ES-401 **PWR Examination Outline** **Form ES-401-2**

Facility: Byron Nuclear Station Date of Exam: 04/29/2013

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	A2		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	1				1	2			2	9	2		2		4				
	Tier Totals	4	5	4				4	5			5	27	5		5		10				
2. Plant Systems	1	3	2	3	3	2	2	3	3	2	2	3	28	3		2		5				
	2	1	1	1	1	1	1	1	1	1	1	0	10	0	2	1		3				
	Tier Totals	4	3	4	4	3	3	4	4	3	3	3	38	5		3		8				
3. Generic Knowledge and Abilities Categories		1			2			3			4		10	1	2	3	4	7				
		2			3			3			2			2	2	2	1					

Note:

1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two).
2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ±1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points and the SRO-only exam must total 25 points.
3. Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; operationally important, site-specific systems that are not included on the outline should be added. Refer to ES-401, Attachment 2, 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.
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. 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 Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO)						Form ES-401-2	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000007 (CE/E02) Reactor Trip - Stabilization - Recovery / 1			01				Actions contained in EOP for reactor trip	4.0	29
000008 Pressurizer Vapor Space Accident / 3		02					Sensors and detectors	2.7	30
000009 Small Break LOCA / 3					S	R	2.01.31 Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. A2.15 RCS parameters	4.6 3.4	31 79
000011 Large Break LOCA / 3	01						Natural circulation and cooling, including reflux boiling	4.1	32
000015/17 RCP Malfunctions / 4		01					RCP indicators and controls	2.8	33
000022 Loss of Rx Coolant Makeup / 2				06			CVCS Charging pump ammeters and running indicators	2.9	34
000025 Loss of RHR System / 4				12			RCS Temperature indicators	3.6	35
000026 Loss of Component Cooling Water / 8					04		The normal values and upper limits for the temperatures of the components cooled by CCW	2.5	36
000027 Pressurizer Pressure Control System Malfunction / 3					S		A2.04 Tech-Spec limits for RCS pressure	4.3	76
000029 ATWS / 1					01		Reactor nuclear instrumentation	4.4	37
000038 Steam Gen. Tube Rupture / 3						S	2.2.22 Knowledge of limiting conditions for operations and safety limits	4.7	77
000040 (CE/E05) Steam Line Rupture - Excessive Heat Transfer / 4					S		A2.03 Difference between steam line rupture and LOCA	4.7	78
WE12 Uncontrolled Depressurization of all Steam Generators / 4	03						Annunciators and conditions indicating signals, and remedial actions associated with the Uncontrolled Depressurization of all Steam Generators	3.4	38
000054 (CE/E06) Loss of Main Feedwater / 4			05				HPI/PORV cycling upon total feedwater loss	4.6	39
000055 Station Blackout / 6									
000056 Loss of Off-site Power / 6						x	2.4.02 Knowledge of system setpoints, interlocks, and automatic actions associated with EOP entry conditions	4.5	40
000057 Loss of Vital AC Inst. Bus / 6					19		The plant automatic actions that will occur on the loss of a vital ac electrical instrument bus	4.0	41
000058 Loss of DC Power / 6						S	2.4.32 Knowledge of operator response to loss of all annunciators	4.0	80
000062 Loss of Nuclear Svc Water / 4						S	2.4.23 Knowledge of the bases for prioritizing emergency procedure implementation during emergency operations	4.4	81
000065 Loss of Instrument Air / 8				03			Restoration of systems served by instrument air when pressure is regained	2.9	42
W/E04 LOCA Outside Containment / 3	02						Normal, abnormal, and emergency operating procedures associated with LOCA Outside Containment	3.5	43
W/E11 Loss of Emergency Coolant Recirc. / 4						x	2.4.13 Knowledge of crew roles and responsibilities during EOP usage.	4.0	44
BW/E04, W/E05 Inadequate Heat Transfer – Loss of Secondary Heat Sink / 4		01					Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features	3.6	45
000077 Generator Voltage and Electric Grid Disturbances / 6			02				Actions contained in abnormal operating procedure for voltage and grid disturbances	3.6	46
K/A Category Totals:	3	3	3	3	3 / 3	3 / 3	Group Point Total:		18/6

