Facility: **Byron Nuclear Generating Station** Date of Exam: **October 28 - November 8, 2019**

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 and Abnormal Plant Evolutions	1	3	3	3	N/A			3	3	N/A		3	18	3		3		6		
	2	1	2	2				2	1			1	9	3		1		4		
	Tier Totals	4	5	5				5	4			4	27	6		4		10		
2. Plant Systems	1	3	3	3	2	2	2	2	3	3	2	3	28	2		3		5		
	2	1	0	1	1	1	1	1	1	1	1	1	10	1	1	1		3		
	Tier Totals	4	3	4	3	3	3	3	4	4	3	4	38	4		4		8		
3. Generic Knowledge and Abilities Categories		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 outline sections (i.e., except for one category in Tier 3 of the SRO-only section, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 radiation control K/A is allowed if it is replaced by a K/A from another Tier 3 category.)

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 outline. Systems or evolutions that do not apply at the facility should be deleted with justification. 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' 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 a category 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.

G* Generic K/As

* These systems/evolutions must be included as part of the sample (as applicable to the facility) when Revision 3 of the K/A catalog is used to develop the sample plan. They are not required to be included when using earlier revisions of the K/A catalog.

** These systems/evolutions may be eliminated from the sample (as applicable to the facility) when Revision 3 of the K/A catalog is used to develop the sample plan.

ES-401	PWR Examination Outline							Form ES-401-2	
Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (RO)									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1									
000008 (APE 8) Pressurizer Vapor Space Accident / 3					15		AA2.15 – Ability to determine and interpret the following as they apply to the Pressurizer Vapor Space Accident: ESF control board, valve controls, and indicators. (CFR: 43.5 / 45.13)	3.9	1
000009 (EPE 9) Small Break LOCA / 3						01. 28	G2.1.28 – Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)	4.1	2
000011 (EPE 11) Large Break LOCA / 3		02					EK2.02 – Knowledge of the interrelations between the Large Break LOCA and the following: Pumps. (CFR 41.7 / 45.7)	2.6	3
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4									
000022 (APE 22) Loss of Reactor Coolant Makeup / 2			07				AK3.07 – Knowledge of the reasons for the following responses as they apply to the Loss of Reactor Coolant Makeup: Isolating charging. (CFR: 41.5,10 / 45.6,13)	3.0	4
000025 (APE 25) Loss of Residual Heat Removal System / 4				23			AA1.23 – Ability to operate and/or monitor the following as they apply to the Loss of Residual Heat Removal System: RHR heat exchangers. (CFR: 41.7 / 45.5,6)	2.8	5
000026 (APE 26) Loss of Component Cooling Water / 8						04. 08	G2.4.8 – Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)	3.8	13
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3						04. 45	G2.4.45 – Ability to prioritize and interpret the significance of each annunciator or alarm. (CFR: 41.10 / 43.5 / 45.3,12)	4.1	6
000029 (EPE 29) Anticipated Transient Without Scram / 1	05						EK1.05 – Knowledge of the operational implications of the following concepts as they apply to the ATWS: definition of negative temperature coefficient as applied to large PWR coolant systems. (CFR: 41.8,10 / 45.3)	2.8	7
000038 (EPE 38) Steam Generator Tube Rupture / 3									
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture—Excessive Heat Transfer / 4		01					W E12: EK2.1 – Knowledge of the interrelations between the (Uncontrolled Depressurization of all Steam Generators) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.7)	3.4	8
000054 (APE 54; CE E06) Loss of Main Feedwater /4			03				AK3.03 – Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): Manual control of AFW flow control valves. (CFR: 41.5,10 / 45.6,13)	3.8	9
000055 (EPE 55) Station Blackout / 6	01						EK1.01 – Knowledge of the operational implications of the following concepts as they apply to the Station Blackout: Effect of battery discharge rates on capacity. (CFR: 41.8,10 / 45.3)	3.3	10
000056 (APE 56) Loss of Offsite Power / 6				10			AA1.10 – Ability to operate and/or monitor the following as they apply to the Loss of Offsite Power: Auxiliary/emergency feedwater pump (motor driven). (CFR: 41.7 / 45.5,6)	4.3	11

