Facility: Arkansas Nuclear One (Unit 1) Retake Exam Date of Exam: June 2017

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	2	3	3	N/A			3	4	N/A		3	18			
	2	2	1	2				1	2			1	9			
	Tier Totals	4	4	5				4	6			4	27			
2. Plant Systems	1	3	3	2	3	2	2	3	3	2	3	2	28			
	2	1	0	1	1	1	1	1	1	1	1	1	10			
	Tier Totals	4	3	3	4	3	3	4	4	3	4	3	38			
3. Generic Knowledge and Abilities Categories		1			2			3			4		10	1	2	3	4	
		3			3			2			2							

Note: RO

1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the 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). (One Tier 3 Radiation Control K/A is allowed if the K/A 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 associated 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' 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 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

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 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1									
000008 Pressurizer Vapor Space Accident / 3				X			AA1. Ability to operate and / or monitor the following as they apply to the Pressurizer Vapor Space Accident: AA1.06 Control of PZR level (CFR 41.7 / 45.5 / 45.6)	3.6	1 1121 MOD
000009 Small Break LOCA / 3		X					EK2. Knowledge of the interrelations between the small break LOCA and the following: EK2.03 S/Gs (CFR 41.7 / 45.7)	3.0	2 368 Bank 2005
000011 Large Break LOCA / 3					X		EA2. Ability to determine or interpret the following as they apply to a Large Break LOCA: EA2.11 Conditions for throttling or stopping HPI (CFR 43.5 / 45.13)	3.9	3 491 Bank 2013
000015/17 RCP Malfunctions / 4	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Reactor Coolant Pump Malfunctions (Loss of RC Flow): AK1.02 Consequences of an RCPS failure (CFR 41.8 / 41.10 / 45.3)	3.7	4 396 Bank 2013
000022 Loss of Rx Coolant Makeup / 2			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Reactor Coolant Makeup: AK3.02 Actions contained in SOPs and EOPs for RCPs, loss of makeup, loss of charging, and abnormal charging (CFR 41.5, 41.10 / 45.6 / 45.13)	3.5	5 610 Bank 2005
000025 Loss of RHR System / 4						X	2.2.42 Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (CFR: 41.7 / 41.10 / 43.2 / 43.3 / 45.3)	3.9	6 1122 New
000026 Loss of Component Cooling Water / 8				X			AA1. Ability to operate and / or monitor the following as they apply to the Loss of Component Cooling Water: AA1.06 Control of flow rates to components cooled by the CCWS (CFR 41.7 / 45.5 / 45.6)	2.9	7 1123 New
000027 Pressurizer Pressure Control System Malfunction / 3		X					AK2. Knowledge of the interrelations between the Pressurizer Pressure Control Malfunctions and the following: AK2.03 Controllers and positioners (CFR 41.7 / 45.7)	2.6	8 933 New

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	#
000029 ATWS / 1									
000038 Steam Gen. Tube Rupture / 3									
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4					X		AA2. Ability to determine and interpret the following as they apply to the Steam Line Rupture: AA2.04 Conditions requiring ESFAS initiation (CFR: 43.5 / 45.13)	4.5	9 1124 New
000054 (CE/E06) Loss of Main Feedwater / 4					**X**		AA2. Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW): AA2.01 Occurrence of reactor and/or turbine trip. (CFR 41.7 / 43.5 / 45.13)	4.3	10 623 Bank 2005
000055 Station Blackout / 6	X						EK1. Knowledge of the operational implications of the following concepts as they apply to the Station Blackout : EK1.02 Natural circulation cooling (CFR 41.8 / 41.10 / 45.3)	4.1	11 1125 MOD
000056 Loss of Off-site Power / 6						X	2.4.4 Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.5	12
000057 Loss of Vital AC Inst. Bus / 6				X			AA1. Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: AA1.06 Manual control of components for which automatic control is lost (CFR 41.7 / 45.5 / 45.6)	3.5	13
000058 Loss of DC Power / 6					X		AA2. Ability to determine and interpret the following as they apply to the Loss of DC Power: AA2.03 DC loads lost; impact on ability to operate and monitor plant systems (CFR 43.5 / 45.13)	3.5	14 41 Bank 2001
000062 Loss of Nuclear Svc Water / 4			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: AK3.02 The automatic actions (alignments) within the nuclear service water resulting from the actuation of the ESFAS (CFR 41.4, 41.8 / 45.7)	3.6	15 947 Bank 2013
000065 Loss of Instrument Air / 8			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Instrument Air: AK3.03 Knowing effects on plant operation of isolating certain equipment from instrument air (CFR 41.5, 41.10 / 45.6 / 45.13)	2.9	16 108 MOD

