

Facility: Columbia Generating Station													Date of Exam:					
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	4	N/A			4	3	N/A			3	20				
	2	2	1	1	N/A			1	1	N/A			1	7				
	Tier Totals	5	4	5	N/A			5	4	N/A			4	27				
2. Plant Systems	1	3	2	3	3	2	3	2	2	2	2	2	26					
	2	1	1	1	1	1	1	2	1	1	1	1	12					
	Tier Totals	4	3	4	4	3	4	4	3	3	3	3	38					
3. Generic Knowledge and Abilities Categories					1		2		3		4		10		1	2	3	4
					3		2		2		3							

- 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	#
295001 (APE 1) Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4		X					Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION and the following: (CFR: 41.7 / 45.8) AK2.04 Reactor/turbine pressure regulating system	3.3	1
295003 (APE 3) Partial or Complete Loss of AC Power / 6		X					Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF A.C. POWER and the following: (CFR: 41.7 / 45.8) AK2.04 A.C. electrical loads	3.4	2
295004 (APE 4) Partial or Total Loss of DC Power / 6			X				Knowledge of the reasons for the following responses as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER: (CFR: 41.5 / 45.6) AK3.03 Reactor SCRAM	3.1	3
295005 (APE 5) Main Turbine Generator Trip / 3				X			Knowledge of the operational implications of the following concepts as they apply to MAIN TURBINE GENERATOR TRIP: (CFR: 41.8 to 41.10) AK1.01 Pressure effects on reactor power	4.0	4
295006 (APE 6) Scram / 1				X			Ability to operate and/or monitor the following as they apply to SCRAM: (CFR: 41.7 / 45.6) AA1.07 Control rod position	4.1	5
295016 (APE 16) Control Room Abandonment / 7						X	2.4.31 Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.2	6
295018 (APE 18) Partial or Complete Loss of CCW / 8	X						Knowledge of the operational implications of the following concepts as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER: (CFR: 41.8 to 41.10) AK1.01 Effects on component/system operations	3.5	7
295019 (APE 19) Partial or Complete Loss of Instrument Air / 8		X					Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR and the following: (CFR: 41.7 / 45.8) AK2.14 Plant air systems	3.2	8
295021 (APE 21) Loss of Shutdown Cooling / 4					X		Ability to determine and/or interpret the following as they apply to LOSS OF SHUTDOWN COOLING: (CFR: 41.10 / 43.5 / 45.13) AA2.07 Reactor recirculation flow	2.9	9
295023 (APE 23) Refueling Accidents / 8			X				Knowledge of the reasons for the following responses as they apply to REFUELING ACCIDENTS: (CFR: 41.5 / 45.6) AK3.01 Refueling floor evacuation	3.6	10
295024 High Drywell Pressure / 5			X				Knowledge of the reasons for the following responses as they apply to HIGH DRYWELL PRESSURE: (CFR: 41.5 / 45.6) EK3.04 Emergency depressurization	3.7	11

295025 (EPE 2) High Reactor Pressure / 3					X		Ability to determine and/or interpret the following as they apply to HIGH REACTOR PRESSURE: (CFR: 41.10 / 43.5 / 45.13) EA2.06 Reactor water level	3.7	12
295026 (EPE 3) Suppression Pool High Water Temperature / 5					X		Ability to determine and/or interpret the following as they apply to SUPPRESSION POOL HIGH WATER TEMPERATURE: (CFR: 41.10 / 43.5 / 45.13) EA2.03 Reactor pressure	3.9	13
295027 (EPE 4) High Containment Temperature (Mark III Containment Only) / 5									
295028 (EPE 5) High Drywell Temperature (Mark I and Mark II only) / 5						X	2.4.21 Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. (CFR: 41.7 / 43.5 / 45.12)	4.0	14
295030 (EPE 7) Low Suppression Pool Water Level / 5	X						Knowledge of the operational implications of the following concepts as they apply to LOW SUPPRESSION POOL WATER LEVEL: (CFR: 41.8 to 41.10) EK1.03 Heat capacity	3.8	15
295031 (EPE 8) Reactor Low Water Level / 2	X						Knowledge of the operational implications of the following concepts as they apply to REACTOR LOW WATER LEVEL: (CFR: 41.8 to 41.10) EK1.02 Natural circulation	3.8	16
295037 (EPE 14) Scram Condition Present and Reactor Power Above APRM Downscale or Unknown / 1			X				Knowledge of the reasons for the following responses as they apply to SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN: (CFR: 41.5 / 45.6) EK3.06 Maintaining heat sinks external to the containment	3.8	17
295038 (EPE 15) High Offsite Radioactivity Release Rate / 9				X			Ability to operate and/or monitor the following as they apply to HIGH OFF-SITE RELEASE RATE: (CFR: 41.7 / 45.6) EA1.01 Stack-gas monitoring system	3.9	18
600000 (APE 24) Plant Fire On Site / 8						X	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. (CFR: 41.5 / 43.5 / 45.12)	4.2	19
700000 (APE 25) Generator Voltage and Electric Grid Disturbances / 6				X			Ability to operate and/or monitor the following as they apply to GENERATOR VOLTAGE AND ELECTRIC GRID DISTURBANCES: (CFR: 41.5 and 41.10 / 45.5, 45.7, and 45.8) AA1.05 Engineered safety features	3.9	20
K/A Category Totals:	3	3	4	4	3	3	Group Point Total:		20

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	#
295002 (APE 2) Loss of Main Condenser Vacuum / 3									
295007 (APE 7) High Reactor Pressure / 3									
295008 (APE 8) High Reactor Water Level / 2									
295009 (APE 9) Low Reactor Water Level / 2	X						Knowledge of the operational implications of the following concepts as they apply to LOW REACTOR WATER LEVEL: (CFR: 41.8 to 41.10) AK1.02 Recirculation pump net positive suction head	3.0	21
295010 (APE 10) High Drywell Pressure / 5					X		Ability to determine and/or interpret the following as they apply to HIGH DRYWELL PRESSURE: (CFR: 41.10 / 43.5 / 45.13) AA2.02 Drywell pressure	3.8	22
295011 (APE 11) High Containment Temperature (Mark III Containment only) / 5									
295012 (APE 12) High Drywell Temperature / 5			X				Knowledge of the reasons for the following responses as they apply to HIGH DRYWELL TEMPERATURE: (CFR: 41.5 / 45.6) AK3.01 Increased drywell cooling	3.5	23
295013 (APE 13) High Suppression Pool Temperature. / 5									
295014 (APE 14) Inadvertent Reactivity Addition / 1		X					Knowledge of the interrelations between INADVERTENT REACTIVITY ADDITION and the following: (CFR: 41.7 / 45.8) AK2.07 Reactor power	3.9	24
295015 (APE 15) Incomplete Scram / 1									
295017 (APE 17) Abnormal Offsite Release Rate / 9									
295020 (APE 20) Inadvertent Containment Isolation / 5 & 7									
295022 (APE 22) Loss of Control Rod Drive Pumps / 1	X						Knowledge of the operational implications of the following concepts as they apply to LOSS OF CRD PUMPS: (CFR: 41.8 to 41.10) AK1.01 Reactor pressure vs. rod insertion capability	3.3	25
295029 (EPE 6) High Suppression Pool Water Level / 5									
295032 (EPE 9) High Secondary Containment Area Temperature / 5									
295033 (EPE 10) High Secondary Containment Area Radiation Levels / 9									
295034 (EPE 11) Secondary Containment Ventilation High Radiation / 9				X			Ability to operate and/or monitor the following as they apply to SECONDARY CONTAINMENT VENTILATION HIGH RADIATION: (CFR: 41.7 / 45.6) EA1.01 Area radiation monitoring system	3.8	26
295035 (EPE 12) Secondary Containment High Differential Pressure / 5									

295036 (EPE 13) Secondary Containment High Sump/Area Water Level / 5									
500000 (EPE 16) High Containment Hydrogen Concentration / 5						X	2.4.50 Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 41.10 / 43.5 / 45.3)	4.2	27
K/A Category Point Totals:	2	1	1	1	1	1	Group Point Total:		7

ES-401													BWR Examination Outline		Form ES-401-1	
Plant Systems—Tier 2/Group 1 (RO/SRO)																
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#		
203000 (SF2, SF4 RHR/LPCI) RHR/LPCI: Injection Mode						X						Knowledge of the effect that a loss or malfunction of the following will have on the RHR/LPCI: INJECTION MODE: (CFR: 41.7 / 45.7) K6.01 A.C. electrical power	3.6	28		
205000 (SF4 SCS) Shutdown Cooling				X								Knowledge of SHUTDOWN COOLING SYSTEM (RHR SHUTDOWN COOLING MODE) design feature(s) and/or interlocks which provide for the following: (CFR: 41.7) K4.01 High temperature isolation	3.4	29		
206000 (SF2, SF4 HPCIS) High-Pressure Coolant Injection																
207000 (SF4 IC) Isolation (Emergency) Condenser																
209001 (SF2, SF4 LPCS) Low-Pressure Core Spray					X							Knowledge of the operational implications of the following concepts as they apply to LOW PRESSURE CORE SPRAY SYSTEM: (CFR: 41.5 / 45.3) K5.05 System venting	2.5	30		
209002 (SF2, SF4 HPCS) High-Pressure Core Spray				X								Knowledge of HIGH PRESSURE CORE SPRAY SYSTEM (HPCS) design feature(s) and/or interlocks which provide for the following: (CFR: 41.7) K4.02 Prevents over filling reactor vessel	3.4	31		
211000 (SF1 SLCS) Standby Liquid Control										X		Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8) A4.03 Explosive valves firing circuit status	4.1	32		
212000 (SF7 RPS) Reactor Protection										X		Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8) A4.01 Provide manual SCRAM signal(s)	4.6	33		
215003 (SF7 IRM) Intermediate-Range Monitor	X											Knowledge of the physical connections and/or cause-effect relationships between INTERMEDIATE RANGE MONITOR (IRM) SYSTEM and the following: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.05 Display control system	3.3	34		
215004 (SF7 SRMS) Source-Range Monitor		X										Knowledge of electrical power supplies to the following: (CFR: 41.7) K2.01 SRM channels/detectors	2.6	35		
215005 (SF7 PRMS) Average Power Range Monitor/Local Power Range Monitor									X			Ability to monitor automatic operations of the AVERAGE POWER RANGE MONITOR/LOCAL POWER RANGE MONITOR SYSTEM including: (CFR: 41.7 / 45.7) A3.07 RPS status	3.8	36		
217000 (SF2, SF4 RCIC) Reactor Core Isolation Cooling								X				Ability to (a) predict the impacts of the following on the REACTOR CORE ISOLATION COOLING SYSTEM (RCIC); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: (CFR: 41.5 / 45.6) A2.16 Low condensate storage tank level	3.5	37		

