

**ADMINISTRATIVE TOPICS OUTLINE      FORM ES-301-1**

Facility: Columbia Generating Station		Date of examination: October 2002
Examination level: <b>SRO</b>		Operating test number:
Administrative Topic/Subject Description		Describe the method of evaluation: 1. ONE admin JPM, OR 2. TWO Administrative questions
A.1	Fuel Handling	2.1.20 4.3/4.2 – Ability to execute procedure steps.  Given PPM 1.3.40, ATT. 7.5 of 1.3.40, and LCS 1.9.2, determine allowable movement of heavy load over the spent fuel pool.
	JPM	
A.2	Shift Turnover	2.1.3 3.0/3.4 – Knowledge of shift turnover practices.  Given a frozen simulator with out of service equipment, complete a shift turnover sheet for the on-coming Shift Manager.
	JPM	
A.3	Use of Piping and Instrumentation Drawings	2.1.24 2.8/3.1 – Ability to obtain and interpret station electrical and mechanical drawings.  Use EWDs to explain the override function of LPCS-RMS-S21 for LPCS-V-5.
	JPM	
A.4	Radiation Exposure Limits	2.3.4 2.5/3.1 – Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized.  Complete the paperwork for Planned Special Exposure. <b>2001 NRC EXAM</b>
	JPM	
A.4	Emergency Action Levels and Classifications	2.4.41 2.3/4.1 – Knowledge of Emergency Plan action level thresholds and classifications.  Given a table top scenario with a security event, complete a CNF form with the correct EAL based on the security event.
	JPM	

**ADMINISTRATIVE TOPICS OUTLINE      FORM ES-301-1**

Facility: Columbia Generating Station		Date of examination: October 2002
Examination level: <b>RO</b>		Operating test number:
Administrative Topic/Subject Description		Describe the method of evaluation: 1. ONE admin JPM, OR 2. TWO Administrative questions
A.1	Plant Parameter Verification	2.1.7 3.7/4.4 – Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.  Using the graph in PPM 3.1.2, determine minimum feedwater temperature prior to entry into the Area of Increased Awareness.
	JPM Shift Turnover	2.1.3 3.0/3.4 – Knowledge of shift turnover practices.  Given a frozen simulator with out of service equipment, complete a shift turnover sheet for the on-coming Reactor Operator.
A.2	Use of Piping and Instrumentation Drawings	2.1.24 2.8/3.1 – Ability to obtain and interpret station electrical and mechanical drawings.  Use EWDs to explain the override function of LPCS-RMS-S21 for LPCS-V-5.
A.3	Radiation Control	2.3.1 2.6/3.0 – Knowledge of 10CFR20 and related facility radiation control requirements.  Given a scenario with projected dose exceeding the Admin Hold point, determine and justify actions. <b>CLOSED REFERENCE</b>  Given a scenario with an entry into a high radiation area, determine dosimetry requirements. <b>CLOSED REFERENCE</b>  <b>2000 NRC Exam</b>
A.4	Emergency facilities	2.4.29 2.6/4.0 – Knowledge of the Emergency Plan.  At what Emergency Action Level are the Columbia Administrative Exposure Hold points automatically waived? <b>CLOSED REFERENCE</b>  Given a scenario with the Shift Manager out of the control room, determine who the Emergency Director is. <b>CLOSED REFERENCE</b>
	2 Questions	
	2 questions	

Tier/Group	Randomly Selected K/A	Reason for Rejection
T2 - GP1 - SRO	215005 2.3.3	The generic KA cannot be used as a question in conjunction with 215005 APRM/LPRM.
T3 – RO/SRO	2.2.4	This generic KA does not apply to Columbia Generating Station, which is a single unit plant.
T2 – GP3 - SRO	233000 2.1.5	The generic KA cannot be used as a question in conjunction with 233000 Fuel Pool Cooling.
T1 – GP1 - SRO	295023AA1.05	Columbia Generating Station does not have a Fuel Transfer System. This KA does not apply.
T1 – GP2 - SRO	295001 2.4.33	The generic KA cannot be used as a question in conjunction with 295001, Complete Loss of Forced Core Flow.
T1 – GP1 – SRO	295006 2.2.9	The generic KA cannot be used as a question in conjunction with 295006, SCRAM.
T1 – GP1 – SRO T1 – GP2 - RO	295030EA1.06	Columbia Generating Station does not use the Condensate Storage and Transfer System for suppression pool make up. This KA does not apply.
T2 – GP2 – SRO	226001 2.2.30	This Generic KA does not make sense with 226001 RHR/LPCI: Containment Spray System Mode.

NOTE: Prior to development of the Written Examination Outline, the BWR Owners Group KA Catalog software, developed by WD Associates, was reviewed and any KAs not applicable to the Columbia Generating Station, BWR-5, were deleted.

**BWR RO EXAM OUTLINE ES-401-2**

COUNT MATRIX

Summarizing Counts by K/A Group  
for  
BWR - Reactor Operator

	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Total
E/APE # - T1 Gp 1	2	4	2				2	2			1	13
E/APE # - T1 Gp 2	4	3	5				3	3			1	19
E/APE # - T1 Gp 3	1	0	2				1	0			0	4
Tier Totals	7	7	9				6	5			2	36
Plant Systems / T2 Gp 1	2	3	3	2	3	3	2	3	2	3	2	28
Plant Systems / T2 Gp 2	1	2	2	2	2	2	2	2	2	2	0	19
Plant Systems / T2 Gp 3	0	1	1	1	0	0	1	0	0	0	0	4
Tier Totals	3	6	6	5	5	5	5	5	4	5	2	51
Generic K/As / T3	CAT 1 - 4		CAT 2 - 3		CAT 3 - 2		CAT 4 - 4				13	
Model Total												100

