Facility: COLUMBIA Date of Exam: April 22, 2011

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 & Abnormal Plant Evolutions	1	3	3	4	N/A			2	5	N/A		3	20	5	2	7
	2	0	2	1				2	1			1	7	1	2	3
	Tier Totals	3	5	5				4	6			4	27	6	4	10
2. Plant Systems	1	3	2	1	3	4	2	2	3	2	2	2	26	3	2	5
	2	2	0	1	1	1	1	0	1	3	1	1	12	0 / 3	0	3
	Tier Totals	5	2	2	4	5	3	2	4	5	3	3	38	6	2	8
3. Generic Knowledge and Abilities Categories		1			2			3			4		10	1	2	3	4	7
		2			3			2			3			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 Form ES-401-1

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO)

Q#	E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
1	295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4	02						Knowledge of the operational implications of the following concepts as they apply to partial or complete loss of forced core flow circulation: Power/Flow distribution	3.3	1
2	295003 Partial or Complete Loss of AC / 6					05		Ability to determine and/or interpret the following as they apply to partial or complete loss of AC power: Whether a partial or complete loss of AC power has occurred	3.9	1
3	295004 Partial or Total Loss of DC Pwr / 6			03				Knowledge of the reason for the following responses as they apply to partial or complete loss of DC power: Reactor SCRAM	3.1	1
4	295005 Main Turbine Generator Trip / 3				01			Ability to operate and/or monitor the following as they apply to Main Turbine Generator Trip: Recirculation System	3.1	1
5	295006 SCRAM / 1		02					Knowledge of the interrelationship between scram and the following: Reactor Water Level Control System	3.8	1
6	295016 Control Room Abandonment / 7						01.13	Control Room Abandonment; Knowledge of facility requirements for controlling vital/controlled access	2.5	1
7	295018 Partial or Total Loss of CCW / 8	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	1
8	295019 Partial or Total Loss of Inst. Air / 8		01					Knowledge of the interrelations between partial or complete loss of instrument air and the following: CRD hydraulics	3.8	1
9	295021 Loss of Shutdown Cooling / 4			01				Knowledge of the reason for the following responses as they apply to loss of shutdown cooling: Raising RPV water level	3.3	1
10	295023 Refueling Acc / 8					02		Ability to determine and/or interpret the following as they apply to refueling accidents: Fuel Pool Level	3.4	1
11	295024 High Drywell Pressure / 5						01.28	High Drywell Pressure - Knowledge of the purpose and function of major system components and controls	4.1	1
12	295025 High Reactor Pressure / 3			06				Knowledge of the reason for the following responses as they apply to High Reactor Pressure: Alternate rod insertion	4.2	1
13	295026 Suppression Pool High Water Temp. / 5					02		Ability to determine and/or interpret the following as they apply to Suppression Pool high water temperature: Suppression Pool level	3.8	1
	295027 High Containment Temperature / 5									0
14	295028 High Drywell Temperature / 5	02						Knowledge of the operational implications of the following as they apply to high drywell temperature: Equipment environmental qualification	2.9	1
15	295030 Low Suppression Pool Wtr Lvl / 5				02			Ability to operate and/or monitor the following as they apply to Low Suppression Pool water level: RCIC	3.4	1
16	295031 Reactor Low Water Level / 2		08					Knowledge of the interrelationship between Reactor Low Water Level and the following: Automatic Depressurization System	4.2	1
17	295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1			03				Knowledge of the reasons for the following as they apply to SCRAM condition present and reactor power above APRM downscale or unknown: Lowering reactor water level	4.1	1
18	295038 High Off-site Release Rate / 9						03.11	High Off-site Release Rate: Ability to control radiation releases	3.8	1
19	600000 Plant Fire On Site / 8					03		Ability to determine and interpret the following as they apply to Plant Fire on site: Fire Alarm	2.8	1
20	700000 Generator Voltage and Electric Grid Disturbances / 6					08		Ability to determine and/or interpret the following as they apply to Generator Voltage and Electric Grid disturbances: Criteria to trip the turbine or reactor	4.3	1
	K/A Category Totals:	3	3	4	2	5	3	Group Point Total:		20

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Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO)

Q#	E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
	295002 Loss of Main Condenser Vac / 3									0
	295007 High Reactor Pressure / 3									0
	295008 High Reactor Water Level / 2									0
21	295009 Low Reactor Water Level / 2		04					Knowledge of the interrelations between Low Reactor Water level and the following: Reactor Water Cleanup	2.6	1
	295010 High Drywell Pressure / 5									0
	295011 High Containment Temp / 5									0
22	295012 High Drywell Temperature / 5				02			Ability to operate and/or monitor the following as they apply to High Drywell Temperature: Drywell cooling system	3.8	1
25	295013 High Suppression Pool Temp. / 5						04.14	High Suppression Pool Temperature; Knowledge of general guidelines for EOP usage	3.8	1
	295014 Inadvertent Reactivity Addition / 1									0
	295015 Incomplete SCRAM / 1									0
27	295017 High Off-site Release Rate / 9			03				Knowledge of the reason for the following responses as they apply to high off-site release rate: Implementation of site emergency plan	3.3	1
	295020 Inadvertent Cont. Isolation / 5 & 7									0
24	295022 Loss of CRD Pumps / 1		04					Knowledge of the interrelations between loss of CRD pumps and the following: Reactor Water Level	2.5	1
	295029 High Suppression Pool Wtr Lvl / 5									0
	295032 High Secondary Containment Area Temperature / 5									0
	295033 High Secondary Containment Area Radiation Levels / 9									0
	295034 Secondary Containment Ventilation High Radiation / 9									0
23	295035 Secondary Containment High Differential Pressure / 5				01			Ability to operate and/or monitor the following as they apply to Secondary Containment High Differential Pressure: Secondary Containment ventilation system	3.6	1
26	295036 Secondary Containment High Sump/Area Water Level / 5					03		Ability to determine and/or interpret the following as they apply to secondary containment high sump/area water level: Cause of the high water level	3.4	1
	500000 High CTMT Hydrogen Conc. / 5									0
	K/A Category Totals:	0	2	1	2	1	1	Group Point Total:		7