218000 (SF3 ADS) Automatic Depressurization					X									Knowledge of the operational implications of the following concepts as they apply to AUTOMATIC DEPRESSURIZATION SYSTEM: (CFR: 41.5 / 45.3) K5.01 ADS logic operation	3.8	38
223002 (SF5 PCIS) Primary Containment Isolation/Nuclear Steam Supply Shutoff														Knowledge of the effect that a loss or malfunction of the PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF will have on following: (CFR: 41.7 / 45.4) K3.20 Standby Gas Treatment System	3.3	39
239002 (SF3 SRV) Safety Relief Valves														Ability to predict and/or monitor changes in parameters associated with operating the RELIEF/SAFETY VALVES controls including: (CFR: 41.5 / 45.5) A1.07 Turbine load	2.9	40
259002 (SF2 RWLCS) Reactor Water Level Control		X												Knowledge of the physical connections and/or cause-effect relationships between REACTOR WATER LEVEL CONTROL SYSTEM and the following: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.09 P sat/T sat (compensation)	2.9	41
261000 (SF9 SGTS) Standby Gas Treatment														Ability to predict and/or monitor changes in parameters associated with operating the STANDBY GAS TREATMENT SYSTEM controls including: (CFR: 41.5 / 45.5) A1.04 Secondary containment differential pressure	3.0	42
262001 (SF6 AC) AC Electrical Distribution														Ability to (a) predict the impacts of the following on the A.C. ELECTRICAL DISTRIBUTION; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: (CFR: 41.5 / 45.6) A2.10 Exceeding current limitations	2.9	43
262002 (SF6 UPS) Uninterruptable Power Supply (AC/DC)														Knowledge of the effect that a loss or malfunction of the following will have on the UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.): (CFR: 41.7 / 45.7) K6.02 D.C. electrical power	2.8	44
263000 (SF6 DC) DC Electrical Distribution														Ability to monitor automatic operations of the D.C. ELECTRICAL DISTRIBUTION including: (CFR: 41.7 / 45.7) A3.01 Meters, dials, recorders, alarms, and indicating lights	3.2	45
264000 (SF6 EGE) Emergency Generators (Diesel/Jet) EDG														Knowledge of the effect that a loss or malfunction of the EMERGENCY GENERATORS (DIESEL/JET) will have on following: (CFR: 41.7 / 45.4) K3.02 A.C. electrical distribution	3.9	46
300000 (SF8 IA) Instrument Air		X												Knowledge of electrical power supplies to the following: (CFR: 41.7) K2.01 Instrument air compressor	2.8	47
400000 (SF8 CCS) Component Cooling Water														X 2.1.27 Knowledge of system purpose and/or function. (CFR: 41.7)	3.9	48
510000 (SF4 SWS*) Service Water (Normal and Emergency)																

209002 (SF2, SF4 HPCS) High-Pressure Core Spray	X																	Knowledge of the physical connections and/or cause-effect relationships between HIGH PRESSURE CORE SPRAY SYSTEM (HPCS) and the following: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.03 Water leg (jockey) pump	3.0	49
215003 (SF7 IRM) Intermediate-Range Monitor																		X 2.1.28 Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)	4.1	50
215004 (SF7 SRMS) Source-Range Monitor				X														Knowledge of SOURCE RANGE MONITOR (SRM) SYSTEM design feature(s) and/or interlocks which provide for the following: (CFR: 41.7) K4.04 Changing detector position	2.8	51
223002 (SF5 PCIS) Primary Containment Isolation/Nuclear Steam Supply Shutoff							X											Knowledge of the effect that a loss or malfunction of the following will have on the PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF: (CFR: 41.7 / 45.7) K6.07 Essential A.C. power	3.2	52
262002 (SF6 UPS) Uninterruptable Power Supply (AC/DC)			X															Knowledge of the effect that a loss or malfunction of the UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.) will have on following: (CFR: 41.7 / 45.4) K3.14 Rx power	2.8	53
K/A Category Point Totals:	3	2	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2	Group Point Total:		26

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														
201002 (SF1 RMCS) Reactor Manual Control								X				Ability to (a) predict the impacts of the following on the REACTOR MANUAL CONTROL SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: (CFR: 41.5 / 45.6) A2.02 Rod drift alarm	3.2	54
201003 (SF1 CRDM) Control Rod and Drive Mechanism	X											Knowledge of the physical connections and/or cause-effect relationships between CONTROL ROD AND DRIVE MECHANISM and the following: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.04 Reactor vessel	2.9	55
201004 (SF7 RSCS) Rod Sequence Control														
201005 (SF1, SF7 RCIS) Rod Control and Information														
201006 (SF7 RWMS) Rod Worth Minimizer														
202001 (SF1, SF4 RS) Recirculation														
202002 (SF1 RSCTL) Recirculation Flow Control											X	2.4.2 Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)	4.5	56
204000 (SF2 RWCU) Reactor Water Cleanup														
214000 (SF7 RPIS) Rod Position Information							X					Knowledge of the effect that a loss or malfunction of the following will have on the ROD POSITION INFORMATION SYSTEM: (CFR: 41.7 / 45.7) K6.02 Position indication probe	2.7	57
215001 (SF7 TIP) Traversing In-Core Probe														
215002 (SF7 RBMS) Rod Block Monitor				X								Knowledge of ROD BLOCK MONITOR SYSTEM design feature(s) and/or interlocks which provide for the following: (CFR: 41.7) K4.03 Initiation point (30%)	2.9	58
216000 (SF7 NBI) Nuclear Boiler Instrumentation														
219000 (SF5 RHR SPC) RHR/LPCI: Torus/Suppression Pool Cooling Mode														
223001 (SF5 PCS) Primary Containment and Auxiliaries														
226001 (SF5 RHR CSS) RHR/LPCI: Containment Spray Mode														
230000 (SF5 RHR SPS) RHR/LPCI: Torus/Suppression Pool Spray Mode														
233000 (SF9 FPCCU) Fuel Pool Cooling/Cleanup							X					Ability to predict and/or monitor changes in parameters associated with operating the FUEL POOL COOLING AND CLEAN-UP controls including: (CFR: 41.5 / 45.5) A1.03 Pool temperature	3.1	59

234000 (SF8 FH) Fuel-Handling Equipment					X													Knowledge of the operational implications of the following concepts as they apply to FUEL HANDLING EQUIPMENT: (CFR: 41.5 / 45.3) K5.03 Water as a shield against radiation	2.9	60	
239001 (SF3, SF4 MRSS) Main and Reheat Steam			X															Knowledge of the effect that a loss or malfunction of the MAIN AND REHEAT STEAM SYSTEM will have on following: (CFR: 41.7 / 45.4) K3.15 Reactor water level control	3.5	61	
239003 (SF9 MSVLCS) Main Steam Isolation Valve Leakage Control																					
241000 (SF3 RTPRS) Reactor/Turbine Pressure Regulating																					
245000 (SF4 MTGEN) Main Turbine Generator/Auxiliary												X						Ability to monitor automatic operations of the MAIN TURBINE GENERATOR AND AUXILIARY SYSTEMS including: (CFR: 41.7 / 45.7) A3.10 Generator output voltage/reactive load	2.5	62	
256000 (SF2 CDS) Condensate			X															Knowledge of electrical power supplies to the following: (CFR: 41.7) K2.01 System pumps	2.7*	63	
259001 (SF2 FWS) Feedwater									X									Ability to predict and/or monitor changes in parameters associated with operating the REACTOR FEEDWATER SYSTEM controls including: (CFR: 41.5 / 45.5) A1.01 Feedwater flow/pressure	3.3	64	
268000 (SF9 RW) Radwaste															X			Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8) A4.01 Sump integrators	3.4	65	
271000 (SF9 OG) Offgas																					
272000 (SF7, SF9 RMS) Radiation Monitoring																					
286000 (SF8 FPS) Fire Protection																					
288000 (SF9 PVS) Plant Ventilation																					
290001 (SF5 SC) Secondary Containment																					
290003 (SF9 CRV) Control Room Ventilation																					
290002 (SF4 RVI) Reactor Vessel Internals																					
51001 (SF8 CWS*) Circulating Water																					
K/A Category Point Totals:	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	Group Point Total:		12	

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.2	Knowledge of operator responsibilities during all modes of plant operation. (CFR: 41.10 / 45.13)	4.1	66		
	2.1.20	Ability to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)	4.6	67		
	2.1.42	Knowledge of new and spent fuel movement procedures. (CFR: 41.10 / 43.7 / 45.13)	2.5	68		
	Subtotal			3		
2. Equipment Control	2.2.22	Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)	4.0	69		
	2.2.39	Knowledge of less than or equal to one hour Technical Specification action statements for systems. (CFR: 41.7 / 41.10 / 43.2 / 45.13)	3.9	70		
	Subtotal			2		
3. Radiation Control	2.3.13	Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 43.4 / 45.9 / 45.10)	3.4	71		
	2.3.11	Ability to control radiation releases. (CFR: 41.11 / 43.4 / 45.10)	3.8	72		
	Subtotal			2		
4. Emergency Procedures/Plan	2.4.4	Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.5	73		
	2.4.6	Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	3.7	74		
	2.4.16	Knowledge of EOP implementation hierarchy and coordination with other support procedures or guidelines such as, operating procedures, abnormal operating procedures, and severe accident management guidelines. (CFR: 41.10 / 43.5 / 45.13)	3.5	75		
	Subtotal			3		
Tier 3 Point Total				10		