ES-401	PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO)							Form ES-401-2
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					03		Proper actions to be taken if automatic safety functions have not taken place	4.5	47
000003 Dropped Control Rod / 1									
000005 Inoperable/Stuck Control Rod / 1						R	2.1.37 Knowledge of procedures, guidelines, or limitations associated with reactivity management	4.3	48
000024 Emergency Boration / 1									
000028 Pressurizer Level Malfunctions / 2					03		Charging subsystem flow indicator and controller	2.8	53
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7									
000036 Fuel Handling Accident / 8		02					Radiation monitoring equipment (portable and installed)	3.4	49
000037 Steam Generator Tube Leak / 3					S		A2.10 Tech-Spec limits for RCS leakage	4.1	82
000051 Loss of Condenser Vacuum / 4									
000059 Accidental Liquid RadWaste Rel. / 9				01			Radioactive-liquid monitor	3.5	50
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 APRM System Alarms / 7			02				Guidance contained in alarm responses for ARM system	3.4	51
000068 (BW/A06) Control Room Evac / 8						S	2.4.49 Ability to perform without reference to procedures those actions that require immediate operation of system	4.4	83
000069 (W/E14) Loss of CTMT Integrity / 5									
000074 Inad. Core Cooling / 4	06						Definition of superheated steam	3.0	52
000076 High Reactor Coolant Activity / 9					S		A2.03 RCS radioactivity level meter	3.0	85
W/E02 SI Termination / 3						R	2.4.46 Ability to verify that the alarms are consistent with the plant conditions	4.2	55
W/E07 Saturated Core Cooling / 4						S	2.4.21 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, containment conditions, radioactivity release control, etc.	4.6	84
W/E16 High Containment Radiation / 9		01					Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features	3.0	54
K/A Category Point Totals:	1	2	1	1	2 / 2	2 / 2	Group Point Total:		9/4

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (RO / SRO)												Form ES-401-2	
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		01						03				RCPs; Problems associated with RCP motors; including faulty motors and current, and winding and bearing temperature problems	3.1 2.7	1 5
004 Chemical and Volume Control					15							K5.15 Boron and control rod reactivity effects as they relate to MTC	3.3	2
005 Residual Heat Removal								04			R	RHR valve malfunction; 2.1.7 Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.	2.9 4.4	3 4
006 Emergency Core Cooling								S		01		Pumps; A2.11 Rupture of ECCS header	4.1 4.4	6 86
007 Pressurizer Relief/Quench Tank								03				Overpressurization of the PZR	3.6	7
008 Component Cooling Water							01					CCW flow rate	2.8	8
010 Pressurizer Pressure Control	03									01		RCS; PZR spray valve	3.6 3.7	9 10
012 Reactor Protection						01					S	Bistables and bistable test equipment G. 2.2.14	2.8 4.3	11 87
013 Engineered Safety Features Actuation			02									RCS	4.3	12
022 Containment Cooling	04							S				Chilled Water A202: Fan motor vibration	2.9 2.6	13 88
026 Containment Spray		01									x	Containment Spray Pumps; G 2.2.22, Knowledge of limiting conditions for operations and safety limits	3.4 4.0	14 15
039 Main and Reheat Steam					08							Effect of steam removal on reactivity	3.6	16
059 Main Feedwater			02						04			AFW System; Turbine driven feed pump	3.6 2.5	17 18
061 Auxiliary/Emergency Feedwater						01						Controllers and positioners	2.5	19
062 AC Electrical Distribution				10							S	Uninterruptable ac power sources G 2.2.42: Ability to recognize system parameters that are entry-level conditions for Technical Specifications	3.1 4.6	20 89
063 DC Electrical Distribution				01					01			Manual/automatic transfers of control; Meters, annunciators, dials, recorders, and indicating lights	2.7 2.7	21 22
064 Emergency Diesel Generator							08					Maintaining minimum load on ED/G (to prevent reverse power)	3.1	23
073 Process Radiation Monitoring			01									Radioactive effluent releases	3.6	24
076 Service Water				06							R	G 2.2.15 Service water train separation; Ability to determine the expected plant configuration using design and configuration control documentation, such as drawings, line-ups, tag-outs, etc.	2.8 3.9	25 26
078 Instrument Air	02											Service Air	2.7	27
103 Containment							01	S				Containment pressure, temperature, and humidity A2.02: Necessary plant conditions for work in containment	3.7 3.2	28 90
K/A Category Point Totals:	3	2	3	3	2	2	3	3 / 3	2	2	3 / 2	Group Point Total:		28/5

