

BWR LSRO NRC Examination Outline

Facility: Hope Creek		Date of Exam: 3/10/2003						Exam Level: LSRO					Point Total
Tier	Group	K/A Category Points											
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	
1. Emergency & Abnormal Plant Evolutions	1	0	1	0				1	2			2	6
	2	2	0	3				3	1			5	14
	Tier Totals	2	1	3				4	3			7	20
2. Plant Systems	1	0	0	1	0	0	1	1	0	1	0	1	5
	2	1	1	0	3	1	0	0	2	0	0	0	8
	3	1	0	0	0	0	2	0	1	0	0	0	4
	Tier Totals	2	1	1	3	1	3	1	3	1	0	1	17
3. Reactor and fuel characteristics and physical aspects of core construction important to fuel handling or shutdown activities											8	8	
4. Health Physics and Radiation Protection for fuel handling activities and general employee responsibilities											5	5	

Note:

- The point total for each **tier** in the proposed outline must match that specified in the table. The final point total for each **tier** may deviate by ± 5 percent from that specified in the table based on NRC revisions. The final exam must total **50** points.
- Select topics from many systems; avoid selecting more than two or three K/A topics from a given system unless they relate to plant-specific priorities.
- Systems/evolutions within each group are identified on the associated outline.
- The shaded areas are not applicable to the category/tier.
- * The generic 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.
- On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings for the SRO license level, and the point totals for each system and category. K/As below 2.5 should be justified on the basis of plant-specific priorities. Enter the tier totals for each category in the table above.

BWR SRO Examination Outline
Emergency and Abnormal Evolutions - Tier 1/Group 1

System #	Name	K1	K2	K3	A1	A2	G	KA Topic(s)	Imp.	Pts.
295003	Partial or Complete Loss of A.C. Power				X			AA1.01 A.C. electrical distribution system	3.8	1
295003	Partial or Complete Loss of A.C. Power						X	2.4.11 Knowledge of abnormal condition procedures.	3.6	1
295006	SCRAM									
295007	High Reactor Pressure									
295009	Low Reactor Water Level									
295010	High Drywell Pressure									
295013	High Suppression Pool Temperature									
295014	Inadvertent Reactivity Addition		X					AK2.05 Neutron monitoring system	4.1	1
295014	Inadvertent Reactivity Addition					X		AA2.01 Reactor power	4.2	1
295015	Incomplete SCRAM									
295016	Control Room Abandonment									
295017	High Off-Site Release Rate									
295023	Refueling Accidents					X		AA2.04 Occurrence of fuel handling accident	4.1	1
295023	Refueling Accidents						X	2.4.35 Knowledge of local auxiliary operator tasks during emergency operations including system geography and system implications.	3.5	1
295024	High Drywell Pressure									
295025	High Reactor Pressure									
295026	Suppression Pool High Water Temperature									
295027	High Containment Temperature (Mark III Containment Only)									
295030	Low Suppression Pool Water Level									

System #	Name	K1	K2	K3	A1	A2	G	KA Topic(s)	Imp.	Pts.
295031	Reactor Low Water Level									
295037	SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown									
295038	High Off-Site Release Rate									
500000	High Containment Hydrogen Concentration									