000057 (APE 57) Loss of Vital AC Instrument Bus / 6					19		AA2.19 – Ability to determine and interpret the following as they apply to the Loss of Vital AC Instrument Bus: The plant automatic actions that will occur on the loss of a vital ac electrical instrument bus. (CFR: 43.5 / 45.13)	4.0	12
000058 (APE 58) Loss of DC Power / 6									
000062 (APE 62) Loss of Nuclear Service Water / 4									
000065 (APE 65) Loss of Instrument Air / 8					08		AA2.08 – Ability to determine and interpret the following as they apply to the Loss of Instrument Air: Failure modes of air-operated equipment. (CFR: 43.5 / 45.13)	2.9	14
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6	02						AK1.02 – Knowledge of the operational implications of the following concepts as they apply to Generator Voltage and Electric Grid Disturbances: Over-excitation. (CFR: 41.4,5,7,10 / 45.8)	3.3	15
(W E04) LOCA Outside Containment / 3		02					W E04: EK2.2 – Knowledge of the interrelations between the (LOCA Outside Containment) and the following: Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. (CFR: 41.7 / 45.7)	3.8	16
(W E11) Loss of Emergency Coolant Recirculation / 4			02				W E11: EK3.02 – Knowledge of the reasons for the following responses as they apply to the (Loss of Emergency Coolant Recirculation): Normal, abnormal and emergency operating procedures associated with (Loss of Emergency Coolant Recirculation. (CFR: 41.5,10 / 45.6,13)	3.5	17
(BW E04; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4				02			W E05: EA1.2 – Ability to operate and/or monitor the following as they apply to the (Loss of Secondary Heat Sink): Operating behavior characteristics of the facility. (CFR: 41.7 / 45.5,6)	3.7	18
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)									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000001 (APE 1) Continuous Rod Withdrawal / 1		08					AK2.08 – Knowledge of the interrelations between the Continuous Rod Withdrawal and the following: Individual rod display lights and indications. (CFR: 41.7 / 45.7)	3.1	19
000003 (APE 3) Dropped Control Rod / 1									
000005 (APE 5) Inoperable/Stuck Control Rod / 1			05				AK3.05 – Knowledge of the reasons for the following responses as they apply to the Inoperable / Stuck Control Rod: Power limits on rod misalignment. (CFR: 41.5,10 / 45.6,13)	3.4	20
000024 (APE 24) Emergency Boration / 1				20			AA1.20 – Ability to operate and/or monitor the following as they apply to Emergency Boration: Manual boration valve and indicators. (CFR: 41.7 / 45.5,6)	3.2	21
000028 (APE 28) Pressurizer (PZR) Level Control Malfunction / 2									
000032 (APE 32) Loss of Source Range Nuclear Instrumentation / 7					04		AA2.04 – Ability to determine and interpret the following as they apply to the Loss of Source Range Nuclear Instrumentation: Satisfactory source-range / intermediate-range overlap. (CFR: 43.5 / 45.13)	3.1	22
000033 (APE 33) Loss of Intermediate Range Nuclear Instrumentation / 7									
000036 (APE 36; BW/A08) Fuel-Handling Incidents / 8									
000037 (APE 37) Steam Generator Tube Leak / 3									
000051 (APE 51) Loss of Condenser Vacuum / 4						01.30	G2.1.30 – Ability to locate and operate components, including local controls. (CFR: 41.7 / 45.7)	4.4	23
000059 (APE 59) Accidental Liquid Radwaste Release / 9									
000060 (APE 60) Accidental Gaseous Radwaste Release / 9	02						AK1.02 – Knowledge of the operational implications of the following concepts as they apply to Accidental Gaseous Radwaste Release: Biological effects on humans of the various types of radiation, exposure levels that are acceptable for personnel in a nuclear reactor power plant; the units used for radiation intensity measurements and for radiation exposure levels. (CFR: 41.8,10 / 45.3)	2.5	24
000061 (APE 61) Area Radiation Monitoring System Alarms / 7									
000067 (APE 67) Plant Fire On Site / 8									
000068 (APE 68; BW A06) Control Room Evacuation / 8									
000069 (APE 69; W E14) Loss of Containment Integrity / 5		03					AK2.03 – Knowledge of the interrelations between the Loss of Containment Integrity and the following: Personnel access hatch and emergency access hatch. (CFR: 41.7 / 45.7)	2.8	25