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	#
W/E04 LOCA Outside Containment / 3									
W/E11 Loss of Emergency Coolant Recirc. / 4									
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4		X					EK2. Knowledge of the interrelations between the (Inadequate Heat Transfer) and the following: EK2.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.7)	3.8	17
000077 Generator Voltage and Electric Grid Disturbances / 6						X	2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 43.5 / 45.12)	3.9	18 1126 New
K/A Category Totals:	2	3	3	3	4	3	**Group Point Total:**		**18**

ES-401 PWR Examination Outline Form ES-401-2
Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (**RO** / SRO)

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					X		AA2. Ability to determine and interpret the following as they apply to the Continuous Rod Withdrawal : AA2.03 Proper actions to be taken if automatic safety functions have not taken place (CFR: 43.5 / 45.13)	4.5	19 397 Bank 2001
000003 Dropped Control Rod / 1			X				AK3. Knowledge of the reasons for the following responses as they apply to the Dropped Control Rod: AK3.04 Actions contained in EOP for a dropped control rod. (CFR: 41.5, 41.10 / 45.6 / 45.13)	3.8	20 1127 New
000005 Inoperable/Stuck Control Rod / 1									
000024 Emergency Boration / 1									
000028 Pressurizer Level Malfunction / 2									
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Loss of Intermediate Range Nuclear Instrumentation: AK1.01 Effects of voltage changes on performance (CFR: 41.8 / 41.10 / 45.3)	2.7	21 1128 New
000036 (BW/A08) Fuel Handling Accident / 8									
000037 Steam Generator Tube Leak / 3									
000051 Loss of Condenser Vacuum / 4									
000059 Accidental Liquid Radwaste Rel. / 9									
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
000067 Plant Fire On-site / 8									
000068 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5									
000074 (W/E06&E07) Inad. Core Cooling / 4									
000076 High Reactor Coolant Activity / 9									
W/EO1 & E02 Rediagnosis & SI Termination / 3									
W/E13 Steam Generator Over-pressure / 4									
W/E15 Containment Flooding / 5									
W/E16 High Containment Radiation / 9									

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	#
BW/A01 Plant Runback / 1		X					AK2. Knowledge of the interrelations between the (Plant Runback) and the following: AK2.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.7)	3.7	22
BW/A02&A03 Loss of NNI-X/Y / 7				X			AA1. Ability to operate and / or monitor the following as they apply to the (Loss of NNI-X) AA1.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.5 / 45.6)	4.0	23
BW/A04 Turbine Trip / 4						X	2.1.27 Knowledge of system purpose and/or function. (CFR: 41.7)	3.9	24
BW/A05 Emergency Diesel Actuation / 6									
BW/A07 Flooding / 8					X		AA2. Ability to determine and interpret the following as they apply to the (Flooding) AA2.2 Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments. (CFR: 43.5 / 45.13)	3.3	25
BW/E03 Inadequate Subcooling Margin / 4									
BW/E08; W/E03 LOCA Cooldown - Depress. / 4			X				EK3. Knowledge of the reasons for the following responses as they apply to the (LOCA Cooldown): EK3.2 Normal, abnormal and emergency operating procedures associated with (LOCA Cooldown). (CFR: 41.5 / 41.10, 45.6, 45.13)	3.0	26
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4									
BW/E13&E14 EOP Rules and Enclosures	X						EK1. Knowledge of the operational implications of the following concepts as they apply to the (EOP Rules) EK1.3 Annunciators and conditions, indicating signals, and remedial actions associated with the (EOP Rules). (CFR: 41.8 / 41.10 / 45.3)	3.0	27
CE/A11; W/E08 RCS Overcooling - PTS / 4									
CE/A16 Excess RCS Leakage / 2									
CE/E09 Functional Recovery									
K/A Category Point Totals:	**2**	**1**	**2**	**1**	**2**	**1**	**Group Point Total:**		**9**