**BWR RO EXAM OUTLINE ES-401-2**

EMERGENCY & ABNORMAL PLANT EVOLUTIONS - TIER 1 GROUP I

BWR - Reactor Operator

Target: 13%

Actual: 13%

	E/APE # - NAME/SAFETY FUNCTION	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	295005 / Main Turbine Generator Trip / 3		X										AK2.03 - Recirculation System	3.2	1
2	295007 / High Reactor Pressure / 3			X									AK3.04 - Safety/Relief valve operation: Plant specific	4.0	1
3	295007 / High Reactor Pressure / 3								X				AA2.03 - Reactor Water Level	3.7	1
4	295010 / High Drywell Pressure / 5		X										AK2.04 - Nitrogen makeup system: Plant specific	2.6	1
5	295015 / Incomplete SCRAM / 1	X											AK1.03 - Reactivity effects	3.8	1
6	295015 / Incomplete SCRAM / 1		X										AK2.05 - Rod Worth Minimizer: Plant specific	2.6	1
7	295024 - High Drywell Pressure / 5							X					EA1.03 - LPCS: Plant specific	4.0	1

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8	295025 / High Reactor Pressure / 3							X				EA2.03 – Suppression Pool Temperature	3.9	1
9	295031 / Reactor Low Water Level / 2	X										EK1.03 – Water level effects on reactor power	3.7	1
10	295031 / Reactor Low Water Level / 2		X									EK2.04 – Rector Core Isolation Cooling: Plant specific	4.0	1
11	295037 / SCRAM Condition Present and Reactor Power above APRM Downscale or Unknown / 1			X								EK3.06 – Maintaining heat sinks external to the containment	3.8	1
12	500000 / High Containment Hydrogen Concentration / 5							X				EA1.07 – Nitrogen purge system	3.4	1
13	500000 / High Containment Hydrogen Concentration / 5										X	2.3.11 – Ability to control radiation releases	2.7	1
Category Point Totals:		2	4	2				2	2			1	Group Point Totals: 13	13

**BWR RO EXAM OUTLINE ES-401-2**

EMERGENCY & ABNORMAL PLANT EVOLUTIONS - TIER 1 GROUP II

BWR - Reactor Operator

Target: 19%

Actual: 19%

	E/APE # - NAME/SAFETY FUNCTION	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	295001 / Partial or Complete loss of Forced Core Flow Circulation / 1		X										AK2.02 - Nuclear Boiler Instrumentation	3.2	1
2	295002 / Loss of Main Condenser Vacuum / 3							X					AA1.07 - Condenser Circulating Water System	3.1	1
3	295003 / Partial or Complete Loss of AC Power / 6			X									AK3.06 - Containment isolation	3.7	1
4	295003 / Partial or Complete Loss of AC Power / 6								X				AA2.05 - Whether a partial or complete loss of AC power has occurred	3.9	1
5	295004 / Partial or Complete Loss of DC Power / 6		X										AK2.03 - DC bus loads	3.3	1

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6	295013 / High Suppression Pool Temperature / 5	X										AK1.01 – Pool stratification	2.5	1
7	295013 / High Suppression Pool Temperature / 5			X								AK3.01 – Suppression pool cooling operation	3.6	1
8	295016 / Control Room Abandonment / 7		X									AK2.02 – Local control stations: Plant specific	4.0	1
9	295017 / High Offsite Release Rate / 9			X								AK3.02 – Plant ventilation	3.5	1
10	295017 / High Offsite Release Rate / 9							X				AA2.03 – Radiation levels: Plant specific	3.1	1
11	295018 / Partial or Complete Loss of Component Cooling Water Flow / 8						X					AA1.01 – Backup systems	3.3	1

12	295026 / Suppression Pool High Water Temperature / 5										X	2.1.25 - Ability to obtain and interpret station reference materials such as graphs, monographs, and tables which contain performance data	2.8	1
13	295028 / High Drywell Temperature / 5	X										EK1.02 - Equipment environmental qualification	2.9	1
14	295030 / Low Suppression Pool Water Level / 5			X								EK3.06 - Reactor SCRAM	3.6	1
15	295004 / Partial or Complete Loss of DC Power / 6							X				AA2.01 - Cause of partial or complete loss of DC power	3.2	1
16	295033 / High Secondary Containment Area Radiation Levels / 9	X										EK1.03 - Radiation releases	3.9	1

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17	295038 / High Off-Site Release Rate / 9	X										EK1.03 - Meteorological effects on off-site release	2.8	1
18	295038 / High Off-Site Release Rate / 9						X					EA1.06 - Plant ventilation	3.5	1
19	600000 / Plant Fire on Site / 8			X								AK3.04 - Actions contained in the abnormal procedure for plant fire on site	2.8	1
Category Point Totals:		4	3	5			3	3			1	Group point totals: 19		19

**BWR RO EXAM OUTLINE ES-401-2**

PLANT SYSTEMS - TIER 1 GROUP III

BWR - Reactor Operator

Target: 4%

Actual: 4%

	E/APE # - NAME/SAFETY FUNCTION	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	295032 / High Secondary Containment Area Temperature / 5			X									EK3.01 - Emergency/Normal depressurization	3.5	1
2	295032 / High Secondary Containment Area Temperature / 5			X									EK3.02 - Reactor SCRAM	3.6	1
3	295035 / Secondary Containment High Differential Pressure / 5	X											EK1.02 - Radiation release	3.7	1
4	295036 / Secondary Containment High Sump/Area Water Level / 5							X					EA1.04 - Radiation monitoring: Plant specific	3.1	1
Category Point Totals:		1	0	2				1	0			0	Group Point Totals: 4		4

