

Facility: Columbia Generating Station														Date of Exam: April 2015				
Tier	Group	RO K/A Category Points												SRO-Only Points				
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	Total	A2	G*	Total		
1. Emergency & Abnormal Plant Evolution	1	3	4	4				3	3				3	20			7	
	2	2	1	1	N/A			1	1	N/A			1	7			3	
	Tier Totals	5	5	5				4	4				4	27			10	
2. Plant Systems	1	3	3	2	2	2	2	3	2	3	2	2	26				5	
	2	2	1	1	1	1	1	1	1	1	1	1	12				3	
	Tier Totals	5	4	3	3	3	3	4	3	4	3	3	38				8	
3. Generic Knowledge and Abilities Categories					1		2		3		4		10	1	2	3	4	7
					3		3		2		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 outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two).
2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ± 1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points and the SRO-only exam must total 25 points.
3. Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; operationally important, site-specific systems/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 shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
- 7.* The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams.
9. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

ES-401		BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO)						Form ES-401-1	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	Q#
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4						X	G2.1.19 Partial or Complete Loss of Forced Core Flow Circulation - Ability to use plant computers to evaluate system or component status	3.9	39
295003 Partial or Complete Loss of AC / 6					X		AA2.04 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF A.C. POWER: System lineups	3.5	40
295004 Partial or Total Loss of DC Pwr / 6				X			AA1.02 Ability to operate and/or monitor the following as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER: Systems necessary to assure safe plant shutdown	3.8	41
295005 Main Turbine Generator Trip / 3			X				AK3.02 Knowledge of the reasons for the following responses as they apply to MAIN TURBINE GENERATOR TRIP: Recirculation pump downshift/trip	3.4	42
295006 SCRAM / 1		X					AK2.01 Knowledge of the interrelations between SCRAM and the following: RPS	4.3	43
295016 Control Room Abandonment / 7					X		AA2.06 Ability to determine and/or interpret the following as they apply to CONTROL ROOM ABANDONMENT: Cooldown rate	3.3	44
295018 Partial or Total Loss of CCW / 8	X						AK1.01 Knowledge of the operational implications of the following concepts as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER : Effects on component/system operations	3.5	45
295019 Partial or Total Loss of Inst. Air / 8		X					AK2.16 Knowledge of the interrelations between PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR and the following: Reactor core isolation cooling	2.8	46
295021 Loss of Shutdown Cooling / 4			X				AK3.04 Knowledge of the reasons for the following responses as they apply to LOSS OF SHUTDOWN COOLING: Maximizing reactor water cleanup flow	3.3	47
295023 Refueling Acc / 8						X	G2.4.18 Knowledge of the specific bases for EOPs	3.3	51
295024 High Drywell Pressure / 5					X		EA2.08 Ability to determine and/or interpret the following as they apply to HIGH DRYWELL PRESSURE: Suppression chamber pressure	3.6	48
295025 High Reactor Pressure / 3						X	G2.1.45 High Reactor Pressure - Ability to identify and interpret diverse indications to validate the response of another indication	4.3	49
295026 Suppression Pool High Water Temp. / 5				X			EA1.03 Ability to operate and/or monitor the following as they apply to SUPPRESSION POOL HIGH WATER TEMPERATURE: Temperature monitoring	3.9	50
295027 High Containment Temperature / 5							Not Selected		
295028 High Drywell Temperature / 5	X						EK1.02 Knowledge of the operational implications of the following concepts as they apply to HIGH DRYWELL TEMPERATURE: Equipment environmental qualification	2.9	52
295030 Low Suppression Pool Wtr Lvl / 5				X			EA1.03 Ability to operate and/or monitor the following as they apply to LOW SUPPRESSION POOL WATER LEVEL: HPSCS	3.4	53
295031 Reactor Low Water Level / 2			X				EK3.02 Knowledge of the reasons for the following responses as they apply to REACTOR LOW WATER LEVEL: Core coverage	4.4	54
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1		X					EK2.14 Knowledge of the interrelationship between SCRAM CONDITION PRESENT AND REACTOR ABOVE APRM DOWNSCALE OR UNKNOWN and the following: RPIS: Plant Specific	3.6	55

295038 High Off-site Release Rate / 9	X						EK1.02 Knowledge of the operational implications of the following concepts as they apply to HIGH OFF-SITE RELEASE RATE : Protection of the general public	4.2	56
600000 Plant Fire On Site / 8		X					AK2.01 Knowledge of the interrelations between PLANT FIRE ON SITE and the following: Sensors / detectors and valves	2.6	57
700000 Generator Voltage and Electric Grid Disturbances / 6			X				AK3.02 Knowledge of the reasons for the following responses as they apply to GENERATOR VOLTAGE AND ELECTRICAL GRID DISTURBANCES: Actions contained in abnormal operating procedure for voltage and grid disturbances	3.6	58
K/A Category Totals:	3	4	4	3	3	3	Group Point Total:		20

ES-401		BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO)						Form ES-401-1	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295002 Loss of Main Condenser Vac / 3					X		AA2.02 Ability to determine and/or interpret the following as they apply to LOSS OF MAIN CONDENSER VACUUM: Reactor power	3.2	59
295007 High Reactor Pressure / 3									
295008 High Reactor Water Level / 2		X					AK2.09.1 Knowledge of the interrelationships between HIGH REACTOR WATER LEVEL and the following: Reactor Water Cleanup System (ability to drain)	3.1	60
295009 Low Reactor Water Level / 2									
295010 High Drywell Pressure / 5									
295011 High Containment Temp / 5									
295012 High Drywell Temperature / 5									
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1						X	G2.4.20 Inadvertent Reactivity Addition - Knowledge of the operational implications of EOP warnings, cautions, and notes. 295014 G2.4.20 (3.8) (CFR 41.10) Tier1 / Group 2	3.8	61
295015 Incomplete SCRAM / 1				X			AA1.07 Ability to operate and/or monitor the following as they apply to INCOMPLETE SCRAM: Neutron monitoring system	3.6	62
295017 High Off-site Release Rate / 9									
295020 Inadvertent Cont. Isolation / 5 & 7			X				AK3.08 Knowledge of the reasons for the following responses as they apply to INADVERTENT CONTAINMENT ISOLATION: Suppression chamber pressure response	3.3	63
295022 Loss of CRD Pumps / 1									
295029 High Suppression Pool Wtr Lvl / 5									
295032 High Secondary Containment Area Temperature / 5	X						EK1.04 Knowledge of the operational implications of the following concepts as they apply to HIGH SECONDARY CONTAINMENT AREA TEMPERATURE: Impact of operating environment on components	3.1	64
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	X						EK1.02 Knowledge of the operational implications of the following concepts as they apply to SECONDARY CONTAINMENT HIGH SUMP/AREA WATER LEVEL: Electrical ground/ circuit malfunction	2.6	65
500000 High CTMT Hydrogen Conc. / 5									
K/A Category Point Totals:	2	1	1	1	1	1	Group Point Total:		7