ES-401 BWR Examination Outline Form ES-401-1

Plant Systems - Tier 2/Group 1 (RO)

Q#	System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
28	203000 RHR/LPCI: Injection Mode								1 7				Ability to predict the impacts of the following on the RHR/LPCI: Injection mode; and based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Keep Fill system failure	3.3	1
29	205000 Shutdown Cooling				0 1								Knowledge of Shutdown Cooling design feature(s) and/or interlocks which provide for the following: High temperature isolation	3.4	1
	206000 HPCI												N/A at Columbia		0
	207000 Isolation (Emergency) Condenser												N/A at Columbia		0
30	209001 LPCS		0 3										Knowledge of the electrical power supply to the following: Initiation Logic	2.9	1
31	209002 HPCS					0 2							Knowledge of the operational implications of the following concepts as they apply to HPCS: Heat removal (transfer) mechanism	2.6	1
32	211000 SLC							0 6					Ability to predict and/or monitor changes in parameters associated with operating the Standby Liquid Control system controls including: flow indication	3.8	1
33	212000 RPS				1 2								Knowledge of Reactor Protection System design feature(s) and/or interlocks which provide for the following: Bypassing of selected SCRAM signals (manually and automatically)	3.9	1
34	215003 IRM	0 7											Knowledge of the physical connections and/or cause-effect relationship between Intermediate Range Monitor System and the following: Reactor vessel	3.0	1
35	215004 Source Range Monitor											01 37	Source Range Monitor System 2.1.37 Knowledge of procedures, guidelines, or limitations associated with reactivity management	4.3	1
36	215005 APRM / LPRM						0 7						Knowledge of the effect that a loss or malfunction of the following will have on the Average Power Range Monitor System, Local Power Range Monitor System: Flow converter/comparator network	3.2	1
37	217000 RCIC									0 4			Ability to manually operate and/or monitor in the control room: Manually initiated controls	3.6	1
38	218000 ADS						0 5						Knowledge of the effect that a loss or malfunction of the following will have on the Automatically Depressurization System: A.C. Power	3.0	1
39	223002 PCIS/Nuclear Steam Supply Shutoff							0 2					Ability to predict and/or monitor changes in parameters associated with operating the Primary Containment Isolation System/Nuclear Steam Supply Shut-Off controls including: Valve Closures	3.7	1
40	239002 SRVs					0 4							Knowledge of the operational implications of the following concepts as they apply to Relief/Safety Valves: Tail pipe temperature monitoring	3.3	1
41	259002 Reactor Water Level Control			0 7									Knowledge of the effect that a loss or malfunction of the Reactor Water Level Control System will have on the following: Reactor Water Level indication	3.4	1
42	261000 SGTS									0 3			Ability to monitor automatic operation of the Standby Gas Treatment System including: valve operation	3.0	1
43	262001 AC Electrical Distribution										0 2		Ability to operate and/or monitor in the control room: Synchroscope, including understanding of running and incoming voltages	3.4	1
44	262002 UPS (AC/DC)	1 6											Knowledge of the physical connections and/or cause-effect relationship between Uninterruptable Power Supply (AC/DC) and the following: MSIVs	3.1	1
45	263000 DC Electrical Distribution					0 1							Knowledge of the operational implications of the following as they apply to DC Electrical Distribution: Hydrogen generation during battery charging	2.6	1
46	264000 EDGs									0 5			Ability to monitor automatic operation of the Emergency Generators including: Load shedding and sequencing	3.4	1
47	300000 Instrument Air		0 1										Knowledge of the electrical power supply to the following: Instrument Air Compressor	2.8	1
48	400000 Component Cooling Water				0 1								Knowledge of the CCWS design feature(s) and or interlocks which provide for the following: Automatic start of standby pump	3.4	1
49	218000 ADS					0 1							Knowledge of the operational implications of the following concepts as they apply to Automatic Depressurization System: ADS logic operation	3.8	1
50	209002 HPCS											02 44	Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions	4.2	1
51	212000 RPS								2 0				Ability to (a) predict the impacts of the following on the Reactor Protection System; and based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions: Full system activation	4.1	1
52	215003 IRM								0 6				06Ability to (a) predict the impacts of the following on the Intermediate Range Monitor (IRM) System; and 9 (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Faulty range switch	3.0	1
53	263000 DC Electrical Distribution	0 2											Knowledge of the physical connections and/or cause-effect relationship between DC Electrical Distribution and the following: Battery charger and battery	3.2	1
	K/A Category Totals:	3	2	1	3	4	2	2	3	2	2	2	Group Point Total:		26

