

Facility Name:Byron 2016 Initial License													Date of Exam:3/14/2016					
Tier	Group	RO K/A Category Points											SRO-Only Points					
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	Total	A 2	G *	Total		
1. Emergency & Abnormal Plant Evolutions	1	3	3	3	N/A			3	3	N/A			3	18	3	3	6	
	2	1	2	2	N/A			1	1	N/A			2	9	2	2	4	
	Tier Totals	4	5	5	N/A			4	4	N/A			5	27	5	5	10	
2. Plant Systems	1	2	2	3	3	2	3	2	2	3	3	3	28	3	2	5		
	2	1	1	1	1	1	1	1	1	1	0	1	10	0	2	1	3	
	Tier Totals	3	3	4	4	3	4	3	3	4	3	4	38	5	3	8		
3. Generic Knowledge and Categories		Abilities			1	2	3	4					10	1	2	3	4	7
					3	3	2	2						2	2	1	2	

Note: 1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only 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 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		PWR Examination Outline						Form ES-401-2		
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	#
39	000007 Reactor Trip - Stabilization - Recovery / 1			0 1				Actions contained in EOP for reactor trip	4.0	1
40	000008 Pressurizer Vapor Space Accident / 3	0 1						Thermodynamics and flow characteristics of open or leaking valves	3.2	1
	000009 Small Break LOCA / 3									0
41	000011 Large Break LOCA / 3		0 2					Pumps	2.6	1
42	000015 RCP Malfunctions / 4 000017 RCP Malfunctions (Loss of RC Flow) / 4				1 0			RCP ammeter and trip alarm	2.7	1
43	000022 Loss of Rx Coolant Makeup / 2					0 2		Charging pump problems	3.2	1
44	000025 Loss of RHR System / 4				2 0			HPI pump control switch, indicators, ammeter running lights, and flow meter	2.6	1
45	000026 Loss of Component Cooling Water / 8					0 1		Location of a leak in the CCWS	2.9	1
46	000027 Pressurizer Pressure Control System Malfunction / 3	0 1						Definition of saturation temperature	3.1	1
47	000029 ATWS / 1		0 6					Breakers, relays, and disconnects	2.9	1
48	000038 Steam Gen. Tube Rupture / 3				3 9			Drawing S/G into the RCS, using the "feed and bleed" method	3.6	1
	000040 Steam Line Rupture - Excessive Heat Transfer / 4									0
	WE12 Uncontrolled Depressurization of all Steam Generators / 4									0
	000054 (CE/E06) Loss of Main Feedwater / 4									0
	000055 Station Blackout / 6									0
49	000056 Loss of Off-site Power / 6						04. 20	Knowledge of the operational implications of EOP warnings, cautions, and notes.	3.8	1
	000057 Loss of Vital AC Inst. Bus / 6									0
50	000058 Loss of DC Power / 6			0 2				Actions contained in EOP for loss of dc power	4.0	1
51	000062 Loss of Nuclear Svc Water / 4			0 2				The automatic actions (alignments) within the nuclear service water resulting from the actuation of the ESFAS	3.6	1
52	000065 Loss of Instrument Air / 8						04. 09	Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies.	3.8	1
53	W/E04 LOCA Outside Containment / 3					0 2		Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments	3.6	1
54	W/E11 Loss of Emergency Coolant Recirc. / 4		0 1					Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.6	1
55	BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4						02. 37	Ability to determine operability and/or availability of safety related equipment.	3.6	1
56	000077 Generator Voltage and Electric Grid Disturbances / 6	0 2						Over-excitation	3.3	1
K/A Category Totals:		3	3	3	3	3	3	Group Point Total:		18