BWR Examination Outline														Form ES-401-1	
Plant Systems - Tier 2/Group 1 (RO)															
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				A2.03 Ability to (a) predict the impacts of the following on the RHR/LPCI: INJECTION MODE (PLANT SPECIFIC) ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Valve closures		3.2	1
205000 Shutdown Cooling							X					A1.06 Ability to predict and/or monitor changes in parameters associated with operating the SHUTDOWN COOLING SYSTEM (RHR SHUTDOWN COOLING MORE) controls including: Reactor temperatures (moderator, vessel, flange)		2.7	2
206000 HPCI												NA CGS			
207000 Isolation Condenser												NA CGS			
209001 LPCS				X								K4.06 Knowledge of LOW PRESSURE CORE SPRAY SYSTEM design feature(s) and/or interlocks which provide for the following: Adequate pump net positive suction head		2.6	3
209002 HPCS			X									K3.03 Knowledge of the effect that a loss or malfunction of the HIGH PRESSURE CORE SPRAY SYSTEM (HPCS) will have on following: Adequate Core Cooling		3.9	4
						X						K6.01 Knowledge of the effect that a loss or malfunction of the following will have on the HIGH PRESSURE CORE SPRAY SYSTEM (HPCS): Electrical power.		3.6	5
211000 SLC		X										K2.02 Knowledge of electrical power supplies to the following: Explosive valves		3.1	6
212000 RPS	X											K1.06 Knowledge of the physical connections and/or cause effect relationships between REACTOR PROTECTION SYSTEM and the following: Control rod drive hydraulic system		3.5	7
215003 IRM											X	G2.1.28 Intermediate Range Monitor System: Knowledge of the purpose and function of major system components and controls.		4.1	8
215004 Source Range Monitor										X		A4.01 Ability to manually operate and/or monitor in the control room: SRM count rate and period		2.9	9
215005 APRM / LPRM									X			A3.06 Ability to monitor automatic operations of the AVERAGE POWER RANGE MONITOR/LOCAL POWER RANGE MONITOR SYSTEM including: Maximum disagreement between flow comparator channels		3.0	10
217000 RCIC	X											K1.01 Knowledge of the physical connections and/or cause – effect relationships between REACTOR CORE ISOLATION COOLING SYSTEM (RCIC) and the following: Condensate storage and transfer system		3.5	11
218000 ADS		X										K2.01 Knowledge of electrical power supplies to the following: ADS logic		3.1	12

223002 PCIS/Nuclear Steam Supply Shutoff				X											K3.11 Knowledge of the effect that a loss or malfunction of the PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF will have on following: Plant ventilation	2.8	13										
239002 SRVs					X										K4.03 Knowledge of RELIEF/SAFETY VALVES design feature(s) and/or interlocks which provide for the following: Prevents siphoning of water into SRV discharge piping and limits loads on subsequent actuation of SRV's	3.1	14										
259002 Reactor Water Level Control						X									K5.01 Knowledge of the operational implications of the following concepts as they apply to REACTOR WATER LEVEL CONTROL SYSTEM: GEMAC/Foxboro/ Bailey controller operation	3.1	15										
261000 SGTS							X								K6.01 Knowledge of the effect that a loss or malfunction of the following will have on the STANDBY GAS TREATMENT SYSTEM : A.C. electrical distribution		16										
												X			G2.1.30 Standby Gas Treatment System: Ability to locate and operate components, including local controls	4.4	17										
262001 AC Electrical Distribution						X									K5.02 Knowledge of the operational implications of the following concepts as they apply to A.C. ELECTRICAL DISTRIBUTION: Breaker control	2.6	18										
								X							A1.03 Ability to predict and/or monitor changes in parameters associated with operating the A.C. ELECTRICAL DISTRIBUTION controls including: Bus voltage	2.9	19										
262002 UPS (AC/DC)									X						A2.01 Ability to (a) predict the impacts of the following on the UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Under voltage	2.6	20										
263000 DC Electrical Distribution										X					A3.01 Ability to monitor automatic operations of the D.C. ELECTRICAL DISTRIBUTION including: Meters, dials, recorders, alarms, and indicating lights.	3.2	21										
264000 EDGs								X							A1.04 Ability to predict and/or monitor changes in parameters associated with operating the EMERGENCY GENERATORS (DIESEL/JET) controls including: Crank case temperature and pressure	2.6	22										
												X			A4.03 Ability to manually operate and/or monitor in the control room: Transfer of emergency control between manual and automatic	3.2	23										
300000 Instrument Air	X														K1.03 Knowledge of the connections and / or cause effect relationships between INSTRUMENT AIR SYSTEM and the following: Containment air	2.8	24										
		X													K2.01 Knowledge of electrical power supplies to the following: Instrument air compressor	3.0	25										
400000 Component Cooling Water										X					A3.01 Ability to monitor automatic operations of the CCWS including: Setpoints on instrument signal levels for normal operations, warnings, and trips that are applicable to the CCWS	3.0	26										
K/A Category Point Totals:															3	3	2	2	2	2	3	2	3	2	2	Group Point Total:	26