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Plant Systems - Tier 2/Group 2 (RO)

Q#	System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
	201001 CRD Hydraulic														0
59	201002 RMCS										01		Ability to manually operate and/or monitor in the control room: Rod movement control switch	3.5	1
58	201003 Control Rod and Drive Mechanism				04								Knowledge of Control Rod Drive Mechanism design feature(s) and/or interlocks which provide for the following: The use of either accumulator or reactor water to scram the control rod	3.6	1
	201004 RSCS														0
	201005 RCIS														0
	201006 RWM														0
54	202001 Recirculation									07			Ability to monitor automatic operation of the Recirculation System including: Pump trips	3.3	1
	202002 Recirculation Flow Control														0
65	204000 RWCU						01						Knowledge of the effect that a loss of the following will have on the Reactor Water Cleanup System: Component cooling water systems	3.1	1
	214000 RPIS														0
	215001 Traversing In-core Probe														0
55	215002 RBM											01 27	Rod Block Monitor System: Knowledge of the system purpose and/or function	3.9	1
64	216000 Nuclear Boiler Inst.									01			Ability to monitor automatic operation of the Nuclear Boiler Instrumentation system including: Relationship between meter/recorder readings and actual parameter values	3.4	1
	219000 RHR/LPCI: Torus/Pool Cooling Mode														0
	223001 Primary CTMT and Aux.														0
57	226001 RHR/LPCI: CTMT Spray Mode	12											Knowledge of the physical connections and/or cause-effect relationships between RHR/LPCI: Containment Spray System Mode and the following: Suppression pool (spray penetration)	3.0	1
	230000 RHR/LPCI: Torus/Pool Spray Mode														0
60	233000 Fuel Pool Cooling/Cleanup	14											Knowledge of the physical connections and/or cause-effect relationships between Fuel Pool Cooling and Clean-up and the following: Reactor Building ventilation	2.5	1
	234000 Fuel Handling Equipment														0
	239001 Main and Reheat Steam														0
	239003 MSIV Leakage Control														0
56	241000 Reactor/Turbine Pressure Regulator			02									Knowledge of the effect that a loss of the Reactor/Turbine Pressure Regulating System will have on the following: Reactor Pressure	4.2	1
	245000 Main Turbine Gen. / Aux.														0
	256000 Reactor Condensate														0
	259001 Reactor Feedwater														0
	268000 Radwaste														0
62	271000 Offgas								09				Ability to (a) predict the impacts of the following on the Offgas System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Valve closures	2.6	1
	272000 Radiation Monitoring														0
	286000 Fire Protection														0
	288000 Plant Ventilation														0
61	290001 Secondary CTMT									02			Ability to monitor automatic operation of the Secondary Containment including: Normal building differential pressure	3.5	1
63	290003 Control Room HVAC					03							Knowledge of the operational implications of the following as they apply to Control Room HVAC: Temperature control	2.6	1
	290002 Reactor Vessel Internals														0
															0
	K/A Category Totals:	2	0	1	1	1	1	0	1	3	1	1	Group Point Total:		12

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Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (SRO)

Q#	E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
15	295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4						01. 32	Ability to explain and apply system limits and precautions.	4.0	1
	295003 Partial or Complete Loss of AC / 6					0 2		Reactor power, pressure, and level	4.3	1
	295004 Partial or Total Loss of DC Pwr / 6									0
	295005 Main Turbine Generator Trip / 3									0
	295006 SCRAM / 1									0
	295016 Control Room Abandonment / 7									0
	295018 Partial or Total Loss of CCW / 8									0
	295019 Partial or Total Loss of Inst. Air / 8									0
	295021 Loss of Shutdown Cooling / 4									0
24	295023 Refueling Acc / 8					0 5		Entry conditions of emergency plan	4.6	1
	295024 High Drywell Pressure / 5									0
	295025 High Reactor Pressure / 3									0
13	295026 Suppression Pool High Water Temp. / 5						02. 38	Knowledge of conditions and limitations in the facility license.	4.5	1
	295027 High Containment Temperature / 5									0
	295028 High Drywell Temperature / 5									0
	295030 Low Suppression Pool Wtr Lvl / 5									0
	295031 Reactor Low Water Level / 2									0
1	295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1					0 4		Suppression pool temperature	4.1	1
	295038 High Off-site Release Rate / 9									0
14	600000 Plant Fire On Site / 8					0 3		Fire alarm	3.2	1
7	700000 Generator Voltage and Electric Grid Disturbances / 6					0 5		Operational status of offsite circuit	3.8	1
	K/A Category Totals:	0	0	0	0	5	2	Group Point Total:		7

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Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (SRO)