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					X							Knowledge of the operational implications of the following concepts as they apply to the RCPS: K5.04 Effects of RCP shutdown on secondary parameters, such as steam pressure, steam flow, and feed flow (CFR: 41.5 / 45.7)	3.2	28
003 Reactor Coolant Pump				X								Knowledge of RCPS design feature(s) and/or interlock(s) which provide for the following: : K4.02 Prevention of cold water accidents or transients (CFR: 41.7)	2.5	29
004 Chemical and Volume Control						X						Knowledge of the effect of a loss or malfunction on the following CVCS components: K6.17 Flow paths for emergency boration (CFR: 41.7 / 45.7)	4.4	30
005 Residual Heat Removal			X									Knowledge of the effect that a loss or malfunction of the RHRS will have on the following: K3.07 Refueling operations (CFR: 41.7 / 45.6)	3.2	31
006 Emergency Core Cooling							X					Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: A1.13 Accumulator pressure (level, boron concentration) (CFR: 41.5 / 45.5)	3.5	32
007 Pressurizer Relief/Quench Tank									X			Ability to monitor automatic operation of the PRTS, including: A3.01 Components which discharge to the PRT (CFR: 41.7 / 45.5)	2.7	33
008 Component Cooling Water								X				Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 High/low surge tank level (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.2	34

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	#
008 Component Cooling Water		X										Knowledge of bus power supplies to the following: K2.02 CCW pump, including emergency backup (CFR: 41.7)	3.0	35
010 Pressurizer Pressure Control									X			A3. Ability to monitor automatic operation of the PZR PCS, including: A3.02 PZR pressure (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.6	36
012 Reactor Protection						**X**						K6. Knowledge of the effect of a loss or malfunction of the following will have on the RPS: K6.03 Trip logic circuits (CFR: 41.7 / 45.7)	3.1	37
013 Engineered Safety Features Actuation											X	013 Engineered Safety Features Actuation System (ESFAS) 2.2.39 Knowledge of less than or equal to one hour Technical Specification action statements for systems.	3.9	38
013 Engineered Safety Features Actuation										X		Ability to manually operate and/or monitor in the control room: A4.01 ESFAS-initiated equipment which fails to actuate (CFR: 41.7 / 45.5 to 45.8)	4.5	39
022 Containment Cooling	X											Knowledge of the physical connections and/or cause-effect relationships between the CCS and the following systems: K1.01 SWS/cooling system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.5	40
025 Ice Condenser														
026 Containment Spray		X										Knowledge of bus power supplies to the following: K2.02 MOVs (CFR: 41.7)	2.7	41
039 Main and Reheat Steam					X							Knowledge of the operational implications of the following concepts as they apply to the MRSS: K5.08 Effect of steam removal on reactivity (CFR: 41.5 / 45.7)	3.6	42

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	#
039 Main and Reheat Steam				X								Knowledge of MRSS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.05 Automatic isolation of steam line	3.7	43
059 Main Feedwater								X				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: A2.03 Overfeeding event (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.7	44
061 Auxiliary/Emergency Feedwater							X					Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the AFW controls including: A1.05 AFW flow/motor amps (CFR: 41.5 / 45.5)	3.6	45
062 AC Electrical Distribution			X									Knowledge of the effect that a loss or malfunction of the ac distribution system will have on the following: K3.03 DC system (CFR: 41.7 / 45.6)	3.7	46
063 DC Electrical Distribution				X								Knowledge of DC electrical system design feature(s) and/or interlock(s) which provide for the following: K4.01 Manual/automatic transfers of control (CFR: 41.7)	2.7	47
063 DC Electrical Distribution											X	063 DC Electrical Distribution 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 43.5 / 45.12)	3.9	48
064 Emergency Diesel Generator										X		Ability to manually operate and/or monitor in the control room: A4.10 Need for, and consequences of, manually shedding (loads) safeguards bus (CFR: 41.7 / 45.5 to 45.8)	3.3	49
073 Process Radiation Monitoring	X											Knowledge of the physical connections and/or cause effect relationships between the PRM system and the following systems: K1.01 Those systems served by PRMs (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.6	50

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	#
073 Process Radiation Monitoring							X					Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PRM system controls including: A1.01 Radiation levels (CFR: 41.5 / 45.7)	3.2	51
076 Service Water										X		Ability to manually operate and/or monitor in the control room: A4.02 SWS valves (CFR: 41.7 / 45.5 to 45.8)	2.6	52
076 Service Water		X										Knowledge of bus power supplies to the following: K2.08 ESF-actuated MOVs (CFR: 41.7)	3.1	53
078 Instrument Air	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the IAS and the following systems: K1.05 MSIV air (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.4	54
103 Containment								X				A2. Ability to (a) predict the impacts of the following malfunctions or operations on the containment system and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations A2 03 Phase A and B isolation (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.5	55
K/A Category Point Totals:	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**Group Point Total:**		**28**

