRP029D	I – RO TS - SRO	DW Pressure Transmitter fails upscale with B2 Channel of RPS failing to de-energize
2	MFW005A	C – PRO TS - SRO	Inadvertent RCIC Start
3	MFH112B MFH012B	R-RO C - PRO	Low Pressure FWH String high level with failure of automatic Isolation
4	MRR441	C-PRO C - RO	Small Coolant Leak into Drywell
5	MMS067	M-ALL	Large DW Leak
6	MEH112A MEG112B	C - RO	Running EHC Pump Trips with standby pump failing to start
7	MRH600A MRH600B	C - PRO	A or B RHR PP trip (based on opening of 16B or 16A)

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

QUANTITATIVE ATTRIBUTES

A. ILT

Target Quantitative Attributes (Per Scenario; See ES-301Section D.5.d)		ACTUAL NUMBER
1.	Malfunctions after EOP entry (1-2)	2
2.	Abnormal events (2-4)	4
3.	Major transients (1–2)	1
4.	EOPs entered/requiring substantive actions (1–2)	2
5.	EOP contingencies requiring substantive actions (0-2)	1
6.	Critical tasks (2–3)	2

Review TQ-AA-151 attachment 5 and ES-301-5 for individual position requirements for scenario and scenario set

Facility: Limerick 1 & 2 Scenario No.: SEG-3005E Rev 1 Op-Test No.: 1 .

Examiners: _____ Operators: _____

_____ _____

_____ _____

Initial Conditions:

Unit 1 is at 5.0 % power. Unit 2 is at 100% power.

Turnover:

D12 D/G is running parallel to 201 Safeguard Bus following maintenance. D12 D/G has been running loaded for 11/2 hours of the required 2 hours per S92.2.N step 4.6.4.

Planned Evolutions :

When the 2 hour loaded run is complete, secure D12 D/G per S92.2.N beginning with step 4.6.4.

Critical Tasks:

1. Manually Insert Control Rods
2. Direct performance of T-290 to personnel outside the control room
3. Perform Emergency Blowdown per T-112

Event No.	Malfunction Number	Event Type*	Event Description
1	MESW600B	C-PRO TS-SRO	'0B' ESW Pump trip
2	MCU002A MCU002B MCU193 HS44-1F004	C-PRO TS-SRO	RWCU Isolation failure on differential flow
3	MED280A	C-RO C-PRO	Trip of 1AY160, RPS/UPS Distribution Panel
4	MRD016G	C-RO	Failure of 3 (three) Control Rods to scram.
5	MFW251B HS06-108A	C-RO	S/U Level Control Valve and HV-06-108A fail closed
6	MFW245B MRC460	C-PRO	'1B' Reactor Feedpump Trip RCIC injection valve fails to open Automatically
7	MHP445	M-ALL	T-103 Steam Leak in HPCI
8	MHP446A MHP446B	C-PRO	HPCI Steam Isolation Valves fail to close
9	MAD141D	C-PRO	SRV "E" fails to open

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

QUANTITATIVE ATTRIBUTES

A. ILT

Target Quantitative Attributes (Per Scenario; See ES-301Section D.5.d)		ACTUAL NUMBER
1.	Malfunctions after EOP entry (1-2)	2
2.	Abnormal events (2-4)	4
3.	Major transients (1–2)	1
4.	EOPs entered/requiring substantive actions (1–2)	2
5.	EOP contingencies requiring substantive actions (0-2)	1
6.	Critical tasks (2–3)	3

Review TQ-AA-151 attachment 5 and ES-301-5 for individual position requirements for scenario and scenario set

Facility: Limerick 1 & 2 Scenario No.: SEG-4058E Rev 0 Op-Test No.: 1 .