000074 (EPE 74; W E06 & E07) Inadequate Core Cooling / 4			03				W E06: EK3.03 – Knowledge of the reasons for the following responses as they apply to the (Degraded Core Cooling): Manipulation of controls required to obtain desired operating results during abnormal, and emergency situations. (CFR: 41.5,10 / 45.6,13)	4.0	26
000076 (APE 76) High Reactor Coolant Activity / 9									
000078 (APE 78*) RCS Leak / 3									
(W E01 & E02) Rediagnosis & SI Termination / 3									
(W E13) Steam Generator Overpressure / 4									
(W E15) Containment Flooding / 5									
(W E16) High Containment Radiation /9									
(BW A01) Plant Runback / 1									
(BW A02 & A03) Loss of NNI-X/Y/7									
(BW A04) Turbine Trip / 4									
(BW A05) Emergency Diesel Actuation / 6									
(BW A07) Flooding / 8									
(BW E03) Inadequate Subcooling Margin / 4									
(BW E08; W E03) LOCA Cooldown—Depressurization / 4									
(BW E09; CE A13**; W E09 & E10) Natural Circulation/4				01			W E9: EA1.1 – Ability to opérate and/or montior the following as they apply to the (Natural Circulation Operations): Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.5,6)	3.5	27
(BW E13 & E14) EOP Rules and Enclosures									
(CE A11**; W E08) RCS Overcooling—Pressurized Thermal Shock / 4									
(CE A16) Excess RCS Leakage / 2									
(CE E09) Functional Recovery									
(CE E13*) Loss of Forced Circulation/LOOP/Blackout / 4									
K/A Category Point Totals:	1	2	2	2	1	1	Group Point Total:		9

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 1 (RO)												Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
003 (SF4P RCP) Reactor Coolant Pump							07					A1.07 – Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating RCPS controls including: RCS temperature and pressure. (CFR: 41.5 / 45.5)	3.4	28
004 (SF1; SF2 CVCS) Chemical and Volume Control			08									K3.08 – Knowledge of the effect that a loss or malfunction of the CVCS will have on the following: RCP seal injection. (CFR: 41.7 / 45.6)	3.6	29
								25				A2.25 – Ability to (a) predict the impacts of the following malfunctions or operations on the CVCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Uncontrolled boration or dilution. (CFR: 41.5 / 43.5 / 45.3,5)	3.8	30
005 (SF4P RHR) Residual Heat Removal										05		A4.05 – Ability to manually operate and/or monitor in the control room: Position of RWST recirculation valve (locked when not in use, continuously monitored when in use). (CFR: 41.7 / 45.5 to 45.8)	2.8	31
006 (SF2; SF3 ECCS) Emergency Core Cooling									08			A3.08 – Ability to monitor automatic operation of the ECCS, including: Automatic transfer of ECCS flowpaths. (CFR: 41.7 / 45.5)	4.2	32
											04. 09	G2.4.9 – Knowledge of low power / shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	3.8	33
007 (SF5 PRTS) Pressurizer Relief/Quench Tank											01. 19	G2.1.19 - Ability to use plant computers to evaluate system or component status. (CFR: 41.10 / 45.12)	3.9	34
008 (SF8 CCW) Component Cooling Water	04											K1.04 – Knowledge of the physical connections and/or cause-effect relationships between the CCWS and the following systems: RCS, in order to determine source(s) of RCS leakage into the CCWS. (CFR: 41.2 to 9 / 45.7 to 9)	3.3	35
010 (SF3 PZR PCS) Pressurizer Pressure Control		01										K2.01 – Knowledge of bus power supplies to the following: PZR heaters. (CFR: 41.7	3.0	36
									02			A3.02 – Ability to monitor automatic operation of the PZR PCS, including: PZR pressure. (CFR: 41.7 / 45.5)	3.6	37