Facility: Columbia Generating Station													Date of Exam:					
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												20	4	3	7		
	2				N/A					N/A			7	1	2	3		
	Tier Totals												27	5	5	10		
2. Plant Systems	1												26	3	2	5		
	2												12	2	1	3		
	Tier Totals												38	5	3	8		
3. Generic Knowledge and Abilities Categories					1	2	3	4					10	1	2	3	4	7
														2	2	1	2	

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

G* Generic K/As

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

ES-401	BWR Examination Outline Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (RO/SRO)						Form ES-401-1		
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
295001 (APE 1) Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4									
295003 (APE 3) Partial or Complete Loss of AC Power / 6						X	2.4.20 Knowledge of the operational implications of EOP warnings, cautions, and notes. (CFR: 41.10 / 43.5 / 45.13)	4.3	76
295004 (APE 4) Partial or Total Loss of DC Power / 6					X		Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER: (CFR: 41.10 / 43.5 / 45.13) AA2.03 Battery voltage	2.9	77
295005 (APE 5) Main Turbine Generator Trip / 3									
295006 (APE 6) Scram / 1					X		Ability to determine and/or interpret the following as they apply to SCRAM: (CFR: 41.10 / 43.5 / 45.13) AA2.06 Cause of reactor SCRAM	3.8	78
295016 (APE 16) Control Room Abandonment / 7									
295018 (APE 18) Partial or Complete Loss of CCW / 8									
295019 (APE 19) Partial or Complete Loss of Instrument Air / 8									
295021 (APE 21) Loss of Shutdown Cooling / 4									
295023 (APE 23) Refueling Accidents / 8					X		Ability to determine and/or interpret the following as they apply to REFUELING ACCIDENTS: (CFR: 41.10 / 43.5 / 45.13) AA2.05 Entry conditions of emergency plan	4.6*	79
295024 High Drywell Pressure / 5									
295025 (EPE 2) High Reactor Pressure / 3						X	2.4.4 Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.7	80
295026 (EPE 3) Suppression Pool High Water Temperature / 5									
295027 (EPE 4) High Containment Temperature (Mark III Containment Only) / 5									
295028 (EPE 5) High Drywell Temperature (Mark I and Mark II only) / 5					X		Ability to determine and/or interpret the following as they apply to HIGH DRYWELL TEMPERATURE: (CFR: 41.10 / 43.5 / 45.13) EA2.02 Reactor pressure	3.9	81
295030 (EPE 7) Low Suppression Pool Water Level / 5						X	2.4.1 Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)	4.8	82
295031 (EPE 8) Reactor Low Water Level / 2									
295037 (EPE 14) Scram Condition Present and Reactor Power Above APRM Downscale or Unknown / 1									

295038 (EPE 15) High Offsite Radioactivity Release Rate / 9										
600000 (APE 24) Plant Fire On Site / 8										
700000 (APE 25) Generator Voltage and Electric Grid Disturbances / 6										
K/A Category Totals:					4	3	Group Point Total:			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	#
295002 (APE 2) Loss of Main Condenser Vacuum / 3									
295007 (APE 7) High Reactor Pressure / 3									
295008 (APE 8) High Reactor Water Level / 2						X	2.2.38 Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)	4.5	83
295009 (APE 9) Low Reactor Water Level / 2									
295010 (APE 10) High Drywell Pressure / 5									
295011 (APE 11) High Containment Temperature (Mark III Containment only) / 5									
295012 (APE 12) High Drywell Temperature / 5									
295013 (APE 13) High Suppression Pool Temperature. / 5									
295014 (APE 14) Inadvertent Reactivity Addition / 1									
295015 (APE 15) Incomplete Scram / 1									
295017 (APE 17) Abnormal Offsite Release Rate / 9									
295020 (APE 20) Inadvertent Containment Isolation / 5 & 7									
295022 (APE 22) Loss of Control Rod Drive Pumps / 1									
295029 (EPE 6) High Suppression Pool Water Level / 5									
295032 (EPE 9) High Secondary Containment Area Temperature / 5									
295033 (EPE 10) High Secondary Containment Area Radiation Levels / 9						X	2.4.21 Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. (CFR: 41.7 / 43.5 / 45.12)	4.6	84
295034 (EPE 11) Secondary Containment Ventilation High Radiation / 9									
295035 (EPE 12) Secondary Containment High Differential Pressure / 5									
295036 (EPE 13) Secondary Containment High Sump/Area Water Level / 5					X		Ability to determine and/or interpret the following as they apply to SECONDARY CONTAINMENT HIGH SUMP/AREA WATER LEVEL: (CFR: 41.10 / 43.5 / 45.13) EA2.02 Water level in the affected area	3.1	85
500000 (EPE 16) High Containment Hydrogen Concentration / 5									
K/A Category Point Totals:					1	2	Group Point Total:		3

BWR Examination Outline													Form ES-401-1	
Plant Systems—Tier 2/Group 1 (RO/SRO)														
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
203000 (SF2, SF4 RHR/LPCI) RHR/LPCI: Injection Mode														
205000 (SF4 SCS) Shutdown Cooling														
206000 (SF2, SF4 HPCIS) High-Pressure Coolant Injection														
207000 (SF4 IC) Isolation (Emergency) Condenser														
209001 (SF2, SF4 LPCS) Low-Pressure Core Spray											X	2.2.12 Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)	4.1	86
209002 (SF2, SF4 HPCS) High-Pressure Core Spray														
211000 (SF1 SLCS) Standby Liquid Control											X	2.1.31 Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. (CFR: 41.10 / 45.12)	4.3	87
212000 (SF7 RPS) Reactor Protection														
215003 (SF7 IRM) Intermediate-Range Monitor														
215004 (SF7 SRMS) Source-Range Monitor														
215005 (SF7 PRMS) Average Power Range Monitor/Local Power Range Monitor														
217000 (SF2, SF4 RCIC) Reactor Core Isolation Cooling														
218000 (SF3 ADS) Automatic Depressurization														
223002 (SF5 PCIS) Primary Containment Isolation/Nuclear Steam Supply Shutoff														
239002 (SF3 SRV) Safety Relief Valves														
259002 (SF2 RWLCS) Reactor Water Level Control														
261000 (SF9 SGTS) Standby Gas Treatment									X			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: (CFR: 41.5 / 45.6) A2.09 Plant air system failure	2.6*	88
262001 (SF6 AC) AC Electrical Distribution														
262002 (SF6 UPS) Uninterruptable Power Supply (AC/DC)														
263000 (SF6 DC) DC Electrical Distribution									X			Ability to (a) predict the impacts of the following on the D.C. ELECTRICAL DISTRIBUTION; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: (CFR: 41.5 / 45.6) A2.02 Loss of ventilation during charging	3.0	89

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														
201002 (SF1 RMCS) Reactor Manual Control														
201003 (SF1 CRDM) Control Rod and Drive Mechanism														
201004 (SF7 RSCS) Rod Sequence Control														
201005 (SF1, SF7 RCIS) Rod Control and Information														
201006 (SF7 RWMS) Rod Worth Minimizer														
202001 (SF1, SF4 RS) Recirculation														
202002 (SF1 RSCTL) Recirculation Flow Control														
204000 (SF2 RWCU) Reactor Water Cleanup														
214000 (SF7 RPIS) Rod Position Information														
215001 (SF7 TIP) Traversing In-Core Probe														
215002 (SF7 RBMS) Rod Block Monitor														
216000 (SF7 NBI) Nuclear Boiler Instrumentation											X	2.2.22 Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)	4.7	91
219000 (SF5 RHR SPC) RHR/LPCI: Torus/Suppression Pool Cooling Mode														
223001 (SF5 PCS) Primary Containment and Auxiliaries														
226001 (SF5 RHR CSS) RHR/LPCI: Containment Spray Mode									X			Ability to (a) predict the impacts of the following on the RHR/LPCI: CONTAINMENT SPRAY SYSTEM MODE; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: (CFR: 41.5 / 45.6) A2.14 High suppression pool level	3.1	92
230000 (SF5 RHR SPS) RHR/LPCI: Torus/Suppression Pool Spray Mode														
233000 (SF9 FPCCU) Fuel Pool Cooling/Cleanup														
234000 (SF8 FH) Fuel-Handling Equipment														
239001 (SF3, SF4 MRSS) Main and Reheat Steam														
239003 (SF9 MSVLCS) Main Steam Isolation Valve Leakage Control														
241000 (SF3 RTPRS) Reactor/Turbine Pressure Regulating														
245000 (SF4 MTGEN) Main Turbine Generator/Auxiliary														
256000 (SF2 CDS) Condensate														
259001 (SF2 FWS) Feedwater														
268000 (SF9 RW) Radwaste														
271000 (SF9 OG) Offgas														
272000 (SF7, SF9 RMS) Radiation Monitoring														
286000 (SF8 FPS) Fire Protection														
288000 (SF9 PVS) Plant Ventilation														

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.7	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 41.5 / 43.5 / 45.12 / 45.13)			4.7	94
	2.1.35	Knowledge of the fuel-handling responsibilities of SROs. (CFR: 41.10 / 43.7)			3.9	95
	Subtotal					2
2. Equipment Control	2.2.25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)			4.2	96
	2.2.40	Ability to apply Technical Specifications for a system. (CFR: 41.10 / 43.2 / 43.5 / 45.3)			4.7	97
	Subtotal					2
3. Radiation Control	2.3.6	Ability to approve release permits. (CFR: 41.13 / 43.4 / 45.10)			3.8	98
	Subtotal					1
4. Emergency Procedures/Plan	2.4.18	Knowledge of the specific bases for EOPs. (CFR: 41.10 / 43.1 / 45.13)			4.0	99
	2.4.29	Knowledge of the emergency plan. (CFR: 41.10 / 43.5 / 45.11)			4.4	100
	Subtotal					2
Tier 3 Point Total						7