Examiners: _____ Operators: _____

_____ _____

_____ _____

Initial Conditions:

Unit 2 Reactor Power is 100%; Unit 1 Reactor Power is 85% power with a load drop in progress

Turnover:

A load drop is in progress per GP-5. Crew is to raising power to 100% using Core Flow

Critical Tasks:

1. Manually Scram the reactor when more than one control rod moves without a demand signal
2. Inhibit Automatic ADS
3. Perform actions to maintain/restore RPV water level above Top of Active Fuel (TAF)

Event No.	Malfunction Number	Event Type*	Event Description
1	N/A	R-RO	Raise Power with Core Flow
2	MRD016F (06-23)	C-RO TS-SRO	Control Rod (06-23) scrams
3	MPC482B	C-PRO	'1B' Drywell Chiller trip
4	MED282D	C-PRO TS-SRO	Loss of Div 4 DC
5	MRD016F (34-47) MRD016F (46-27)	C-RO C-PRO	2nd and 3rd Control Rod (34-47) and (46-27) scram
6	MFW252A MRR440A	M-All	FW Line A Break Inside the Primary Containment
7	MRC457B	C-PRO	RCIC Flow Controller fails in AUTO
8	MCS184A	C-PRO	Core Spray Injection Valve HV-52-1F005 Fails to Auto Open

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

QUANTITATIVE ATTRIBUTES

A. ILT

Target Quantitative Attributes (Per Scenario; See ES-301Section D.5.d)		ACTUAL NUMBER
1.	Malfunctions after EOP entry (1-2)	2
2.	Abnormal events (2-4)	3
3.	Major transients (1–2)	1
4.	EOPs entered/requiring substantive actions (1–2)	2
5.	EOP contingencies requiring substantive actions (0-2)	2
6.	Critical tasks (2–3)	3

Review TQ-AA-151 attachment 5 and ES-301-5 for individual position requirements for scenario and scenario set

Facility: Limerick 1 & 2 Scenario No.: SEG-6221E Rev 0 Op-Test No.: 1 .

Examiners: _____ Operators: _____

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Initial Conditions:

Unit 1 Reactor Power is 100%
Unit 2 Reactor Power is 100%

Turnover:

Crew is required to cross-tie 124A LC to 114A LC per S93.7.A to remove 124A Reactor Area Load Center Transformer Supply Breaker for Maintenance. Return LC Transformer to service when maintenance is complete.

Critical Tasks:

1. Inhibit Auto ADS
2. Terminate and prevent injection into the RPV (second lowering)
3. Direct performance of control rod insertion via T-215 to personnel located outside the MCR

Event No.	Malfunction Number	Event Type*	Event Description
1	N/A	N-PRO	Cross tie 124A to 114A Load Center
2	MCW485B MCW480A	C-PRO	RECW Pump Trip, standby fails to auto start
3	MEH101C	R-RO TS-SRO	# 3 Turbine Stop Valve fail closed
4	MFW001	C-PRO	HWC Lockup
5	MED262B	C-RO TS-SRO	Loss of 12 BUS
6	MSL001B	C-RO	'1B' SLC Pump spuriously starts and injects
7	MRP029B MSL559 MRP407C	M-ALL	ATWS, SLC failure, RRCS ARI Failure
8	C11A-S16	C-RO	Control Rod Continuous Insert pushbutton fails
9	MMT002	C - PRO	Main Turbine Trip and BPV Failure

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

QUANTITATIVE ATTRIBUTES

A. ILT

Target Quantitative Attributes (Per Scenario; See ES-301Section D.5.d)		ACTUAL NUMBER
1.	Malfunctions after EOP entry (1-2)	2
2.	Abnormal events (2-4)	4
3.	Major transients (1–2)	1
4.	EOPs entered/requiring substantive actions (1–2)	2
5.	EOP contingencies requiring substantive actions (0-2)	1
6.	Critical tasks (2–3)	4

Review TQ-AA-151 attachment 5 and ES-301-5 for individual position requirements for scenario and scenario set