012 (SF7 RPS) Reactor Protection			01								K3.01 – Knowledge of the effect that a loss or malfunction of the RPS will have on the following: CRDS. (CFR: 41.7 / 45.6)	3.9	38
							01				A1.01 – Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RPS controls including: Trip setpoint adjustments. (CFR: 41.5 / 45.5)	2.9	39
013 (SF2 ESFAS) Engineered Safety Features Actuation				12							K4.12 – Knowledge of ESFAS design feature(s) and/or interlock(s) which provide for the following: Safety injection block. (CFR: 41.7)	3.7	40
								05			A2.05 - Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of DC control power. (CFR: 41.5 / 43.5 / 45.3,13)	3.7	41
022 (SF5 CCS) Containment Cooling									01		A3.01 – Ability to monitor automatic operation of the CCS, including: Initiation of safeguards mode of operation. (CFR: 41.7 / 45.5)	4.1	42
025 (SF5 ICE) Ice Condenser													
026 (SF5 CSS) Containment Spray				02							K4.02 – Knowledge of CSS design feature(s) and/or interlock(s) which provide for the following: Neutralized boric acid to reduce corrosion and remove inorganic fission product iodine from steam (NAOH) in containment spray (CFR: 41.7)	3.1	43
039 (SF4S MSS) Main and Reheat Steam					08						K5.08 – Knowledge of the operational implications of the following concepts as they apply to the MRSS: Effect of steam removal on reactivity. (CFR: 41.5 / 45.7)	3.6	44
059 (SF4S MFW) Main Feedwater	05										K1.05 – Knowledge of the physical connections and/or cause-effect relationships between the MFW and the following systems: RCS. (CFR: 41.2 to 41.9 / 45.7, 8)	3.1	45
								05			A2.05 - Ability to (a) predict the impacts of the following malfunctions or operations on the MFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Rupture in MFW suction or discharge line. (CFR: 41.5 / 43.5 / 45.3,13)	3.1	46
061 (SF4S AFW) Auxiliary/Emergency Feedwater					02						K5.02 – Knowledge of the operational implications of the following concepts as they apply to the AFW: Decay heat sources and magnitude. (CFR: 41.5 / 45.7)	3.2	47
						01					K6.01 – Knowledge of the effect that a loss or malfunction of the following will have on the AFW components: Controllers and positioners. (CFR: 41.7 / 45.7)	2.5	48

062 (SF6 ED AC) AC Electrical Distribution										03		A4.03 – Ability to manually operate and/or monitor in the control room: Synchroscope, including an understanding of running and incoming voltages. (CFR: 41.7 / 45.5 to 45.8)	2.8	49
063 (SF6 ED DC) DC Electrical Distribution		01										K2.01 – Knowledge of bus power supplies to the following: Major DC loads. (CFR: 41.7)	2.9	50
064 (SF6 EDG) Emergency Diesel Generator						07						K6.07 – Knowledge of the effect that a loss or malfunction of the following will have on the ED/G system: Air receivers. (CFR: 41.7 / 45.7)	2.7	51
073 (SF7 PRM) Process Radiation Monitoring			01									K3.01 – Knowledge of the effect that a loss or malfunction of the PRM system will have on the following: Radioactive effluent releases. (CFR: 41.7 / 45.6)	3.6	52
076 (SF4S SW) Service Water		01										K2.01 – Knowledge of bus power supplies to the following: Service Water. (CFR: 41.7)	2.7	53
078 (SF8 IAS) Instrument Air											04.35	G2.4.35 – Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. (CFR: 41.10 / 43.5 / 45.13)	3.8	54
103 (SF5 CNT) Containment	08											K1.08 – Knowledge of the physical connections and/or cause-effect relationships between the containment system and the following systems: SIS, including action of safety injection reset. (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.6	55
053 (SF1; SF4P ICS*) Integrated Control														
K/A Category Point Totals:	3	3	3	2	2	2	2	3	3	2	3	Group Point Total:		28