BWR SRO Examination Outline
Emergency and Abnormal Evolutions - Tier 1/Group 2

System #	Name	K1	K2	K3	A1	A2	G	KA Topic(s)	Imp.	Pts.
295001	Partial or Complete Loss of Forced Core Flow Circulation				X			AA1.01 Recirculation system	3.6	1
295002	Loss of Main Condenser Vacuum									
295004	Partial or Complete Loss of D.C. Power									
295005	Main Turbine Generator Trip									
295008	High Reactor Water Level									
295011	High Containment Temperature (Mark III Containment Only)									
295012	High Drywell Temperature									
295018	Partial or Complete Loss of Component Cooling Water	X						AK1.01 Effects on component/system operations	3.6	1
295018	Partial or Complete Loss of Component Cooling Water					X		AA2.01 Component temperatures	3.4	1
295019	Partial or Complete Loss of Instrument Air									
295020	Inadvertent Containment Isolation									
295021	Loss of Shutdown Cooling				X			AA1.04 Alternate heat removal methods	3.7	1
295022	Loss of CRD Pumps	X						AK1.02 Reactivity control	3.7	1
295028	High Drywell Temperature									
295029	High Suppression Pool Water Level									
295032	High Secondary Containment Area Temperature									
295033	High Secondary Containment Area Radiation Levels			X				EK3.04 Personnel evacuation	4.4	1
295033	High Secondary Containment Area Radiation Levels				X			EA1.01 Area radiation monitoring system	4.0	1
295034	Secondary Containment Ventilation High Radiation			X				EK3.01 Isolating secondary containment ventilation	4.1	1

BWR SRO Examination Outline
 Emergency and Abnormal Evolutions - Tier 1/Group 2

System #	Name	K1	K2	K3	A1	A2	G	KA Topic(s)	Imp.	Pts.
295035	Secondary Containment High Differential Pressure						X	2.4.30 Knowledge of which events related to system operations/status should be reported to outside agencies.	3.6	1
295035	Secondary Containment High Differential Pressure						X	2.2.20 Knowledge of the process for managing troubleshooting activities.	3.3	1
295035	Secondary Containment High Differential Pressure						X	2.1.4 Knowledge of shift staffing requirements.	3.4	1
295035	Secondary Containment High Differential Pressure						X	2.1.10 Knowledge of conditions and limitations in the facility license.	3.9	1
295035	Secondary Containment High Differential Pressure						X	2.1.1 Knowledge of conduct of operations requirements.	3.8	1
295036	Secondary Containment High Sump/Area Water Level									
600000	Plant Fire On Site				X			EK3.02 Steps called out in the site fire protection plant, fire protection system manual, and fire zone manual	2.8	1

System	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	KA Topic(s)	Imp.	Pts.
201005	Rod Control and Information System (RCIS)														
202002	Recirculation Flow Control System														
203000	RHR/LPCI: Injection Mode (Plant Specific)			X									K3.01 Reactor water level	4.4	1
206000	High Pressure Coolant Injection System														
207000	Isolation (Emergency) Condenser														
209001	Low Pressure Core Spray System														
209002	High Pressure Core Spray System (HPCS)														
211000	Standby Liquid Control System														
212000	Reactor Protection System														
215004	Source Range Monitor (SRM) System												X 2.2.32 Knowledge of RO duties in the control room during fuel handling such as alarms from fuel handling area, communication with fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentation.	3.3	1
215005	Average Power Range Monitor/Local Power Range Monitor System							X					A1.03 Control rod block status	3.6	1
216000	Nuclear Boiler Instrumentation														
217000	Reactor Core Isolation Cooling System (RCIC)														
218000	Automatic Depressurization System														
223001	Primary Containment System and Auxiliaries														
223002	Primary Containment Isolation System/Nuclear Steam Supply Shut-Off														
226001	RHR/LPCI: Containment Spray System Mode														
239002	Relief/Safety Valves														
241000	Reactor/Turbine Pressure Regulating System														

System Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	KA Topic(s)	Imp.	Pts.
259002 Reactor Water Level Control System														
261000 Standby Gas Treatment System									X			A3.01 System flow	3.3	1
262001 A.C. Electrical Distribution														
264000 Emergency Generators (Diesel/Jet)						X						K6.09 D.C. power	3.5	1
290001 Secondary Containment														