Q#	E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
8	295002 Loss of Main Condenser Vac / 3						04. 11	Knowledge of abnormal condition procedures.	4.2	1
	295007 High Reactor Pressure / 3									0
	295008 High Reactor Water Level / 2									0
	295009 Low Reactor Water Level / 2									0
	295010 High Drywell Pressure / 5									0
	295011 High Containment Temp / 5									0
	295012 High Drywell Temperature / 5									0
3	295013 High Suppression Pool Temp. / 5						01. 25	Ability to interpret reference materials, such as graphs, curves, tables, etc.	4.2	1
	295014 Inadvertent Reactivity Addition / 1									0
	295015 Incomplete SCRAM / 1									0
	295017 High Off-site Release Rate / 9									0
	295020 Inadvertent Cont. Isolation / 5 & 7									0
6	295022 Loss of CRD Pumps / 1					0 2		CRD system status	3.4	1
	295029 High Suppression Pool Wtr Lvl / 5									0
	295032 High Secondary Containment Area Temperature / 5									0
	295033 High Secondary Containment Area Radiation Levels / 9									0
	295034 Secondary Containment Ventilation High Radiation / 9									0
	295035 Secondary Containment High Differential Pressure / 5									0
	295036 Secondary Containment High Sump/Area Water Level / 5									0
	500000 High CTMT Hydrogen Conc. / 5									0
	K/A Category Totals:	0	0	0	0	1	2	Group Point Total:		3

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Plant Systems - Tier 2/Group 1 (SRO)

Q#	System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	IR	#
	203000 RHR/LPCI: Injection														0
	205000 Shutdown Cooling Mode														0
	206000 HPCI														0
	207000 Isolation (Emergency) Condenser														0
	209001 LPCS														0
	209002 HPCS														0
	211000 SLC														0
	212000 RPS														0
	215003 IRM														0
	215004 Source Range Monitor														0
	215005 APRM / LPRM														0
	217000 RCIC														0
10	218000 ADS											02.36	Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations.	4.2	1
	223002 PCIS/Nuclear Steam Supply Shutoff														0
	239002 SRVs														0
4	259002 Reactor Water Level Control								05				Loss of applicable plant air systems	3.4	1
19	261000 SGTS											04.18	Knowledge of the specific bases for EOPs.	4.0	1
	262001 AC Electrical Distribution														0
	262002 UPS (AC/DC)														0
	263000 DC Electrical Distribution														0
23	264000 EDGs								05				Synchronization of the emergency generator with other electrical supplies	3.6	1
	300000 Instrument Air														0
22	400000 Component Cooling Water								01				Loss of CCW pump	3.4	1
															0
	K/A Category Totals:	0	0	0	0	0	0	0	3	0	0	2	Group Point Total:		5

ES-401 BWR Examination Outline Form ES-401-1

Plant Systems - Tier 2/Group 2 (SRO)

Q#	System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
	201001 CRD Hydraulic														0
	201002 RMCS														0
	201003 Control Rod and Drive Mechanism														0
	201004 RSCS														0
	201005 RCIS														0
	201006 RWM														0
	202001 Recirculation														0
16	202002 Recirculation Flow Control								0 2				Loss of A.C.	3.0	1
	204000 RWCU														0
	214000 RPIS														0
	215001 Traversing In-core Probe														0
	215002 RBM														0
	216000 Nuclear Boiler Inst.														0
	219000 RHR/LPCI: Torus/Pool Cooling Mode														0
12	223001 Primary CTMT and Aux.								1 1				Abnormal suppression pool level	3.8	1
	226001 RHR/LPCI: CTMT Spray Mode														0
	230000 RHR/LPCI: Torus/Pool Spray Mode														0
	233000 Fuel Pool Cooling/Cleanup														0
	234000 Fuel Handling Equipment														0
	239001 Main and Reheat Steam														0
	239003 MSIV Leakage Control														0
	241000 Reactor/Turbine Pressure Regulator														0
	245000 Main Turbine Gen. / Aux.														0
	256000 Reactor Condensate														0
	259001 Reactor Feedwater														0
	268000 Radwaste														0
	271000 Offgas														0
	272000 Radiation Monitoring														0
	286000 Fire Protection														0
	288000 Plant Ventilation														0
	290001 Secondary CTMT														0
2	290003 Control Room HVAC								0 2				Extreme environmental conditions	3.4	1
	290002 Reactor Vessel Internals														0
															0
	K/A Category Totals:	0	0	0	0	0	0	0	3	0	0	0	Group Point Total:		3

Facility Name:Columbia Date of Exam:April 2011

Q#	Category	K/A #	Topic	RO IR	RO #	SRO-Only IR	SRO-Only #
66	1. Conduct of Operations	2.1. 07	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.	4.4	1		
67		2.1. 17	Ability to make accurate, clear, and concise verbal reports.	3.9	1		
		2.1.					
		2.1.					
		2.1.					
		2.1.					
		Subtotal			2		0
68	2. Equipment Control	2.2. 22	Knowledge of limiting conditions for operations and safety limits.	4.0	1		
73		2.2. 14	Knowledge of the process for controlling equipment configuration or status.	3.9	1		
74		2.2. 12	Knowledge of surveillance procedures.	3.7	1		
		2.2.					
		2.2.					
		2.2.					
		Subtotal			3		0
69	3. Radiation Control	2.3. 07	Ability to comply with radiation work permit requirements during normal or abnormal conditions.	3.5	1		
70		2.3. 14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.	3.4	1		
		2.3.					
		2.3.					
		2.3.					
		2.3.					
		Subtotal			2		0
71	4. Emergency Procedures / Plan	2.4. 39	Knowledge of RO responsibilities in emergency plan implementation.	3.9	1		
72		2.4. 27	Knowledge of "fire in the plant" procedures.	3.4	1		
75		2.4. 18	Knowledge of the specific bases for EOPs.	3.3	1		
		2.4.	TRUE				
		2.4.					
		2.4.					
		Subtotal			3		0
Tier 3 Point Total					10		0