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Facility: Columbia Generating Station			Date of Exam: April, 2015			
Category	K/A #	Topic	RO		SRO-Only	
			IR	Q#	IR	#
1. Conduct of Operations	2.1.4				3.8	94
	2.1.26				3.6	95
	2.1.14	Knowledge of criteria or conditions that require plant-wide announcements, such as pump starts, reactor trips, mode changes, etc	3.1	66		
	2.1.29	Knowledge of how to conduct system lineups, such as valves, breakers, switches, etc	4.1	67		
	2.1.44	Knowledge of RO duties in the control room during fuel handling such as responding to alarms from the fuel handling area, communication with the fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentation	3.9	68		
	Sub-total			3		2
2. Equipment Control	2.2.5				3.2	96
	2.2.19				3.4	97
	2.2.1	Ability to perform pre-startup procedures for the facility, including operating those controls associated with plant equipment that could affect reactivity	4.5	69		
	2.2.21	Knowledge of pre- and post-maintenance operability requirements	4.0	70		
	2.2.42	Ability to recognize system parameters that are entry-level conditions for Technical Specifications	3.9	71		
	Sub-total			3		2
3. Radiation Control	2.3.6				3.8	98
	2.3.12				3.7	99
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities	3.4	72		
	2.3.15	Knowledge of radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc	2.9	73		
	Sub-total			3		2
4. Emergency Procedures / Plan	2.4.30				4.1	100
	2.4.1	Knowledge of EOP entry conditions and immediate action steps	4.6	74		
	2.4.6	Knowledge of EOP mitigation strategies	3.7	75		
	Sub-total			2		1
Tier 3 Point Total				10		7

Facility: Columbia Gen Station														Date of Exam: April, 2015			
Tier	Group	RO K/A Category Points												SRO-Only Points			
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	Total	A2	G*	Total	
1. Emergency & Abnormal Plant Evolutions	1												20	3	4	7	
	2												7	2	1	3	
	Tier Totals												27	5	5	10	
2. Plant Systems	1												26	3	2	5	
	2												12	1	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	2	1	

Note:

1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two).
2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ± 1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points and the SRO-only exam must total 25 points.
3. Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; operationally important, site-specific systems/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 shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
- 7.* The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams.
9. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

ES-401		BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (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									
295003 Partial or Complete Loss of AC / 6									
295004 Partial or Total Loss of DC Pwr / 6					X		AA2.04 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER: System lineups	3.3	76
295005 Main Turbine Generator Trip / 3									
295006 SCRAM / 1									
295016 Control Room Abandonment / 7					X		AA2.02 Ability to determine and/or interpret the following as they apply to CONTROL ROOM ABANDONMENT: Reactor Water Level	3.9	77
295018 Partial or Total Loss of CCW / 8									
295019 Partial or Total Loss of Inst. Air / 8					X		AA2.02 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR: Status of safety-related instrument air system loads	3.7	78
295021 Loss of Shutdown Cooling / 4									
295023 Refueling Acc / 8						X	G2.2.40 Refueling Accidents - Ability to apply Technical Specifications for a system	4.5	79
295024 High Drywell Pressure / 5									
295025 High Reactor Pressure / 3									
295026 Suppression Pool High Water Temp. / 5						X	G2.2.38 Suppression Pool High Water Temperature - Knowledge of conditions and limitations in the facility license.	4.5	80
295027 High Containment Temperature / 5									
295028 High Drywell Temperature / 5									
295030 Low Suppression Pool Wtr Lvl / 5									
295031 Reactor Low Water Level / 2									
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1									
295038 High Off-site Release Rate / 9						X	G2.4.44 High Off-Site Release Rate - Knowledge of emergency plan protective action recommendations	4.4	81
600000 Plant Fire On Site / 8									
700000 Generator Voltage and Electric Grid Disturbances / 6						X	G2.2.37 Generator Voltage and Electric Grid Disturbances - Ability to determine operability and/or availability of safety related equipment.	4.6	82
K/A Category Totals:					3	4	Group Point Total:		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										
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										
295012 High Drywell Temperature / 5										
295013 High Suppression Pool Temp. / 5										
295014 Inadvertent Reactivity Addition / 1										
295015 Incomplete SCRAM / 1						X	G2.1.45 Ability to identify and interpret diverse indications to validate the response of another indication	4.3	83	
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	84	
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					X		EA2.01 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	3.2	85	
500000 High CTMT Hydrogen Conc. / 5										
K/A Category Point Totals:					2	1	Group Point Total:		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															
205000 Shutdown Cooling															
206000 HPCI															
207000 Isolation (Emergency) Condenser															
209001 LPCS								X				A2.07 Ability to (a) predict the impacts of the following on the LOW 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: Loss of room cooling	2.8	86	
209002 HPCS											X	G2.2.12 Knowledge of surveillance procedures	4.1	87	
211000 SLC															
212000 RPS															
215003 IRM															
215004 Source Range Monitor															
215005 APRM / LPRM															
217000 RCIC								X				A2.15 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: Steam line break.	3.8	88	
218000 ADS															
223002 PCIS/Nuclear Steam Supply Shutoff															
239002 SRVs															
259002 Reactor Water Level Control															
261000 SGTS															
262001 AC Electrical Distribution															
262002 UPS (AC/DC)															
263000 DC Electrical Distribution															
264000 EDGs											X	G2.2.17 EDG's - Knowledge of the process for managing maintenance activities during power operations, such as risk assessments, work prioritization, and coordination with the transmission system operator.	3.8	89	