**BWR RO EXAM OUTLINE ES-401-2**

PLANT SYSTEMS - TIER 2 GROUP I

BWR - Reactor Operator

Target: 28%

Actual: 28%

	SYSTEM #/NAME	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	201002 / Reactor Manual Control System											X	2.4.6 – Knowledge of symptom based EOP mitigation strategies	3.1	1
2	202002 / Recirculation Flow Control System							X					A1.01 – Recirculation pump speed	3.2	1
3	203000 / RHR/LPCI Injection Mode: Plant specific		X										K2.03 – Initiation logic	2.7	1
4	203000 / RHR/LPCI Injection Mode: Plant specific				X								K4.02 – Prevention of piping overpressurization	3.3	1
5	209001 / Low Pressure Core Spray System						X						K6.03 – Torus/suppression pool water level	3.3	1
6	209002 / High Pressure Core Spray System	X											K1.03 – Water leg (jockey) pump	3.0	1
7	209002 / High Pressure Core Spray System						X						K6.03 – Component cooling water system	2.5	1

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8	212000 / Reactor Protection System						X						K6.05 – RPS sensor inputs	3.5	1
9	212000 / Reactor Protection System					X							K5.01 – Fuel thermal time constant	2.7	1
10	215003 / Intermediate Range Monitor (IRM)		X										K2.01 – IRM channels/detectors	2.5	1
11	215003 / Intermediate Range Monitor (IRM)			X									K3.04 – Reactor power indication	3.6	1
12	215004 / Source Range Monitor System (SRM)									X			A4.06 – Alarms and lights	3.2	1
13	215005 / Average Power Range Monitor/Local Power Range Monitor System			X									K3.03 – Reactor Manual Control system: Plant specific	3.3	1
14	215005 / Average Power Range Monitor/Local Power Range Monitor System									X			A4.02 – CRT display indicators: Plant specific	2.8	1

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15	217000 / Reactor Core Isolation Cooling			X									K3.02 – Reactor vessel pressure	3.6	1
16	217000 / Reactor Core Isolation Cooling					X							K5.01 – Indications of pump cavitation	2.6	1
17	218000 / Automatic Depressurization System	X											K1.03 – Nuclear Boiler instrumentation system	3.7	1
18	218000 / Automatic Depressurization System									X			A4.02 – ADS logic initiation	4.2	1
19	223001 / Primary Containment System and Auxiliaries		X										K2.09 – Drywell cooling fans: Plant specific	2.7	1
20	223001 / Primary Containment System and Auxiliaries								X				A3.02 – Vacuum breaker/relief valve operation	3.4	1
21	239002 / Relief/Safety Valves				X								K4.06 – Detection of valve leakage	3.5	1

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22	259001 / Reactor Feedwater System											X	2.4.25 – Knowledge of fire protection procedures	2.9	1
23	259002 / Reactor Water Level Control System								X				A2.02 – Loss of any number of reactor feed flow inputs	3.3	1
24	259002 / Reactor Water Level Control System									X			A3.03 – Changes in main steam flow	3.2	1
25	261000 / Standby Gas Treatment System							X					A1.07 – SBGTS train temperature	2.8	1
26	261000 / Standby Gas Treatment System								X				A2.12 – High fuel pool ventilation radiation: Plant Specific	3.2	1
27	264000 / Emergency Generators (Diesel/Jet)					X							K5.06 – Load sequencing	3.4	1
28	264000 / Emergency Generators (Diesel/Jet)								X				A2.09 – Loss of AC power	3.7	1
Category Point Totals:		2	3	3	2	3	3	2	3	2	3	2	Group Point Total: 28		28

**BWR RO EXAM OUTLINE ES-401-2**

PLANT SYSTEMS - TIER 2 GROUP II

BWR - Reactor Operator

Target: 19%

Actual: 19%

	SYSTEM #/NAME	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	201003 / Control Rod Drive and Mechanism			X									K3.02 – Flux shaping	2.8	1
2	201004 / Rod Sequence Control System (Plant Specific)					X							K5.02 – Sequences and groups: BWR-4, 5	3.1	1
3	201004 / Rod Sequence Control System (Plant Specific)										X		A4.01 – System bypass switches: BWR-4, 5	3.4	1
4	201006 / Rod Worth Minimizer								X				A2.01 – Power supply loss: P-specific	2.5	1
5	202001 / Recirculation System										X		A4.01 – Recirculation pumps	3.7	1
6	204000 / Reactor Water Cleanup System									X			A3.01 – system pressure downstream of the pressure regulation valve: LP-RWCU	3.3	1

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7	205000 / Shutdown Cooling System (RHR Shutdown Cooling Mode)						X						K6.03 – Recirculation system	3.1	1
8	214000 / Rod Position Information System				X								K4.02 – Thermocouple	2.5	1
9	215002 / Rod Block Monitor System						X						K6.01 – RPS: BWR-3, 4, 5	3.0	1
10	226001 / RHR/LPCI: Containment Spray System Mode								X				A2.20 – Loss of coolant accident	3.7	1
11	226001 / RHR/LPCI: Containment Spray System Mode		X										K2.02 – Pumps	2.9	1
12	239001 / Main and Reheat Steam System		X										K2.01 – Main steam isolation valve solenoids	3.2	1
13	262001 / AC Electrical Distribution								X				A3.02 – Automatic bus transfer	3.2	1

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14	263000 / DC Electrical Distribution							X					A1.01 - Battery charging/discharging rate	2.5	1
15	272000 / Radiation Monitoring System	X											K1.05 - Radwaste System	2.8	1
16	290001 / Secondary Containment				X								K4.02 - Protection against over pressurization: Plant specific	3.4	1
17	290001 / Secondary Containment							X					A1.01 - System lineups	3.1	1
18	290003 / Control Room HVAC			X									K3.01 - Control room habitability	3.5	1
19	290003 / Control Room HVAC					X							K5.02 - Differential pressure control	2.8	
Category Point Totals:		1	2	2	2	2	2	2	2	2	2	0	Group point totals: 19		19