Facility: Limerick Generating Station Date of Exam: December 2018

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	3	3	3	N/A			4	3	N/A		4	20	4		3		7		
	2	1	1	1				1	2			1	7	2		1		3		
	Tier Totals	4	4	4				5	5			5	27	6		4		10		
2. Plant Systems	1	3	1	3	3	3	2	2	3	2	2	2	26	3		2		5		
	2	1	2	1	1	1	1	1	1	1	1	1	12		2	1		3		
	Tier Totals	4	3	4	4	4	3	3	4	3	3	3	38	5		3		8		
3. Generic Knowledge and Abilities Categories		1		2		3		4		10				1	2	3	4	7		
		3		3		2		2						2	2	2	1			

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/SRO)							Form ES-401-1	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
295003 (APE 3) Partial or Complete Loss of AC Power / 6						X	G2.2.3 (multi-unit license) Knowledge of the design, procedural, and operational differences between units.	3.9	76
295005 (APE 5) Main Turbine Generator Trip / 3					X		AA2.07 Ability to determine and/or interpret the following as they apply to MAIN TURBINE GENERATOR TRIP : Reactor water level	3.6	77
295016 (APE 16) Control Room Abandonment / 7					X		AA2.06 Ability to determine and/or interpret the following as they apply to CONTROL ROOM ABANDONMENT : Cooldown rate	3.5	78
295018 (APE 18) Partial or Complete Loss of CCW / 8					X		AA2.03 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER : Cause for partial or complete loss	3.5	79
295019 (APE 19) Partial or Complete Loss of Instrument Air / 8					X		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)	3.7	80
295025 (EPE 2) High Reactor Pressure / 3						X	G2.4.9 Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies.	4.2	81
295031 (EPE 8) Reactor Low Water Level / 2						X	G2.1.30 Ability to locate and operate components, including local controls.	4.0	82
295001 (APE 1) Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4			X				AK3.02 Knowledge of the reasons for the following responses as they apply to PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION : Reactor power response	3.7	1
295003 (APE 3) Partial or Complete Loss of AC Power / 6		X					AK2.03 Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF A.C. POWER and the following: A.C. electrical distribution system	3.7	2
295004 (APE 4) Partial or Total Loss of DC Power / 6				X			AA1.03 Ability to operate and/or monitor the following as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER : A.C. electrical distribution	3.4	3
295005 (APE 5) Main Turbine Generator Trip / 3					X		AA2.03 Ability to determine and/or interpret the following as they apply to MAIN TURBINE GENERATOR TRIP : Turbine valve position	3.1	4
295006 (APE 6) Scram / 1	X						AK1.02 Knowledge of the operational implications of the following concepts as they apply to SCRAM : Shutdown margin	3.4	5
295016 (APE 16) Control Room Abandonment / 7					X		AA2.02 Ability to determine and/or interpret the following as they apply to CONTROL ROOM ABANDONMENT : Reactor water level	4.2	6