RO EXAM

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	295004.AK3.01 (RO Question 3)	<p><u>Original K/A:</u> Knowledge of the reasons for the following responses as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER: Load shedding (CFR: 41.5 / 45.6) IR: 2.6</p> <p><u>Reason for Rejection:</u> Columbia DC systems do not incorporate load shedding.</p> <p><u>Recommended Replacement K/A:</u> 295004.AK3.03 - Knowledge of the reasons for the following responses as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER: Reactor SCRAM (CFR: 41.5 / 45.6) IR: 3.1</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
1/1	295019.AK2.12 (RO Question 8)	<p><u>Original K/A:</u> Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR and the following: Standby gas treatment/FRVS (CFR: 41.7 / 45.8) IR: 3.3</p> <p><u>Reason for Rejection:</u> Unable to write a question meeting Tier 1 requirements. No ties to AOP/EOP procedures concerning Loss of CIA and SGT system.</p> <p><u>Recommended Replacement K/A:</u> 295019.AK2.14 - Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR and the following: Plant air systems (CFR: 41.7 / 45.8) IR: 3.2</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
1/1	295023.AK3.02 (RO Question 10)	<p><u>Original K/A:</u> Knowledge of the reasons for the following responses as they apply to REFUELING ACCIDENTS : Interlocks associated with fuel handling equipment (CFR: 41.5 / 45.6) IR: 3.4</p> <p><u>Reason for Rejection:</u> Unable to write a question that meets Tier 1 requirements based on Columbia procedures.</p> <p><u>Recommended Replacement K/A:</u> 295023.AK3.01 -Knowledge of the reasons for the following responses as they apply to REFUELING ACCIDENTS : Refueling floor evacuation (CFR: 41.5 / 45.6) IR: 3.6</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>

1/1	295024.EK3.05 (RO Question 11)	<p><u>Original K/A:</u> Knowledge of the reasons for the following responses as they apply to HIGH DRYWELL PRESSURE: RPV Flooding (CFR: 41.5 / 45.6) IR: 3.5</p> <p><u>Reason for Rejection:</u> RPV Flooding not a response to High Drywell Pressure at Columbia.</p> <p><u>Recommended Replacement K/A:</u> 295024.EK3.04 - Knowledge of the reasons for the following responses as they apply to HIGH DRYWELL PRESSURE: Emergency depressurization (CFR: 41.5 / 45.6) IR: 3.7</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
1/1	295028.2.4.45 (RO Question 14)	<p><u>Original K/A:</u> High Drywell Temperature (Mark I and Mark II only) Ability to prioritize and interpret the significance of each annunciator or alarm. (CFR: 41.10 / 43.5 / 45.3 / 45.12) IR: 4.1</p> <p><u>Reason for Rejection:</u> Unable to write an RO level question. Interpretation of significance of alarm associated with High Drywell Temperature is complex and requires calculations. This is better suited for a JPM.</p> <p><u>Recommended Replacement K/A:</u> 295028.2.4.21 - Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. (CFR: 41.7 / 43.5 / 45.12) IR: 4.0</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
1/1	295037.EK3.08 (RO Question 17)	<p><u>Original K/A:</u> Knowledge of the reasons for the following responses as they apply to SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN: ATWS circuitry (CFR: 41.5 / 45.6) IR: 3.6</p> <p><u>Reason for Rejection:</u> Columbia does not have ATWS circuitry.</p> <p><u>Recommended Replacement K/A:</u> 295037.EK3.06 - Knowledge of the reasons for the following responses as they apply to SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN: Maintaining heat sinks external to the containment (CFR: 41.5 / 45.6) IR: 3.8</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>

<p>1/2</p>	<p>295009.AK1.05 (RO Question 21)</p>	<p><u>Original K/A:</u> Knowledge of the operational implications of the following concepts as they apply to LOW REACTOR WATER LEVEL: Natural circulation (CFR: 41.8 to 41.10) IR: 3.3</p> <p><u>Reason for Rejection:</u> Same as K/A for question RO-16.</p> <p><u>Recommended Replacement K/A:</u> 295009.AK1.02 - Knowledge of the operational implications of the following concepts as they apply to LOW REACTOR WATER LEVEL: Recirculation pump net positive suction head (CFR: 41.8 to 41.10) IR: 3.0</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
<p>1/2</p>	<p>295010.AA2.03 (RO Question 22)</p>	<p><u>Original K/A:</u> Ability to determine and/or interpret the following as they apply to HIGH DRYWELL PRESSURE: Drywell radiation levels (CFR: 41.10 / 43.5 / 45.13) IR: 3.3</p> <p><u>Reason for Rejection:</u> Unable to write an RO level question to this K/A.</p> <p><u>Recommended Replacement K/A:</u> 295010.AA2.02 Ability to determine and/or interpret the following as they apply to HIGH DRYWELL PRESSURE: Drywell pressure (CFR: 41.10 / 43.5 / 45.13) IR: 3.8</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
<p>1/2</p>	<p>295014.AK2.03 (RO Question 24)</p>	<p><u>Original K/A:</u> Knowledge of the interrelations between INADVERTENT REACTIVITY ADDITION and the following: Fuel temperature (CFR: 41.7 / 45.8) IR: 3.3</p> <p><u>Reason for Rejection:</u> Unable to write an RO-level question.</p> <p><u>Recommended Replacement K/A:</u> 295014.AK2.07 Knowledge of the interrelations between INADVERTENT REACTIVITY ADDITION and the following: Reactor Power (CFR: 41.7 / 45.8) IR: 3.9</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
<p>2/1</p>	<p>203000.K6.08 (RO Question 28)</p>	<p><u>Original K/A:</u> Knowledge of the effect that a loss or malfunction of the following will have on the RHR/LPCI: INJECTION MODE: ECCS room cooling (CFR: 41.7 / 45.7) IR: 2.9</p> <p><u>Reason for Rejection:</u> Unable to write a RO level question. Question would require detailed Licensee Controlled Specification (LCS) analysis which is outside RO required knowledge.</p> <p><u>Recommended Replacement K/A:</u> 203000.K6.01 Knowledge of the effect that a loss or malfunction of the following will have on the RHR/LPCI: INJECTION MODE: A.C. electrical power (CFR: 41.7 / 45.7) IR: 3.6</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>

2/1	212000.A4.13 (RO Question 33)	<p><u>Original K/A:</u> Ability to manually operate and/or monitor in the control room: Perform individual control rod SCRAM testing (CFR: 41.7 / 45.5 to 45.8) IR: 3.4</p> <p><u>Reason for Rejection:</u> Unable to write an RO level question.</p> <p><u>Recommended Replacement K/A:</u> 212000.A4.01 - Ability to manually operate and/or monitor in the control room: Provide manual SCRAM signal(s) (CFR: 41.7 / 45.5 to 45.8) IR: 4.6</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
2/1	217000.A2.13 (RO Question 37)	<p><u>Original K/A:</u> Ability to (a) predict the impacts of the following on the REACTOR CORE ISOLATION COOLING SYSTEM (RCIC); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Loss of room cooling (CFR: 41.5 / 45.6) IR: 2.9</p> <p><u>Reason for Rejection:</u> Unable to write an RO level question. There is no procedural guidance for loss of room cooling.</p> <p><u>Recommended Replacement K/A:</u> 217000.A2.16 - Ability to (a) predict the impacts of the following on the REACTOR CORE ISOLATION COOLING SYSTEM (RCIC); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Low condensate storage tank level (CFR: 41.5 / 45.6) IR: 3.5</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
2/1	223002.K3.06 (RO Question 39)	<p><u>Original K/A:</u> Knowledge of the effect that a loss or malfunction of the PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF will have on following: Turbine building radiation (CFR: 41.7 / 45.4) IR: 2.8</p> <p><u>Reason for Rejection:</u> Unable to write an RO level question.</p> <p><u>Recommended Replacement K/A:</u> 223002.K3.20 - Knowledge of the effect that a loss or malfunction of the PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF will have on following: Standby gas treatment system (CFR: 41.7 / 45.4) IR: 3.3</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>

<p>2/1</p>	<p>261000.A1.02 (RO Question 42)</p>	<p><u>Original K/A:</u> Ability to predict and/or monitor changes in parameters associated with operating the STANDBY GAS TREATMENT SYSTEM controls including: Primary containment pressure (CFR: 41.5 / 45.5) IR: 3.1</p> <p><u>Reason for Rejection:</u> Unable to write a satisfactory question. Insufficient information for plausible distractors.</p> <p><u>Recommended Replacement K/A:</u> 261000.A1.04 - Ability to predict and/or monitor changes in parameters associated with operating the STANDBY GAS TREATMENT SYSTEM controls including: Secondary containment differential pressure (CFR: 41.5 / 45.5) IR: 3.0</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
<p>2/2</p>	<p>201002.A2.01 (RO Question 54)</p>	<p><u>Original K/A:</u> Ability to (a) predict the impacts of the following on the REACTOR MANUAL CONTROL SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Rod movement sequence timer malfunctions (CFR: 41.5 / 45.6) IR: 2.7</p> <p><u>Reason for Rejection:</u> Unable to write a satisfactory question for this A2 K/A. No information for specific actions.</p> <p><u>Recommended Replacement K/A:</u> 201002.A2.02 - Ability to (a) predict the impacts of the following on the REACTOR MANUAL CONTROL SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Rod drift alarm (CFR: 41.5 / 45.6) IR: 3.2</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
<p>3</p>	<p>2.1.43 (RO Question 68)</p>	<p><u>Original K/A:</u> Ability to use procedures to determine the effects on reactivity of plant changes, such as reactor coolant system temperature, secondary plant, fuel depletion, etc. (CFR: 41.10 / 43.6 / 45.6) IR: 4.1</p> <p><u>Reason for Rejection:</u> Unable to write a satisfactory question. There are no RO-level procedures linking plant changes to specific reactivity effects.</p> <p><u>Recommended Replacement K/A:</u> 2.1.42 - Knowledge of new and spent fuel movement procedures. (CFR: 41.10 / 43.7 / 45.13) IR: 2.5</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>