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 2 (RO)											Form ES-401-2		
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 (SF1 CRDS) Control Rod Drive										08		A4.08 – Ability to manually operate and/or monitor in the control room: Mode select for CRDS; operation of rod control M/G sets and control panel. (CFR: 41.7 / 45.5 to 45.8)	3.7	56
002 (SF2; SF4P RCS) Reactor Coolant			03									K3.03 – Knowledge of the effect that a loss or malfunction of the RCS will have on the following: Containment. (CFR: 41.7)	4.2	59
011 (SF2 PZR LCS) Pressurizer Level Control														
014 (SF1 RPI) Rod Position Indication											04. 31	G2.4.31 – Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.2	57
015 (SF7 NI) Nuclear Instrumentation	02											K1.02 – Knowledge of the physical connections and/or cause-effect relationships between the NIS and the following systems: Vital ac systems. (CFR: 41.2 to 41.9 / 45.7,8)	3.4	58
016 (SF7 NNI) Nonnuclear Instrumentation														
017 (SF7 ITM) In-Core Temperature Monitor														
027 (SF5 CIRS) Containment Iodine Removal														
028 (SF5 HRPS) Hydrogen Recombiner and Purge Control														
029 (SF8 CPS) Containment Purge														
033 (SF8 SFPCS) Spent Fuel Pool Cooling				03								K4.03 – Knowledge of design feature(s) and/or interlock(s) which provide for the following: Anti-siphon devices. (CFR: 41.7 / 45.6)	2.6	60
034 (SF8 FHS) Fuel-Handling Equipment														
035 (SF 4P SG) Steam Generator					03							K5.03 – Knowledge of operational implications of the following concepts as the apply to the S/GS: Shrink and swell concept. (CFR: 41.5 / 45.7)	2.8	61
041 (SF4S SDS) Steam Dump/Turbine Bypass Control														
045 (SF 4S MTG) Main Turbine Generator									05			A3.05 – Ability to monitor automatic operation of the MT/G system, including: Electrohydraulic control. (CFR: 41.7 / 45.5)	2.6	62
055 (SF4S CARS) Condenser Air Removal														
056 (SF4S CDS) Condensate														
068 (SF9 LRS) Liquid Radwaste						10						K6.10 – Knowledge of the effect that a loss or malfunction of the following will have on the Liquid Radwaste System: Radiation monitors. (CFR: 41.7 / 45.7)	2.5	63
071 (SF9 WGS) Waste Gas Disposal							06					A1.06 – Ability to predict and/or monitor changes in parameter (to prevent exceeding design limits) associated with Waste Gas Disposal System operating the controls including: Ventilation system. (CFR: 41.5 / 45.5)	2.5	64
072 (SF7 ARM) Area Radiation Monitoring														

075 (SF8 CW) Circulating Water													
079 (SF8 SAS**) Station Air													
086 Fire Protection							03				A2.03 – Ability to (a) predict the impacts of the following malfunctions or operations on the Fire Protection System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Inadvertent actuation of the FPS due to circuit failure or welding. (CFR: 41.5 / 43.5 / 45.3,13)	2.7	65
050 (SF 9 CRV*) Control Room Ventilation													
K/A Category Point Totals:	1	0	1	1	1	1	1	1	1	1	1	Group Point Total:		10