System	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	KA Topic(s)	Imp.	Pts.
201001	Control Rod Drive Hydraulic System														
201002	Reactor Manual Control System														
201004	Rod Sequence Control System (Plant Specific)														
201006	Rod Worth Minimizer System (RWM) (Plant Specific)														
202001	Recirculation System				X								K4.01 2/3 core coverage: Plant-Specific	3.9	1
204000	Reactor Water Cleanup System														
205000	Shutdown Cooling System (RHR Shutdown Cooling Mode)				X								K4.02 High pressure isolation: Plant-Specific	3.8	1
205000	Shutdown Cooling System (RHR Shutdown Cooling Mode)							X					A2.05 System isolation	3.7	1
214000	Rod Position Information System														
215002	Rod Block Monitor System														
215003	Intermediate Range Monitor (IRM) System		X										K2.01 IRM channels/detectors	2.7	1
219000	RHR/LPCI: Torus/Suppression Pool Cooling Mode														
230000	RHR/LPCI: Torus/Suppression Pool Spray Mode														
234000	Fuel Handling Equipment					X							K5.02 Fuel handling equipment interlocks	3.7	1
234000	Fuel Handling Equipment	X											K1.05 Reactor vessel components: Plant-Specific	3.3	1
239003	MSIV Leakage Control System														
245000	Main Turbine Generator and Auxiliary Systems														
259001	Reactor Feedwater System														
262002	Uninterruptable Power Supply (A.C./D.C.)														
263000	D.C. Electrical Distribution														

ES-401

BWR SRO Exam on Outline
Plant Systems - Tier 2/Group 2

ES-401-1

System	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	KA	Topic(s)	Imp.	Pts.
271000	Offgas System															
272000	Radiation Monitoring System								X					A2.01 Fuel element failure	4.1	1
286000	Fire Protection System															
290003	Control Room HVAC															
300000	Instrument Air System (IAS)															
400000	Component Cooling Water System (CCWS)				X									K4.01 Automatic start of standby pump	3.9	1

System	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	KA Topic(s)	Imp.	Pts.
201003	Control Rod and Drive Mechanism	X											K1.01 Control rod drive hydraulic system	3.3	1
215001	Traversing In-Core Probe						X						K6.04 Primary containment isolation system: Mark-I&II(Not- BWR1)	3.4	1
233000	Fuel Pool Cooling and Clean-up								X				A2.02 Low pool level	3.3	1
239001	Main and Reheat Steam System														
256000	Reactor Condensate System														
268000	Radwaste														
288000	Plant Ventilation Systems														
290002	Reactor Vessel Internals						X						K6.05 SBLC	3.4	1

Facility: Hope Creek		Date of Exam: 3/10/03		Exam Level: LSRO	
Category	K/A#	Topic	Imp.	Points	
3. Reactor and fuel characteristics and physical aspects of core construction important to fuel handling or shutdown activities	292001 K1.02	Reactor Theory – Neutrons – Define prompt and delayed neutrons.	3.1	1	
	292002 K1.08	Reactor Theory – Neutron Life Cycle – Define effective multiplication factor and discuss its relationship to the state of d reactor.	2.8	1	
	292003 K1.07	Reactor Theory – Reactor Kinetics and Neutron Sources – Explain prompt critical, prompt jump, and prompt drop.	3.3	1	
	292004 K1.05	Reactor Theory – Reactivity Coefficients – Define the Doppler coefficient of reactivity.	2.9	1	
	292008 K1.30	Reactor Theory – Reactor Operational Physics – Explain the relationship between decay heat generation and: a) power level history, b) power production, and c) time since reactor shutdown.	3.5	1	
	293006 K1.13	Thermodynamics Theory – Fluid Statics – Explain the results of putting centrifugal pumps in parallel or series combinations	2.7	1	
	293008 K1.06	Thermodynamics Theory – Thermal Hydraulics – Define natural convection heat transfer.	2.6	1	
	293010 K1.01	Thermodynamics Theory – Brittle Fracture and Vessel Thermal Stress – State the brittle fracture mode of failure.	2.8	1	
	Total				8
4. Health Physics and Radiation Protection for fuel handling activities and general employee responsibilities	G 2.3.1	Knowledge of 10CFR20 and related facility radiation control requirements.	3.0	1	
	G 2.3.2	Knowledge of facility ALARA program.	2.9	1	
	G 2.3.4	Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized.	3.1	1	
	G 2.3.5	Knowledge of use and function of personnel monitoring equipment.	2.5	1	
	G 2.3.10	Ability to perform procedures to reduce excessive levels of radiation and guard against personnel exposure.	3.3	1	
		Total			