SRO Exam

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	295025.2.4.3 (SRO Question 80)	<p><u>Original K/A:</u> High Reactor Pressure: Ability to identify post-accident instrumentation. (CFR: 41.6 / 45.4) IR: 3.9</p> <p><u>Reason for Rejection:</u> Unable to write a SRO-level question for this EPE/KA combination.</p> <p><u>Recommended Replacement K/A:</u> 295036.2.4.4 - Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6) IR: 4.7</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
1/2	295033.2.4.44 (SRO Question 84)	<p><u>Original K/A:</u> High Secondary Containment Area Radiation Levels: Knowledge of emergency plan protective action recommendations. (CFR: 41.10 / 41.12 / 43.5 / 45.11) IR: 4.4</p> <p><u>Reason for Rejection:</u> This K/A is not allowed for use in Tier 1 or 2 in accordance with NUREG 1021, ES-401, section D.1.b.</p> <p><u>Recommended Replacement K/A:</u> 295036.2.4.21 High Secondary Containment Area Radiation Levels: Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. (CFR: 41.7 / 43.5 / 45.12) IR: 4.6</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
1/2	295036.EA2.01 (SRO Question 85)	<p><u>Original K/A:</u> Ability to determine and/or interpret the following as they apply to SECONDARY CONTAINMENT HIGH SUMP/AREA WATER LEVEL: Operability of components within the affected area (CFR: 41.10 / 43.5 / 45.13) IR: 3.2</p> <p><u>Reason for Rejection:</u> Unable to write a SRO-level question. There is no documentation to allow constructing a question that meets requirements for SRO question.</p> <p><u>Recommended Replacement K/A:</u> 295036.EA2.02 - Ability to determine and/or interpret the following as they apply to SECONDARY CONTAINMENT HIGH SUMP/AREA WATER LEVEL: Water level in the affected area (CFR: 41.10 / 43.5 / 45.13) IR: 3.1</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>

<p>2/1</p>	<p>263000.A2.01 (SRO Question 89)</p>	<p><u>Original K/A:</u> Ability to (a) predict the impacts of the following on the D.C. ELECTRICAL DISTRIBUTION; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Grounds (CFR: 41.5 / 45.6) IR: 3.2</p> <p><u>Reason for Rejection:</u> Unable to write a satisfactory question. At Columbia, licensed operators report grounds to the maintenance organization. Maintenance performs troubleshooting and mitigation of grounds.</p> <p><u>Recommended Replacement K/A:</u> 263000.A2.02 - Ability to (a) predict the impacts of the following on the D.C. ELECTRICAL DISTRIBUTION; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Loss of ventilation during charging (CFR: 41.5 / 45.6) IR: 3.0</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
<p>2/2</p>	<p>216000.2.4.49 (SRO Question 91)</p>	<p><u>Original K/A:</u> Ability to perform without reference to procedures those actions that require immediate operation of system components and controls. (CFR: 41.10 / 43.2 / 45.6) IR: 4.4</p> <p><u>Reason for Rejection:</u> Unable to write a satisfactory SRO question. Immediate actions are RO level.</p> <p><u>Recommended Replacement K/A:</u> 216000.2.2.22 - Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2) IR: 4.7</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>
<p>2/2</p>	<p>226001.A2.16 (SRO Question 92)</p>	<p><u>Original K/A:</u> Ability to (a) predict the impacts of the following on the RHR/LPCI: CONTAINMENT SPRAY SYSTEM MODE; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Loss of, or inadequate heat exchanger cooling flow (CFR: 41.5 / 45.6) IR: 3.1</p> <p><u>Reason for Rejection:</u> Unable to write a SRO-level question. No procedural guidance for reduced/loss of heat exchanger cooling flow.</p> <p><u>Recommended Replacement K/A:</u> 226001.A2.14 - Ability to (a) predict the impacts of the following on the RHR/LPCI: CONTAINMENT SPRAY SYSTEM MODE; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: High suppression pool level (CFR: 41.5 / 45.6) IR: 3.1</p> <p>Replacement K/A randomly selected in accordance with NUREG-1021 and guidance provided by the Chief Examiner.</p>

Facility: <u>Columbia Generating Station</u>		Date of Examination: <u>2/22/21</u>
Examination Level: RO <input checked="" type="checkbox"/> SRO <input type="checkbox"/>		Operating Test Number: <u>1</u>
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
A-1 Conduct of Operations K/A: 2.1.25 (3.9 / 4.2)	(M)(R)	DELTA T CAVITATION ALARM VERIFICATION – TIME CRITICAL Description: Verifies validity of Delta T Cavitation alarm 4.602.A6 3-7 and determines actions that should be taken based on results. Alarm is NOT valid.
A-2 Conduct of Operations K/A: 2.1.7 (4.4 / 4.7)	(M)(R)	DETERMINE IF APRM READINGS ARE GREATER THAN EXTRAPOLATED BPV POSITION POWER LEVELS Description: Given plant conditions, determine extrapolated power using Bypass Valve position per step Q38 of PPM 3.1.2 and determine if APRM readings are greater than the values calculated.
A-3 Radiation Control K/A: 2.3.4 (3.2 / 3.7)	(M)(R)	CALCULATE STAY TIME FOR A HIGH RADIATION AREA AND DETERMINE IF YOU CAN COMPLETE THE ASSIGNED TASK. Description: For plant conditions given, determine stay time for the given task and determine that the task cannot be completed based on dose projections.
A-4 Equipment Control K/A: 2.2.13 (4.1 / 4.3)	(N)(R)	MANUAL TAG OUT OF RHR-P-3 Description: Determines isolation points for manual tagout of RHR-P-3 to include component EPN, Tag type and required position.
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 (4) (D)irect from bank (≤ 3 for ROs) (0) (N)ew or (M)odified from bank (≥ 1) (4) (P)revious 2 exams (≤ 1, randomly selected) (0)		

Facility: <u>Columbia Generating Station</u>	Date of Examination: <u>2/22/21</u>
Examination Level: RO <input type="checkbox"/> SRO <input checked="" type="checkbox"/>	Operating Test Number: <u>1</u>

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
A-5 Conduct of Operations K/A: 2.1.20 (4.6 / 4.6)	(M)(R)	HALON BOTTLE FIRE PROTECTION IMPAIRMENT
		Description: Verifies completed PPM 15.3.6 Halon Bottle pressure check and completed Fire Protection Impairment Notification
A-6 Conduct of Operations K/A: 2.1.7 (4.4 / 4.7)	(M)(R)	VERIFY CALCULATION MADE BY REACTOR OPERATOR FOR DETERMINATION OF STEP Q39 of PPM 3.1.2
		Description: Given plant conditions and the reactor operator determination of power based on bypass valve position. Verify the results and determine which APRMs require a gain adjustment per step Q39 pf PPM 3.1.2
A-7 Equipment Control K/A: 2.2.18 (2.6 / 3.9)	(N)(R)	VERIFICATION OF CISP MOVE OVER THE SPENT FUEL POOL.
		Description: Given plant conditions and LCS. Determine if the Cavity In-Vessel Service Platform can be moved over the spent fuel pool and provide justification for your answer.
A-8 Radiation Control K/A: 2.3.14 (3.4 / 3.8)	(D)(P)(R)	ESTIMATE MC AE GROSS GAMMA ACTIVITY AND DETERMINE ACTIONS
		Description: Performs calculation associated with ABN-OG to determine gross gamma activity and determines actions to be taken based on those results.
A-9 Emergency Plan K/A: 2.4.9 (4.6 / 4.4)	(N)(R)	BASED ON GIVEN CONDITIONS DETERMINE ACTIONS AND CLASSIFY THE EVENT – TIME CRITICAL
		Description: List the actions that would be directed (ABN-SECURITY Immediate actions). And classify the event per 13.1.1

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 **(5)**
 (D)irect from bank (≤ 4 for SROs) **(1)**
 (N)ew or (M)odified from bank (≥ 1) **(4)**
 (P)revious 2 exams (≤ 1, randomly selected) **(1)**

Facility: <u>Columbia Generating Station</u>	Date of Examination: <u>02/22/21</u>
Exam Level: RO <input checked="" type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/>	Operating Test Number: <u>1</u>

Control Room Systems: * 8 for RO		
System/JPM Title	Type Code*	Safety Function
S-1: Vent the Drywell per SOP-CN-CONT-VENT	(S)(A)(M)(EN)	5
<u>Description:</u> When the candidate lines up Standby Gas treatment for venting the Drywell SGT-V-5B2 fails to auto open. Manual operator action will result in SGT-V-5B2 opening.		
K/A: 223001 A2.07 (4.2 / 4.3)		
S-2: TRANSFER SL-21 to SL-11 from SM-2	(S)(D)	6
<u>Description:</u> During the transfer of SL-21 to SL-11 CB-21/2 Fails to automatically trip. Manual operator action is required to trip CB-21/2.		
K/A: 262001 A4.01 (3.4 / 3.7)		
S-3: Lower Reactor Pressure to 1015 psig per SOP-DEH-OPS	(S)(A)(N)	3
<u>Description:</u> Reactor pressure is lowered using SOP-DEH-OPS with DEH in Throttle Pressure Automatic. During the course of lowering pressure, a slow failure of the pressure transmitters results in reactor pressure continuing to lower. Candidate must take manual control of Throttle pressure to stop the pressure transient prior to an automatic scram at 831 psig.		
K/A: 241000 A4.02 (4.1 / 4.1)		
S-4: Swap RB HVAC Fans per SOP/HVAC/RB-OPS	(S)(D)	9
<u>Description:</u> Candidate will swap RB HVAC line up to ROA-FN-1A and REA-FN-1A Running and ROA-FN-1B and REA-FN-1B Secured.		
K/A: 288000 A4.01 (3.1 / 2.9)		

S-5: RPS-MG-1 Overcurrent trip, Candidate performs ABN-RPS actions	(S)(A)(EN)(M)	7
<u>Description:</u> Candidate performs actions of ABN-RPS. During the performance EDR-V-20 Failed to automatically close. Manual action is required. The operator will continue with ABN-RPS and restore RPS-A from the alternate power supply.		
K/A: 212000 A2.01 (3.7 / 3.9)		