295018 (APE 18) Partial or Complete Loss of CCW / 8				X			AA1.02 Ability to operate and/or monitor the following as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER : System loads	3.3	7
295019 (APE 19) Partial or Complete Loss of Instrument Air / 8						X	G2.4.4 Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures.	4.5	8
295021 (APE 21) Loss of Shutdown Cooling / 4				X			AA1.06 Ability to operate and/or monitor the following as they apply to LOSS OF SHUTDOWN COOLING : Containment/ drywell temperature	2.8	9
295023 (APE 23) Refueling Accidents / 8				X			AA1.04 Ability to operate and/or monitor the following as they apply to REFUELING ACCIDENTS : Radiation monitoring equipment	3.4	10
295024 High Drywell Pressure / 5	X						EK1.01 Knowledge of the operational implications of the following concepts as they apply to HIGH DRYWELL PRESSURE : Drywell integrity: Plant-Specific	4.1	11
295025 (EPE 2) High Reactor Pressure / 3					X		EA2.01 Ability to determine and/or interpret the following as they apply to HIGH REACTOR PRESSURE: Reactor pressure	4.3	12
295026 (EPE 3) Suppression Pool High Water Temperature / 5						X	G2.4.49 Ability to perform without reference to procedures those actions that require immediate operation of system components and controls.	4.6	13
295028 (EPE 5) High Drywell Temperature (Mark I and Mark II only) / 5						X	G2.4.18 Knowledge of the specific bases for EOPs.	3.3	14
295030 (EPE 7) Low Suppression Pool Water Level / 5			X				EK3.07 Knowledge of the reasons for the following responses as they apply to LOW SUPPRESSION POOL WATER LEVEL: NPSH considerations for ECCS pumps	3.5	15
295031 (EPE 8) Reactor Low Water Level / 2		X					EK2.12 Knowledge of the interrelations between REACTOR LOW WATER LEVEL and the following: Primary containment isolation system/ Nuclear steam supply shutoff	4.5	16
295037 (EPE 14) Scram Condition Present and Reactor Power Above APRM Downscale or Unknown / 1		X					EK2.10 Knowledge of the interrelations between SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN and the following: Reactor pressure	3.8	17
295038 (EPE 15) High Offsite Radioactivity Release Rate / 9	X						EK1.02 Knowledge of the operational implications of the following concepts as they apply to HIGH OFF-SITE RELEASE RATE : Protection of the general public	4.2	18
600000 (APE 24) Plant Fire On Site / 8			X				AK3.04 Knowledge of the reasons for the following responses as they apply to PLANT FIRE ON SITE: Actions contained in the abnormal procedure for plant fire on site	2.8	19
700000 (APE 25) Generator Voltage and Electric Grid Disturbances / 6						X	G2.2.25 Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.	3.2	20
K/A Category Totals:	3	3	3	4	3/4	4/3	Group Point Total:		20/7

ES-401	BWR Examination Outline Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (RO/SRO)							Form ES-401-1
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
295010 (APE 10) High Drywell Pressure / 5						X	G2.4.35 Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects.	4.0	83
295032 (EPE 9) High Secondary Containment Area Temperature / 5					X		EA2.01 Ability to determine and/or interpret the following as they apply to HIGH SECONDARY CONTAINMENT AREA TEMPERATURE : Area temperature	3.8	84
295033 (EPE 10) High Secondary Containment Area Radiation Levels / 9					X		EA2.03 Ability to determine and/or interpret the following as they apply to HIGH SECONDARY CONTAINMENT AREA RADIATION LEVELS : Cause of high area radiation	4.2	85
295002 (APE 2) Loss of Main Condenser Vacuum / 3				X			AA1.02 Ability to operate and/or monitor the following as they apply to LOSS OF MAIN CONDENSER VACUUM : Offgas system	2.9	21
295009 (APE 9) Low Reactor Water Level / 2						X	G2.4.47 Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material.	4.2	22
295012 (APE 12) High Drywell Temperature / 5					X		AA2.01 Ability to determine and/or interpret the following as they apply to HIGH DRYWELL TEMPERATURE : Drywell temperature	3.8	23
295029 (EPE 6) High Suppression Pool Water Level / 5		X					EK2.02 Knowledge of the interrelations between HIGH SUPPRESSION POOL WATER LEVEL and the following: HPCI: Plant-Specific	3.4	24
295032 (EPE 9) High Secondary Containment Area Temperature / 5					X		EA2.01 Ability to determine and/or interpret the following as they apply to HIGH SECONDARY CONTAINMENT AREA TEMPERATURE : Area temperature	3.8	25
295034 (EPE 11) Secondary Containment Ventilation High Radiation / 9	X						EK1.01 Knowledge of the operational implications of the following concepts as they apply to SECONDARY CONTAINMENT VENTILATION HIGH RADIATION : Personnel protection	3.8	26
295036 (EPE 13) Secondary Containment High Sump/Area Water Level / 5			X				EK3.03 Knowledge of the reasons for the following responses as they apply to SECONDARY CONTAINMENT HIGH SUMP/AREA WATER LEVEL : Isolating affected systems	3.5	27
K/A Category Point Totals:	1	1	1	1	2/2	1/1	Group Point Total:		7/3