ES-401		PWR Examination Outline							Form ES-401-2	
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	#
	000001 Continuous Rod Withdrawal / 1									0
	000003 Dropped Control Rod / 1									0
57	000005 Inoperable/Stuck Control Rod / 1						02. 39	Knowledge of less than or equal to one hour Technical Specification action statements for systems.	3.9	1
58	000024 Emergency Boration / 1			01				When emergency boration is required	4.1	1
	000028 Pressurizer Level Malfunction / 2									0
	000032 Loss of Source Range NI / 7									0
	000033 Loss of Intermediate Range NI / 7									0
	000036 Fuel Handling Accident / 8									0
59	000037 Steam Generator Tube Leak / 3					03		That the expected indication on main steam lines from the S/Gs should show increasing radiation levels	3.4	1
60	000051 Loss of Condenser Vacuum / 4			01				Loss of steam dump capability upon loss of condenser vacuum	2.8	1
	000059 Accidental Liquid RadWaste Rel. / 9									0
61	000060 Accidental Gaseous Radwaste Rel. / 9		01					ARM system, including the normal radiation-level indications and the operability status	2.6	1
	000061 ARM System Alarms / 7									0
	000067 Plant Fire On-site / 8									0
62	000068 Control Room Evac. / 8				11			Emergency borate valve controls and indicators	3.9	1
	000069 Loss of CTMT Integrity / 5									1
63	WE14 High Containment Pressure / 5	02						Normal, abnormal and emergency operating procedures associated with High Containment Pressure	3.2	
64	000074 Inad. Core Cooling / 4		06					Turbine bypass and atmospheric dump valves	3.5	
	WE06 Degraded Core Cooling / 4									1
	WE07 Saturated Core Cooling / 4									
	000076 High Reactor Coolant Activity / 9									0
	WE01 Rediagnosis / 3									0
	WE02 SI Termination / 3									0
65	WE13 Steam Generator Over-pressure / 4						04. 06	Knowledge of EOP mitigation strategies.	3.7	1
	WE15 Containment Flooding / 5									0
	WE16 High Containment Radiation / 9									0
	WE03 LOCA Cooldown - Depress. / 4									0
	WE09 Natural Circulation Operations / 4									0
	WE10 Natural Circulation with Steam Voide in Vessel with/without RVLIS. / 4									0
	WE08 RCS Overcooling - PTS / 4									0
K/A Category Totals:		1	2	2	1	1	2	Group Point Total:		9

ES-401		PWR Examination Outline											Form ES-401-2		
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	#
1,2	003 Reactor Coolant Pump		0 2	0 4									CCW pumps; RPS	2.5; 3.9	2
3	004 Chemical and Volume Control					0 9							Thermal shock: high component stress due to rapid temperature change	3.7	1
4,24	005 Residual Heat Removal					0 3					0 2		Reactivity effects of RHR fill water; Heat exchanger bypass flow control	2.9; 3.4	2
5	006 Emergency Core Cooling						0 5						HPI/LPI cooling water	3.0	1
6	007 Pressurizer Relief/Quench Tank											04. 11	Knowledge of abnormal condition procedures.	4.0	1
7	008 Component Cooling Water			0 1									Loads cooled by CCWS	3.4	1
8	010 Pressurizer Pressure Control									0 2			PZR pressure	3.6	1
9	012 Reactor Protection		0 1										RPS channels, components, and interconnections	3.3	1
10,11	013 Engineered Safety Features Actuation						0 1	0 1					Sensors and detectors; RCS pressure and temperature	2.7; 4	2
12	022 Containment Cooling	0 4											Chilled water	2.9	1
	025 Ice Condenser														0
13,14	026 Containment Spray						0 5					01. 20	Chemical additive tank level and concentration; Ability to interpret and execute procedure steps.	3.1; 4.6	2
15	039 Main and Reheat Steam			0 4									MFW pumps	2.5	1
16	059 Main Feedwater								0 7				Tripping of MFW pump turbine	3.0	1
17,18	061 Auxiliary/Emergency Feedwater	0 7							0 4				Emergency water source; pump failure or improper operation	3.6; 3.4	2
19	062 AC Electrical Distribution				1 0								Uninterruptable ac power sources	3.1	1
20	063 DC Electrical Distribution				0 4								Trips	2.6	1
22,23	064 Emergency Diesel Generator					0 8			0 1				Fuel oil storage tanks; Automatic start of compressor and ED/G	3.2; 4.1	2
25	073 Process Radiation Monitoring											04. 31	Knowledge of annunciator alarms, indications, or response procedures.	4.2	1
26, 2	076 Service Water				0 6						0 1		Service water train separation; SWS pumps	2.8; 2.9	2
27	078 Instrument Air										0 1		Pressure gauges	3.1	1
28	103 Containment									0 1			Containment isolation	3.9	1
															0
K/A Category Totals:		2	2	3	3	2	3	2	2	3	3	3	Group Point Total:	28	

ES-401		PWR Examination Outline												Form ES-401-2	
		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	#
29	001 Control Rod Drive		0 2										One-line diagram of power supply to trip breakers	3.6	1
30	002 Reactor Coolant			0 3									Containment	4.2	1
	011 Pressurizer Level Control														0
31	014 Rod Position Indication							0 2					Control rod position indication on control room panels	3.2	1
	015 Nuclear Instrumentation														0
32	016 Non-nuclear Instrumentation					0 1							Separation of control and protection circuits	2.7	1
33	017 In-core Temperature Monitor									0 1			Indications of normal, natural, and interrupted circulation of RCS	3.6	1
34	027 Containment Iodine Removal								0 1				High temperature in the filter system	3.0	1
	028 Hydrogen Recombiner and Purge Control														0
	029 Containment Purge														0
	033 Spent Fuel Pool Cooling														0
	034 Fuel Handling Equipment														0
35	035 Steam Generator			0 3									Automatic blowdown and sample line isolation and reset	2.6	1
36	041 Steam Dump/Turbine Bypass Control	0 5											RCS	3.5	1
	045 Main Turbine Generator														0
	055 Condenser Air Removal														0
	056 Condensate														0
37	068 Liquid Radwaste						1 0						Radiation monitors	2.5	1
	071 Waste Gas Disposal														0
	072 Area Radiation Monitoring														0
	075 Circulating Water														0
38	079 Station Air											04. 50	Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.	4.2	1
	086 Fire Protection														0
K/A Category Totals:		1	1	1	1	1	1	1	1	1	0	1	Group Point Total:	10	