S-6: Initiate RCIC per SOP-RCIC-INJECTION-QC	(S)(A)(L) (M)	4
<u>Description:</u> Candidate must manually initiate RCIC, during the initiation RCIC-V-46 Fails to automatically open (CGS OE CR359064). Manual operator action will result in RCIC-V-46 opening.		
K/A: 217000 A2.01 (3.8 / 3.7)		
S-7: Perform a Reactor Feed Pump 'A' Restart.	(S)(L)(D)(P)	2
<u>Description:</u> Following trip of both Reactor Feed Pumps on high RPV water level, a restart of Reactor Feed Pump 'A' is performed using SOP-RFT-RESTART-QC.		
K/A: 259001 A4.02 (3.9 / 3.7)		
S-8: Swap CRD Pumps per SOP-CRD-PUMPS	(S)(M)	1
<u>Description:</u> Candidate swaps the operating CRD pumps to a CRD-P-1B running and CRD-P-1A secured line up.		
K/A: 201001 A4.01 (3.1 / 3.1)		

In-Plant Systems: * 3 for RO		
P-1: Start SW 'A' from the Alternate Remote Shutdown Panel per ABN-CR-EVAC.	(R)(D) (E)(L)	4
<u>Description:</u> Candidate start SW-P-1A from the Alternate Remote Shutdown panel per ABN-CR-EVAC to support heat removal from the core. Requires activation of emergency transfer switches at ARSD panel.		
K/A: 295016 A.07 (4.2 / 4.3)		
P-2: Shift CRD Flow Control Valves	(R)(D)(E)(L)	1
<u>Description:</u> Candidate will shift the in-service CRD flow control valve to CRD-FCV-2A per SOP-CRD-VALVES Section 5.4 to support PPM 5.5.11 Tab F.		
K/A: 201001 A1.03 (2.9 / 2.8)		
P-3: Trip DG-1 using the mechanical overspeed.	(A)(R)(E)(M)	6
<u>Description:</u> Candidate will trip DG-1 using the local manual mechanical overspeed trip mechanism due to failure to trip during normal shutdown of the engine.		
K/A: 264000 A4.04 (3.7 / 3.7)		

<p>* All RO control room (and in-plant) systems must be different and serve different safety functions. In-plant systems and functions may overlap those tested in the control room.</p>	
* Type Codes	Criteria for RO
(A)lternate path (C)ontrol room (D)irect from bank (E)mergency or abnormal in-plant (EN)gineered safety feature (L)ow-Power/Shutdown (N)ew or (M)odified from bank including 1(A) (P)revious 2 exams (R)CA (S)imulator	4–6 (5) ≤ 9 (5) ≥ 1 (3) ≥ 1 (2) (control room system) ≥ 1 (4) ≥ 2 (6) ≤ 3 (1) (randomly selected) ≥ 1 (3) (8)

Facility: <u>Columbia Generating Station</u>	Date of Examination: <u>02/22/21</u>
Exam Level: RO <input type="checkbox"/> SRO-I <input checked="" type="checkbox"/> SRO-U <input type="checkbox"/>	Operating Test Number: <u>1</u>

Control Room Systems: * 7 for SRO-I

System/JPM Title	Type Code*	Safety Function
S-1: Vent the Drywell per SOP-CN-CONT-VENT	(S)(A)(M) (EN)	5
<u>Description:</u> When the candidate lines up Standby Gas treatment for venting the Drywell SGT-V-5B2 fails to auto open. Manual operator action will result in SGT-V-5B2 opening.		
K/A: 223001 A2.07 (4.2 / 4.3)		
S-2: TRANSFER SL-21 to SL-11 from SM-2	(S)(D)	6
<u>Description:</u> During the transfer of SL-21 to SL-11 CB-21/2 Fails to automatically trip. Manual operator action is required to trip CB-21/2.		
K/A: 262001 A4.01 (3.4 / 3.7)		
S-3: Lower Reactor Pressure to 1015 psig per SOP-DEH-OPS	(S)(A)(N)	3
<u>Description:</u> Reactor pressure is lowered using SOP-DEH-OPS with DEH in Throttle Pressure Automatic. During the course of lowering pressure, a slow failure of the pressure transmitters results in reactor pressure continuing to lower. Candidate must take manual control of Throttle pressure to stop the pressure transient prior to an automatic scram at 831 psig.		
K/A: 241000 A4.02 (4.1 / 4.1)		
S-4: Swap RB HVAC Fans per SOP/HVAC/RB-OPS	(S)(D)	9
<u>Description:</u> Candidate will swap RB HVAC line up to ROA-FN-1A and REA-FN-1A Running and ROA-FN-1B and REA-FN-1B Secured.		
K/A: 288000 A4.01 (3.1 / 2.9)		

S-5: RPS-MG-1 Overcurrent trip, Candidate performs ABN-RPS actions	(S)(A)(EN) (M)	9
<u>Description:</u> Candidate performs actions of ABN-RPS. During the performance EDR-V-20 Failed to automatically close. Manual action is required. The operator will continue with ABN-RPS and restore RPS-A from the alternate power supply.		
K/A: 212000 A2.01 (3.7 / 3.9)		

S-6: Initiate RCIC per SOP-RCIC-INJECTION-QC		
<u>Description:</u> Candidate must manually initiate RCIC, during the initiation RCIC-V-46 Fails to automatically open (CGS OE CR359064). Manual operator action will result in RCIC-V-46 open.	(S)(A)(L)(M)	4
K/A: 217000 A2.01 (3.8 / 3.7)		
S-7: Perform a Reactor Feed Pump 'A' Restart.		
<u>Description:</u> Following trip of both Reactor Feed Pumps on high RPV water level, a restart of Reactor Feed Pump 'A' is performed using SOP-RFT-RESTART-QC.	(S)(L)(D)(P)	2
K/A: 259001 A4.02 (3.9 / 3.7)		
In-Plant Systems: * 3 for SRO-I		
P-1: Start SW 'A' from the Alternate Remote Shutdown Panel per ABN-CR-EVAC.		
<u>Description:</u> Candidate start SW-P-1A from the Alternate Remote Shutdown panel per ABN-CR-EVAC to support heat removal from the core. Requires activation of emergency transfer switches at ARSD panel.	(R)(D) (E)(L)	4
K/A: 295016 A.07 (4.2 / 4.3)		
P-2: Shift CRD Flow Control Valves		
<u>Description:</u> Candidate will shift the in-service CRD flow control valve to CRD-FCV-2A per SOP-CRD-VALVES Section 5.4 to support PPM 5.5.11 Tab F.	(R)(D)(E)(L)	1
K/A: 201001 A1.03 (2.9 / 2.8)		
P-3: Trip DG-1 using the mechanical overspeed.		
<u>Description:</u> Candidate will trip DG-1 using the local manual mechanical overspeed trip mechanism due to failure to trip during normal shutdown of the engine.	(A)(R)(E)(M)	6
K/A: 264000 A4.04 (3.7 / 3.7)		

* All RO control room (and in-plant) systems must be different and serve different safety functions. In-plant systems and functions may overlap those tested in the control room.	
* Type Codes	Criteria for SRO-I
(A)lternate path	4–6 (5)
(C)ontrol room	
(D)irect from bank	≤ 8 (5)
(E)mergency or abnormal in-plant	≥ 1 (3)
(E)ngineered safety feature	≥ 1 (2) (control room system)
(L)ow-Power/Shutdown	≥ 1 (4)
(N)ew or (M)odified from bank including 1(A)	≥ 2 (5)
(P)revious 2 exams	≤ 3 (1) (randomly selected)
(R)CA	≥ 1 (3)
(S)imulator	(7)

Facility: <u>Columbia Generating Station</u>		Date of Examination: <u>02/22/21</u>
Exam Level: RO <input type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input checked="" type="checkbox"/>		Operating Test Number: <u>1</u>
Control Room Systems: * 2 or 3 for SRO-U		
System/JPM Title	Type Code*	Safety Function
S-1: Vent the Drywell per SOP-CN-CONT-VENT	(S)(A)(M) (EN)	5
Description: When the candidate lines up Standby Gas treatment for venting the Drywell SGT-V-5B2 fails to auto open. Manual operator action will result in SGT-V-5B2 opening.		
K/A: 223001 A2.07 (4.2 / 4.3)		
S-5: RPS-MG-1 Overcurrent trip, Candidate performs ABN-RPS actions	(S)(A)(M) (EN)	7
Description: Candidate performs actions of ABN-RPS. During the performance EDR-V-20 Failed to automatically close. Manual action is required. The operator will continue with ABN-RPS and restore RPS-A from the alternate power supply.		
K/A: 212000 A2.01 (3.7 / 3.9)		
S-4: Swap RB HVAC Fans per SOP/HVAC/RB-OPS	(S)(D)	9
Description: Candidate will swap RB HVAC line up to ROA-FN-1A and REA-FN-1A Running and ROA-FN-1B and REA-FN-1B Secured.		
K/A: 288000 A4.01 (3.1 / 2.9)		

In-Plant Systems: * 2 or 3 for SRO-U		
P-1: Start SW 'A' from the Alternate Remote Shutdown Panel per ABN-CR-EVAC.	(R)(D) (E)(L)	4
<u>Description:</u> Candidate start SW-P-1A from the Alternate Remote Shutdown panel per ABN-CR-EVAC to support heat removal from the core. Requires activation of emergency transfer switches at ARSD panel.		
K/A: 295016 A.07 (4.2 / 4.3)		
P-3: Trip DG-1 using the mechanical overspeed.	(A)(R)(E)(M)	6
<u>Description:</u> Candidate will trip DG-1 using the local manual mechanical overspeed trip mechanism due to failure to trip during normal shutdown of the engine.		
K/A: 264000 A4.04 (3.7 / 3.7)		

* All RO control room (and in-plant) systems must be different and serve different safety functions. In-plant systems and functions may overlap those tested in the control room.	
* Type Codes	Criteria for SRO-U
(A)lternate path	2-3 (3)
(C)ontrol room	
(D)irect from bank	≤ 4 (2)
(E)mergency or abnormal in-plant	≥ 1 (2)
(EN)gineered safety feature	≥ 1 (2) (control room system)
(L)ow-Power/Shutdown	≥ 1 (2)
(N)ew or (M)odified from bank including 1(A)	≥ 1 (3)
(P)revious 2 exams	≤ 2 (0) (randomly selected)
(R)CA	≥ 1 (2)
(S)imulator	(3)