Facility Name: Date of Exam:

Q#	Category	K/A #	Topic	RO IR	RO #	SRO-Only IR	SRO-Only #
5	1. Conduct of Operations	2.1. 36	Knowledge of procedures and limitations involved in core alterations.			4.1	1
9		2.1. 07	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.			4.7	1
		2.1.					
		2.1.					
		2.1.					
		2.1.					
		Subtotal			0		2
17	2. Equipment Control	2.2. 43	Knowledge of the process used to track inoperable alarms.			3.3	1
25		2.2. 06	Knowledge of the process for making changes to procedures.			3.6	1
		2.2.					
		2.2.					
		2.2.					
		2.2.					
		Subtotal			0		2
18	3. Radiation Control	2.3. 06	Ability to approve release permits.			3.8	1
21		2.3. 04	Knowledge of radiation exposure limits under normal or emergency conditions.			3.7	1
		2.3.					
		2.3.					
		2.3.					
		2.3.					
		Subtotal			0		2
11	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	1
		2.4.					
		2.4.					
		2.4.					
		2.4.					
		2.4.					
		Subtotal			0		1
Tier 3 Point Total					0		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	295025EK3.05	RCIC and High Reactor Pressure - Could not write a discerning question; Selected EK3.06 instead
2/1	218000K3.02	ADS - Could not write a discerning question; Selected K6.05 instead
2/2	226001K1.07	The K/A for RO of 2.4 (SRO K/A is 2.5); Selected K1.12 instead
3/1	2.1.44	Cannot write an SRO Only question concerning RO Duties; Selected K/A 2.1.36 instead
3/1	2.2.35	Cannot write a generic SRO Only question; Selected K/A 2.2.43 instead

Facility: **Columbia Generating Station** Date of Examination: **April 2011**

Examination Level: RO X SRO ☐ Operating Test Number: **1**

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	N, R	Alternate Determination of Drywell Identified Leakage per SOP-EDR-OPS Section 5.7 – Candidate is given parameters associated with EDR-P-5 and asked to determine the calculated identified Drywell leak rate
Conduct of Operations	D, R	The RO is given a turnover sheet that states a RX S/U is in progress and then parameters that indicate the reactor is critical. He has to realize the Reactor is Critical or will be critical prior to the ECP and take actions per PPM 3.1.2 which states to: stop control rod withdrawal and notify the CRS. The candidate will fill out an attachment indicating what his next action will be and the basis for that action.
Equipment Control	M, R	The RO is given a section of OSP-INST-H101 that has 4 reading that are incorrect. Candidate is told to perform a peer check and red circle any errors found.
Radiation Control	P, R	The RO Candidate is given data for his personal dose and told he is to perform work that is in a High Radiation Area. The candidate has to calculate his maximum stay time
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: **Columbia Generating Station**		Date of Examination: **April 2011**
Examination Level: RO SRO **X**		Operating Test Number: **1**
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	D, R	The SRO candidate is given a turnover sheet that states a RX S/U is in progress and then parameters that indicate the reactor is critical. He is cued to determine his next action. To successfully complete the JPM he has to realize the Reactor is Critical prior to the ECP and take actions per PPM 3.1.2 which states to: stop control rod withdrawal, the CRS should direct the CRO to drive control rods in the reverse order until all rods are fully inserted.
Conduct of Operations	M, R	The SRO candidate is told that I & C has determined that one required CST Level Monitoring channel is not operational. Due to the LAN Operations Log System being out of service the SRO is directed to manually complete an INOP EQUIP/LCO/RFO STATUS SHEET and make the Log entry using PPM 1.3.1 Attachments 6.4 & 6.5.
Equipment Control	P, R	The SRO candidate is given a request to allow or disallow a move of a heavy load over the Spent Fuel Pool and a copy of PPM 1.3.40 and LCS 1.9.2. PPM 1.3.40 attachment 7.5 should be referenced which has 3 requirements to satisfy. Requirement #3 will not be satisfied and the move should not be allowed.
Radiation Control	N, R	The SRO Candidate is given parameters associated with Circ Water blowdown and is asked to approve or not approve the release permit. He is required to determine if the instrumentation necessary for blowdown is available. The primary and approved alternate flow instrumentation is NOT available and the blowdown will not be approved.
Emergency Procedures/Plan	N, R	The SRO candidate is given plant data and directed to perform a QEDPS and determine the EAL. The SRO will use the electronic QEDPS program to calculate the offsite release. The calculations will show that the CDE Thyroid dose at 1.2 miles is GT the General Emergency level and a GE will be declared per 5.1.G.2.