**BWR RO EXAM OUTLINE ES-401-2**

PLANT SYSTEMS - TIER 2 GROUP III

BWR - Reactor Operator

Target: 4%

Actual: 4%

	SYSTEM #/NAME	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	215001 / Traversing In-Core Probe				X								K4.01 – Primary containment isolation: Mark-I&II	3.4	1
2	234000 / Fuel Handling Equipment			X									K3.01 – Reactor Manual Control System	2.9	1
3	233000 / Fuel Pool Cooling and Cleanup		X										K2.02 – RHR pumps	2.8	1
4	268000 / Radwaste							X					A1.01 – Radiation level	2.7	1
Category Point Totals:		0	1	1	1	0	0	1	0	0	0	0	Group point totals: 4		4

**BWR RO EXAM OUTLINE ES-401-2**

PLANT-WIDE GENERIC RESPONSIBILITIES TIER 3

BWR - Reactor Operator

Target: 13%

Actual: 13%

	Category	K/A	TOPICS	IMP	POINTS
1	Conduct Of Operations	2.1.7	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.	3.7	1
2		2.1.20	Ability to execute procedure steps.	4.3	1
3		2.1.33	Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications.	3.4	1
4		2.1.11	Knowledge of less than one hour technical specification action statements for systems.	3.0	1

5	Equipment Control	2.2.27	Knowledge of the refuel process.	2.6	1
6		2.2.2	Ability to manipulate the console controls as required to operate the facility between shutdown and designated power levels.	4.0	1
7		2.2.23	Ability to track limiting conditions for operations.	2.6	1

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8	Radiation	2.3.9	Knowledge of the process for performing a containment purge.	2.5	1
9	Control	2.3.10	Ability to perform procedures to reduce excessive levels of radiation and guard against personnel exposure.	2.9	1

10	Emergency Procedures Plan	2.4.39	Knowledge of the ROs responsibilities in emergency plan implementation.	3.3	1
11		2.4.45	Ability to prioritize and interpret the significance of each annunciator or alarm.	3.3	1
12		2.4.46	Ability to verify that the alarms are consistent with the plant conditions.	3.5	1
13		2.4.21	Knowledge of the parameters and logic used to assess the status of safety functions including: <ul style="list-style-type: none"> <li>1. Reactivity control</li> <li>2. Core cooling and heat removal</li> <li>3. Reactor coolant system integrity</li> <li>4. Containment conditions</li> <li>5. Radioactivity release control</li> </ul>	3.7	1
			Group point totals: 13		13

**Facility:** COLUMBIA**Scenario No.:** 1**Op-Test No.:** 1

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

**Initial conditions:** IC-191 (batch file NRC02.1.txt). The reactor is approaching criticality. IRM "B" is out of service and bypassed. SGT-V-2B has lost control power and is shut.

**Turnover:** A plant startup is in progress. The reactor is approaching criticality. The off-going shift pulled rods up through RWM group 12. The "B" IRM failed downscale 4 hours ago and the associated bypass switch is caution tagged. As the startup continues, RWCUC will need to be lined up for reactor water level control. The off-going shift just found SGT-V-2B in the closed position. Upon attempting to open the valve from the control room, the valve lost control power.

Event No.	Malf. No.	Event Type*	Event Description
1.	Initiated by turnover T= 0 min	N (BOP)	Establish Reactor Water Cleanup blow-down flow for Reactor Water Level control.
2.	Initiated by turnover T=8 min	R (RO)	Withdraw control rods to bring the reactor critical.
3.	Trigger 3 T= 18 min	C (BOP)	Loss of REA-FN-1B resulting in a high reactor building pressure and entry into EOP Secondary Containment Control, 5.3.1.
4.	Trigger 4 T= 30 min	I (RO)	IRM 'A' fails upscale resulting in a half scram on the 'A' side of RPS.

5.	Trigger 5 T= 40 min	M (All)	An earthquake results in a Loss of All Offsite Power and a LOCA. <b>(Columbia IPE)</b>
6.	Initiated as part of Trigger 5 T= 40 min	C	The Division 1 emergency bus, SM-7, locks-out resulting in a loss of power to the bus and its loads.
7.	Initiated as part of Trigger 5 T= 40 min	C	The output breaker of the HPCS diesel generator fails to auto close requiring the operator to manually close the breaker in order to operate HPCS.
8.	Initiated as part of Trigger 5 T= 40 min	C	The injection valve for the 'C' loop of RHR, RHR-V-42C, fails to auto open on an injection signal.

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

**Facility:** COLUMBIA**Scenario No.:** 2**Op-Test No.:** 1**Examiners:** \_\_\_\_\_ **Operators:** \_\_\_\_\_

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**Initial conditions:** IC-171 (batch file NRC02.2.txt). The reactor is at 100% power on a beginning of life core. Diesel Generator #1 is operating at full load for its monthly operability check. RHR-V-24B is tagged out while the motor operator is being replaced.

**Turnover:** The plant is at 100% power. DG-1 is fully loaded for OSP-ELEC-M701 (currently at step 7.5.62). There are 20 minutes left on the one-hour diesel run. Suppression Pool temperature is slowly rising due to two SRVs that are leaking by. The off-going shift recommends that suppression pool cooling be initiated as soon as you take the shift. RHR-V-24B is tagged out while the motor operator is being replaced (job completion is expected in two hours).

Event No.	Malf. No.	Event Type	Event Description
1.	Initiated by turnover  T=0	N (BOP)	Place RHR loop 'A' into the suppression pool cooling mode.
2.	Trigger 2  T= 10 min	C (BOP)	High-pressure feedwater heater '6A' level controller fails high resulting in the trip of feedwater heater '6A'.
3.	Initiated by procedure carried out in Event 2  T≈13 min	R (RO)	Reduces reactor power with recirc flow in accordance with the subsequent actions of ABN-POWER.
4.	Trigger 4  T≈15 min	C (RO)	The 'A' recirc pump fails to follow the automatic controller and must be taken to manual for reduction and balance of recirc flow.