Tier/Group	Randomly Selected K/A	Reason for Rejection
1/2	295021 K3.02	Reduce oversampling in RHR Shutdown Cooling following NRC Outline review. Replaced 295021K3.02 with 261000A3.01 SBGTS/FRVS system flow. Randomly selected from 261000 system KA's.
1/2	295021 G 2.4.35	Reduce oversampling in RHR Shutdown Cooling following NRC Outline review. Replaced KA 295021G2.4.35 with KA Generic 2.3.5 by random selection of remaining Health Physics KA's.
1/2	295022 K3.02	Reduce oversampling in CRD following NRC Outline review. Replaced KK 295022 K3.02 with KA 203000 K3.01 RHR LPCI Reactor water level. Randomly selected from 203000 System KA's.
2/2	201001 K5.03	Replaced KA 201001 K5.03 with KA 215005A1.03 APRM / LPRM Control Rod Block status due to oversampling in CRD following NRC Outline review. Randomly selected from the 215005 system KA's.
3	G 2.1.10	Replaced Generic 2.1.10 with KA 295035 G 2.1.10 to move from Category 4 to Procedures section due to NRC request. IGNORE 295035 K/A Title due to software limitations.
3	G 2.4.30	Replaced Generic KA G 2.4.30 with KA 295035 G 2.4.30 when moved from Category 4 to Procedures section due to NRC request. IGNORE 295035 K/A Title due to software limitations.
3	G 2.1.4	Replaced Generic KA G 2.1.4 with KA 295035 G 2.1.4 when moved from Category 4 to Procedures section due to NRC request. IGNORE 295035 K/A Title due to software limitations.
2/2	204000 K5.04	Replaced KA from 204000 K5.04 with 234000 K5.02 Fuel Handling Equipment - interlocks per NRC Lead Examiner request due to oversampling. RWCU KA too close to JPM.
2/2	205000 K6.03	Replaced KA from 205000 K6.03 with 205000 K4.02 High pressure isolation due to too similar to 295001A101. Randomly selected from 205000 K categories.
1/2	600000 K3.04	Replaced KA 600000 K3.04 with 600000 K3.02 based on original KA outside LSRO responsibilities. KA Selected randomly from 600000K3 category.
1/1	295023 G 2.1.20	Replaced KA 295023 G 2.1.20 with 295023 G 2.4.35 due to being too similar to 272000A201. Randomly selected due to oversampling.
2/3	290002 K6.02	Replaced KA 290002 K6.02 with 290002 K6.05 due to oversampling of CRD. Randomly selected from 290002K6 category.

1/2	295001 A2.04	Replaced 295001 A2.04 with 295035 G 2.2.20 due to oversampling of SDC. Ignore 295035 K/A Title due to software limitations.
1/2	295034 A1.02	Replaced KA 295034 A1.02 with Generic KA 295035 G 2.1.1 due to oversampling of High radiation in the secondary containment. Randomly selected from Generic topics. Ignore 295035 K/A Title due to software limitations.
1/1	295003 G2.4.32	295003 G 2.4.32 replaced with 295003 G 2.4.11. Could not make valid question from KA topic that was not either a direct lookup, or outside scope of LSRO. Replaced KA with KA not already used from same Generic category. Change does not impact Outline KA distribution.
GFE	292005 K1.01	Replaced 292005 K1.01 with 292002 K1.08 due to low discriminatory value IAW Lead Examiner following NRC review. KA selected from remaining unused RX Theory KAs.