ES-401	PWR Examination Outline							Form ES-401-2		
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	#
	000007 Reactor Trip - Stabilization - Recovery / 1									0
84	000008 Pressurizer Vapor Space Accident / 3					2 0		The effect of an open PORV on code safety, based on observation of plant parameters	3.6	1
	000009 Small Break LOCA / 3									0
85	000011 Large Break LOCA / 3					0 2		Consequences to RHR of not resetting safety injection	3.7	1
	000015 RCP Malfunctions / 4 000017 RCP Malfunctions (Loss of RC Flow) / 4									0
86	000022 Loss of Rx Coolant Makeup / 2						02. 22	Knowledge of limiting conditions for operations and safety limits.	4.7	1
	000025 Loss of RHR System / 4									0
	000026 Loss of Component Cooling Water / 8									0
	000027 Pressurizer Pressure Control System Malfunction / 3									0
	000029 ATWS / 1									0
87	000038 Steam Gen. Tube Rupture / 3					0 6		Shutdown margins and required boron concentrations	4.4	1
	000040 Steam Line Rupture - Excessive Heat Transfer / 4									0
	WE12 Uncontrolled Depressurization of all Steam Generators / 4									0
88	000054 (CE/E06) Loss of Main Feedwater / 4						04. 41	Knowledge of the emergency action level thresholds and classifications.	4.6	1
89	000055 Station Blackout / 6						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.	4.4	1
	000056 Loss of Off-site Power / 6									0
	000057 Loss of Vital AC Inst. Bus / 6									0
	000058 Loss of DC Power / 6									0
	000062 Loss of Nuclear Svc Water / 4									0
	000065 Loss of Instrument Air / 8									0
	W/E04 LOCA Outside Containment / 3									0
	W/E11 Loss of Emergency Coolant Recirc. / 4									0
	BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									0
	000077 Generator Voltage and Electric Grid Disturbances / 6									0
K/A Category Totals:		0	0	0	0	3	3	Group Point Total:		6

ES-401		PWR Examination Outline							Form ES-401-2	
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	#
	000001 Continuous Rod Withdrawal / 1									0
90	000003 Dropped Control Rod / 1						01. 23	Ability to perform specific system and integrated plant procedures during all modes of plant operation.	4.4	1
	000005 Inoperable/Stuck Control Rod / 1									0
	000024 Emergency Boration / 1									0
	000028 Pressurizer Level Malfunction / 2									0
	000032 Loss of Source Range NI / 7									0
	000033 Loss of Intermediate Range NI / 7									0
91	000036 Fuel Handling Accident / 8						02	Occurrence of a fuel handling incident	4.1	1
	000037 Steam Generator Tube Leak / 3									0
	000051 Loss of Condenser Vacuum / 4									0
	000059 Accidental Liquid RadWaste Rel. / 9									0
	000060 Accidental Gaseous Radwaste Rel. / 9									0
	000061 ARM System Alarms / 7									0
	000067 Plant Fire On-site / 8									0
	000068 Control Room Evac. / 8									0
	000069 Loss of CTMT Integrity / 5									0
	W/E14 High Containment Pressure / 5									0
	000074 Inad. Core Cooling / 4									0
	W/E06 Degraded Core Cooling / 4									0
	W/E07 Saturated Core Cooling / 4									0
92	000076 High Reactor Coolant Activity / 9						02	Corrective actions required for high fission product activity in RCS	3.4	1
	W/E01 Rediagnosis / 3									1
93	W/E02 SI Termination / 3						04. 47	Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material.	4.2	1
	W/E13 Steam Generator Over-pressure / 4									0
	W/E15 Containment Flooding / 5									0
	W/E16 High Containment Radiation / 9									0
	W/E03 LOCA Cooldown - Depress. / 4									0
	W/E09 Natural Circulation Operations / 4									0
	W/E10 Natural Circulation with Steam Voide in Vessel with/without RVLIS. / 4									0
	W/E08 RCS Overcooling - PTS / 4									0
K/A Category Totals:		0	0	0	0	2	2	Group Point Total:		4

