

Facility Name:		Date of Exam:															
Tier	Group	RO K/A Category Points												Total	SRO-Only Points		
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	A2		G*	Total	
1. Emergency & Abnormal Plant Evolutions	1	3	4	3	N/A			3	3	N/A			4	20	4	3	7
	2	1	1	1	N/A			1	2	N/A			1	7	2	1	3
	Tier Totals	4	5	4	N/A			4	5	N/A			5	27	6	4	10
2. Plant Systems	1	3	2	2	3	1	2	2	3	3	2	3	26	3	2	5	
	2	1	0	0	2	2	1	2	1	1	1	1	12	0	2	3	
	Tier Totals	4	2	2	5	3	3	4	4	4	3	4	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 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).

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  $\pm 1$  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.

3. 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 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 shall be selected. 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' 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.

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.

ES-401 BWR Examination Outline Form ES-401-1									
Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO)									
Q#	E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR #
1	295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4			0 5				Reduced loop operating requirements: Plant-Specific	3.2 1
2	295003 Partial or Complete Loss of AC / 6		0 6					D.C. electrical loads	3.4 1
3	295004 Partial or Total Loss of DC Pwr / 6				0 3			A.C. electrical distribution	3.4 1
4	295005 Main Turbine Generator Trip / 3	0 2						Core thermal limit considerations	3.2 1
5	295006 SCRAM / 1				0 3			Reactor/turbine pressure regulating system	3.7 1
6	295016 Control Room Abandonment / 7						01. 19	Ability to use plant computers to evaluate system or component status.	3.9 1
7	295018 Partial or Total Loss of CCW / 8					0 3		Cause for partial or complete loss	3.2 1
8	295019 Partial or Total Loss of Inst. Air / 8		0 3					Reactor feedwater	3.2 1
9	295021 Loss of Shutdown Cooling / 4						01. 30	Ability to locate and operate components, including local controls.	4.4 1
10	295023 Refueling Acc / 8			0 1				Refueling floor evacuation	3.6 1
11	295024 High Drywell Pressure / 5						04. 02	Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions.	4.5 1
12	295025 High Reactor Pressure / 3		0 4					ARI/RPT/ATWS: Plant-Specific	3.9 1
13	295026 Suppression Pool High Water Temp. / 5			0 1				Emergency/normal depressurization	3.8 1
	295027 High Containment Temperature / 5								0
14	295028 High Drywell Temperature / 5	0 1						Reactor water level measurement	3.5 1
15	295030 Low Suppression Pool Wtr Lvl / 5					0 3		Reactor pressure	3.7 1
16	295031 Reactor Low Water Level / 2		1 4					Emergency generators	3.9 1
17	295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1	0 2						Reactor water level effects on reactor power	4.1 1
18	295038 High Off-site Release Rate / 9				0 7			Control room ventilation: Plant-Specific	3.6 1
19	600000 Plant Fire On Site / 8						04. 34	Knowledge of RO tasks performed outside the main control room during an emergency and the resultant operational effects.	4.2 1
20	700000 Generator Voltage and Electric Grid Disturbances / 6					0 4		VARs outside capability curve	3.6 1
K/A Category Totals:		3	4	3	3	3	4	Group Point Total:	20

ES-401		BWR Examination Outline							Form ES-401-1	
Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO)										
Q#	E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
21	295002 Loss of Main Condenser Vac / 3					0 1		Condenser vacuum/absolute pressure	2.9	1
	295007 High Reactor Pressure / 3									0
22	295008 High Reactor Water Level / 2			0 8				RCIC steam supply valve closure: Plant-Specific	3.4	1
	295009 Low Reactor Water Level / 2									0
	295010 High Drywell Pressure / 5									0
	295011 High Containment Temp / 5									0
23	295012 High Drywell Temperature / 5					02. 42		Ability to recognize system parameters that are entry-level conditions for Technical Specifications.	3.9	1
24	295013 High Suppression Pool Temp. / 5					0 2		Localized heating/stratification	3.2	1
	295014 Inadvertent Reactivity Addition / 1									0
25	295015 Incomplete SCRAM / 1	0 2						Cooldown effects on reactor power	3.9	1
	295017 High Off-site Release Rate / 9									0
	295020 Inadvertent Cont. Isolation / 5 & 7									0
	295022 Loss of CRD Pumps / 1									0
	295029 High Suppression Pool Wtr Lvl / 5									0
26	295032 High Secondary Containment Area Temperature / 5				0 5			Affected systems so as to isolate damaged portions	3.7	1
	295033 High Secondary Containment Area Radiation Levels / 9									0
	295034 Secondary Containment Ventilation High Radiation / 9									0
	295035 Secondary Containment High Differential Pressure / 5									0
27	295036 Secondary Containment High Sump/Area Water Level / 5		0 1					Secondary containment equipment and floor drain system	3.1	1
	500000 High CTMT Hydrogen Conc. / 5									0
	K/A Category Totals:	1	1	1	1	2	1	Group Point Total:		7