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System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
201001 CRD Hydraulic														
201002 RMCS														
201003 Control Rod and Drive Mechanism														
201004 RSCS														
201005 RCIS														
201006 RWM														
202001 Recirculation								X				A2.05 Ability to (a) predict the impacts of the following on the RECIRCULATION SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Inadvertent recirculation flow increase	4.0	91
202002 Recirculation Flow Control														
204000 RWCU														
214000 RPIS														
215001 Traversing In-core Probe														
215002 RBM														
216000 Nuclear Boiler Inst.														
219000 RHR/LPCI: Torus/Pool Cooling Mode														
223001 Primary CTMT and Aux.														
226001 RHR/LPCI: CTMT Spray Mode											X	G2.2.40 RHR/LPCI: Containment Spray System Mode - Ability to apply Technical Specifications for a system	4.7	92
230000 RHR/LPCI: Torus/Pool Spray Mode														
233000 Fuel Pool Cooling/Cleanup														
234000 Fuel Handling Equipment					X							K5.02 Knowledge of the operational implications of the following concepts as they apply to FUEL HANDLING EQUIPMENT: Fuel handling equipment interlocks	3.7	93
239001 Main and Reheat Steam														
239003 MSIV Leakage Control														
241000 Reactor/Turbine Pressure Regulator														
245000 Main Turbine Gen. / Aux.														
256000 Reactor Condensate														
259001 Reactor Feedwater														
268000 Radwaste														
271000 Offgas														
272000 Radiation Monitoring														

286000 Fire Protection																			
288000 Plant Ventilation																			
290001 Secondary CTMT																			
290003 Control Room HVAC																			
290002 Reactor Vessel Internals																			
K/A Category Point Totals:						1			1					1				Group Point Total:	3

Facility: Columbia Generating Station			Date of Exam: April, 2015			
Category	K/A #	Topic	RO		SRO-Only	
			IR	Q#	IR	#
1. Conduct of Operations	2.1.29	Knowledge of how to conduct system lineups, such as valves, breakers, switches, etc.			3.8	94
	2.1.35	Knowledge of fuel handling responsibilities of SROs.			3.6	95
	2.1.14					
	2.1.29					
	2.1.44					
	Sub-total					2
2. Equipment Control	2.2.5	Knowledge of the process for making design or operating changes to the facility.			3.2	96
	2.2.25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.			3.4	97
	2.2.1					
	2.2.21					
	2.2.42					
	Sub-total					2
3. Radiation Control	2.3.6	Ability to approve release permits.			3.8	98
	2.3.12	Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc.			3.7	99
	2.3.14					
	2.3.15					
	Sub-total					2
4. Emergency Procedures / Plan	2.4.30	Knowledge of events related to system operation/status that must be reported to internal organizations or external agencies, such as the State, the NRC, or the transmission system operator.			4.1	100
	2.4.1					
	2.4.6					
	Sub-total					1
Tier 3 Point Total						7

Tier / Group	Randomly Selected K/A	Reason for Rejection
2 / 1	205000 A1.04	RO Exam #2 – This K/A's topic is SDC/RHR pump suction pressure. RO exam question # 1 topic is RHR and suction valve; question #3 topic is NPSH for LPCS; question #11 topic is RCIC and suction flowpath. Felt this K/A would over sample the topic of suction valving/NPSH – K/A A1.06 was randomly chosen as replacement.
2 / 1	215004 A4.03	RO Exam #9 – Could not write a question to this K/A as Columbia does not have CRT display for SRMs. K/A A4.01 was randomly chosen as replacement.
2 / 1	261000 K6.04	RO Exam #16 – This K/A is very similar to question written for 223002 K3.11 which is Question #13 on the RO Exam. K/A K6.01 randomly chosen as replacement.
2 / 1	300000 K2.02	RO Exam #25 – This K/A is not applicable to Columbia. 300000 K2.01 randomly chosen as replacement.
2 / 2	259001 K2.01	RO Exam #35 – This K/A is not applicable to Columbia. No other K2 K/A was available. 259001 K1.09 randomly chosen as replacement.
1 / 1	295024 AA2.08	RO Exam #48 – Could not write a question to this K/A topic. K/A EA2.04 randomly chosen as replacement.
1 / 1	295027	RO Exam #51 – 295027 High Containment Temperature is not applicable to Columbia. 295023 – Refueling Accidents chosen as replacement as this topic was only topic in Tier 1 Group 1 not originally chosen.
1 / 2	295008 AK2.01	RO Exam #60 – Could not write a question to this K/A topic as there is no interrelationship between RPV High Level and our RPS system. K/A AK2.09 was randomly chosen as replacement.

Other items noted concerning the RO Exam outline – Question #7 - 212000 K1.06 has a 3.5 IR not a 3.3 IR; Question #42 - 295005 K/A should be AK3.02 not AA3.02; Question #48 - 295024 K/A should be EA2.08 not AA2.08; Question #53 - 295030 K/A should be EA1.03 not AA1.03; Question #57 - 600000 K/A should be AK2.01 not EK2.01; Question #58 - 700000 K/A should be AK3.02 not EK3.02; Question #60 - 295008 - K2 was checked but K/A indicated was AK3.1; Question #64 - 295032 K/A should be EK1.04 not AK1.04

[illegible]

Facility: Columbia Generating Station		Date of Examination: April 2015
Examination Level: RO X SRO		Operating Test Number: 1
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	M, R	Main Turbine change of load rate determination
Conduct of Operations	P, R	Alternate determination of drywell identified leak rate
Equipment Control	D, R	Determine FPC-P-1A clearance order requirements
Radiation Control	N, R	Determine Radiological posting requirements
Emergency Procedures/Plan		
NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when all 5 are required.		
* Type Codes & Criteria: (C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes) (N)ew or (M)odified from bank (≥ 1) (P)revious 2 exams (≤ 1 ; randomly selected)		

Facility: <u>Columbia Generating Station</u>		Date of Examination: <u>April 2015</u>
Examination Level: RO	SRO X	Operating Test Number: <u>1</u>
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	P, D, R	Based on plant conditions and pull sheets supplied, determine early criticality will occur and then determine required procedural actions.
Conduct of Operations	M, R	Based on plant conditions, determine if 'Voluntary Entry into AIA' is allowable.
Equipment Control	M, R	Determination of Operating Point and required action following feedwater heater trip.
Radiation Control	D, R	Estimate Main Condenser air ejector gross gamma activity and determine required actions.
Emergency Procedures/Plan	M, R	Determine correct SAG Flowchart Tab to be entered.
NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when all 5 are required.		
* Type Codes & Criteria: (C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes) (N)ew or (M)odified from bank (≥ 1) (P)revious 2 exams (≤ 1 ; randomly selected)		

