

Facility: Columbia		Date of Exam: March 2009																
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	4	4	N/A			3	4	N/A			2	20	5	2	7	
	2	1	2	1				2	1				0	7	2	1	3	
	Tier Totals	4	6	5				5	5				2 7	27	7	3	10	
2. Plant Systems	1	3	2	3	2	2	2	2	3	2	3	2	26	3	2	5		
	2	2	0	0	2	2	1	1	2	2	0	0	12	3	1	3		
	Tier Totals	5	2	3	4	4	3	3	5	4	3	2	38	6	2	8		
3. Generic Knowledge and Abilities Categories					1		2		3		4		10	1	2	3	4	7
					2		2		2		4			2	2	1	2	
Note:	<p>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).</p> <p>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 <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.</p> <p>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/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.</p> <p>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.</p> <p>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.</p> <p>6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.</p> <p>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.</p> <p>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.</p> <p>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.</p>																	

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	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			AA1.02 Ability to operate and/or monitor the following as they apply to partial or complete loss of forced core flow circulation: RPS	3.3	1 (1)
295003 Partial or Complete Loss of AC / 6		X					AK2.06 Knowledge of the interrelationships between Partial or Complete Loss of AC Power and the following: DC electrical loads	3.4	1 (2)
295004 Partial or Total Loss of DC Pwr / 6					X		AA2.02 Ability to determine and/or interpret the following as they apply to Partial or Complete Loss of DC power: Extent of partial or complete loss of DC Power	3.5	1 (3)
295005 Main Turbine Generator Trip / 3			X				AK3.02 Knowledge of the reason for the following responses as they apply to Main Turbine Generator Trip: Recirculation pump downshift/trip	3.4	1 (4)
295006 SCRAM / 1	X						AK1.02 Knowledge of the operational implications of the following as they apply to SCRAM: Shutdown Margin	3.4	1 (5)
295016 Control Room Abandonment / 7		X					AK2.03 Knowledge of the interrelationships between Control Room abandonment and the following: Control room HVAC	2.9	1 (6)
295018 Partial or Total Loss of CCW / 8					X		AA2.05 Ability to determine and/or interpret the following as they apply to Partial or Complete Loss of Component Cooling Water: system pressure	2.9	1 (7)
295019 Partial or Total Loss of Inst. Air / 8						X	2.4.11 Partial or complete loss of Inst. Air. Knowledge of Annunciator response procedures	4.0	1 (8)
295021 Loss of Shutdown Cooling / 4						X	2.1.41 Loss of Shutdown Cooling. Knowledge of the refueling process	2.8	1 (9)
295023 Refueling Acc / 8			X				AK3.04 Knowledge of the reason for the following responses as they apply to Refueling Accidents: Non-coincident Scram function	3.0	1 (10)
295024 High Drywell Pressure / 5				X			EA1.20 Ability to operate and/or monitor the following as they apply to High Drywell Pressure: Standby Gas Treatment/FRVS	3.5	1 (11)

295025 High Reactor Pressure / 3				X			EA1.07 Ability to operate and/or monitor the following as they apply to High Reactor Pressure: ARI/RPT/ATWS	4.1	1 (12)
295026 Suppression Pool High Water Temp. / 5			X				EK3.05 Knowledge of the reason for the following responses as they apply to Suppression Pool High Water Temperature: Reactor Scram	3.9	1 (13)
295027 High Containment Temperature / 5							N/A MARK III CONTAINMENT ONLY		
295028 High Drywell Temperature / 5	X						EK1.01 Knowledge of the operational implications of the following concepts as they apply to High Drywell Temperature: Reactor water level measurement	3.5	1 (14)
295030 Low Suppression Pool Wtr Lvl / 5			X				EK3.01 Knowledge of the reason for the following responses as they apply to Low Suppression Pool Water Level: Emergency Depressurization	3.8	1 (15)
295031 Reactor Low Water Level / 2		X					EK2.08 Knowledge of the interrelationships between Reactor Low Water Level and the following: Automatic Depressurization System	4.2	1 (16)
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1					X		EA1.10 Ability to operate and/or monitor the following as they apply to Scram Condition Present and Reactor Power Above APRM Downscale or Unknown: Alternate boron injection methods	3.7	1 (17)
295038 High Off-site Release Rate / 9	X						EK1.05 Knowledge of the operational implications of the following concepts as they apply to Scram Condition Present And Reactor Power Above APRM Downscale or Unknown; Cold Shutdown Boron Weight	3.4	1 (20)
600000 Plant Fire On Site / 8		X					EK2.02 Knowledge of the interrelationships between High Off-Site Release Rate and the following: Offgas System	3.6	1 (18)
700000 Generator Voltage and Electric Grid Disturbances / 6					X		AA2.04 Ability to determine and interpret the following as they apply to Plant Fire On Site: The fire's extent of potential operational damage to plant equipment	2.8	1 (19)
K/A Category Totals:	3	4	4	3	4	2	Group Point Total: 20/7	20/7	