ES-401		BWR Examination Outline													Form ES-401-1	
Plant Systems - Tier 2/Group 1 (RO)																
Q#	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	#	
28,29	203000 RHR/LPCI: Injection Mode				1 5						1 1		Pump runout protection: Plant-Specific; Indicating lights and alarms	2.5; 3.7	2	
30	205000 Shutdown Cooling		0 2										Motor operated valves	2.5	1	
	206000 HPCI														0	
	207000 Isolation (Emergency) Condenser														0	
31,32	209001 LPCS	0 5							0 3				Automatic depressurization system ; A.C. failures	3.7; 3.4	2	
33	209002 HPCS				0 7								Override of reactor water level interlock: Plant-Specific	3.5	1	
34	211000 SLC							0 9					SBLC system lineup	4.0	1	
35,36	212000 RPS	0 5										01. 28	Process radiation monitoring system ; Knowledge of the purpose and function of major system components and controls.	3.3; 4.1	2	
37	215003 IRM			0 2									Reactor manual control	3.6	1	
38	215004 Source Range Monitor					0 3							Changing detector position	2.8	1	
39	215005 APRM / LPRM									0 2			Full core display	3.5	1	
40	217000 RCIC								1 5				Steam line break	3.8	1	
41	218000 ADS						0 3						Nuclear boiler instrument system (level indication)	3.8	1	
42	223002 PCIS/Nuclear Steam Supply Shutoff				0 8								Manual defeating of selected isolations during specified emergency conditions	3.3	1	
43	239002 SRVs		0 1										SRV solenoids	2.8	1	
44	259002 Reactor Water Level Control										0 1		All individual component controllers in the manual mode	3.8	1	
45	261000 SGTS									0 3			Valve operation	3.0	1	
46	262001 AC Electrical Distribution							0 3					Bus voltage	2.9	1	
47	262002 UPS (AC/DC)								0 2				Over voltage	2.5	1	
48,49	263000 DC Electrical Distribution			0 3								01. 23	Systems with D.C. components (i.e. valves, motors, solenoids, etc.); Ability to perform specific system and integrated plant procedures during all modes of plant operation	3.4; 4.3	2	
50	264000 EDGs											02. 12	Knowledge of surveillance procedures.	3.7	1	
51	300000 Instrument Air	0 2											Service air	2.7	1	
52,53	400000 Component Cooling Water						0 7			0 1			Breakers, relays, and disconnects; Setpoints on instrument signal levels for normal operations, warnings, and trips that are applicable to the CCWS	2.7; 3	2	
															0	
K/A Category Totals:		3	2	2	3	1	2	2	3	3	2	3	Group Point Total:		26	

ES-401		BWR Examination Outline												Form ES-401-1	
Plant Systems - Tier 2/Group 2 (RO)															
Q#	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	#
54	201001 CRD Hydraulic					0 2							Flow indication	2.6	1
	201002 RMCS														0
	201003 Control Rod and Drive Mechanism														0
	201004 RSCS														0
	201005 RCIS														0
55	201006 RWM											0 4	Rod withdrawal error indication: P-Spec(Not-BWR6)	3.3	1
56	202001 Recirculation											02: 22	Knowledge of limiting conditions for operations and safety limits.	4.0	1
57	202002 Recirculation Flow Control								0 4				Recirculation pump speed mismatch between loops: Plant-Specific	3.0	1
	204000 RWCU														0
	214000 RPIS														0
	215001 Traversing In-core Probe														0
58	215002 RBM					0 4							APRM reference channel: BWR-3, 4, 5	2.8	1
59	216000 Nuclear Boiler Inst.					0 9							Recirculation flow effects on level indications: Design-Specific	2.9	1
	219000 RHR/LPCI: Torus/Pool Cooling Mode														0
	223001 Primary CTMT and Aux.														0
	226001 RHR/LPCI: CTMT Spray Mode														0
60	230000 RHR/LPCI: Torus/Pool Spray Mode				0 3								Unintentional reduction in vessel injection flow during accident conditions	3.5	1
	233000 Fuel Pool Cooling/Cleanup														0
	234000 Fuel Handling Equipment														0
61	239001 Main and Reheat Steam									0 2			Opening and closing of drain valves as turbine load changes: Plant-Specific	2.9	1
	239003 MSIV Leakage Control														0
62	241000 Reactor/Turbine Pressure Regulator							1 3					Main turbine speed	2.7	1
	245000 Main Turbine Gen. / Aux.														0
63	256000 Reactor Condensate	0 5											CRD hydraulics system	3.1	1
64	259001 Reactor Feedwater							0 4					RFP turbine speed: Turbine-Driven-Only	2.8	1
	268000 Radwaste														0
	271000 Offgas														0
	272000 Radiation Monitoring														0
	286000 Fire Protection														0
	288000 Plant Ventilation														0
65	290001 Secondary CTMT				0 2								Protection against over pressurization: Plant-System	3.4	1
	290003 Control Room HVAC														0
	290002 Reactor Vessel Internals														0
															0
K/A Category Totals:		1	0	0	2	2	1	2	1	1	1	1	Group Point Total:		12