ES-401	PWR Examination Outline							Form ES-401-2	
Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (SRO)									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1					04		EA2.04 – Ability to determine or interpret the following as they apply to a reactor trip: If reactor should have tripped but has not done so, manually trip the reactor and carry out actions in ATWS EOP. (CFR: 41.7 / 45.5,6)	4.6	76
000008 (APE 8) Pressurizer Vapor Space Accident / 3									
000009 (EPE 9) Small Break LOCA / 3									
000011 (EPE 11) Large Break LOCA / 3									
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4					08		AA2.08 – Ability to determine and interpret the following as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow): When to secure RCPs on high bearing temperature. (CFR 43.5 / 45.13)	3.5	78
000022 (APE 22) Loss of Reactor Coolant Makeup / 2									
000025 (APE 25) Loss of Residual Heat Removal System / 4									
000026 (APE 26) Loss of Component Cooling Water / 8									
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3									
000029 (EPE 29) Anticipated Transient Without Scram / 1									
000038 (EPE 38) Steam Generator Tube Rupture / 3						02.38	G2.2.38 – Knowledge of conditions and limitations in the facility license. (CFR: 41.7,10 / 43.1 / 45.13)	4.5	77
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture—Excessive Heat Transfer / 4									
000054 (APE 54; CE E06) Loss of Main Feedwater /4									
000055 (EPE 55) Station Blackout / 6									
000056 (APE 56) Loss of Offsite Power / 6						02.40	G2.2.40 – Ability to apply Technical Specifications for a system. (CFR: 41.10 / 43.2,5 / 45.3)	4.7	79
000057 (APE 57) Loss of Vital AC Instrument Bus / 6									
000058 (APE 58) Loss of DC Power / 6					03		AA2.03 – Ability to determine and interpret the following as they apply to the Loss of DC Power: DC loads lost; impact on ability to operate and monitor plant systems. (CFR: 43.5 / 45.13)	3.9	80
000062 (APE 62) Loss of Nuclear Service Water / 4									
000065 (APE 65) Loss of Instrument Air / 8									
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6						04.46	G2.4.46 – Ability to verity that the alarms are consistent with the plant conditions. (CFR: 41.10 / 43.5 / 45.3,12)	4.2	81
(W E04) LOCA Outside Containment / 3									
(W E11) Loss of Emergency Coolant Recirculation / 4									

(BW E04; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4									
K/A Category Totals:					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)									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000001 (APE 1) Continuous Rod Withdrawal / 1									
000003 (APE 3) Dropped Control Rod / 1									
000005 (APE 5) Inoperable/Stuck Control Rod / 1									
000024 (APE 24) Emergency Boration / 1									
000028 (APE 28) Pressurizer (PZR) Level Control Malfunction / 2									
000032 (APE 32) Loss of Source Range Nuclear Instrumentation / 7									
000033 (APE 33) Loss of Intermediate Range Nuclear Instrumentation / 7									
000036 (APE 36; BW/A08) Fuel-Handling Incidents / 8					01		AA2.01 – Ability to determine and interpret the following as they apply to the Fuel Handling Incidents: ARM system indications. (CFR: 43.5 / 45.13)	3.9	82
000037 (APE 37) Steam Generator Tube Leak / 3					12		AA2.12 – Ability to determine and interpret the following as they apply to the Steam Generator Tube Leak: Flow rate of leak. (CFR: 43.5 / 45.13)	4.1	83
000051 (APE 51) Loss of Condenser Vacuum / 4									
000059 (APE 59) Accidental Liquid Radwaste Release / 9									
000060 (APE 60) Accidental Gaseous Radwaste Release / 9									
000061 (APE 61) Area Radiation Monitoring System Alarms / 7									
000067 (APE 67) Plant Fire On Site / 8									
000068 (APE 68; BW A06) Control Room Evacuation / 8					03		AA2.03 – Ability to determine and interpret the following as they apply to the Control Room Evacuation: T-hot, T-cold, and in-core temperatures. (CFR: 43.5 / 45.13)	4.2	84
000069 (APE 69; W E14) Loss of Containment Integrity / 5									
000074 (EPE 74; W E06 & E07) Inadequate Core Cooling / 4									
000076 (APE 76) High Reactor Coolant Activity / 9									
000078 (APE 78*) RCS Leak / 3									
(W E01 & E02) Rediagnosis & SI Termination / 3									
(W E13) Steam Generator Overpressure / 4									
(W E15) Containment Flooding / 5									
(W E16) High Containment Radiation /9									
(BW A01) Plant Runback / 1									
(BW A02 & A03) Loss of NNI-X/Y/7									
(BW A04) Turbine Trip / 4									
(BW A05) Emergency Diesel Actuation / 6									
(BW A07) Flooding / 8									
(BW E03) Inadequate Subcooling Margin / 4									
(BW E08; W E03) LOCA Cooldown—Depressurization / 4									
(BW E09; CE A13**; W E09 & E10) Natural Circulation/4									
(BW E13 & E14) EOP Rules and Enclosures									