Facility: Hope Creek
 Examination Level: SRO(L)

Date of Examination: 3/17/03
 Operating Test Number: 1

Administrative Topic/Subject Description		Describe method of evaluation: 1. ONE Administrative JPM, OR 2. TWO Administrative Questions
A.1	Conduct of Operations JPM	2.1.5 (3.4) – Ability to locate and use procedures and directives related to shift staffing and activities JPM: Apply working hour limitations for LSRO and platform operator
	Conduct of Operations JPM	2.1.18 (3.0) – Ability to make accurate / clear and concise logs / records / status boards / and reports. JPM: Verify HC.OP-DL.ZZ-0026 log requirements for resuming Core Alterations
A.2	Equipment Control JPM	2.2.26 (3.7) – Knowledge of refueling administrative requirements. JPM: Verification of Minor changes to the Fuel Movement Sheet IAW HC.RE-FR.ZZ-0001(Q) Attachment 4
A.3	Radiation Control Questions	2.3. 5 (2.5) – Knowledge of use of personnel monitoring equipment QUESTION: Personnel contamination response
		2.3. 10 (3.3) – Ability to perform procedures to reduce excessive levels of radiation and guard against personnel exposure QUESTION: Requirements for removal of tools or equipment from the Spent Fuel Pool
A.4	Emergency Plan Questions	2.4.40 (4.0) – Knowledge of SRO responsibilities in emergency plan implementation QUESTION: EP Event requiring Accountability of plant personnel
		2.4.41 (4.1) – Knowledge of emergency action level thresholds and classifications QUESTION: EP Event classification for fuel handling event

Facility: Hope Creek

Date of Examination: 3/17/03

Exam Level: SRO(L)

Operating Test No.: 1

B.1: Control Room Systems

	System	JPM Description	Type Code*	Safety Function
S.1	215004 G2.1.23 (4.0) Source Range Monitor	Ability to perform specific system and integrated plant procedures during different modes of plant operation. SRM/IRM Rod Block Bypassing during refueling operations IAW HC.OP-SO.SE-0001 Section 5.4. Perform independent verification of installed jumpers.	D, L	IC
S.2	204000 G2.1.20 (4.2) RWCU	Ability to execute procedure steps. Align RWCU for Alternate Heat Removal Alternate path for bypassing RHX for additional cooling.	N, R, E, L, A	AUX/ DHR
S.3	234000 G2.2.28 (3.5) Fuel Handling Systems	Knowledge of new and spent fuel movement procedures. Manual transfer of dummy bundle within Spent Storage Pool. Unexpected Slack Cable / Bent Mast IAW HC.OP-SO.KE-0001 Attachment 2 (perform or simulate) (JPM-KE-014 Modified for Alternate path due to unexpected Slack Cable.)	N, R, A	FHE
S.4	234000 A3.02 (3.7) Fuel Handling Systems	Interlock operation Perform Monorail Aux Hoist Controls Functional Test HC.OP-FT.KE-0001 Section 5.4.1 through 5.4.15 (perform or simulate)	N, R	FHE
S.5	234000 A3.01 (3.6) Fuel Handling Systems	Crane/refuel bridge movement. Semi-Automatic dummy bundle transfer in the Spent Fuel Pool (perform actual movement).	N, R	FHE

B.2: Facility Walk-Through (Same as RO In-Plant Walkthrough)

NA	NA	NA	NA	NA
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* Type Codes: (D)irect from bank, (M)odified from bank, (N)ew, (A)lternate path, (C)ontrol Room, (S)imulator, (L)ow-Power, (R)CA, (E)OP/AB

Facility: Hope Creek

Scenario No.: 1

Op Test No.: 1

Examiners: _____

Candidates: _____ LSRO

_____ LSRO

_____ LSRO

Objectives: Evaluate applicants' response to an SRM failure. Applicant determines requirements for CRB removal are not met. Evaluate applicants' response to a CRD Mechanism leak. Discuss the effects of lowering fuel pool level. Demonstrate knowledge of method to stop CRDM leak from above with CRB.