ES-401		BWR Examination Outline							Form ES-401-1	
Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (SRO)										
Q#	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									0
97	295003 Partial or Complete Loss of AC / 6					0 5		Whether a partial or complete loss of A.C. power has occurred	4.2	1
	295004 Partial or Total Loss of DC Pwr / 6									0
	295005 Main Turbine Generator Trip / 3									0
	295006 SCRAM / 1									0
	295016 Control Room Abandonment / 7									0
	295018 Partial or Total Loss of CCW / 8									0
	295019 Partial or Total Loss of Inst. Air / 8									0
	295021 Loss of Shutdown Cooling / 4									0
91	295023 Refueling Acc / 8					0 4		Occurrence of fuel handling accident	4.1	1
83	295024 High Drywell Pressure / 5						04. 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	4.6	1
93	295025 High Reactor Pressure / 3					0 2		Reactor power	4.2	1
	295026 Suppression Pool High Water Temp. / 5									0
	295027 High Containment Temperature / 5									0
98	295028 High Drywell Temperature / 5						01. 25	Ability to interpret reference materials, such as graphs, curves, tables, etc.	4.2	1
	295030 Low Suppression Pool Wtr Lvl / 5									0
95	295031 Reactor Low Water Level / 2						04. 16	Knowledge of EOP implementation hierarchy and coordination with other support procedures or guidelines such as, operating procedures, abnormal operating procedures, and severe accident	4.4	1
92	295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1					0 6		Reactor pressure	4.1	1
	295038 High Off-site Release Rate / 9									0
	600000 Plant Fire On Site / 8									0
	700000 Generator Voltage and Electric Grid Disturbances / 6									0
K/A Category Totals:		0	0	0	0	4	3	Group Point Total:	7	

ES-401 BWR Examination Outline Form ES-401-1										
Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (SRO)										
Q#	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									0
	295007 High Reactor Pressure / 3									0
	295008 High Reactor Water Level / 2									0
	295009 Low Reactor Water Level / 2									0
	295010 High Drywell Pressure / 5									0
	295011 High Containment Temp / 5									0
	295012 High Drywell Temperature / 5									0
	295013 High Suppression Pool Temp. / 5									0
80	295014 Inadvertent Reactivity Addition / 1					0 3		Cause of reactivity addition	4.3	1
	295015 Incomplete SCRAM / 1									0
	295017 High Off-site Release Rate / 9									0
	295020 Inadvertent Cont. Isolation / 5 & 7									0
	295022 Loss of CRD Pumps / 1									0
96	295029 High Suppression Pool Wtr Lvl / 5					04 06		Knowledge of EOP mitigation strategies.	4.7	1
	295032 High Secondary Containment Area Temperature / 5									0
	295033 High Secondary Containment Area Radiation Levels / 9									0
	295034 Secondary Containment Ventilation High Radiation / 9									0
86	295035 Secondary Containment High Differential Pressure / 5					0 1		Secondary containment pressure: Plant-Specific	3.9	1
	295036 Secondary Containment High Sump/Area Water Level / 5									0
	500000 High CTMT Hydrogen Conc. / 5									0
K/A Category Totals:		0	0	0	0	2	1	Group Point Total:		3