(CE A11**; W E08) RCS Overcooling—Pressurized Thermal Shock / 4						02.22	G2.2.22 – Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 /45.2)	4.7	85
(CE A16) Excess RCS Leakage / 2									
(CE E09) Functional Recovery									
(CE E13*) Loss of Forced Circulation/LOOP/Blackout / 4									
K/A Category Point Totals:					3	1	Group Point Total:		4

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 1 (SRO)												Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
003 (SF4P RCP) Reactor Coolant Pump											01. 23	G2.1.23 – Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 41.10 / 43.5 / 45.2,6)	4.4	86
004 (SF1; SF2 CVCS) Chemical and Volume Control														
005 (SF4P RHR) Residual Heat Removal														
006 (SF2; SF3 ECCS) Emergency Core Cooling														
007 (SF5 PRTS) Pressurizer Relief/Quench Tank														
008 (SF8 CCW) Component Cooling Water														
010 (SF3 PZR PCS) Pressurizer Pressure Control														
012 (SF7 RPS) Reactor Protection														
013 (SF2 ESFAS) Engineered Safety Features Actuation														
022 (SF5 CCS) Containment Cooling								05				A2.05 - Ability to (a) predict the impacts of the following malfunctions or operations on the CCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Major leak in CCS. (CFR: 41.5 / 43.5 / 45.3,13)	3.5	87
025 (SF5 ICE) Ice Condenser														
026 (SF5 CSS) Containment Spray														
039 (SF4S MSS) Main and Reheat Steam														
059 (SF4S MFW) Main Feedwater														
061 (SF4S AFW) Auxiliary/Emergency Feedwater														
062 (SF6 ED AC) AC Electrical Distribution														
063 (SF6 ED DC) DC Electrical Distribution											02. 12	G2.2.12 – Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)	4.1	88
064 (SF6 EDG) Emergency Diesel Generator								03				A2.03 – Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Parallel operation of ED/Gs. (CFR: 41.5 / 43.5 / 45.3,13)	3.1	89
073 (SF7 PRM) Process Radiation Monitoring														
076 (SF4S SW) Service Water														
078 (SF8 IAS) Instrument Air														

103 (SF5 CNT) Containment										01.32	G2.1.32 – Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	4.0	90
053 (SF1; SF4P ICS*) Integrated Control													
K/A Category Point Totals:							2			3	Group Point Total:		5