5.	AUTO Trigger 5 at 95% power  T=19 min	I (RO)	APRM 'C' gain drifts during the power reduction resulting in APRM indication reading out of specification for Tech Spec tolerance.
6.	Trigger 6  T=40 min	N (BOP)  C (BOP)	Reduces load on DG-1 at completion of OSP-ELEC-M701.  DG-1 Governor begins oscillating requiring the emergency trip of the diesel from the control room. <b>(Columbia LER 98-014)</b>
7.	Trigger 7  T=49 min	C (All)	DEH oil leak resulting in a Main Turbine trip and a loss of Bypass Valves.
8.	Initiated by event 7 actions  T=49 min	M (All)	Reactor scrams due to the Main Turbine trip. A 100% ATWS prevents inward rod movement by scram <b>(Columbia IPE)</b>
9.	Initiated manually by disconnect of GDS computers  T=49 min	C	The Graphical Display System (GDS) locks up during the Main Turbine trip transient.
10.	AUTO Trigger 10 on SLC initiation  T=50 min	C	The SLC common discharge header ruptures in the reactor building preventing boron from reaching the core.

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

<b>Facility:</b> COLUMBIA	<b>Scenario No.:</b> 3	<b>Op-Test No.:</b> 1	
<b>Examiners:</b> _____		<b>Operators:</b> _____	
_____		_____	
_____		_____	
<b>Initial conditions:</b> IC-172 (batch file NRC02.3.txt). Reactor power is at 21% on a beginning of life core. The feedwater system is in a "10 Valve" lineup with 2 reactor feed pumps in operation.			
<b>Turnover:</b> The reactor is at 21% power with a reactor shutdown in progress. The rod sequence is at RWM group 39, rod 14-31, at position 48. The feedwater system is in a "10 Valve" lineup with 2 reactor feed pumps in operation. A power reduction to 15% has been directed, at which point, the 'A' reactor feedwater pump will be taken out of service. You are to hold the plant at 15% with the main turbine on line while the Feedwater system engineer gathers data on the feedwater system.			
Event No.	Malf. No.	Event Type*	Event Description
1.	Initiated by turnover T= 0 min	R (RO)	Reactor power reduction to 15% by inserting control rods
2.	Trigger 2 T= 8 min	I (RO)	The "C" Recirc Flow Unit fails downscale resulting in a rod block requiring the RO to bypass the unit.
3.	Trigger 3 T= 18 min	I (RO)	The RWM fails, requiring the RO to bypass the RWM.
4.	Initiated by turnover T= 30 min	N (BOP)	The "A" RFP is removed from service
5.	Trigger 5 T= 46 min	C (BOP)	The running plant service water pump trips. The standby plant service water pump fails to auto start requiring the BOP to manually start it.
6.	Trigger 6	C (BOP)	The hotwell level controller fails causing a low condenser hotwell level requiring the BOP to manually restore level and transfer control

	T= 51 min		level, requiring the BOP to manually restore level and transfer control to the standby controller.
7.	Trigger 7 T= 67 min	C (All)	The shaft of the running plant service water pump shears, resulting in a total loss of plant service water, requiring a manual reactor scram.
8.	Trigger 8 T= 69 min	M (All)	A high vibration condition occurs on the "B" recirc pump resulting in a large LOCA on the "B" reactor recirc loop.
9.	Preset  This is in from the beginning and is recognized upon HPCS pump auto initiation	C	The HPCS pump experiences reduced head resulting in the loss of injection capability.
10.	Preset  This is in from the beginning and is recognized upon RHR pump auto initiation	C	RHR pump 2A fails to auto start on its initiation signal.

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

**COUNT MATRIX**

Summarizing Counts by K/A Group  
 for  
 BWR - Senior Reactor Operator

	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Total
E/APE # - T1 Gp 1	4	4	5				2	8			3	26
E/APE # - T1 Gp 2	3	3	3				2	4			2	17
Tier Totals	7	7	8				4	12			5	43
Plant Systems / T2 Gp 1	2	2	2	2	2	2	3	2	2	1	3	23
Plant Systems / T2 Gp 2	1	1	1	1	1	2	1	1	1	1	2	13
Plant Systems / T2 Gp 3	0	0	0	1	0	0	1	0	0	0	2	4
Tier Totals	3	3	3	4	3	4	5	3	3	2	7	40
Generic K/As / T3	CAT 1 - 5    CAT 2 - 3    CAT 3 - 4    CAT 4 - 5										17	
Model Total												100

**BWR SRO EXAM OUTLINE ES-401-1**

**EMERGENCY & ABNORMAL PLANT EVOLUTIONS - TIER 1 GROUP I**

BWR - Senior Reactor Operator

Target: 26%

Actual: 26%

	E/APE # - NAME/SAFETY FUNCTION	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	295003 / Partial or Complete Loss of AC Power / 6			X									AK3.06 – Containment isolation	3.7	1
2	295003 / Partial or Complete Loss of AC Power / 6								X				AA2.05 – Whether a partial or complete loss of AC power has occurred	4.2	1
3	<b>295006 / SCRAM / 1</b>								X				AA2.04 – Reactor pressure 10CFR55.43.5	4.1	1
4	<b>295037 / Scram Condition Present and Reactor Power Above APRM Downscale or Unknown / 1</b>								X				EA2.06 – Ability to determine/interpret reactor pressure 10CFR55.43.5	4.1	1
5	295007 / High Reactor Pressure / 3								X				AA2.02 – Reactor power 10CFR55.43.5	4.1	1

**BWR SRO EXAM OUTLINE ES-401-1**

6	<b>295009 / Low Reactor Water Level / 2</b>										X	2.2.24 – Ability to analyze the affect of maintenance activities on LCO status 10CFR55.43.2	3.8	1
7	<b>295010 / High Drywell Pressure / 5</b>										X	2.4.6 – Knowledge of symptom based EOP mitigation strategies 10CFR55.43.5	4.0	1
8	295010 / High Drywell Pressure / 5		X									AK2.04 – Nitrogen makeup system: Plant specific	2.8	1
9	295013 / High Suppression Pool Temperature / 5	X										AK1.01 – Pool stratification	3.3	1
10	295013 / High Suppression Pool Temperature / 5			X								AK3.01 – Suppression pool cooling operation	3.8	1
11	295015 / Incomplete SCRAM / 1	X										AK1.03 – Reactivity effects	3.9	1
12	295015 / Incomplete SCRAM / 1		X									AK2.05 – Rod Worth Minimizer: Plant specific	2.9	1
13	<b>295016 / Control Room Abandonment / 7</b>							X				AA2.02 – Reactor water level 10CFR55.43.5	4.3	1