Facility: <u>Columbia</u>		Date of Examination: <u>April, 2015</u>
Exam Level: RO <input checked="" type="checkbox"/> SRO-I <input checked="" type="checkbox"/> SRO-U <input checked="" type="checkbox"/>		Operating Test No.: <u>1</u>
Control Room Systems® (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)		
System / JPM Title	Type Code*	Safety Function
<p>S1. Reduce RPV pressure with DEH; BPV fail in Auto – take manual control. (241000A4.02) The task is to lower RPV pressure to 550 psig at 50 psig per minute with DEH in automatic. DEH does not open the bypass valves in auto. The operator then takes manual control of bypass valves to lower RPV pressure.</p> <p>Performed by the RO, SRO-I and SRO-U</p>	N, A, L, S	3
<p>S2. Restore power to RPS-B. (212000A4.14) The task is to restore power and reset RPS-B. The B MG set is found not to be operable and power is then supplied from alternate power source. Additionally, FDR-V-4 will not open during performance of subsequent actions.</p> <p>Performed by the RO, SRO-I and SRO-U</p>	M, A, EN, L, S	7
<p>S3 . Relatch the Main Turbine (245000A4.06) Initial condition has the Main Turbine tripped and coasting down. The task is to relatch the Main Turbine , perform the TV/GV transfer and raise speed to 1800 rpm.</p> <p>Performed by the RO, SRO-I and SRO-U</p>	N, L, S	4
<p>S4. Transfer SL-31 to SL-21 from SM-3 (262001A4.01) During the transfer it is realized that there is too much combined load to make the transfer. When that is corrected and the procedure is continued. When the transfer is made the supply breaker does not auto trip but can be tripped manually.</p> <p>Performed by the RO and SRO-I</p>	M, A, S	6

<p>S5. Start RRC-P-1B at power (202001A4.01) Performs procedure and when RRC-P-1B is started, its speed does not stop increasing. The operator will trip RRC-P-1B per the immediate operator action of ABN-POWER.</p> <p>Performed by the RO and SRO-I</p>	D, A, S	1
<p>S6. Align SSW to the FPC HX (233000A2.08) The task is to align service water to both Fuel Pool Cooling heat exchangers following a complete loss of RCC.</p> <p>Performed by the RO and SRO-I</p>	D, P, S	8
<p>S7. Transfer SM-7 to TR-B (400000A2.01) The task is to transfer SM-7 from SM-1 to TR-B. During the transfer, SL-71 develops an overcurrent lockout which causes a loss of one of the operating RCC pump. Immediate operator actions of ABN-ELEC-SM1/SM7 is taken to start the second RCC pump and place the first RRC pump's control switch to PTL.</p> <p>Performed by the RO</p>	D, P, A, S	9
<p>C1. Emergency Drywell Venting per PPM 5.5.15. (223001A4.07) The task is to vent the Drywell with Standby Gas Treatment train B.</p> <p>Performed by RO and SRO-I</p>	D, C, R, E, EN	5

In-Plant Systems[®] (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)

P1. Start RCIC from the Remote Shutdown Panel. (295016AA2.02)
The task is to start RCIC from the Remote Shutdown Panel with RCIC not initially running.

N, E, R, L

2

Performed by the RO, SRO-I and SRO-U

P2. Reset the HPCS DG mechanical overspeed trip. (264000A4.04)
The task is to reset the mechanical overspeed trip on the HPCS diesel generator.

D, R

6

Performed by the RO and SRO-I

P3. Respond to CR HVAC High Radiation. (288000A2.02) During isolation of the Northwest Remote Air Intake, one of the valves cannot be closed which then requires removal of a fuse to complete isolation the intake path.

D, E, A

9

Performed by the RO, SRO-I and SRO-U

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

* Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3 Actual - 6 / 5 / 3
(C)ontrol room	Actual - 1 / 1 / 0
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4 Actual - 6 / 5 / 1
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1 Actual - 2 / 2 / 2
(EN)gineered safety feature	- / - / ≥ 1 (control room system) Actual - 2 / 2 / 2
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1 Actual - 4 / 4 / 4
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1 Actual - 5 / 5 / 4
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected) Actual - 2 / 2 / 0
(R)CA	≥ 1 / ≥ 1 / ≥ 1 Actual - 3 / 3 / 3
(S)imulator	Actual - 7 / 6 / 3

Facility:		Date of Exam:									Operating Test No.:								
A P P L I C A N T	E V E N T T Y P E	Scenarios												T O T A L	M I N I M U M (*)				
		1			2			3			4								
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION								
		S R O	A T C	B O P	S R O	A T C	B O P	S R O	A T C	B O P	S R O	A T C	B O P						
																	R	I	U
RO <input type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/> U1, U2	RX														0	1	1	0	
	NOR														0	1	1	1	
	I/C							2,4,6				3,4,8			6	4	4	2	
	MAJ							5,8				5			3	2	2	1	
	TS							2,3				3,4			4	0	2	2	
RO <input type="checkbox"/> R1, R4 SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/>	RX											2		1	1	1	0		
	NOR									1				1	1	1	1		
	I/C									3,6,7		4,6		5	4	4	2		
	MAJ									5,8		5		3	2	2	1		
	TS													0	0	2	2		
RO <input type="checkbox"/> R2, R3 SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/>	RX								4					1	1	1	0		
	NOR												1	1	1	1	1		
	I/C								2,4,6				3,6,7	6	4	4	2		
	MAJ								5,8				5	3	2	2	1		
	TS													0	0	2	2		
RO <input type="checkbox"/> SRO-I <input type="checkbox"/> I1, I4 SRO-U <input type="checkbox"/>	RX								4					1	1	1	0		
	NOR						1							1	1	1	1		
	I/C	3,6,9					3		2,4,6					7	4	4	2		
	MAJ	7,8					7,8		5,8					6	2	2	1		
	TS	3,5												2	0	2	2		