Facility:	Columbia Generating Station	Scenario No.:	1	Op Test No.:	1
Examiners:	_____	Operators:	_____	_____	_____
Initial Conditions:	Columbia is operating at 100% power.				
Turnover:	Lower reactor power to 90% using Reactor Recirculation flow per PPM 3.2.6 (Power Maneuvering) after assuming the shift based on BPA Load Following request. Steps 5.1.1 thru 5.1.6 of PPM 3.2.6 are complete. Proper margin to Pre-Conditioned Status (PCS) exists per PPM 9.3.18. The Reactivity brief has been performed.				
Critical Tasks:					
CT-1	A reactor scram should have occurred due to core oscillations. Crew takes actions to manually scram the reactor per ABN-CORE.				
CT-2	With DG-2 Running with no service water, restore service water flow to DG-2 within 10 minutes of auto start.				
NOTE: An unintentional or unnecessary RPS or ESF actuation may result in the creation of a post-scenario Critical Task, if that actuation results in a significant plant degradation or significantly alters a mitigation strategy.					
Event No.	Trigger	Event Type*	Event Description		
1	-	R (SRO/ATC) N (BOP)	ATC lowers reactor power (for load following) using Reactor Recirculation (RRC) flow to 90% per PPM 3.2.6 (Power Maneuvering). The BOP operator takes the Main Turbine out of Governor Valve Optimization mode per SOP-MT-GV/OPTIMIZATION (Section 5.2) prior to the RRC flow reduction.		
2	2	C (ATC) TS (SRO)	The crew receives a Rod Drift Alarm, ATC responds and takes immediate actions to continuous insert Rod 22-31. When the operator initially releases the continuous insert pushbutton the rod will start to drift back out of the core. After the rod is hydraulically isolated in the field it will remain full in. The SRO will evaluate TS and declare the rod inoperable. LCO 3.1.3 C.1 and C.2		
3	3	TS (SRO)	MS-LIS-200A will spurious trip bringing in alarms (no actual trip) for MSIV half trip and NS4 group 1 isolation on low reactor level. Crew will determine that that it is not valid based on plant indications, SRO evaluate TS for the failed instrument. LCO 3.3.6.1 A1 – Place the channel in trip in 24 hours.		
4	4		Operating Basis Earthquake causes instrument line failures, Crew enters ABN-EARTHQUAKE and ABN-INSTRUMENTATION and takes actions.		
	11	C (SRO / ATC) R (SRO / ATC)	The previous OBE causes a leak in the RFW-P-1A turbine oil system. Crew enters ABN-OIL for a large oil leak and takes manual actions to trip of RFW-P-1A.		
5	5	M (ALL)	An aftershock earthquake results in further loss of RPV level instrumentation. The plant will experience core oscillations and should have automatically scrammed but did not. (Electric ATWS). The crew takes actions to manually scram the reactor. CT-1 . Initiation of ARI is successful, control rods insert into the core. Crew Enters PPM 5.1.1 RPV Control.		
6	-	C (SRO/ATC)	During the course of lining up on the startup flow control valves, RFW-V-118 will not open. This complicates RPV level control for ATC. RFW-V-109 can be manually throttled to control level while controlling RFP speed in MDEM. ATC can also use HPCS and RCIC as an alternative.		

7	-	C (BOP)	Following the scram, BOP will find that CB-S3 failed to auto close. CB-B7 Fails as is. BOP takes manual actions to close CB-S3 and repower SL-31.
8	-	C (BOP)	SW-P-1B fails to auto start due to failure of SW-V-2B to auto open. DG-2 will be running without service water. Manual opening of SW-V-2B will result in proper operation of SW-P-1B. CT-2
9	9	M (ALL)	OBE earthquake causes a complete loss of RPV Level instrumentation. Crew will enter PPM 5.1.4 to open 7 SRVs and flood the core to the elevation of the main steam lines.
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor, (TS)Technical Specifications			

Target Quantitative Attributes	Actual	Description
Malfunctions after EOP entry (1-2)	3	RFW-V-118 Failure / CB-S3 FAC / SW-V-2B FAO
Abnormal events (2-4)	3	ABN-ROD / ABN-EARTHQUAKE and ABN-INSTRUMENTATION / ABN-OIL
Major transients (1-2)	2	Scram (Electric ATWS) / PPM 5.1.4 Core flood up
EOPs entered/requiring substantive actions (1-2)	1	5.1.1 RPV Control
Entry into a contingency EOP with substantive actions (≥ 1 per scenario set)	1	5.1.4 RPV Flooding
Pre-identified Critical tasks (≥ 2)	2	See Critical Task Sheets.

Facility:	Columbia Generating Station	Scenario No.:	2	Op Test No.:	1
Examiners:	_____	Operators:	_____	_____	_____
Initial Conditions:	The reactor is at 100% Power.				
Turnover:	The reactor is at 100% Power. Following turnover the crew is to shift DEH pumps per SOP-DEH-OPS.				
Critical Tasks:					
CT-1	During ATWS with power > 5%, terminate and prevent injection with exception of SLC, RCIC, and CRD, into the RPV until RPV level is -65 inches to establish a Lowered Level (LL). -AND- Maintain RPV level above -186 inches. Short excursions below -186 inches does not constitute failure of CT provided level restored and maintained above -186 inches within 10 minutes of going below -186 inches.				
CT-2	With reactor scram required and the reactor not shutdown, commence inserting control rods per PPM 5.5.11 Attachment 6.1 Tab B prior to transitioning to Tab E.				
NOTE: An unintentional or unnecessary RPS or ESF actuation may result in the creation of a post-scenario Critical Task, if that actuation results in a significant plant degradation or significantly alters a mitigation strategy.					
Event No.	Trigger	Event Type*	Event Description		
1	-	N (BOP)	BOP swaps DEH Pumps per SOP-DEH-OPS. DEH-P-1A is placed in service and DEH-P-1B is secured. This is a normal evolution and is not faulted.		
2	TRG-2	TS (SRO)	LPCS relay K4 will trip and cause a ½ initiation of LPCS / RHR A initiation logic. BOP refers to the ARP and determines that the K4 relay has tripped. SRO evaluates technical specifications.		
3	TRG-3	C (ALL) R (SRO / ATC) TS (SRO)	MS-RV-1A spurious opens. SRO will take actions per ABN-SRV. ATC will lower power to LE 90%. When the control switch for MS-RV-1A is taken to off, the SRV will remain open. The SRO will direct BOP to remove the control power fuses for MS-RV-1A which will result in the closure of MS-RV-1A.		
4	TRG-4	I (ATC / SRO)	APRM-4 Fails upscale. ATC verifies APRM-4 is faulted using the trip status display on P603. BOP verifies the diagnosis on APRM chassis (Back Panels). SRO directs ATC to bypass APRM-4 and evaluates technical specifications.		
5	TRG-5	C (BOP / SRO) TS (SRO)	Fire in TR-B / TR-B lockout. Crew will take actions of ABN-FIRE and ABN-ELEC-GRID. SRO Evaluates Tech Specs for the loss of TR-B.		
6	TRG-6	M (ALL)	DEH-P-1A will experience a winding overcurrent trip. DEH-P-1B will not auto start and will not manually start. DEH hydraulic pressure will degrade. The SRO will enter ABN-DEH-LEAK and direct a manual scram of the reactor. The plant will experience a Hydraulic ATWS and fail to scram.		
7	-	M (ALL)	On scram the crew will experience a Hydraulic ATWS. SRO will enter PPM 5.1.2 RPV Control ATWS. ATC will take immediate actions for reactor power GT 5%, SLC-P-1A will trip and SLC-P-1B will experience reduced flow. BOP will take manual control of HPCS and inhibit ADS. (Critical Task #1) SRO will direct stop and prevent with exception of SLC, RCIC and CRD and intentionally lower level to below -65". ATC will control RPV level GT -186" using condensate and feed. (Critical Task #2) Crew will perform PPM 5.5.11 to insert control rods. Control rod insertion will be successful by manually driving control rods. (Scram-Reset-Scram will not work)		

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor, (TS)Technical Specifications		
Target Quantitative Attributes	Actual	Description
Malfunctions after EOP entry (1-2)	1	Hydraulic ATWS with Degraded SLC
Abnormal events (2-4)	4	ABN-INSTRUMENTATION, ABN-SRV, ABN-FIRE / ABN-ELEC-GRID, ABN-DEH-LEAK
Major transients (1-2)	2	Loss of DEH Scram, Hydraulic ATWS
EOPs entered/requiring substantive actions (1-2)	1	PPM 5.1.2 RPC Control ATWS
Entry into a contingency EOP with substantive actions (≥ 1 per scenario set)	0	Scenarios 1 and 3 contain EOP contingencies for this scenario set
Pre-identified Critical tasks (≥ 2)	2	See Critical Task Sheets.