**BWR SRO EXAM OUTLINE ES-401-1**

14	295016 / Control Room Abandonment / 7		X									AK2.02 – Local control stations: Plant specific	4.1	1
15	295007 / High Reactor Pressure							X				AA2.03 – Reactor water level 10CFR55.43.5	3.7	1
16	295017 / High Offsite Release Rate / 9			X								AK2.03 – Radiation levels: Plant specific	3.9	1
17	295014 / Inadvertent Reactivity Addition / 1							X				AA2.01 – Reactor power 10CFR55.43.5	4.2	1
18	295026 / Suppression Pool High Water Temperature / 5										X	2.1.25 – Ability to obtain and interpret station reference materials such as graphs, monographs, and tables which contain performance data	3.1	1
19	295030 / Low Suppression Pool Water Level / 5			X								EK3.06 – Reactor SCRAM	3.8	1
20	295006 / SCRAM / 1							X				AA2.01 – Reactor pressure 10CFR55.43.5	4.6	1
21	295031 / Reactor Low Water Level / 2	X										EK1.03 – Water level effects on reactor power	4.1	1

**BWR SRO EXAM OUTLINE ES-401-1**

22	295031 / Reactor Low Water Level / 2		X									EK2.04 – Rector Core Isolation Cooling: Plant specific	4.4.1	1
23	295037 / SCRAM Condition Present and Reactor Power above APRM Downscale or Unknown / 1			X								EK3.06 – Maintaining heat sinks external to the containment	4.1	1
24	295038 / High Off-Site Release Rate / 9	X										EK1.03 – Meteorological effects on off-site release	3.8	1
25	295038 / High Off-Site Release Rate / 9						X					EA1.06 – Plant ventilation	3.6	1
26	500000 / High Containment Hydrogen Concentration / 5						X					EA1.07 – Nitrogen purge system	3.3	1
<b>Category Point Totals:</b>		4	4	4			2	9			3	<b>Group Point Totals: 26</b>		26

**BWR SRO EXAM OUTLINE ES-401-1**

**EMERGENCY & ABNORMAL PLANT EVOLUTIONS - TIER 1 GROUP II**

BWR - Senior Reactor Operator

Target: 17%

Actual: 17%

	E/APE # - NAME/SAFETY FUNCTION	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	295004 / Partial or Complete Loss of DC Power / 6								X				AA2.01 – Cause of partial or complete loss of DC power 10CFR55.43.5	3.6	1S
2	295001 / Partial or Complete loss of Forced Core Flow Circulation / 1		X										AK2.02 – Nuclear Boiler Instrumentation	3.3	1
3	295004 / Partial or Complete Loss of DC Power / 6		X										AK2.03 – DC bus loads	3.3	1
4	<b>295005 / Main Turbine Trip / 3</b>											X	2.3.2 – Knowledge of the facility ALARA program 10CFR55.43.4	2.9	1
5	295005 / Main Turbine Generator Trip / 3		X										AK2.03 – Recirculation System	3.3	1

**BWR SRO EXAM OUTLINE ES-401-1**

6	295018 / Partial or Complete Loss of Component Cooling Water Flow / 8							X				AA1.01 – Backup systems	3.4	1
7	<b>295019 / Partial or Complete Loss of Instrument Air / 8</b>								X			AA2.01 – Instrument Air System pressure 10CFR55.43.5	3.6	1
8	<b>295028 / High Drywell Temperature / 5</b>								X			EA2.05 – Torus/suppression chamber pressure: Plant specific 10CFR55.43.5	3.8	1
9	295028 / High Drywell Temperature / 5	X										EK1.02 – Equipment environmental qualification	3.1	1
10	295032 / High Secondary Containment Area Temperature / 5			X								EK3.01 – Emergency/Normal depressurization	3.8	1
11	295032 / High Secondary Containment Area Temperature / 5			X								EK3.02 – Reactor SCRAM	3.8	1

12	295033 / High Secondary Containment Area Radiation Levels / 9	X									EK1.03 – Radiation releases	4.2	1
13	295034 / Secondary Containment Ventilation High Radiation / 9							X			EA2.02 – Cause of high radiation levels 10CFR55.43.5	4.2	1
14	295035 / Secondary Containment High Differential Pressure / 5	X									EK1.02 – Radiation release	4.2	1
15	295036 / Secondary Containment High Sump/Area Water Level / 5							X			EA1.04 – Radiation monitoring: Plant specific	3.4	1
16	<b>600000 / Plant Fire on site / 8</b>									X	2.1.5 – Ability to locate and use procedures and directives related to shift staffing and activities 10CFR55.43.5	3.4	1

**BWR SRO EXAM OUTLINE ES-401-1**

17	600000 / Plant Fire on Site / 8			X									AK3.04 - Actions contained in the abnormal procedure for plant fire on site	3.4	1
Category Point Totals:		3	3	3				2	4			2	Group point totals: 17		17

**BWR SRO EXAM OUTLINE ES-401-1**

**PLANT SYSTEMS - TIER 2 GROUP I**

BWR - Senior Reactor Operator

Target: 23%

Actual: 23%

	SYSTEM #/NAME	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	202002 / Recirculation Flow Control System							X					A1.01 – Recirculation pump speed	3.2	1
2	203000 / RHR/LPCI Injection Mode: Plant specific		X										K2.03 – Initiation logic	2.9	1
3	209002 / High Pressure Core Spray System	X											K1.03 – Water leg (jockey) pump	3.0	1
4	209002 / High Pressure Core Spray System						X						K6.03 – Component cooling water system	2.6	1
5	212000 / Reactor Protection System						X						K6.05 – RPS sensor inputs	3.8	1
6	215004 / Source Range Monitor System (SRM)										X		A4.06 – Alarms and lights	3.1	1