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)											Form ES-401-2		
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			02									RCS	3.4	56
002 Reactor Coolant														
014 Rod Position Indication										04		Re-zeroing of rod position prior to startup	2.7	59
015 Nuclear Instrumentation														
016 Non-nuclear Instrumentation								S				A2.01 Detector failure	3.1	91
017 In-core Temperature Monitor					01							Temperature at which cladding and fuel melt	3.1	57
027 Containment Iodine Removal		01										Fans	3.1	58
033 Spent Fuel Pool Cooling														
034 Fuel Handling Equipment						02						Radiation Monitoring Systems	2.6	60
035 Steam Generator								S				A2.06: Small Break LOCA	4.6	93
041 Steam Dump / Turbine Bypass Control				03								Relationship of low/low T-ave. setpoint in SDS to primary cooldown	3.0	61
045 Main Turbine Generator											S	G 2.4.27: Knowledge of “fire in the palnt” procedures	3.9	92
056 Condensate								04				Loss of condensate pumps	2.6	63
071 Waste Gas Disposal									03			Radiation monitoring system alarm and actuating signals	3.6	62
075 Circulating Water	01											SWS	2.5	064
079 Station Air														
086 Fire Protection							01					Fire header pressure	2.9	65
K/A Category Point Totals:	1	1	1	1	1	1	1	2	1	1	0	Group Point Total:		10/3

ES-401 **Generic Knowledge and Abilities Outline (Tier 3)** **Form ES-401-3**

Facility: Palisades Nuclear Plant Date of Exam: 02/ 26/2013

Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.05	Ability to use procedures related to shift staffing, such as minimum crew complement, overtime limitations, etc.			3.9	94
	2.1.06	Ability to manager the control room crew during plant transients	3.8	66		
	2.1.23	Ability to perform specific system and integrated plant procedures during all modes of plant operation.			4.4	95
	2.1.40	Knowledge of refueling administrative requirements	2.8	67		
	Subtotal			2		2
2. Equipment Control	2.2.04	Ability to explain the variations in control board layouts, systems, instrumentation, and procedural actions between units at a facility	3.6	68		
	2.2.20	Knowledge of the process for managing troubleshooting activities			3.8	96
	2.2.25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits			4.2	97
	2.2.36	Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations	3.1	69		
	Subtotal			2		2
3. Radiation Control	2.3.04	Knowledge of radiation exposure limits under normal or emergency conditions			3.7	98
	2.3.07	Ability to comply with radiation work permit requirements during normal or abnormal conditions.	3.5	71		
	2.3.11	Ability to control radiation releases	4		4.3	99
	2.3.13	Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc	3.4	72		
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities	3.4	73		
	Subtotal			3		2
4. Emergency Procedures / Plan	2.4.11	Knowledge of abnormal condition procedures.			4.2	100
	2.4.16	Knowledge of EOP implementation hierarchy and coordination with other support procedures or guidelines such as, operating procedures, abnormal operating procedures, and severe accident management guidelines.	3.5	74		
	2.4.32	Knowledge of operator response to loss of all annunciators.	3.6	75		
	Subtotal			2		1
Tier 3 Point Total				10		7