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295036 Secondary Containment High Sump/Area Water Level / 5										
500000 High CTMT Hydrogen Conc. / 5			X					EK3.04 Knowledge of the reasons for the following responses as they apply to High Primary Containment Hydrogen Concentrations: Emergency Depressurization	3.1	1 (24)
K/A Category Point Totals:	1	2	1	2	1	0		Group Point Total: 7/3		7/3

ES-401		BWR Examination Outline Plant Systems - Tier 2/Group 1 (RO / 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									X			A3.08 Ability to monitor automatic operation of the RHR/LPCI Injection Mode including System initiation sequence	4.1	1 (28)
205000 Shutdown Cooling		X										K2.01 Knowledge of the electrical power supplies to the following: Pump Motors	3.1	1 (29)
206000 HPCI												N/A AT CGS		
207000 Isolation (Emergency) Condenser												N/A AT CGS		
209001 LPCS			X									K3.02 Knowledge of the effect that a loss or malfunction of the Low Pressure Core Spray System will have on the following: ADS logic	3.8	1 (30)
209002 HPCS								X				A2.12 Ability to predict the impacts of the following on the High Pressure Core Spray System and based on those predictions, use procedures to correct, or mitigate the consequences of those abnormal conditions or operations: High Suppression Pool Water Level	3.3	1 (31)
209002 HPCS											X	2.4.2 Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions	4.5	1 (49)
211000 SLC											X	2.1.29 SLC System - Knowledge of how to conduct system lineups, such as valves, breakers, switches, etc.	4.0	1 (32)
212000 RPS					X							K5.02 Knowledge of the operational implications of the following concepts as they apply to Reactor Protection System: Specific logic arrangements	3.3	1 (33)
212000 RPS		X										K2.02 Knowledge of the electrical power supplies to the following: Analog Trip System Logic Cabinets	2.7	1 (52)

215003 IRM							X					A1.05 Ability to predict and/or monitor parameters associated with the Intermediate Range Monitoring System controls including: scram and rod block trip setpoints	3.9	1 (34)
215004 Source Range Monitor				X								K4.06 Knowledge of Source Range Monitor (SRM) System design feature(s) and/or interlocks which provide for the following: IRM/SRM interlock	3.2	1 (35)
215005 APRM / LPRM					X							K5.06 Knowledge of the operational implications of the following concepts as they apply to Average Power Range Monitor/ Local Power Range Monitor System: Assignment of LPRMs to specific APRM Channels	2.5	1 (36)
215005 APRM / LPRM						X						K6.07 Knowledge of the effect that a loss of the following will have on APRM System: Flow converter/comparator network	3.2	1 (50)
217000 RCIC								X				A2.01 Ability to predict the impacts of the following on the Reactor Core Isolation Cooling System (RCIC); and based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: System initiation signal	3.8	1 (37)
218000 ADS	X											K1.05 Knowledge of the physical connections and/or cause-effect relationships between Automatic Depressurizing System and the following: Remote Shutdown System	3.9	1 (38)
223002 PCIS/Nuclear Steam Supply Shutoff									X			A3.02 Ability to monitor automatic operations of the Primary Containment Isolation System/Nuclear Steam Supply Shut-Off including: Valve Closures	3.5	1 (39)
239002 SRVs						X						K6.05 Knowledge of the effect that a loss or malfunction of the following will have on Relief/Safety Valves: Discharge Line Vacuum Breaker	3.0	1 (40)