Facility:	Columbia Generating Station	Scenario No.:	SPARE	Op Test No.:	1
Examiners:	_____	Operators:	_____	_____	_____
Initial Conditions:	Reactor Power is 100%. After the crew takes the shift, they will swap operation of WMA fans. (Per the turnover sheet).				
	RWCU-DM-1B is removed from service for planned backwash/precoat.				
Turnover:	<p>After taking the shift, the crew will swap WMA fans to WMA-FN-51A running and WMA-FN-51B secured for run time equalization. Pre-requisites 3.1, 3.2, 3.3, 3.4, 3.5 and 3.6 of SOP-HVAC/CR-OPS have been previously completed by the off-going crew.</p> <p>Backwash / Precoat of RWCU-DM-1B is scheduled for the shift. Section 5.1 of SOP-RWCU-DEMINT was completed the previous shift (Removing Filter Demineralizers from Service and Placing in Hold.). Backwash and precoat of RWCU-DM-1B will commence after the crew takes the shift.</p> <p>No other equipment is out of service or protected.</p>				
Critical Tasks:					
CT-1	With no CRD pumps running and two or more control rod accumulator trouble alarms are in, initiate a manual scram within 20 minutes. (ABN-CRD / TS 3.1.5)				
CT-2	Initiate Emergency Depressurization (ED) by opening the first of seven (7) Safety Relief Valves (ADS preferred) when Wetwell pressure cannot be restored and maintained below the Pressure Suppression Pressure (PSP). CT is considered met if any combination of 7 Safety Relief Valves are opened within 15 minutes of reaching PSP. (PPM 5.2.1, PPM 5.1.3)				
NOTE: An unintentional or unnecessary RPS or ESF actuation may result in the creation of a post-scenario Critical Task, if that actuation results in a significant plant degradation or significantly alters a mitigation strategy.					
Event No.	Trigger	Event Type*	Event Description		
1	-	C (SRO / BOP) TS (SRO)	BOP Swap WMA fans to WMA-FN-51A running and WMA-FN-51B secured. During the swap, WMA-AD-51A1 will experiences blown control power fuse rendering WMA-FN-51A inoperable. SRO will evaluate TS.		
2	TRG-2	C (SRO)	RWCU-TK-2 overflows during the performance of a backwash and precoat. Results in required entry into ABN-FLOODING and ABN-RAD-SPILL. Additionally, the flooding causes a ground on MC-6B and overcurrent trip of SL-63. (CGS OE –RWCU-TK-2 Overflow CR390321 02/25/19)		
	-	C (ATC)	Following the trip of SL-63, RRC-P-1A fails to automatically run back to 51hz. ATC will manually lower speed of RRC-P-1A to 51hz.		
3	TRG-3	R (SRO / ATC) TS (SRO)	RRC ASD CH 1A1 overcurrent trip. Crew Enters ABN-RRC-LOSS and evaluates the single loop power to flow map. The crew reduces rod line per the fast shutdown sequence for single loop operations. SRO evaluates and enters LCO 3.4.1 (CGS OE – CR404225 02/14/20)		
4	TRG-4	C (BOP) M (ALL)	SM-7 lockout. Crew enters ABN-ELEC-SM1/SM7. BOP takes immediate actions for the loss of SM-7 and ABN-RPS. Due to the loss of SM-7, CRD-P-1A will trip. ATC will attempt to restore CRD, however CRD-P-1B will not start. The crew enters ABN-CRD and scrams the reactor with reactor pressure GE 900 psig and 2 or more scram accumulators are inoperable with charging header pressure LT 940 psig. CT-1		

5	-	C (SRO / BOP)	A Main steam line break aft of the flow restrictor (LOCA) results in rising DW pressure. Crew enters PPM 5.2.1 Containment control. SRO directs Wetwell sprays at 2#. (Due to the lockout on SM-7, RHR-A is unavailable for WW Sprays)
6	-	I (BOP)	Upon verification of 1.68# Actuations, BOP will find that FDR-V-4 did not close. Manual operator action will result in closure of FDR-V-4.
7	-	M (ALL)	During the CREW performance of PPM 5.2.1 Containment Control, the crew will attempt to spray the drywell at 12# and recognize RHR-V-16B will not open. With drywell sprays un-available, DW pressure will continue to rise. The crew will be required to emergency depressurize when Drywell pressure cannot be restored and maintained below PSP. CT-2
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor, (TS)Technical Specifications			

Target Quantitative Attributes	Actual	Description
Malfunctions after EOP entry (1-2)	3	LOCA with drywell floor failure / Failure of RHR-V-16B (Results in loss of drywell spray function / FDR-V-4 Failure to auto close
Abnormal events (2-4)	4	WMA-AD-51A1 Failure / RWCU tank overflow causes OC trip of SL-63 / ASD-CH-1A1 Trip / Lockout of SM-7
Major transients (1-2)	2	Reactor scram due to loss of CRD / Emergency Depressurization on WW pressure
EOPs entered/requiring substantive actions (1-2)	2	PPM 5.1.1 (RPV Control); PPM 5.2.1 (Primary Containment Control)
Entry into a contingency EOP with substantive actions (≥ 1 per scenario set)	1	PPM 5.1.3 (Emergency RPV Depressurization)
Pre-identified Critical tasks (≥ 2)	2	See Critical Task Sheets.

SCENARIO SUMMARY

Event 1

BOP swaps WMA fans to WMA-FN-51A running and WMA-FN-51B secured for run time equalization. Pre-requisites 3.1, 3.2, 3.3, 3.4, 3.5 and 3.6 of SOP-HVAC/CR-OPS have been previously completed by the off-going crew. During the performance of this evolution WMA-AD-51A1 control power fuse blows charring the fuse block resulting in inability to swap the fans.

SRO Evaluates Tech Specs

- TS 3.7.3 Condition A – Restore CREF subsystem to operable status in 7 days.
- TS 3.7.4 Condition A – Restore control room AC subsystem to operable status in 30 days.

(Pre-Inserted Malfunction and Event – NO TRIGGER REQUIRED) Pre-Inserted OVR-RWB024C WMA-AD-51A1 Closed / On start of WMA-FN-51A it creates event 15 and inserts malfunction 15 (MOV-RWB001F Fail Control Power)

Event 2

Crew receives a call from the Radwaste tool crib attendant who reports a large puddle of water in the service air compressor area. The Crew will enter ABN-FLOODING. The flooding causes a ground in MC-6B resulting in an overcurrent trip of SL-63. After the bus loss RRC-P-1A fails to automatically run back to 51HZ. The RWCR operator reports that during the performance of RWCU backwash and precoat, RWCU-TK-2 overflowed and the flooding has been stopped.

Facility:	Columbia Generating Station	Scenario No.:	4	Op Test No.:	1
Examiners:	_____	Operators:	_____	_____	_____
Initial Conditions:	Reactor startup is in progress with power at 11%. Plant recently entered Mode 1. RPV pressure is ~950 psig with DEH in Auto and Turbine Bypass Valves controlling pressure. TDRFP 'A' is in MDEM on the Start Up Level Controller (In Automatic). TSW-P-1B is out of service for the next 24 hours to allow work on discharge check valve TSW-V-52B.				
Turnover:	After turnover, withdraw control rods as required to raise reactor power to ~15%. Next in-sequence rod move is per RWM Page 24, Step 8 (Rod 34-51). Continuous rod withdrawal is permitted. Reactivity Brief has been conducted. All Precautions and Limitations have been addressed.				
Critical Tasks:					
CT-1	When a primary system is discharging into the secondary containment, manually scram the reactor before any area exceeds its Maximum Safe Operating Temperature (MSOT).				
CT-2	When a primary system is discharging into the secondary containment, isolate the discharge before area temperatures exceed MSOT in more than one area.				
NOTE: An unintentional or unnecessary RPS or ESF actuation may result in the creation of a post-scenario Critical Task, if that actuation results in a significant plant degradation or significantly alters a mitigation strategy.					
Event No.	Trigger	Event Type*	Event Description		
1	-	N (ATC / SRO) R (ATC / SRO)	Withdraw control rods as required to raise reactor power to ~15%.		
2	-	C (ATC / SRO) TS (SRO)	Control Rod 26-51 is stuck. Crew enters ABN-ROD for control rod immovable under normal drive pressure. Crew attempts to increase drive water pressure to move the rod and are unsuccessful. SRO Evaluates TS (LCO 3.1.3 A.1/A.2/A.4)		
3	TRG-3	C (BOP / SRO) TS (SRO)	Overcurrent trip pf SL-81. BOP takes immediate actions of ABN-ELEC-SM3/SM8 to ensure RCC flow to the drywell. SRO enters and directs actions of ABN-ELEC-SM3/SM8. BOP ensures two Main Steam tunnel fans are in operation. SRO Evaluates TS (LCO 3.8.7 A.1, 3.5.1 A.1/C.1, 3.6.1.5 A.1, LCS 1.6.1.5 A.1)		
4	TRG-4	C (BOP)	CAS-C-1B will experience a shaft break, CAS-C-1A and CAS-C-1C will fail to auto start. BOP takes manual actions to start CAS-C-1A and CAS-C-1C. SRO enters ABN-CAS and sets a key parameter for CAS pressure.		
5	TRG-5	M (ALL)	Steam leak develops upstream of RCIC-V-8 (RCIC Turbine Steam Isolation) in TIP Mezzanine area in the Reactor Building. RCIC-V-63 (RCIC Steam Supply Inboard Isolation) fails to completely close requiring manual scram before TIP Mezzanine area exceeds MSOT. (CT-1)		
6	TRG-6	C (SRO/BOP)	Following the scram, RCC-P-1A overcurrent trips. Crew enters ABN-RCC. Due to RCC-P-1B and RCC-P-1C previously lost due to the trip pf SI-81, this results in a complete loss of RCC flow.		
7	TRG-7	M (ALL)	OBE (Earthquake) results in piping rupture in Main Steam Tunnel. All inboard MSIVs fail to automatically close on high tunnel temperature. Manual closure required to isolate the rupture before exceeding 2nd MSOT. (CT-2)		
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor, (TS)Technical Specifications					

Target Quantitative Attributes	Actual	Description
Malfunctions after EOP entry (1-2)	2	OBE Earthquake with rupture in the Main Steam Tunnel. Trip of RCC-P-1A (complete loss of RCC)
Abnormal events (2-4)	4	ABN-ELEC-SM3/SM8 on loss of SL-81 / ABN-EARTHQUAKE on OBE / ABN-HELB for RCIC Steam leak / ABN-RCC
Major transients (1-2)	2	RCIC Steam leak PPM 5.5.1 Scram required / OBE Earthquake with rupture in the Main Steam Tunnel
EOPs entered/requiring substantive actions (1-2)	2	PPM 5.1.1 (RPV Control); PPM 5.3.1 (Secondary Containment Control)
Entry into a contingency EOP with substantive actions (≥ 1 per scenario set)	0	[NONE] (SC-1 and SC-3 contain EOP Contingency actions for this scenario set.)
Pre-identified Critical tasks (≥ 2)	2	See Critical Task Sheets.