ES-401	BWR Examination Outline Plant Systems—Tier 2/Group 1 (RO/SRO)											Form ES-401-1	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G *	K/A Topic(s)	IR	#
211000 (SF1 SLCS) Standby Liquid Control											X	G2.4.31 Knowledge of annunciator alarms, indications, or response procedures.	4.1	86
215003 (SF7 IRM) Intermediate Range Monitor											X	G2.1.27 Knowledge of system purpose and/or function.	4.0	87
261000 (SF9 SGTS) Standby Gas Treatment								X				A2.01 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: Low system flow	3.1	88
264000 (SF6 EGE) Emergency Generators (Diesel/Jet) EDG								X				A2.09 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 A.C. power	4.1	89
400000 (SF8 CCS) Component Cooling Water								X				A2.02 Ability to (a) predict the impacts of the following on the CCWS and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal operation: High/low surge tank level	3.0	90
203000 (SF2, SF4 RHR/LPCI) RHR/LPCI: Injection Mode									X			A3.04 Ability to monitor automatic operations of the RHR/LPCI: INJECTION MODE (PLANT SPECIFIC) including: System flow	3.8	28
205000 (SF4 SCS) Shutdown Cooling				X								K4.02 Knowledge of SHUTDOWN COOLING SYSTEM (RHR SHUTDOWN COOLING MODE) design feature(s) and/or interlocks which provide for the following: High pressure isolation: Plant-Specific	3.7	29
206000 (SF2, SF4 HPCIS) High-Pressure Coolant Injection					X							K5.08 Knowledge of the operational implications of the following concepts as they apply to HIGH PRESSURE COOLANT INJECTION SYSTEM : Vacuum breaker operation: BWR-2,3,4	3.0	30
209001 (SF2, SF4 LPCS) Low-Pressure Core Spray		X										K2.01 Knowledge of electrical power supplies to the following: Pump power	3.0	31
211000 (SF1 SLCS) Standby Liquid Control			X									K3.01 Knowledge of the effect that a loss or malfunction of the STANDBY LIQUID CONTROL SYSTEM will have on following: Ability to shutdown the reactor in certain conditions	4.3	32
215004 (SF7 SRMS) Source Range Monitor					X							K5.03 Knowledge of the operational implications of the following concepts as they apply to SOURCE RANGE MONITOR (SRM) SYSTEM : Changing detector position	2.8	33

212000 (SF7 RPS) Reactor Protection						X						K6.05 Knowledge of the effect that a loss or malfunction of the following will have on the REACTOR PROTECTION SYSTEM : RPS sensor inputs	3.5	34
215003 (SF7 IRM) Intermediate-Range Monitor							X					A1.03 Ability to predict and/or monitor changes in parameters associated with operating the INTERMEDIATE RANGE MONITOR (IRM) SYSTEM controls including: RPS status	3.6	35
215004 (SF7 SRMS) Source-Range Monitor								X				A2.02 Ability to (a) predict the impacts of the following on the SOURCE RANGE MONITOR (SRM) SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: SRM inop condition	3.4	36
215005 (SF7 PRMS) Average Power Range Monitor/Local Power Range Monitor							X					A1.04 Ability to predict and/or monitor changes in parameters associated with operating the AVERAGE POWER RANGE MONITOR/ LOCAL POWER RANGE MONITOR SYSTEM controls including: SCRAM and rod block trip setpoints	4.1	37
215005 (SF7 PRMS) Average Power Range Monitor/Local Power Range Monitor								X				A2.01 Ability to (a) predict the impacts of the following on the AVERAGE POWER RANGE MONITOR/ LOCAL POWER RANGE MONITOR SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Power supply degraded	2.7	38
217000 (SF2, SF4 RCIC) Reactor Core Isolation Cooling			X									K3.01 Knowledge of the effect that a loss or malfunction of the REACTOR CORE ISOLATION COOLING SYSTEM (RCIC) will have on following: Reactor water level	3.7	39
218000 (SF3 ADS) Automatic Depressurization								X				A2.06 Ability to (a) predict the impacts of the following on the AUTOMATIC DEPRESSURIZATION SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: ADS initiation signals present	4.2	40
223002 (SF5 PCIS) Primary Containment Isolation/Nuclear Steam Supply Shutoff			X									K3.12 Knowledge of the effect that a loss or malfunction of the PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF will have on following: High pressure coolant injection: Plant-Specific	3.6	41
239002 (SF3 SRV) Safety Relief Valves											X	G2.2.44 Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions.	4.2	42
259002 (SF2 RWLCS) Reactor Water Level Control	X											K1.05 Knowledge of the physical connections and/or cause/effect relationships between REACTOR WATER LEVEL CONTROL SYSTEM and the following: Reactor feedwater system	3.6	43