Initial Conditions: Operational Condition 5, core alterations in progress. The Reactor Mode Switch is Operable and locked in Refuel position. All Control Rods are inserted except rod 30-31 for friction testing. The CRDM for 14-23 has been replaced after rebuild. All SRMs are operable. Shutdown Margin requirements are met. The Dominion Engineering Inc. (DEI) FSP tool with grid guide is attached to the Frame Mounted Aux Hoist. The Control Rod Grapple is on the Monorail Hoist.

Turnover: You are the Refueling SRO. All fuel is in the vessel except the 4 bundles of the 14-23 cell. Control Rod Blade 14-23 needs to be removed and replaced. The Control Rod Blade 14-23 is fully withdrawn with the CRDM uncoupled from under-vessel. The double blade guide was just removed from cell 14-23 and is on the Main Hoist. You are at Step 5.3 of HC.RE-FR.ZZ-0002.

Event No.	Malf. No.	Event Type*	Event Description	Evaluator Guide
1	1	I	SRM A fails to zero (0) cps	Reviews Tech Spec 3.9.2 for SRM Operability. Determines core alterations may continue for 14-23.
2	N/A	N	Removal of the Control Rod Blade.	Determines rod does not meet Tech Spec 3.9.10.1 requirements for a single control rod removal. Rod 30-30 must be fully inserted. Discusses Restricted Core Operations Form (RCOF) to continue. Remove fuel support piece. Uses CRB Grapple on Monorail Hoist to remove CRB.

3	NA	M	Under vessel crew reports water pouring out 14-23 CRDM flange. They are unable to stop the leak.	<p>Recognizes cavity level would be lowering and takes actions of HC.OP-AB.COOL-0004 Fuel Pool Cooling.</p> <ul style="list-style-type: none"> -Evacuates the Refuel Floor - Notifies Control Room. - Notifies Reactor Engineer. - Notifies Radiation Protection. <p>Recognizes that the CRB needs to be placed back into the guide tube to bottom in order to stop leak. (Not required for full credit)</p>
4	N/A	M	Reactor Engineer and OS concurs with placing CRB back into guide tube.	Puts CRB back into guide tube and lowers to the bottom to stop the leak.

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

Facility: Hope Creek

Scenario No.: 2

Op Test No.: 1

Examiners: _____

Candidates: _____ LSRO

_____ LSRO

_____ LSRO

_____ LSRO

Objectives: To evaluate the applicants' ability to recognize and address problems with control rod support. Recognize HC.OP-AB.CONT-0005 IRRADIATED FUEL DAMAGE entry and take required actions.

Initial Conditions: Core Alterations are in progress. A fuel bundle is in the Fuel Prep Machine, being re-assembled. A move sheet and core map is provided.

Turnover: You are the Refueling SRO. Double blade guide 29-26/31-28 is about to be removed from the core.

Event No.	Malf. No.	Event Type*	Event Description	Evaluator Guide
1	N/A	N	Double blade guide removed IAW HC.OP-SO.KE-0001	Double Blade Guide is grappled to be removed from the core location according to procedure.
2	1	N	Provide adequate support for Control Rod 30-27.	Determines inadequate support and initiates corrective action.
3	N/A	C	A fuel bundle fails in a location causing high radiation conditions on the Refueling Floor and in the Drywell.	Notify Control Room. Implement actions of HC.OP-AB.CONT-0005 IRRADIATED FUEL DAMAGE. Suspends all refueling operations. Recognizes radiological effects on the Drywell.
4	N/A	M	Refuel Floor Exhaust Hi-Hi Radiation alarms	Evacuate the refuel floor. Recognizes FRVS auto start and Reactor Building Ventilation isolation setpoints.
5	N/A	M	Classify the event.	Classifies the event as an ALERT IAW ECG 6.4.2.a

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