259002 Reactor Water Level Control			X															K3.06 Knowledge of the effect that a loss or malfunction of the Reactor Water Level Control System will have on the following: Main Turbine	2.8	1 (41)
261000 SGTS																	X	A4.02 Ability to manually operate and/or monitor in the control room: Suction Valves	3.1	1 (42)
261000 SGTS																X		A1.03 Ability to predict and/or monitor changes in parameters associated with operation of the Standby Gas Treatment System controls including: Off-Site Release Levels	3.2	1 (51)
262001 AC Electrical Distribution																X		A2.05 Ability to predict the impacts of the following on the AC Electrical Distribution; and based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Bus Grounds	2.9	1 (43)
262002 UPS (AC/DC)			X															K1.16 Knowledge of the physical connections and/or cause relationships between Uninterruptible Power Supply (A.C./D.C.) and the following: MSIVs	3.1	1 (44)
262002 UPS (AC/DC)																	X	A4.01 Ability to manually operate or monitor in the control room: Transfer from alternate source to preferred source	2.8	1 (53)
263000 DC Electrical Distribution				X														K3.03 Knowledge of the effect that a loss or malfunction of the D.C. Electrical Distribution will have on the following: Systems with DC components (i.e. valves, motors, solenoids, etc)	3.4	1 (45)
264000 EDGs																	X	A4.01 Ability to manually operate and/or monitor in the Control Room: Adjustment of exciter voltage	3.3	1 (46)
300000 Instrument Air					X													K4.02 Knowledge of the Instrument Air design features and/or interlocks which provide for the following: Cross-over to other air systems	3.0	1 (47)



400000 Component Cooling Water	X												K1.04 Knowledge of the physical connections and/or cause-effect relationships between CCWS and the following: Reactor Coolant System in order to determine source (s) of RCS leakage into CCWS	2.9	1 (48)
K/A Category Point Totals:	3	2	3	2	2	2	2	3	2	3	2		Group Point Total: 26/5		26/5

ES-401		BWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / 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								X				A2.01 Ability to predict the impacts of the following on the Control Rod Drive Hydraulic System and based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Pump Trips	3.2	1 (54)
201002 RMCS														
201003 Control Rod and Drive Mechanism														
201004 RSCS					X							K5.03 Knowledge of the operational implications of the following concepts as the apply to Rod Sequence Control System: Group notch control limits and rod density	3.3	1 (55)
201005 RCIS												N/A AT CGS		
201006 RWM	X											K1.04 Knowledge of the physical connections and/or cause-effect relationships between Rod Worth Minimizer and the following: Steam flow/Reactor power	3.1	1 (63)
202001 Recirculation														
202002 Recirculation Flow Control				X								K4.07 Knowledge of the Recirculation Flow Control System design features and/or interlocks which provide for the following: Minimum and maximum pump speed setpoint	2.9	1 (56)
204000 RWCU														
214000 RPIS														
215001 Traversing In-core Probe														
215002 RBM														

216000 Nuclear Boiler Inst.										X			A3.01 Ability to monitor automatic operation of the Nuclear Boiler Instrumentation including: Relationship between meter/recorder readings and actual parameter valves: Plant Specific	3.4	1 (57)
219000 RHR/LPCI: Torus/Pool Cooling Mode															
223001 Primary CTMT and Aux.				X									K4.06 Knowledge of the Primary Containment System and Auxiliaries design feature(s) and/or interlocks which provide for the following: Maintains proper containment/secondary containment to drywell differential pressure	3.1	1 (58)
226001 RHR/LPCI: CTMT Spray Mode						X							Knowledge of the effect that a loss or malfunction of the following will have on the RHR/LPCI Containment Spray System Mode: Suction Flow Path	3.2	1 (65)
230000 RHR/LPCI: Torus/Pool Spray Mode															
233000 Fuel Pool Cooling/Cleanup															
234000 Fuel Handling Equipment															
239001 Main and Reheat Steam									X				A2.10 Ability to predict the impacts of the following on the Main And Reheat Steam System and based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Closure of one or more MSIVs at power	3.8	1 (59)
239003 MSIV Leakage Control															
241000 Reactor/Turbine Pressure Regulator															
245000 Main Turbine Gen. / Aux.															
256000 Reactor Condensate								X					A1.01 Ability to predict and/or monitor changes in parameters associated with operating the Reactor Condensate System controls including: System Flow	2.9	1 (61)

259001 Reactor Feedwater											X			A3.09 Ability to monitor operation of the Reactor Feedwater System including: Lights and Alarms	3.0	1 (62)
268000 Radwaste	X													K1.09 Knowledge of the physical connections and/or cause-effect relationship between Radwaste and the following: ECCS Systems	2.6	1 (60)
271000 Offgas																
272000 Radiation Monitoring																
286000 Fire Protection																
288000 Plant Ventilation						X								K3.05 Knowledge of the effect that a loss or malfunction of the Plant Ventilation System will have on the following: Reactor Building pressure	3.1	1 (64)
290001 Secondary CTMT																
290003 Control Room HVAC																
290002 Reactor Vessel Internals																
K/A Category Point Totals:	2	0	0	2	2	1	1	2	2	0	0	Group Point Total: 12/3				12/3