Facility:		Date of Exam:									Operating Test No.:									
A P P L I C A N T	E V E N T T Y P E	Scenarios												T O T A L	M I N I M U M (*)					
		1			2			3			4									
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION									
		S R O	A T C	B O P	S R O	A T C	B O P	S R O	A T C	B O P	S R O	A T C	B O P							
																		R	I	U
RO <input type="checkbox"/>	RX		2												1	1	1	0		
SRO-I <input type="checkbox"/>	NOR								1						1	1	1	1		
<input type="checkbox"/> 12, 15	I/C		3		5,3				3,6,7						6	4	4	2		
SRO-U <input type="checkbox"/>	MAJ		7,8		7,8				5,8						6	2	2	1		
	TS				2,3										2	0	2	2		
RO <input type="checkbox"/>	RX					4									1	1	1	0		
SRO-I <input type="checkbox"/>	NOR			1,4											2	1	1	1		
<input type="checkbox"/> 13, 16	I/C			8		2,5,6		2,4,6							7	4	4	2		
SRO-U <input type="checkbox"/>	MAJ			7,8		7,8		5,8							6	2	2	1		
	TS							2,3							2	0	2	2		
RO <input type="checkbox"/>	RX											2			1	1	1	0		
SRO-I <input type="checkbox"/>	NOR			1,4											2	1	1	1		
<input type="checkbox"/> 17, 110	I/C	3,6,9		8								4,6			6	4	4	2		
SRO-U <input type="checkbox"/>	MAJ	7,8		7,8								5			5	2	2	1		
	TS	3,5													2	0	2	2		
RO <input type="checkbox"/>	RX		2												2	1	1	0		
SRO-I <input type="checkbox"/>	NOR											1			1	1	1	1		
<input type="checkbox"/> 18, 111	I/C		3		5,3							3,6,7			6	4	4	2		
SRO-U <input type="checkbox"/>	MAJ		7,8		7,8							5			5	2	2	1		
	TS				2,3										2	0	2	2		

Facility:			Date of Exam:			Operating Test No.:											
A P P L I C A N T	E V E N T T Y P E	Scenarios												T O T A L	M I N I M U M ^(*)		
		1			2			3			4						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		S R O	A T C	B O P	S R O	A T C	B O P	S R O	A T C	B O P	S R O	A T C	B O P				
														R	I	U	
RO <input type="checkbox"/>	RX					4								1	1	1	0
	NOR			1,4										2	1	1	1
SRO-I <input type="checkbox"/>	I/C			8		2,5,6						3,4,8		7	4	4	2
I9, I12	MAJ			7,8		7,8						5		5	2	2	1
SRO-U <input type="checkbox"/>	TS											3,4		2	0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES-D-1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the "at-the-controls (ATC)" and "balance-of-plant (BOP)" positions; Instant SROs must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an Instant SRO additionally serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.
2. Reactivity manipulations may be conducted under normal or controlled abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional instrument or component malfunctions on a 1-for-1 basis.
3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right-hand columns.

Facility: Columbia

NRC Scenario No: 1

Examiners: _____

Operators: _____

Initial conditions: Reactor Power is 90%. Power was reduced due to economic dispatch. TSW-P-1A is scheduled to be tagged out to facilitate planned pump maintenance. Chemistry has been informed of the pump shift and chemical addition to TSW-P-1B has been secured. OPS 4 is standing by for the pump swap. OSP-ELEC-M701, DG-1 monthly surveillance is in progress and completed up to step 7.3.69. SM-1 has been transferred to TR-S. There are twenty minutes left in the run. OPS2 is in DG-1 room.

Turnover: Swap TSW pumps. Raise reactor power with Flow to 95% power. The reactivity brief has been performed. At that time stop the power increase and perform OSP-CRD-M701, Control Rod Exercise of Fully Withdrawn Rods (MODE 1) starting with rod 18-59 and working across from left to right and then from top to bottom until all fully withdrawn control rods have been exercised. After the TSW pump swap, complete OSP-ELEC-M701.

Event No.	Timeline	Event Type*	Event Description
1.	T = 0	N (BOP)	Swap TSW Pumps to TSW-P-1B running.
2.	T = 0	R (ATC)	Raise power with Flow.
3.	T = 10	C (ATC) C (SRO) TS (SRO)	Perform Control Rod Exercise surveillance - OSP-CRD-M701. Second rod is uncoupled.
4.	T = 10	N (BOP)	Complete OSP-ELEC-M701, DG-1 Monthly Operability Test.
5.	T = 25	TS (SRO)	Minimum Seismic Earthquake. RHR-V-16A loses power.
6.	T = 35	C (SRO)	Another Seismic Tremor. CW Pipe Rupture outside Protected Area. MT Back Pressure rise requiring a Reactor scram and MT Trip.
7.	T = 50	M (All)	Operating Basis Earthquake. Loss of Startup Power.

Critical Task is to initiate systems required to restore RPV level back to +13" to +54" level band.

8.	T = 55	M (All)	LOCA. Drywell Floor Rupture.
		C (BOP)	RHR-P-2B breaker fails to auto close.
9.	T = 60	C (SRO)	RHR-B-16B Fails to open results in the inability to spray the Drywell.
10.	T = 70		Emergency Depressurize due to High Drywell Temperature GT 330°F.
Critical Task is to initiate an EMERGENCY DEPRESSURIZATION when drywell Temperature cannot be restored and maintained LT 330°F			

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

Facility: Columbia

NRC Scenario No: 2

Examiners: _____

Operators: _____

Initial conditions: Columbia is operating 100% power. OSP-SGT-M702 is scheduled to be performed. APRM 'A' has a failed power supply and is bypassed.