ES-401		PWR Examination Outline											Form ES-401-2		
Plant Systems - Tier 2/Group 1 (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	#
	003 Reactor Coolant Pump														0
	004 Chemical and Volume Control														0
76	005 Residual Heat Removal								0	1			Failure modes for pressure, flow, pump motor amps, motor temperature, and tank level instrumentation	2.9	1
77	006 Emergency Core Cooling								0	8			Effect of electric power loss on valve position	3.3	1
	007 Pressurizer Relief/Quench Tank														0
	008 Component Cooling Water														0
	010 Pressurizer Pressure Control														0
	012 Reactor Protection														0
	013 Engineered Safety Features Actuation														0
	022 Containment Cooling														0
	025 Ice Condenser														0
	026 Containment Spray														0
	039 Main and Reheat Steam														0
78	059 Main Feedwater											04.08	Knowledge of how abnormal operating procedures are used in conjunction with EOPs.	4.5	1
	061 Auxiliary/Emergency Feedwater														0
	062 AC Electrical Distribution														0
	063 DC Electrical Distribution														0
	064 Emergency Diesel Generator														0
	073 Process Radiation Monitoring														0
79	076 Service Water								0	1			Loss of SWS	3.7	1
	078 Instrument Air														0
80	103 Containment											04.21	Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity.	4.6	1
															0
K/A Category Totals:		0	0	0	0	0	0	0	3	0	0	2	Group Point Total:		5

ES-401		PWR Examination Outline											Form ES-401-2		
		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	#
	001 Control Rod Drive														0
	002 Reactor Coolant														0
81	011 Pressurizer Level Control								0 3				Loss of PZR level	3.9	1
	014 Rod Position Indication														0
82	015 Nuclear Instrumentation								0 4				Effects on axial flux density of control rod alignment and sequencing, xenon production and decay, and boron vs. control rod reactivity changes	3.8	1
	016 Non-nuclear Instrumentation														0
	017 In-core Temperature Monitor														0
	027 Containment Iodine Removal														0
	028 Hydrogen Recombiner and Purge Control														0
	029 Containment Purge														0
	033 Spent Fuel Pool Cooling														0
83	034 Fuel Handling Equipment											02, 25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.	4.2	1
	035 Steam Generator														0
	041 Steam Dump/Turbine Bypass Control														0
	045 Main Turbine Generator														0
	055 Condenser Air Removal														0
	056 Condensate														0
	068 Liquid Radwaste														0
	071 Waste Gas Disposal														0
	072 Area Radiation Monitoring														0
	075 Circulating Water														0
	079 Station Air														0
	086 Fire Protection														0
K/A Category Totals:		0	0	0	0	0	0	0	2	0	0	1	Group Point Total:		3

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Q#	Category	K/A #	Topic	RO		SRO-Only		
				IR	#	IR	#	
66	1. Conduct of Operations	2.1. 28	Knowledge of the purpose and function of major system components and controls.	4.1	1			
67		2.1. 31	Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup.	4.6	1			
68		2.1. 43	Ability to use procedures to determine the effects on reactivity of plant changes, such as reactor coolant system temperature, secondary plant, fuel depletion, etc.	4.1	1			
		2.1.						
94		2.1. 07	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.			4.7	1	
95		2.1. 40	Knowledge of refueling administrative requirements.			3.9	1	
		Subtotal				3		2
69	2. Equipment Control	2.2. 02	Ability to manipulate the console controls as required to operate the facility between shutdown and designated power levels.	4.6	1			
70		2.2. 12	Knowledge of surveillance procedures.	3.7	1			
71		2.2. 42	Ability to recognize system parameters that are entry-level conditions for Technical Specifications.	3.9	1			
		2.2.						
96		2.2. 14	Knowledge of the process for controlling equipment configuration or status.			4.3	1	
97		2.2. 40	Ability to apply Technical Specifications for a system.			4.7	1	
	Subtotal				3		2	
72	3. Radiation Control	2.3. 04	Knowledge of radiation exposure limits under normal or emergency conditions.	3.2	1			
73		2.3. 05	Ability to use radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc.	2.9	1			
		2.3.						
		2.3.						
		2.3. 06						
98		2.3. 14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.			3.8	1	
	Subtotal				2		1	
74	4. Emergency Procedures / Plan	2.4. 18	Knowledge of the specific bases for EOPs.	3.3	1			
75		2.4. 39	Knowledge of RO responsibilities in emergency plan implementation.	3.9	1			
		2.4.						
		2.4.						
99		2.4. 38	Ability to take actions called for in the facility emergency plan, including supporting or acting as emergency coordinator if required.			4.4	1	
100		2.4. 40	Knowledge of SRO responsibilities in emergency plan implementation.			4.5	1	
	Subtotal				2		2	
Tier 3 Point Total					10		7	