261000 (SF9 SGTS) Standby Gas Treatment				X								K4.05 Knowledge of STANDBY GAS TREATMENT SYSTEM design feature(s) and/or interlocks which provide for the following: Fission product gas removal	2.6	44
262001 (SF6 AC) AC Electrical Distribution										X		A4.02 Ability to manually operate and/or monitor in the control room: Synchroscope, including understanding of running and incoming voltages	3.4	45
262002 (SF6 UPS) Uninterruptable Power Supply (AC/DC)				X								K4.01 Knowledge of UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.) design feature(s) and/or interlocks which provide for the following: Transfer from preferred power to alternate power supplies	3.1	46
262002 (SF6 UPS) Uninterruptable Power Supply (AC/DC)	X											K1.06 Knowledge of the physical connections and/or cause/effect relationships between UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.) and the following: Unit computer: Plant-Specific	2.6	47
263000 (SF6 DC) DC Electrical Distribution										X		A4.03 Ability to manually operate and/or monitor in the control room: Battery discharge rate: Plant-Specific	2.7	48
264000 (SF6 EGE) Emergency Generators (Diesel/Jet) EDG									X			A3.05 Ability to monitor automatic operations of the EMERGENCY GENERATORS (DIESEL/JET) including: Load shedding and sequencing	3.4	49
300000 (SF8 IA) Instrument Air					X							K5.01 Knowledge of the operational implications of the following concepts as they apply to the INSTRUMENT AIR SYSTEM: Air compressors	2.5	50
300000 (SF8 IA) Instrument Air						X						K6.07 Knowledge of the effect that a loss or malfunction of the following will have on the INSTRUMENT AIR SYSTEM: Valves	2.5	51
400000 (SF8 CCS) Component Cooling Water											X	G2.4.4 Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures.	4.5	52
263000 (SF6 DC) DC Electrical Distribution	X											K1.02 Knowledge of the physical connections and/or cause/effect relationships between D.C. ELECTRICAL DISTRIBUTION and the following: Battery charger and battery	3.2	53
K/A Category Point Totals:	3	1	3	3	3	2	2	3/3	2	2	2/2	Group Point Total:		26/5