Turnover: Perform OSP-SGT-M702.

Event No.	Timeline	Event Type*	Event Description
1.	T = 0	N (BOP)	Perform SGT B System Operability surveillance – OSP-SGT-M702.
2.	T = 05	C (ATC) TS (SRO)	APRM Flow Unit "A" fails upscale.
3.	T=15	C (BOP) C (SRO) TS (SRO)	LD-TE-4A fails high causing a RCIC isolation and RCIC turbine trip. RCIC-V-8 does not auto close – is closed manually.
4.	T=25	R (ATC)	RRC-P-1A high vibration. Reduce reactor power with RRC flow.
5.	T = 45	C (ATC) C (SRO)	RRC-P-1A upper and lower seals fail requiring entry into single loop operations. When seals fail a LOCA begins and a manual reactor scram is inserted.
6.	T = 55	C (ATC)	Hydraulic ATWS. Reduced SLC Flow. RWCU-V-4 does not close – close RWCU-V-1 to isolate RWCU. Lower RPV Level -80" to -140".

Critical Task is to inhibit ADS prior to an automatic initiation to prevent an uncontrolled depressurization and significant power excursion.

Critical Task is to terminate and prevent injection into the RPV with the exception of SLC, RCIC, and CRD, to establish a Lowered Level.

7.	T = 50	M (All)	Hydraulic ATWS; Scram/Reset/Scram not effective in inserting control rods; Control rods can be manually driven in.
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Critical Task is to Insert Control Rods.

8.	T = 70	M (All)	Both RFW Pumps trip and cannot be restarted. ATWS Emergency Depressurization required due to Low RPV Water Level.
Critical Task is to initiate an Emergency Depressurization when RPV water level cannot be maintained above -183".			
Critical Task is during an ATWS with an Emergency Depressurization required, stop and prevent injection except from RCIC, SLC and CRD.			
Critical Task is when RPV pressure is below MSCP, slowly inject into the RPV with Table 5 systems to return RPV level to -183" to LL.			

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

Facility: Columbia

NRC Scenario No: 3

Examiners: _____

Operators: _____

Initial Conditions: This is a Division 3 work week. OSP-ELEC-M703, DG-3 Monthly Surveillance, is in progress. OPS 2 is standing by in the HPCS DG room. DG-3 is running and SM-2 is being powered from TR-S per OPS-ELEC-M703. PDIS signal X108 (DG3 voltage) is not available.

Turnover Information: Continue with DG-3 monthly surveillance which has been completed through step 7.3.31.

Event No.	Time	Position	Applicants Actions or Behavior
1.	T = 0	N (BOP)	Synchronize and load DG-3 per monthly surveillance OSP-ELEC-M703.
2.	T = 05	C (ATC) C (SRO) TS (SRO)	Control Rod 06-43 Drifts In. SRO – Tech Spec.
3.	T = 15	C (BOP) TS (SRO)	Failure of HPCS-P-2 requiring manual trip of DG-3. SRO - Tech Spec.
4.	T = 25	R (ATC) C (SRO)	High Level Trip of FWH-6B requiring reducing core flow to LE 92 Mlbm/hr. Rod Line GT 100% requiring using Fast Shutdown Sequence to insert control rods to lower rod line.
5.	T = 45	M (All)	DEH Leak - eventually requires a manual scram be inserted.
Critical Task is to initiate a Manual Reactor Scram when the DEH Low Low Reservoir Level alarm annunciates within 15 minutes of the Low Reservoir level annunciator.			
6.	T = 55	C (BOP) C (SRO)	TR-S Lockout; MSIVs close, Initiate RCIC/CRD for level control.
7.	T = 60	C (BOP)	DG-1 and DG-2 Fails to Auto Start.

8.	T = 65	M (All)	LOCA - Spray wetwell and drywell.
9.	T = 70		RPV level drops to TAF. Initiate Emergency Depressurization on low RPV Level and return level to normal with low pressure ECCS pumps.
Critical Task is to initiate Drywell Sprays when Wetwell Pressure exceeds 12 psig, prior to exceeding PSP and after verifying DSIL and RHR not required for adequate core cooling.			

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

Facility: Columbia

NRC Scenario No: 4

Examiners: _____

Operators: _____

Initial conditions: Reactor Power is 90%. Power was reduced due to CW-P-1B not being available. The work on CW-P-1B has been completed. OPS4 is standing by in the CWPH for a start of CW-P-1B

Turnover: Start CW-P-1B. After the pump start, raise reactor power with flow to 100%. The reactivity brief has been performed.

Event No.	Timeline	Event Type*	Event Description
1.	T = 0	N (BOP)	Start CW-P-1B.
2.	T = 5	R (ATC)	Raise power with Flow.
3.	T = 10	C (BOP) C(SRO) TS (SRO)	RHR-RLY-K112C Fails and RHR-V-42C opens.
4.	T = 20	I (ATC) I (SRO) TS (SRO)	Scram Discharge Volume level instrument fails – Half Scram. 2 Control Rods Scram but one does not go full in.
5.	T = 35	M (All)	Main Steam Tunnel steam leak – Insert a manual reactor scram. One Main steam line does not isolate.
6.	T = 40	I (BOP)	Electric ATWS – B RPS side – Pull fuses to insert control rods. SLC fails to initiate.
Critical task is to insert control rods.			
7.	T = 60	C (BOP)	CB-S1 Fails to auto close – closed manually – repower SL-11.
8.	T = 70		Main Steam Tunnel steam leak gets larger and spreads to another area.
9.	T = 70		Emergency Depressurize when 2 Areas GT Max Safe Temperatures.

Critical task is to initiate an EMERGENCY DEPRESSURIZATION when 2 Areas have exceeded their Max Safe Operating Temperatures.

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

*

Facility: Columbia

NRC Scenario No: 5

Examiners: _____

Operators: _____

Initial conditions: Reactor Power is 60%. RFW-P-1A was removed from service for required maintenance and is ready to be placed back on line. SOP-RFT-START is in progress.