**BWR SRO EXAM OUTLINE ES-401-1**

7	216000 / Nuclear Boiler Instrumentation											X	2.1.6 – Ability to supervise and assume management role during plant transients and upset conditions 10CFR55.43.5	4.3	1
8	215005 / Average Power Range Monitor/Local Power Range Monitor System			X									K3.03 – Reactor Manual Control system: Plant specific	3.3	1
9	216000/ Nuclear Boiler Instrumentation											X	2.2.25 – Knowledge of bases in technical specifications for limiting conditions for operations and safety limits 10CFR55.43.2	3.7	1
10	217000 / Reactor Core Isolation Cooling			X									K3.02 – Reactor vessel pressure	3.6	1
11	217000 / Reactor Core Isolation Cooling					X							K5.01 – Indications of pump cavitation	2.6	1
12	218000 / Automatic Depressurization System	X											K1.03 – Nuclear Boiler instrumentation system	3.8	1

**BWR SRO EXAM OUTLINE ES-401-1**

13	223001 / Primary Containment System and Auxiliaries		X									K2.09 – Drywell cooling fans: Plant specific	2.9	1
14	223001 / Primary Containment System and Auxiliaries								X			A3.02 – Vacuum breaker/relief valve operation	3.4	1
15	<b>261000 / Standby Gas Treatment System</b>										X	2.2.14 – Knowledge of the process for making configuration changes 10CFR55.43.3	3.0	1
16	226001 / RHR/LPCI: Containment Spray System Mode							X				A2.20 – Loss of coolant accident	4.1	1
17	239002 / Relief/Safety Valves				X							K4.06 – Detection of valve leakage	3.7	1
18	259002 / Reactor Water Level Control System							X				A2.02 – Loss of any number of reactor feed flow inputs	3.4	1
19	261000 / Standby Gas Treatment System						X					A1.07 – SBGTS train temperature	2.9	1

**BWR SRO EXAM OUTLINE ES-401-1**

20	262001 / AC Electrical Distribution									X			A3.02 – Automatic bus transfer	3.3	1
21	264000 / Emergency Generators (Diesel/Jet)					X							K5.06 – Load sequencing	3.5	1
22	290001 / Secondary Containment				X								K4.02 – Protection against over pressurization: Plant specific	3.5	1
23	290001 / Secondary Containment							X					A1.01 – System lineups	3.1	1
Category Point Totals:		2	2	2	2	2	2	3	2	2	1	3	Group Point Total: 23		23

**BWR SRO EXAM OUTLINE ES-401-1**

**PLANT SYSTEMS - TIER 2 GROUP II**

BWR - Senior Reactor Operator

Target: 13%

Actual: 13%

	SYSTEM #/NAME	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	201001 / Control Rod Drive Hydraulic System											X	2.4.45 – Ability to prioritize and interpret the significance of each annunciator or alarm 10CFR55.43.5	3.6	1
2	201004 / Rod Sequence Control System (Plant Specific)					X							K5.02 – Sequences and groups: BWR-4, 5	3.3	1
3	201004 / Rod Sequence Control System (Plant Specific)										X		A4.01 – System bypass switches: BWR-4, 5	3.5	1
4	201006 / Rod Worth Minimizer								X				A2.01 – Power supply loss: P-specific	2.8	1
5	<b>202001 / Recirculation System</b>											X	2.2.25 – Knowledge of bases in technical specifications for limiting conditions for operations and safety limits 10CFR55.43.2	3.7	1

6	204000 / Reactor Water Cleanup System								X			A3.01 – system pressure downstream of the pressure regulation valve: LP-RWCU	3.3	1
7	205000 / Shutdown Cooling System (RHR Shutdown Cooling Mode)					X						K6.03 – Recirculation system	3.2	1
8	214000 / Rod Position Information System				X							K4.02 – Thermocouple	2.5	1
9	215002 / Rod Block Monitor System					X						K6.01 – RPS: BWR-3, 4, 5	3.2	1
10	215003 / Intermediate Range Monitor (IRM)		X									K2.01 – IRM channels/detectors	2.7	1
11	263000 / DC Electrical Distribution						X					A1.01 – Battery charging/discharging rate	2.8	1

**BWR SRO EXAM OUTLINE ES-401-1**

12	272000 Radiation Monitoring System	X											K1.05 - Radwaste System	3.1	1
13	290003 / Control Room HVAC			X									K3.01 - Control room habitability	3.8	1
Category Point Totals:		1	1	1	1	1	2	1	1	1	1	2	Group point totals:		13

**BWR SRO EXAM OUTLINE ES-401-1**

**PLANT SYSTEMS - TIER 2 GROUP III**

BWR - Senior Reactor Operator

Target: 4%

Actual: 4%

	SYSTEM #/NAME	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A TOPICS	IMP	POINTS
1	215001 / Traversing In-Core Probe				X								K4.01 - Primary containment isolation: Mark-I&II	3.4	1
2	290002 / Reactor Vessel Internals											X	2.4.21 - Knowledge of the parameters and logic used to assess the status of safety functions including: 1. Reactivity control 2. Core cooling and heat removal 3. Reactor coolant system integrity 4. Containment conditions Radioactivity release control	4.3	1
3	288000 / Plant Ventilation System											X	2.4.30 - Knowledge of which events related to system operation/status should be reported to outside agencies 10CFR55.43.5	3.6	1
4	268000 / Radwaste							X					A1.01 - Radiation level	2.7	1
Category Point Totals:		0	0	0	1	0	0	1	0	0	0	2	Group point totals: 4		4