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 2 (SRO)											Form ES-401-2		
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 (SF1 CRDS) Control Rod Drive														
002 (SF2; SF4P RCS) Reactor Coolant														
011 (SF2 PZR LCS) Pressurizer Level Control														
014 (SF1 RPI) Rod Position Indication														
015 (SF7 NI) Nuclear Instrumentation														
016 (SF7 NNI) Nonnuclear Instrumentation														
017 (SF7 ITM) In-Core Temperature Monitor														
027 (SF5 CIRS) Containment Iodine Removal														
028 (SF5 HRPS) Hydrogen Recombiner and Purge Control														
029 (SF8 CPS) Containment Purge														
033 (SF8 SFPCS) Spent Fuel Pool Cooling														
034 (SF8 FHS) Fuel-Handling Equipment				01								K4.01 – Knowledge of design feature(s) and/or interlock(s) which provide for the following: Fuel protection from binding and dropping. (CFR: 41.7)	3.4	91
035 (SF 4P SG) Steam Generator														
041 (SF4S SDS) Steam Dump/Turbine Bypass Control								02				A2.02 – Ability to (a) predict the impacts of the following malfunctions or operations on the SDS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Steam valve stuck open. (CFR: 41.5 / 43.5 / 45.3,13)	3.9	92
045 (SF 4S MTG) Main Turbine Generator														
055 (SF4S CARS) Condenser Air Removal														
056 (SF4S CDS) Condensate														
068 (SF9 LRS) Liquid Radwaste														
071 (SF9 WGS) Waste Gas Disposal														
072 (SF7 ARM) Area Radiation Monitoring														
075 (SF8 CW) Circulating Water														
079 (SF8 SAS**) Station Air											04.47	G2.4.47 – Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material. (CFR: 41.10 / 43.5 / 45.12)	4.2	93
086 Fire Protection														
050 (SF 9 CRV*) Control Room Ventilation														
K/A Category Point Totals:	0	0	0	1	0	0	0	1	0	0	1	Group Point Total:		3

Facility: **Byron Nuclear Generating Station** Date of Exam: **October 28 - November 8, 2019**

Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.25	G2.1.25 - Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 43.5 / 45.12)	3.9	66		
	2.1.18	G2.1.18 – Ability to make accurate, clear, and concise logs, records, status boards, and reports.. (CFR: 41.10 / 45.12,13)	3.6	67		
	2.1.39	G2.1.39 – Knowledge of conservative decision making practices. (CFR: 41.10 / 43.5 / 45.12)	3.6	68		
	2.1.35	G2.1.35 – Knowledge of the fuel-handling responsibilities of SROs. (CFR: 41.10 / 43.7)			3.9	94
	2.1.37	G2.1.37 – Knowledge of procedures, guidelines, or limitations associated with reactivity management. (CFR: 41.1 / 43.6 / 45.6)			4.6	95
	Subtotal			3		2
2. Equipment Control	2.2.3	G2.2.3 - Knowledge of the design, procedural, and operational differences between units. (CFR: 41.5,6,7,10 / 45.12)	3.8	69		
	2.2.35	G2.2.35 – Ability to determine Technical Specification Mode of Operation. (CFR: 41.7,10 / 43.2 / 45.13)	3.6	70		
	2.2.39	G2.2.39 – Knowledge of less than or equal to one hour Technical Specification action statements for systems. (CFR: 41.7,10 / 43.2 / 45.13)	3.9	71		
	2.2.37	G2.2.37 – Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)			4.6	96
	2.2.44	G2.2.44 – 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. (CFR: 41.5 / 43.5 / 45.12)			4.4	97
	Subtotal			3		2
3. Radiation Control	2.3.4	G2.3.4 – Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)	3.2	72		
	2.3.7	G2.3.7 – Ability to comply with radiation work permit requirements during normal or abnormal conditions. (CFR: 41.12 / 45.10)	3.5	73		
	2.3.14	G2.3.14 – Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities. (CFR: 41.12 / 43.4 / 45.10)			3.8	98
	Subtotal			2		1
4. Emergency Procedures/Plan	2.4.3	G2.4.3 – Ability to identify post-accident instrumentation. (CFR: 41.6 / 45.4)	3.7	74		
	2.4.29	G2.4.29 – Knowledge of the emergency plan. (CFR: 41.10 / 43.5 / 45.11)	3.1	75		
	2.4.38	G2.4.38 – Ability to take actions called for in the facility emergency plan, including supporting or acting as emergency coordinator if required. (CFR: 41.10 / 43.5 / 45.11)			4.4	99

	2.4.23	G2.4.23 – Knowledge of the bases for prioritizing emergency procedure implementation during emergency operations. (CFR: 41.10 / 43.5 / 45.13)			4.4	100
	Subtotal			2		2
Tier 3 Point Total				10		7