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: COLUMBIA GENERATING STATION Date of Examination: April 2011

Exam Level: RO X SRO-I X SRO-U X Operating Test No.: 1

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
a. LPCS-P-2 Fails, Start LPCS-P-1, SW-V-12A Fails to Auto Open (LO001722) (IC 171)	N, A, S	8 R, SRO/I, SRO-U
b. Manually Initiate Containment Isolations (TIP Fails to Isolate) (LO001599) (IC 171)	D, A, S, L, EN	5 R, SRO/I, SRO-U
c. SRV Fails open does not close requiring a scram (ATWS occurs to aid in performance of other JPM but is not part of this JPM. This JPM is ended when MODE switch goes to shutdown. (LO001717) (IC 172)	M, A, S	3 R, SRO/I
d. ATWS – Install RPS Jumpers per PPM 5.5.11 (LO001685) (IC 172)	P, D, S	7 R, SRO/I
e. Rx Building Ventillation Trouble – Start SGT (LO001602) (IC 173)	M, A, S	9 R, SRO/I
f. Slow close the MSIVs (LR001792) (IC 173)	D, L, S	4 R, SRO/I
g. Start ASD Channel 1A2 – Uncontrolled rise in RRC/P speed (LO001718) (IC 174)	M, S, A	1 R, SRO/I
h. Transfer SM-7 from Startup Power to Backup Power (LR001943) (IC 174)	D, S	6 R
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Vent Scram Air Header EOP 5.5.11 Tab D (LO001593)	D, E, R	1 R, SRO/I, SRO-U
j. Start RCIC from RSD – RPV/L LT –147" requires ED (LR001846)	D, P, A, E, R, L	2 R, SRO/I, SRO-U
k. CR EVAC - Start DG-2 and Trip HPCS per Attachment 7.5 (LO001719)	N, R, E, L, EN	6 R, SRO/I, 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
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(EN)gineered safety feature	- / - / ≥1 (control room system)
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Actual JPM count:

(A) – 6 / 6 / 3
(C) - None
(D) – 6 / 5 / 3
(E) – 3 / 3 / 3
(EN) – 2 / 2 / 1
(L) – 4 / 4 / 3
(N) (M) – 5 / 5 / 2
(P) – 2 / 2 / 1
(R) – 3 / 3 / 3
(S) – 8 / 7 / 2

NRC EXAM SCENARIO #1

Columbia Generating Station NRC Exam - April, 2011

Facility: Columbia NRC Exam Scenario No: 1

Examiners: _____ Operators: _____

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Initial conditions: The plant is operating at 90% power (Due to economic dispatch).

Shift Directions: Reactor Power is to be raised to allow the Main Turbine to be placed into Governor Valve Optimization. When the DEH 'OKAY TO SELECT' light illuminates, stop the power increase and place the Main Turbine into Governor Valve Optimization. A Reactivity brief for the power increase has been held and power is to be increased immediately following shift turnover. There are no pre-conditioning limits. Control Room HVAC planned maintenance is scheduled. Immediately following shift turnover, swap CR HVAC Supply Fans to WMA-FN-51A running and WMA-FN-51B in standby per SOP-HVAC/CR-OPS. The power increase and fan swap are to be performed concurrently.

Event No.	Timeline	Event Type*	Event Description
1.	T = 0	R (SRO/ATC)	Increase power with flow.
2.	T = 15	C (SRO/BOP)	Swap Control Room HVAC Fans – WMA-AD-51A1 does not auto open and WMA-FN-51A trips (Tech Spec).
3.	T = 10	N (BOP)	Place the Main Turbine in Governor Valve Optimization when the OKAY TO SELECT light illuminates.
4.	T = 15	C (SRO)	HPCS-P-1 becomes inoperable due to loss of oil (Tech Spec).
5.	T = 25	C (SRO/BOP)	DEH pressure slowly lowers due to a failing DEH pump. The standby DEH pump does not auto start but may be manually started. DEH pressure is restored.
6.	T = 35	C (ALL)	Lowering TSW system pressure, Standby pump does not start due to discharge valve failing to auto open. Manual actions to open the valve are successful and the standby pump starts. TSW system pressure continues to lower. RRC flow lowered to 60 Mlbm/hr and a manual scram is inserted.

7.	T = 45	M, C (ALL)	Loss of Startup Power when the Main Turbine Trips, MSIVs close, LOCA.
8.	T = 50	C (BOP)	RCIC Trips and cannot be reset.
9.	T = 70		Attempts RPV level restoration but Emergency Depressurization is required when RPV Level cannot be maintained GT -183" and return RPV level to GT –161"(Critical Task).

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

The scenario starts with Columbia at 90% power due to economic dispatch.

After the crew takes the shift, power is to be raised to allow the Main Turbine to be placed into Governor Valve Optimization. The crew will raise power with flow at the rate of 10 Mwe/ minute.

At the same time, the BOP operator will swap operating Control Room Supply Fans per SOP-HVAC/CR-OPS. The Air Inlet damper for the fan being placed into service will not auto open. When manually opened, fan WMA-FN-51A will trip and Technical Specifications will be referenced.

When the OK to select light illuminates (at approximately 97% power), the crew will place the Main Turbine into Governor Valve Optimization per SOP-MT-GV/Optimization.

After the BOP Operator has been directed to place the Main Turbine in Governor Valve Optimization, the next event will start with a call to the SRO from OPS2 stating that oil was found all over the floor in the HPCS Pump Room. Investigation revealed that the oil came from HPCS-P-1 and ran down the side of the pump and onto the floors and that the oil reservoir on HPCS-P-1 indicates empty. The crew will declare HPCS Inoperable, enter Tech Spec 3.5.1B and direct the control power fuses for HPCS-P-1 be removed. The LPCS, RCIC and ADS A/B systems should be protected per PPM 1.3.83.

The next event is a failure of DEH-P-1A to maintain DEH pressure. The DEH Warning and the DEH Low Pressure alarms will annunciate. The crew will respond and as pressure continues to drop they will note that DEH-P-1B should have auto started but did not. DEH-P-1B will be manually started which will restore DEH system pressure.