Turnover: The following evolutions are to be completed concurrently: Place RFW-P-1A in service. SOP-RFT-START has been completed up through step 5.9.14 and Dittmer has requested that CB-4888 be opened to facilitate switchyard maintenance. Open CB-4888. After RFW-P-1A has been placed in service, raise reactor power to 70% using Reactor Recirculation Pumps. The reactivity brief has been completed.

Event No.	Timeline	Event Type*	Event Description
1.	T = 0	C (BOP)	CRD flow controller fails
2.	T = 5	N (BOP)	Open CB-4888
3.	T = 5	N (ATC)	Place second RFW Pump in service
4.	T = 30	R (ATC)	Raise power with flow to 70% reactor power
5.	T = 50	I (BOP) TS (SRO)	HPCS Spurious Injection
6.	T = 65	TS (SRO)	ARM-RIS-3 fails downscale
7.	T = 80	M (All)	MSR Drain Tank Controller Fails – Requires manual scram. MT trip.
8.	T = 85	C (BOP)	MG Fail to trip
9.	T = 90	M (ALL)	LOCA
10.	T = 95	C (BOP)	Initiate containment sprays - Wetwell Spray Valve RHR-V27A or RHR-V-27B fails to open. (First loop selected for wetwell spray.)

Critical Task is to spray the Drywell when Wetwell pressure reaches 12 psig.

Critical Task is to secure Drywell sprays prior to Drywell pressure reaching zero psig.

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

Columbia Generating Station April, 2015

Scenario Recapitulation: Scenario Set No: 1 Scenario No: 1

	<u>Req'd</u>	<u>Actual</u>	<u>Description</u>
Total Malfunctions	5-8	8	Control rod uncoupled; RHR-V-16A; CW Pipe rupture; Startup power loss; LOCA; RHR-P-2B Breaker; RHR-V-16B; Drywell floor rupture
Malfs after EOP entry	1-2	3	RHR-P-2B Breaker; RHR-V-16B; Drywell floor rupture
Abnormal Events	2-4	2	Earthquake; CW Pipe Rupture
Major transients	1-2	2	OBE, Loss of Startup Power; LOCA
EOPs entered	1-2	2	RPV Control, Primary Containment Control
EOP contingencies	0-2	1	Emergency RPV Depressurization
Critical tasks	2-3	2	ED at DW/T of 330°F; Initiate systems to maintain RPV/L

Scenario Recapitulation: Scenario Set No: 1 Scenario No: 2

	<u>Req'd</u>	<u>Actual</u>	<u>Description</u>
Total Malfunctions	5-8	8	APRM Flow Unit; LD-TE-4A; RRC-P-1A Seals Fail; LOCA; Hydraulic ATWS; Reduce SLC; RWCU-V-4; RFP's Trip
Malfs after EOP entry	1-2	2	Reduce SLC; RFP's Trip
Abnormal Events	2-4	3	RCIC Isolation; Loss of RRC-Pump; RRC Seal Failure
Major transients	1-2	2	Hydraulic ATWS; Loss of Feedwater
EOPs entered	1-2	1	RPV Control – ATWS
EOP contingencies	0-2	1	Emergency RPV Depressurization - ATWS
Critical tasks	2-3	6	Inhibit ADS; Terminate and prevent injection to establish an LL; Insert Control Rods; ED when RPV level cannot be maintained GT -183"; Terminate and Prevent during ED; Maintain RPV level when LT MSCP

Scenario Recapitulation: Scenario Set No: 1 Scenario No: 3

	<u>Req'd</u>	<u>Actual</u>	<u>Description</u>
Total Malfunctions	5-8	7	Control Rod drift; HPCS-P-2; FWH-6B Trip; DEH Leak; TR-S Lockout; DG-1/DG-2; LOCA
Malfs after EOP entry	1-2	3	TR-S Lockout; DG-1/DG-2; LOCA
Abnormal Events	2-4	4	Control rod drift; HPCS SW Loss; FWH Loss; DEH leak
Major transients	1-2	2	TR-S Lockout; LOCA
EOPs entered	1-2	2	RPV Control; Primary Containment Control
EOP contingencies	0-2	1	Emergency RPV Depressurization
Critical tasks	2-3	3	Spray Drywell; ED at TAF; Restore RPV water level.

Scenario Recapitulation: Scenario Set No: 2 Scenario No: 4

	<u>Req'd</u>	<u>Actual</u>	<u>Description</u>
Total Malfunctions	5-8	8	RHR-RLY-K112C; SDV Level Switch; 2 Rods Scram; MS Tunnel Steam Leak; MSIV Fail to isolate; Electric ATWS; SLC Failure; CB-S1
Malfs after EOP entry	1-2	3	CB-S1; MS Tunnel Steam Leak expands; MSIV Fail to isolate
Abnormal Events	2-4	2	Control rods scram; Steam Leak
Major transients	1-2	2	Steam Leak; Electric ATWS
EOPs entered	1-2	2	RPV Control – ATWS; Secondary Containment Control
EOP contingencies	0-2	1	Emergency RPV Depressurization
Critical tasks	2-3	2	Insert Control Rods; Initiate ED when 2 areas are GT Max Safe

Scenario Recapitulation: Scenario Set No: 2 Scenario No: 5

	<u>Req'd</u>	<u>Actual</u>	<u>Description</u>
Total Malfunctions	5-8	7	CRD Flow Controller; HPCS Initiation; ARM-RIS-3; MSR Drain Tank Controller; MG Fails to trip; LOCA; RHR-V-27A/B
Malfs after EOP entry	1-2	2	LOCA; RHR-V-27A/B
Abnormal Events	2-4	2	CRD Controller; HPCS Initiation
Major transients	1-2	2	MSR Drain Tank controller failure; LOCA
EOPs entered	1-2	2	RPV Control; Primary Containment Control
EOP contingencies	0-2	0	
Critical tasks	2-3	2	Spray the Drywell; Secure Sprays