ES-401		BWR Examination Outline												Form ES-401-1	
Plant Systems - Tier 2/Group 1 (SRO)															
Q#	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														0
	205000 Shutdown Cooling Mode														0
	206000 HPCI														0
	207000 Isolation (Emergency) Condenser														0
	209001 LPCS														0
	209002 HPCS														0
100	211000 SLC								0 2				Failure of explosive valve to fire	3.9	1
79	212000 RPS								0 6				High reactor power	4.2	1
	215003 IRM														0
82	215004 Source Range Monitor											02. 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.	4.4	1
	215005 APRM / LPRM														0
	217000 RCIC														0
	218000 ADS														0
	223002 PCIS/Nuclear Steam Supply Shutoff														0
	239002 SRVs														0
	259002 Reactor Water Level Control														0
	261000 SGTS														0
90	262001 AC Electrical Distribution								0 3				Loss of off-site power	4.3	1
	262002 UPS (AC/DC)														0
89	263000 DC Electrical Distribution											02. 25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.	4.2	1
	264000 EDGs														0
	300000 Instrument Air														0
	400000 Component Cooling Water														0
															0
K/A Category Totals:		0	0	0	0	0	0	0	3	0	0	2	Group Point Total:		5



ES-401 BWR Examination Outline Form ES-401-1													
Plant Systems - Tier 2/Group 2 (SRO)													
Q#	System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	#
	201001 CRD Hydraulic												0
	201002 RMCS												0
	201003 Control Rod and Drive Mechanism												0
	201004 RSCS												0
	201005 RCIS												0
	201006 RWM												0
	202001 Recirculation												0
	202002 Recirculation Flow Control												0
77	204000 RWCU								1 0				2.8 1
78	214000 RPIS								0 1				3.3 1
	215001 Traversing In-core Probe												0
	215002 RBM												0
	216000 Nuclear Boiler Inst.												0
	219000 RHR/LPCI: Torus/Pool Cooling Mode												0
	223001 Primary CTMT and Aux.												0
	226001 RHR/LPCI: CTMT Spray Mode												0
	230000 RHR/LPCI: Torus/Pool Spray Mode												0
	233000 Fuel Pool Cooling/Cleanup												0
	234000 Fuel Handling Equipment												0
	239001 Main and Reheat Steam												0
	239003 MSIV Leakage Control												0
	241000 Reactor/Turbine Pressure Regulator												0
	245000 Main Turbine Gen. / Aux.												0
	256000 Reactor Condensate												0
	259001 Reactor Feedwater												0
	268000 Radwaste												0
	271000 Offgas											02. 36	4.2 1
	272000 Radiation Monitoring												0
	286000 Fire Protection												0
	288000 Plant Ventilation												0
	290001 Secondary CTMT												0
	290003 Control Room HVAC												0
	290002 Reactor Vessel Internals												0
													0
K/A Category Totals:		0	0	0	0	0	0	0	2	0	0	1	Group Point Total: 3

Facility Name:		Date of Exam:					
Q#	Category	K/A #	Topic	RO		SRO-Only	
				IR	#	IR	#
88	1. Conduct of Operations	2.1. 07	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.			4.7	1
99		2.1. 42	Knowledge of new and spent fuel movement procedures.			3.4	1
66		2.1. 01	Knowledge of conduct of operations requirements.	3.8	1		
67		2.1. 15	Knowledge of administrative requirements for temporary management directives, such as standing orders, night orders, operations memos, etc.	2.7	1		
68		2.1. 38	Knowledge of the station's requirements for verbal communications when implementing procedures.	3.7	1		
		2.1.					
		Subtotal				3	
76	2. Equipment Control	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	1
94		2.2. 11	Knowledge of the process for controlling temporary design changes.			3.3	1
69		2.2. 06	Knowledge of the process for making changes to procedures.	3.0	1		
70		2.2. 13	Knowledge of tagging and clearance procedures.	4.1	1		
71		2.2. 35	Ability to determine Technical Specification Mode of Operation.	3.6	1		
		2.2.					
		Subtotal				3	
81	3. Radiation Control	2.3. 04	Knowledge of radiation exposure limits under normal or emergency conditions.			3.7	1
87		2.3. 05	Ability to use radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc.			2.9	1
72		2.3. 07	Ability to comply with radiation work permit requirements during normal or abnormal conditions.	3.5	1		
73		2.3. 11	Ability to control radiation releases.	3.8	1		
		2.3.					
		2.3.					
		Subtotal				2	
85	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	1
74		2.4. 19	Knowledge of EOP layout, symbols, and icons.	3.4	1		
75		2.4. 43	Knowledge of emergency communications systems and techniques.	3.2	1		
		2.4.					
		2.4.					
		2.4.					
		Subtotal				2	
Tier 3 Point Total					10		7