ES-401	BWR Examination Outline Plant Systems—Tier 2/Group 2 (RO/SRO)											Form ES-401-1		
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
201001 (SF1 CRDH) CRD Hydraulic								X				A2.12 Ability to (a) predict the impacts of the following on the CONTROL ROD DRIVE HYDRAULIC SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: High cooling water flow	2.9	91
201003 (SF1 CRDM) Control Rod and Drive Mechanism											X	G2.1.28 Knowledge of the purpose and function of major system components and controls.	4.1	92
286000 (SF8 FPS) Fire Protection								X				A2.07 Ability to (a) predict the impacts of the following on the FIRE PROTECTION SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Inadvertent system initiation	2.9	93
202002 (SF1 RSCTL) Recirculation Flow Control				X								K4.06 Knowledge of RECIRCULATION FLOW CONTROL SYSTEM design feature(s) and/or interlocks which provide for the following: Recirculation pump adequate NPSH: Plant-Specific	3.1	54
215002 (SF7 RBMS) Rod Block Monitor										X		A4.02 Ability to manually operate and/or monitor in the control room: RBM back panel switches, meters and indicating lights: BWR-3,4,5	2.9	55
223001 (SF5 PCS) Primary Containment and Auxiliaries					X							K5.08 Knowledge of the operational implications of the following concepts as they apply to PRIMARY CONTAINMENT SYSTEM AND AUXILIARIES : Pressure measurement	2.7	56
230000 (SF5 RHR SPS) RHR/LPCI: Torus/Suppression Pool Spray Mode		X										K2.02 Knowledge of electrical power supplies to the following: Pumps	2.8	57
234000 (SF8 FH) Fuel-Handling Equipment	X											K1.05 Knowledge of the physical connections and/or cause/effect relationships between FUEL HANDLING EQUIPMENT and the following: Reactor vessel components: Plant-Specific	2.9	58
241000 (SF3 RTPRS) Reactor/Turbine Pressure Regulating											X	G2.2.12 Knowledge of surveillance procedures.	3.7	59
245000 (SF4 MTGEN) Main Turbine Generator/Auxiliary			X									K3.02 Knowledge of the effect that a loss or malfunction of the MAIN TURBINE GENERATOR AND AUXILIARY SYSTEMS will have on following: Reactor pressure	3.9	60
259001 (SF2 FWS) Feedwater									X			A3.04 Ability to monitor automatic operations of the REACTOR FEEDWATER SYSTEM including: Reactor water level	3.8	61
268000 (SF9 RW) Radwaste								X				A2.01 Ability to (a) predict the impacts of the following on the RADWASTE ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: System rupture	2.9	62
272000 (SF7, SF9 RMS) Radiation Monitoring							X					A1.02 Ability to predict and/or monitor changes in parameters associated with operating the RADIATION MONITORING SYSTEM controls including: Lights, alarms, and indications associated with surveillance testing	2.9	63
286000 (SF8 FPS) Fire Protection		X										K2.02 Knowledge of electrical power supplies to the following: Pumps	2.9	64

288000 (SF9 PVS) Plant Ventilation						X						K6.03 Knowledge of the effect that a loss or malfunction of the following will have on the PLANT VENTILATION SYSTEMS : Plant air systems	2.7	65
K/A Category Point Totals:	1	2	1	1	1	1	1	1/2	1	1	1/1	Group Point Total:		12/3

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.13	Knowledge of facility requirements for controlling vital/controlled access.			3.2	94
	2.1.35	Knowledge of the fuel-handling responsibilities of SROs.			3.9	95
	2.1.32	Ability to explain and apply system limits and precautions.	3.8	66		
	2.1.36	Knowledge of procedures and limitations involved in core alterations.	3.0	67		
	2.1.43	Ability to use procedures to determine the effects on reactivity of plant changes, such as reactor coolant system temperature, secondary plant, fuel depletion, etc.	4.1	68		
	Subtotal			3		2
2. Equipment Control	2.2.14	Knowledge of the process for controlling equipment configuration or status.			4.3	96
	2.2.25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.			4.2	97
	2.2.4	(multi-unit license) Ability to explain the variations in control board/control room layouts, systems, instrumentation, and procedural actions between units at a facility.	3.6	69		
	2.2.23	Ability to track Technical Specification limiting conditions for operations.	3.1	70		
	2.2.44	Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions.	4.2	71		
	Subtotal			3		2
3. Radiation Control	2.3.11	Ability to control radiation releases.			4.3	98
	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions.			3.7	99
	2.3.12	Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc.	3.2	72		
	2.3.15	Knowledge of radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc.	2.9	73		
	Subtotal			2		2
4. Emergency Procedures/Plan	2.4.25	Knowledge of fire protection procedures.			3.7	100
	2.4.27	Knowledge of “fire in the plant” procedures.	3.4	74		
	2.4.39	Knowledge of RO responsibilities in emergency plan implementation.	3.9	75		
	Subtotal			2		1
Tier 3 Point Total				10		7