Facility: Columbia		Date of Exam: March 2009				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.8	Ability to coordinate personnel activities outside the control room	3.4	1 (75)		
	2.1.18	Ability to make accurate, clear, and concise logs, records, status boards, and reports	3.6	1 (69)		
	2.1.19	Ability to use plant computer to evaluate system or component status	3.9	1 (66)		
	Subtotal			3		
2. Equipment Control	2.2.13	Knowledge of tagging and clearance procedure	4.1	1 (72)		
	2.2.25	Knowledge of bases in technical specifications for limiting conditions for operations and safety limits	3.2	1 (67)		
	Subtotal			2		
3. Radiation Control	2.3.11	Ability to control radiation releases	3.8	1 (68)		
	Subtotal			1		
4. Emergency Procedures / Plan	2.4.3	Ability to identify post-accident instrumentation	3.7	1 (70)		
	2.4.17	Knowledge of EOP terms and definitions	3.9	1 (74)		
	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	4.0	1 (73)		
	2.4.49	Ability to perform without reference to procedures those actions that require immediate operation of system components and controls	4.6	1 (71)		
	Subtotal			4		
Tier 3 Point Total				10		7

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295031 Reactor Low Water Level / 2									
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1					X		EA2.02 Ability to determine and/or interpret the following as they apply to Scram Condition Present and Reactor Power above APRM Downscale or Unknown: Reactor water level	4.2	1
295038 High Off-site Release Rate / 9									
600000 Plant Fire On Site / 8									
700000 Generator Voltage and Electric Grid Disturbances / 6									
K/A Category Totals:					5	2	Group Point Total:	20/7	

ES-401		BWR Examination Outline 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						X	2.4.49 Loss of Main Condenser Vacuum. Ability to perform without reference to procedures those actions that require immediate operation of system components and controls	4.4	1	
295007 High Reactor Pressure / 3										
295008 High Reactor Water Level / 2										
295009 Low Reactor Water Level / 2										
295010 High Drywell Pressure / 5										
295011 High Containment Temp / 5							N/A AT CGS			
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										
295032 High Secondary Containment Area Temperature / 5						X	EA2.02 Ability to determine and/or interpret the following as they apply to High Secondary Containment Area Temperature: Equipment operability	3.5	1	
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						X	EA2.04 Ability to determine and/or interpret the following as they apply to High Primary Containment Hydrogen Concentrations: Combustible limits for Wetwell	3.3	1	
K/A Category Point Totals:					2	1	Group Point Total: 7/3		7/3	



ES-401		BWR Examination Outline 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								X				A2.17 Ability to (a) predict the impacts of the following on RHR/LPCI Injection Mode and b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Keep fill system failure	3.5	1	
205000 Shutdown Cooling															
206000 HPCI												N/A AT CGS			
207000 Isolation (Emergency) Condenser												N/A AT CGS			
209001 LPCS															
209002 HPCS								X				A2.01 Ability to (a) predict the impacts of the following on High Pressure Core Spray System and b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: System initiation	3.8	1	
211000 SLC															
212000 RPS															
215003 IRM															
215004 Source Range Monitor											X	2.2.36 SRM System – Ability to analyze the affect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations	4.2	1	
215005 APRM / LPRM															
217000 RCIC															
218000 ADS															
223002 PCIS/Nuclear Steam Supply Shutoff															
239002 SRVs											X	2.4.6 Relief/Safety Valves. Knowledge of EOP mitigation strategies	4.7	1	
259002 Reactor Water Level Control															

261000 SGTS									X				A2.10 Ability to (a) predict the impacts of the following on 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 reactor water level	3.2	1
262001 AC Electrical Distribution															
262002 UPS (AC/DC)															
263000 DC Electrical Distribution															
264000 EDGs															
300000 Instrument Air															
400000 Component Cooling Water															
K/A Category Point Totals:									3			2	Group Point Total: 26/5		26/5



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Facility: Columbia		Date of Exam: March 2009				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.14	Knowledge of criteria or condition that require plant-wide announcements, such as pump starts, reactor trips, mode change, etc.			3.1	1
	2.1.42	Knowledge of new and spent fuel movement procedures			3.4	1
	Subtotal					2
2. Equipment Control	2.2.25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits			4.2	1
	2.2.36	2.2.36 Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations			4.2	1
	Subtotal					2
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal and emergency conditions			3.7	1
	Subtotal					1
4. Emergency Procedures / Plan	2.4.32	Knowledge of operator response to loss of all annunciators			4.0	1
	2.4.44	Knowledge of emergency plan protective action recommendations			4.4	1
	Subtotal					2
Tier 3 Point Total: 10/7				10		7

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