[illegible]

Facility: ColumbiaDate of Examination: February 2013Examination Level: RO ☒ SRO ☐Operating Test Number: 1

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations	M, R	Determine if APRM indication is greater than reactor power as calculated from Main Turbine Bypass Valve position and Reactor Feedwater temperature (2.1.25 RO 3.9). Given the positions of the four Main Turbine Bypass Valves, Reactor Feedwater temperature and house loads, calculate current reactor power by plotting the values on the "Core Thermal Power Versus Bypass Valve Position" graph in PPM 3.1.2 and summing the values. Compare the results to the APRM reading to determine if APRM indications are greater than reactor power.
Conduct of Operations	N, R	Use procedures to assign operators to the positions required to meet minimum crew compliment (2.1.5 RO 2.9). Provided a list of the On-Coming crew operators and the PQD Viewer duty areas, assign operators to positions to meet the requirements for the minimum crew compliment.
Equipment Control	M, R	Use electrical prints to determine why RHR-P-2C did not start following a manual initiation (2.2.41 RO 3.5). Given a set of initial conditions, explain which contacts prevent starting RHR-P-2C using the ARM & DEPRESS pushbutton.
Radiation Control	D, R, P	Use radiological survey maps to determine the minimum and maximum stay times until radiation exposure limits are reached (2.3.4 RO 3.2). Given year-to-date exposure and work instructions, refer to radiological survey maps to determine work area radiation levels and calculate the time at which a radiation exposure limit will be reached.
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: ColumbiaDate of Examination: February 2013Examination Level: RO ☐ SRO ☒Operating Test Number: 1

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations	D, R	Determine if a MODE change is allowed during a plant startup (2.1.23 SRO 4.4). With a plant startup in progress, the SRO candidate is provided a list of plant conditions and required to determine if a MODE change is allowed. The candidate must recognize that HPCS is inoperable and LCO 3.0.4 is not applicable.
Conduct of Operations	N, R	Use procedures to project On-Coming Crew's watch manning, and verify qualifications meet the minimum requirements (2.1.5 SRO 3.9). Provided the list of operators scheduled for the new crew starting a series of nightshifts and PQD Viewer areas, the SRO candidate must determine that the minimum qualifications are not satisfied.
Equipment Control	M, R	Maintain control of equipment status by issuing a Fire Protection System Impairment (2.2.14 SRO 4.3). During the performance of a surveillance, two Main Control Room Halon Tanks have been reported to have UNSAT pressures. The SRO candidate must determine that a Fire Protection System Impairment is required to track the equipment status, and complete the Impairment.
Radiation Control	D, P, R	The SRO Candidate is tasked with reviewing a request to initiate blowdown from the Circulating Water and Plant Service Water systems (2.3.6 SRO 3.8). Given parameters associated with CW and TSW blowdown, the SRO candidate must determine that the minimum instrumentation required to initiate blowdown is not available, and should not be allowed.
Emergency Procedures/Plan	D, R	The SRO Candidate is given that a UE was previously declared due to a credible threat security event. The situation then escalates and the SRO has to determine that an Emergency Plan upgrade is required, the applicable EAL and then fill out the required Classification Notification Form.

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: ColumbiaDate of Examination: February 2013Exam Level: RO ☒ SRO-I ☐ SRO-U ☐Operating Test Number: 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. Reactor Manual Control System / Conduct a Refueling Interlocks Functional Test of the Refuel Position One-Rod-Out Interlock (201002 A3.01). With the MODE Switch in SHUTDOWN, place the plant in MODE 5 and perform OSP-NSSE-W402 (Refuel Position One-Rod-Out Interlock CFT). The designated control rod is in a quadrant that does not have an operable SRM.	A, L, N, S	1
b. Component Cooling Water System / Restore adequate Component Cooling Water (RCC) flow to containment loads (400000 A1.01). While transferring SM-7 to the Backup Transformer, a lockout on SL-71 occurs. This results in the loss of one RCC pumps and requires manual action to start the standby RCC pump to restore normal system flow.	A, M, S	8
c. Reactor Core Isolation Cooling System / Manually initiate RCIC and establish normal RPV water level (217000 A4.04). Initiate RCIC for level control following a scram. The controller is failed and manual control is required to establish flow and restore RPV water level.	A, D, L, S	2
d. Main and Reheat Steam / Open the inboard MSIVs to establish the Main Condenser as a heat sink (239001 A4.01). Following a loss and restoration of Containment Instrument Air, open the inboard MSIVs to restore the Main Condenser heat sink.	D, L, S	4
e. Reactor/Turbine Pressure Regulating System / Lower RPV pressure with Main Turbine Bypass Valves (241000 A2.03). Three Main Turbine Bypass Valves fail open while manually reducing RPV pressure. Entry into ABN-PRESSURE and actions to close the MSIVs are required prior to RPV Pressure reaching 500 psig.	A, D, L, S	3
f. Traversing In-Core Probe System / Manually Initiate Containment Isolations (223002 A2.03; A3.01; A3.02). TIP-V-5 is found to be opened when -50" Isolations are verified. Action is then taken to manually isolate the containment penetration by firing the associated squib valve.	A, D, P, S	7
g. Fuel Pool Cooling and Clean-up / Align Standby Service Water to the Fuel Pool Cooling HX following a complete loss of RCC (233000 A2.08). Following a reactor scram due to a complete loss of RCC and with Fuel Pool Temperatures rising, align Service Water A and B to the Fuel Pool Cooling HXs.	L, N, S	9
h. Secondary Containment / Restore Secondary Containment differential pressure (290001 A4.01). Operate the Reactor Building HVAC System to restore Reactor Building differential pressure. Start ROA-FN-1A and REA-FN-1A.	M, S	5