**BWR SRO EXAM OUTLINE ES-401-1**

**PLANT-WIDE GENERIC RESPONSIBILITIES TIER 3**

BWR - Senior Reactor Operator

Target: 17%

Actual: 17%

	Category	K/A	TOPICS	IMP	POINTS
1	Conduct of Operations	2.1.6	Ability to supervise and assume a management role during plant transients and upset conditions 10CFR55.43.5	4.3	1
2		2.1.13	Knowledge of facility requirements for controlling vital/controlled access 10CFR55.43.5	4.0	1
3		2.1.7	Ability to evaluate plant performance and make operational judgments base on operating characteristics, reactor behavior, and instrument interpretation	4.4	1
4		2.1.20	Ability to execute procedure steps	4.2	1
5		2.1.33	Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications 10CFR55.43.2, 43.3	4.0	1

6	Equipment	2.2.27	Knowledge of the refueling process 10CFR55.43.6	3.5	1
7		2.2.34	Knowledge of the affects of alterations on core configuration 10CFR55.43.6	3.3	1
8	Control	2.2.2	Ability to manipulate the console controls as required to operate the facility between shutdown and designated power levels.	3.5	1

9	Radiation	2.3.3	Knowledge of SRO responsibilities for auxiliary system that are outside the control room (e.g., waste disposal and handling systems) 10CFR55.43.4	2.9	1
10		2.3.1	Knowledge of 10CFR20 and related facility radiation control requirements 10CFR55.43.4	3.0	1
11	Control	2.3.9	Knowledge of the process for performing a containment purge.	3.4	1
12		2.3.10	Ability to perform procedures to reduce excessive levels of radiation and guard against personnel exposure.	3.3	1

**BWR SRO EXAM OUTLINE ES-401-1**

13	Emergency Procedures  Plan	2.4.49	Ability to perform without reference to procedures those actions that require immediate operation of system components and controls 10CFR55.43.2	4.0	1
14		2.4.40	Knowledge of the SROs responsibilities in emergency plan implementation.	4.0	1
15		2.4.45	Ability to prioritize and interpret the significance of each annunciator or alarm.	3.6	1
16		2.4.46	Ability to verify that the alarms are consistent with the plant conditions.	3.6	1
17		2.4.21	Knowledge of the parameters and logic used to assess the status of safety functions including:  5. Reactivity control 6. Core cooling and heat removal 7. Reactor coolant system integrity 8. Containment conditions 9. Radioactivity release control	4.3	1
			Group point totals: 17		

**INDIVIDUAL WALK-THROUGH TEST OUTLINE      FORM ES-301-2**  
 Columbia Generating Station      October 2002

Facility: Columbia Generating Station		Date of examination: October 2002	
Exam level: RO /		SRO-I	
B.1 Control Room Systems			
System / JPM Title		Type Code*	Safety Function
a.	Start Control Room Ventilation  Simulator	D, ESF, A	9
b.	Main Generator / Generator Capability Curve LR001153  Simulator	D, A  2000 NRC Exam	4
c.	Reactor Closed Cooling / Change RCC Pump  Simulator/2000 NRC Exam	D, A	8
d.	Start RCIC with Arm and Depress  Simulator	N, A, L	2
e.	AC Dist. / Transfer SL-31 480V Bus Power Supply From Alternate to Normal.  Simulator	N	6
f.	Change Operating CRD Pump  Control Room	N	1
g.	Purge Drywell LR000164  Control Room	D	9
B2. Facility Walkthrough			
a.	Control Room Evacuation – ED on RPV level LR000147  Plant – Remote Shutdown	D, RCA	3
b.	Close RPS Breakers LR000173  Plant	D, RCA	7
c.	Manual Start of HPCS DG LR000199  Plant	D, RCA	6

**INDIVIDUAL WALK-THROUGH TEST OUTLINE      FORM ES-301-2**  
 Columbia Generating Station      October 2002

<b>Facility: Columbia Generating Station</b>		<b>Date of examination: October 2002</b>	
<b>Exam level: RO / SRO-I</b>			
Spare JPMs			
System / JPM Title		Type Code*	Safety Function
1.	Vent Overpiston Area for Control Rod Insertion LR000258  Plant	D, RCA, L	1
2.	Suppression Pool to CST via FPC LR000208  Simulator	D	9
* Type Codes: (D)irect from bank, (M)odified from bank, (N)ew, (A)lternate path, (L)ow power			
☐	Indicates spare JPMs		

**INDIVIDUAL WALK-THROUGH TEST OUTLINE    FORM ES-301-2**  
 Columbia Generating Station    October 2002

<b>Facility: Columbia Generating Station</b>		<b>Date of examination: October 2002</b>	
<b>Exam level:</b>		<b>SRO-U</b>	
<b>B.1 Control Room Systems</b>			
<b>System / JPM Title / Type Codes *</b>		<b>Type Code</b>	<b>Safety Function</b>
a.	Start Control Room Ventilation  Simulator	D, ESF, A	9
b.	Main Generator / Generator Capability Curve LR001153  Simulator	D, A  2000 NRC Exam	4
d.	Start RCIC with Arm and Depress  Simulator	N, A, L	2
<b>B2. Facility Walkthrough</b>			
a.	Control Room Evacuation – ED on RPV level LR000147  Plant – Remote Shutdown	D, RCA	3
c.	Manual Start of HPCS DG LR000199  Plant	D, RCA	6
<b>Spare JPMs</b>			
<b>System / JPM Title / Type Codes *</b>		<b>Type Code</b>	<b>Safety Function</b>
1.	Vent Overpiston Area for Control Rod Insertion LR000258  Plant	D, RCA, L	1
2.	Suppression Pool to CST via FPC LR000208  Simulator	D, RCA	9
* Type Codes: (D)irect from bank, (M)odified from bank, (N)ew, (A)lternate path, (L)ow power			
Indicates spare JPMs			