The next event is a loss of Plant Service Water. TSW System pressure will begin to lower. The crew will respond to annunciation and note the lowering pressure. ABN-TSW will be entered and the standby TSW pump will be started. When started, the discharge valve will fail to auto open but will be able to be opened by operation of the control switch. TSW pressure will return to normal but will again begin to drop. The crew will eventually recognize a complete loss of TSW is occurring, lower core flow to 60 Mlbm/hr, and insert a manual reactor scram.

When the Main Turbine trips, the Startup Transformer will lockout causing a loss of power. SM-7 and SM-8 will be repowered from the Backup Transformer. The MSIVs will close and pressure control will be via SRVs. Wetwell and Drywell sprays will be initiated as necessary.

Additionally, when the Main turbine trips a LOCA will start. Due to the loss of Startup power, a loss of Condensate and Feed occurs. When RCIC is started, it will trip and will not reset.

CRD and SLC should be started in an attempt to maintain RPV level but will not be sufficient to prevent continued RPV level drop. If HPCS-P-1 fuses are reinstalled the pump will seize (due to lack of oil) shortly after being started.

When RPV level drops to -161" the crew will initiate an Emergency Depressurization. RPV level will be returned with low pressure ECCS Systems.

The scenario will be terminated when the Emergency Depressurization has performed and RPV level is being returned to normal band.

NRC EXAM SCENARIO #2

Columbia Generating Station NRC Exam – April, 2011

Facility: Columbia NRC Exam Scenario No: 2

Examiners: _____ Operators: _____

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Initial conditions: The plant is operating at 100% power. RWCU-P-1A was shutdown 30 minutes ago. Both Filter Demins have been removed from service and are being backwashed.

Shift Directions: Immediately following shift turnover, the ATC operator is to perform a quick restart of RWCU-P-1A. OPS 3 has been briefed on the evolution and is on station standing by to assist.

Concurrently with RWCU-P-1A restoration, place RHR-P-2C in Suppression Pool Mixing at 7000 gpm to allow Suppression Pool sampling, per SOP-RHR-SPC. Allow service water to auto start. OPS 2 and OPS 4 have reported RHR-P-2C and SW-P-1B are ready to start and are on station waiting for the pump starts. Health Physics has been notified. Notify Chemistry when RHR-P-2C is in Suppression Pool mixing.

Event No.	Timeline	Event Type*	Event Description
1.	T = 0	N (SRO/ATC)	Restart RWCU-P-1A per SOP-RWCU-START.
2.	T = 0	N (SRO/BOP)	Place RHR-P-2C in Suppression Pool Mixing per SOP-RHR-SPC.
3.	T = 20	C (SRO/ATC)	CRD-P-1A trips. Standby pump does not start initially start (Tech Spec).
4.	T = 30	C (SRO/BOP)	Shaft Seizure and Trip of RHR-P-2C. (Tech Spec).
5.	T = 40	C, R (SRO/ATC)	ASD Channel 1A/2 Fault (Tech Spec).
6.	T = 45	M, C (ALL)	ASD UPS trouble caused by a trip of power feeding inverters requiring insertion of a manual scram.
7.	T = 50	M, C (ALL)	Hydraulic ATWS; Reduced SLC; Lower RPV Level (Critical Task).
8.	T = 55		When level is lowered, Scram / Reset / Scram inserts control rods (Critical Task); RPV level is restored.

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

The scenario starts with Columbia at full power. The first and second events are initiated by the turnover.

The first event is for the ATC Operator to place RWCU-P-1A back in service per the quick restart procedure.

The second event, is for the BOP Operator to place RHR-P-2C in Suppression Pool mixing to facilitate sampling.

After the RWCU pump is in service, the next event is a trip of the running CRD pump. ABN-CRD will be entered and the standby pump will attempt to be started but the breaker will not close in. Tech Specs will be entered when the accumulator low pressure alarms annunciate. Field investigation will identify and correct the problem with the standby pumps breaker and the standby pump will eventually be started. CRD pressure will return and Tech Specs will be exited.

The next event is a trip of RHR-P-2C which was running in Suppression Pool mixing. The lineup will be secured and Tech Specs will be referenced.

The next event is an alarm and fault of ASD channel A2 which causes a runback of RRC-P-1A to 51 Hz. A RRC High Flow Delta alarm annunciates. Tech Spec 3.4.1 will be addressed and RRC flows will be matched. The crew will respond to the ASD fault per SOP-RRC-ASD.

After Tech Specs have been addressed and flows are matched, an ASD UPS trouble alarm will annunciate. The crew will refer to ABN-ASD-UPS. OPS4 will report that ASD is on battery power which will require the crew to reduce flow to 60 Mlbm/hr and insert a manual reactor scram.

All control rods will not insert due to a Hydraulic ATWS. PPM 5.1.2 will be entered and will direct SLC initiation. When started, only approximately 20 gpm flow will develop. The crew should continue normal SLC injection but may start lining up SLC injection with RCIC.

PPM 5.5.6, Bypass MSIV Isolations and PPM 5.5.1, making ECCS injection valves closed and throttleable, will be performed. RPV injection will stopped and prevented and level be lowered to below -65". Injection will be re-initiated and direction will be to maintain RPV level between -80" to -140".

PPM 5.5.11 will be performed to insert control rods. When RPV level is being maintained at a lowered level, the next scram/reset/scram will be successful in inserting all control rods.