In-Plant Systems <sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Emergency Generators / Shutdown DG-2 from the local control panel (264000 K4.07). DG-2 fails to stop when the stop pushbutton is depressed requiring a manual trip using the mechanical overspeed device.	A, D, EN, R	6
j. Reactor Core Isolation Cooling System / Prevent a RCIC High Exhaust Pressure Trip (217000 A2.02). During a Station Blackout, performs the actions of PPM 5.6.1 required to prevent a high exhaust pressure trip of the RCIC turbine.	D, E, EN, L, P, R	2
k. Primary Containment System and Auxiliaries / Perform Emergency Drywell Venting during a LOCA using SGT-B (223001 A2.07). With a LOCA signal present, emergency vent the Drywell using SGT.	C, D, E, EN, L, R	5
<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.		
* 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: ColumbiaDate of Examination: February 2013Exam Level: RO ☐ SRO-I ☒ SRO-U ☐Operating Test Number: 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. Reactor Manual Control System / Conduct a Refueling Interlocks Functional Test of the Refuel Position One-Rod-Out Interlock (201002 A3.01). With the MODE Switch in SHUTDOWN, place the plant in MODE 5 and perform OSP-NSSE-W402 (Refuel Position One-Rod-Out Interlock CFT). The designated control rod is in a quadrant that does not have an operable SRM.	A, L, N, S	1
b. Component Cooling Water System / Restore adequate Component Cooling Water (RCC) flow to containment loads (400000 A1.01). While transferring SM-7 to the Backup Transformer, a lockout on SL-71 occurs. This results in the loss of one RCC pumps and requires manual action to start the standby RCC pump to restore normal system flow.	A, M, S	8
c.		
d. Main and Reheat Steam / Open the inboard MSIVs to establish the Main Condenser as a heat sink (239001 A4.01). Following a loss and restoration of Containment Instrument Air, open the inboard MSIVs to restore the Main Condenser heat sink.	D, L, S	4
e. Reactor/Turbine Pressure Regulating System / Lower RPV pressure with Main Turbine Bypass Valves (241000 A2.03). Three Main Turbine Bypass Valves fail open while manually reducing RPV pressure. Entry into ABN-PRESSURE and actions to close the MSIVs are required prior to RPV Pressure reaching 500 psig.	A, D, L, S	3
f. Traversing In-Core Probe System / Manually Initiate Containment Isolations (223002 A2.03; A3.01; A3.02). TIP-V-5 is found to be opened when -50" Isolations are verified. Action is then taken to manually isolate the containment penetration by firing the associated squib valve.	A, D, P, S	7
g. Fuel Pool Cooling and Clean-up / Align Standby Service Water to the Fuel Pool Cooling HX following a complete loss of RCC (233000 A2.08). Following a reactor scram due to a complete loss of RCC and with Fuel Pool Temperatures rising, align Service Water A and B to the Fuel Pool Cooling HXs.	L, N, S	9
h. Secondary Containment / Restore Secondary Containment differential pressure (290001 A4.01). Operate the Reactor Building HVAC System to restore Reactor Building differential pressure. Start ROA-FN-1A and REA-FN-1A.	M, S	5