SLC injection will be secured, PPM 5.1.2 will be exited, and RPV level will be returned to -50" to +13" level band.

The scenario will be terminated when RPV level is being returned to normal.

NRC EXAM SCENARIO #3

Columbia Generating Station NRC Exam – April, 2011

Facility: Columbia NRC Exam Scenario No: 3

Examiners: _____ Operators: _____

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Initial Conditions: Columbia is operating at 90% power due to economic dispatch. RHR-P-2A is running in Suppression Pool Cooling per SOP-RHR-SPC at 7000 gpm. OSP-ELEC-M701, the DG-1 Monthly Operability Test Surveillance is in progress and step 7.3.23 has been completed. SM-7 has been transferred to TR-B. DG-1 has been running at IDLE speed for GT 10 minutes. PDIS is unavailable. OPS 2 is standing by at extension 4740 in DG-1 Room.

Shift Directions: Immediately after shift turnover, the BOP Operator is to secure RHR Loop A from Suppression Pool Cooling up to the step of verifying RHR Loop A in a standby lineup (another operator will perform that step). HP has been notified. After, the BOP Operator is to continue with OSP-ELEC-M701, starting at step 7.3.24.

Additionally, raise reactor power to 95% with flow. A reactivity brief for the power increase has been held. There are no pre-conditioning limits. The power increase will be performed concurrently with securing RHR Loop A and the DG surveillance.

Event No.	Timeline	Event Type*	Event Description
1.	T = 0	R (SRO/ATC)	Raise Reactor Power to 95%.
2.	T = 0	N (SRO/BOP)	Secure RHR Loop A from Suppression Pool Cooling.
3.	T = 10	C (SRO/BOP)	Continue with OSP-ELEC-M701, DG-1 Monthly surveillance. When DG-1 is paralleled with SM-1, MVAR meter deflects and remains left of zero requiring the DG-1 output breaker to be opened (Tech Spec).
4.	T = 20	R, C (SRO/ATC)	Drifting Control Rod sticks at a position GT position 00 requiring a RRC flow reduction to LE 80 Mlbm/hr (Tech Spec).
5.	T=25	M, C (ALL)	Lowering CAS system pressure that continues to lower causing MSIV closure (a manual scram should be inserted prior to MSIV closure).
6.	T=30	C (SRO/ATC)	Hydraulic ATWS – 7 Control Rods fail to insert.

7.	T=35	C (ALL)	RCIC Steam Line Steam Leak.
8.	T=45	M (ALL)	Failure of RCIC-V-8 and RCIC-V-63 to fully close (unisolable leak).
9.	T=60		ATWS Emergency Depressurization (PPM 5.1.5) when two areas exceed their Max Safe Operating Temperature (Critical Task).

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

The scenario starts with Columbia at 90% power. RHR-P-2A is in Suppression Pool Cooling and a DG-1 monthly surveillance is in progress.

After the Crew takes the shift, reactor power will be raised to 95% with flow at the rate of 10 Mwe/ minute.

In conjunction with the power increase, RHR Loop A will be secured from Suppression Pool Cooling. After, the DG-1 Monthly surveillance will continue. When DG-1 is paralleled with SM-7 the MVAR meter will deflect and remain downscale. The operator will attempt to restore MVARs on scale but will not be successful. In response the output breaker will be opened. Technical Specification 3.8.1 Condition B will be entered.

The next event is a drifting control rod. The ATC operator will acknowledge drift alarm and note that control rod 18-15 is drifting into the core. The continuous insert pushbutton will be depressed in an attempt to insert the rod. The control rod will stick in a position greater than 00. ABN-ROD will be entered and in response to the stuck control rod, recirc flow will be lowered to less than or equal to 80 Mlbm/hr. Technical Specification 3.1.3 Condition A will be entered.

The next event is lowering CAS system pressure. The standby compressors will start but CAS pressure will continue to lower. The crew will enter ABN-CAS and take actions for lowering pressure. The crew will eventually determine that a complete loss of air is apparent and initiate a manual scram.

When the scram is initiated, 7 total control rods will fail to insert. PPM 5.1.1 will be entered on low RPV level and exited to PPM 5.1.2, RPV Control ATWS. Due to the loss of air, rods cannot be inserted via scram/reset/scram.

When the MSIVs close, pressure control will be via SRVs. The crew should initiate RCIC (if the steam leak is not apparent). When RCIC stream leak does occur, the crew should lower RPV pressure with SRVs to facilitate feeding with the Condensate Booster Pumps. RPV level will be returned to normal level band.

As a result of the MSIV closure, a RCIC steam line break will occur, RCIC-V-8 and RCIC-V-63, Steam line admission valves fail to isolate on the isolation signal. The crew will attempt to close the valves but they will not close. The crew will enter PPM 5.3.1 and the RCIC pump room will exceed its Max Safe temperature.

The leak will eventually spread to a second area, the RHR-A Pump Room. When that area exceeds its Max Safe temperature, it will require the crew to initiate an emergency depressurization. PPM 5.1.2 pressure leg will be exited and PPM 5.1.5, RPV Emergency Depressurization – ATWS will be entered.

The crew will terminate and prevent injection and open 7 SRV's. When MSCP has been reached, injection will be recommenced if necessary.

The scenario will be terminated when the ED is performed and RPV level is in the normal band.