In-Plant Systems <sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Emergency Generators / Shutdown DG-2 from the local control panel (264000 K4.07). DG-2 fails to stop when the stop pushbutton is depressed requiring a manual trip using the mechanical overspeed device.	A, D, EN, R	6
j. Reactor Core Isolation Cooling System / Prevent a RCIC High Exhaust Pressure Trip (217000 A2.02). During a Station Blackout, performs the actions of PPM 5.6.1 required to prevent a high exhaust pressure trip of the RCIC turbine.	D, E, EN, L, P, R	2
k. Primary Containment System and Auxiliaries / Perform Emergency Drywell Venting during a LOCA using SGT-B (223001 A2.07). With a LOCA signal present, emergency vent the Drywell using SGT.	C, D, E, EN, L, R	5
<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.		
* 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: ColumbiaDate of Examination: February 2013Exam Level: RO ☐ SRO-I ☐ SRO-U ☒Operating Test Number: 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. Reactor Manual Control System / Conduct a Refueling Interlocks Functional Test of the Refuel Position One-Rod-Out Interlock (201002 A3.01). With the MODE Switch in SHUTDOWN, place the plant in MODE 5 and perform OSP-NSSE-W402 (Refuel Position One-Rod-Out Interlock CFT). The designated control rod is in a quadrant that does not have an operable SRM.	A, L, N, S	1
b. Component Cooling Water System / Restore adequate Component Cooling Water (RCC) flow to containment loads (400000 A1.01). While transferring SM-7 to the Backup Transformer, a lockout on SL-71 occurs. This results in the loss of one RCC pumps and requires manual action to start the standby RCC pump to restore normal system flow.	A, M, S	8
c.		
d.		
e.		
f.		
g.		
h.		

In-Plant Systems <sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Emergency Generators / Shutdown DG-2 from the local control panel (264000 K4.07). DG-2 fails to stop when the stop pushbutton is depressed requiring a manual trip using the mechanical overspeed device.	A, D, EN, R	6
j. Reactor Core Isolation Cooling System / Prevent a RCIC High Exhaust Pressure Trip (217000 A2.02). During a Station Blackout, performs the actions of PPM 5.6.1 required to prevent a high exhaust pressure trip of the RCIC turbine.	D, E, EN, L, P, R	2
k. Primary Containment System and Auxiliaries / Perform Emergency Drywell Venting during a LOCA using SGT-B (223001 A2.07). With a LOCA signal present, emergency vent the Drywell using SGT.	C, D, E, EN, L, R	5
<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.		
* 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: ColumbiaScenario No.: 1Op-Test No.: 2013

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

Initial conditions: Columbia is operating at 100% power. TSW-P-1A is tagged out for motor replacement. TSW-P-1B is protected and selected as the emergency standby TSW pump.

Shift Directions: Perform OSP-MS-M701, the Bypass Valve Test monthly surveillance. The pre job brief and the reactivity brief have been conducted. Proper margin to Pre-Conditioned Status (PCS) exists per PPM 9.3.18. The Dittmer Dispatcher has been notified of the upcoming Bypass Valve Testing. The MT is in Sequential Valve mode.

Event No.	Timeline	Event Type*	Event Description
1	T = 0	C (BOP) R (ATC) R (CRS)	Perform OSP-MS-M701, Main Turbine Bypass Valves Test. BV2 fails to open, requiring BPV's to be declared inoperable (Tech Spec). Power reduction by lowering RRC flow to facilitate performance of OSP-MS-M701.
2	T = 20	I (ATC) I (CRS)	RFW-LI-606A (the selected NR instrument) fails downscale (Tech Spec).
3	T = 35	I (BOP)	Fire in the Turbine Building resulting in degrading Control Air header pressure. Both standby CAS compressors fail to auto start on low header pressure, and must be manually started to restore header pressure.
4	T = 45	M (All)	Loss of CAS-C-1A and CAS-C-1B. A manual reactor scram is required prior to MSIV closure.
5	T = 55	M (All)	A Steam LOCA develops inside containment when the MSIVs close.
6	T = 60	C (BOP) C (CRS)	When Drywell pressure reaches 1.68 psig, RHR-P-2A will automatically start with an overcurrent condition. The output breaker will fail to trip and cause a lockout on SM-7. DG-1 must be emergency tripped (Critical Task).
7	T = 65	C (BOP) C (CRS)	RHR-P-2B fails to auto start. RHR-P-2B has a sheared shaft when manually started. Initiate Drywell sprays with SW-B through RHR-B using PPM 5.5.2 after Drywell temperature reaches 285°F, but before Drywell temperature reaches 330°F (Critical Task).
8	T = 65	C (ATC)	The stop pushbutton fails to stop RRC-P-1A.

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

Facility: ColumbiaScenario No.: 2Op-Test No.: 2013

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

\_\_\_\_\_

Initial Conditions: Reactor power has been lowered to support a Control Rod Set. HPCS-P-1 is tagged out for shaft replacement. The #1 and #2 RFW Heaters have been removed from service per the Reactivity Control Plan. The reactivity brief and the task preview for the shift's scheduled activities have been completed. An SNE is stationed in the Control Room to monitor core conditions.

Turnover: Adjust control rods to the target pattern per the Control Rod Withdrawal Deviation Sheet and then return the plant to 100% power.

Event No.	Timeline	Event Type*	Event Description
1	T = 0	R (ATC) R (CRS)	Pull Control Rods per the Control Rod Withdrawal Deviation Sheet to achieve the target rod pattern.
2	T = 10	C (ATC) C (CRS)	While moving control rods, a previously adjusted rod (38-23) begins to drift out. Once inserted, releasing the continuous insert pushbutton causes the control rod to drift out again, requiring the control rod to be isolated (Tech Spec).
3	T = 20	I (BOP) I (CRS)	SGT-A high temperature due to strip heaters failing to de-energize (Tech Spec).
4	T = 45	C (BOP)	DEH-P-1B Fails. DEH-P-1A, the standby pump, does not auto start but can be manually started.
5	T = 50	I (ATC) I (CRS)	Operating Basis Earthquake. RFW-P-1A Trip. RRC pumps fail to automatically run back to 30Hz.
6	T = 50	M (All)	A trip of RFW-P-1B results in a loss of Feedwater and a reactor scram.
7	T = 51	C (All)	When the Main Turbine trips, Startup Power will not close in on SM-1, SM-2 or SM-3.
8	T = 70	M (All)	Aftershock results in a rupture in the RHR-A suction line. Emergency Depressurize the RPV before Suppression Pool level reaches 19 feet 2 inches (Critical Task).
9	T = 70	C (BOP) C (CRS)	The cross-connect valve between the RHR-A and RCIC pump rooms (FDR-V-607) fails to automatically close due to a failed level switch, and must be manually closed to maintain RCIC operation. Close FDR-V-607 prior to reaching the Maximum Safe Operating Value water level in the RCIC pump room (Critical Task). NOTE: This was determined during the exam not to be a critical task.

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

Facility: ColumbiaScenario No.: 3Op-Test No.: 2013

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

Initial Conditions: The plant is operating at approximately 95% power. RCC-P-1B is tagged out due to excessive vibrations and imminent failure. OSP-HPCS/IST-Q701, HPCS System Operability Test, is in-progress.

Turnover: Return Columbia to 100% power. Continue with the performance of OSP-HPCS/IST-Q701, starting at Step 7.3. The two year VPI and channel calibration are NOT due. The pre-job brief has been completed, and Equipment Operators are on station to support completion of the surveillance. HP has been informed of surveillance performance. The power increase and surveillance are to be performed concurrently.

Event No.	Timeline	Event Type*	Event Description
1	T = 0	R (ATC) R (CRS)	Increase Reactor Power from 95% to 100% with RRC Flow.
2	T = 0	N (BOP) N (CRS)	Perform the HPCS System Operability Test, OSP-HPCS/IST-Q701.
3	T = 15	I (BOP) I (CRS)	The HPCS min flow, HPCS-V-12, fuses clear while closing. (Tech Spec).
4	T = 25	C (ATC) C (CRS)	CRD-P-1B trips on low suction pressure.
5	T = 45	C (CRS) R (ATC)	A grid disturbance causes a trip of ASD Channel 1B1. (Tech Spec) Power reduction by lowering RRC-P-1A speed to match loop flows.
6	T = 60	C (ATC) C (CRS)	Another grid disturbance results in a lockout of SH-5 and SH-6, and a complete loss of RRC flow requiring a manual reactor scram.
7	T = 60	M (All)	Hydraulic ATWS. Inhibit ADS prior to automatic initiation to prevent an uncontrolled depressurization and significant power excursion (Critical Task). Terminate and prevent injection into the RPV with the exception of SLC, RCIC, and CRD, to establish an LL (Critical Task). Perform PPM 5.5.11 to insert control rods. Rods insert. Return RPV level to normal band (Critical Task).
8	T = 65	C (ATC)	Inject Standby Liquid Control (boron) prior to exceeding 110°F Suppression Pool temperature (Critical Task). RWCU-V-4 fails to automatically close when SLC is initiated.

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