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	X											Knowledge of the physical connections and/or cause effect relationships between the CRDS and the following systems: K1.09 CCWS must be cut in before energizing CRDS (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.8	56
002 Reactor Coolant			X									Knowledge of the effect that a loss or malfunction of the RCS will have on the following: K3.02 Fuel (CFR: 41.7)	4.2	57
011 Pressurizer Level Control														
014 Rod Position Indication					X							Knowledge of the operational implications of the following concepts as they apply to the RPIS: K5.02 RPIS independent of demand position (CFR: 41.5 / 45.7)	2.8	58
015 Nuclear Instrumentation							X					A1. Ability to predict and/or monitor changes in parameters to prevent exceeding design limits associated with operating the NIS controls including: A1.02 SUR (CFR: 41.5 . 45.5)	3.5	59
016 Non-Nuclear Instrumentation									X			Ability to monitor automatic operation of the NNIS, including: A3.01 Automatic selection of NNIS inputs to control systems (CFR: 41.7 / 45.5)	2.9	60
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge											X	2.4.46 Ability to verify that the alarms are consistent with the plant conditions. (CFR: 41.10 / 43.5 / 45.3 / 45.12)	4.2	61
033 Spent Fuel Pool Cooling														
034 Fuel Handling Equipment														
035 Steam Generator														
041 Steam Dump/Turbine Bypass Control										X		Ability to manually operate and/or monitor in the control room: A4.08 Steam dump valves (CFR: 41.7 / 45.5 to 45.8)	3.0	62

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	#
045 Main Turbine Generator														
055 Condenser Air Removal														
056 Condensate														
068 Liquid Radwaste								X				Ability to (a) predict the impacts of the following malfunctions or operations on the Liquid Radwaste System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.04 Failure of automatic isolation (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.3	63
071 Waste Gas Disposal														
072 Area Radiation Monitoring														
075 Circulating Water														
079 Station Air				X								Knowledge of SAS design feature(s) and/or interlock(s) which provide for the following: K4.01 Cross-connect with IAS (CFR: 41.7)	2.9	64
086 Fire Protection						X						Knowledge of the effect of a loss or malfunction on the Fire Protection System following will have on the : K6.04 Fire, smoke, and heat detectors (CFR: 41.7 / 45.7)	2.6	65
K/A Category Point Totals:	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**Group Point Total:**		**10**

Facility:	Arkansas Nuclear One (Unit 1) Retake Exam		Date of Exam: June 2017			
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.3	Knowledge of shift or short-term relief turnover practices. (CFR: 41.10 / 45.13)	3.7	66		
	2.1.29	Knowledge of how to conduct system lineups, such as valves, breakers, switches, etc. (CFR: 41.10 / 45.1 / 45.12)	4.1	67		
	2.1.37	Knowledge of procedures, guidelines, or limitations associated with reactivity management. (CFR: 41.1 / 43.6 / 45.6)	4.3	68		
	Subtotal		3			
2. Equipment Control	2.2.6	Knowledge of the process for making changes to procedures. CFR: 41.10 / 43.3 / 45.13)	3.0	69		
	2.2.22	Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)	4.0	70 115 Bank 2004		
	2.2.35	Ability to determine Technical Specification Mode of Operation (CFR: 41.7 / 41.10 / 43.2 / 45.13)	3.6	71 458 Bank 2011		
	Subtotal		3			
3. Radiation Control	2.3.12	Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 45.9 / 45.10)	3.2	72		
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities. (CFR: 41.12 / 43.4 / 45.10)	3.4	73		
	Subtotal		2			
4. Emergency Procedures / Plan	2.4.29	Knowledge of the emergency plan. (CFR: 43.5 / 45.11)	2.6	74 128 Bank 2005		
	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. (CFR: 41.10 / 43.5 / 45.13)	3.5	75		
	Subtotal		2			
Tier 3 Point Total			**10**			

Tier / Group	Randomly Selected K/A	Reason for Rejection
T1/G1	054 AK1.02	This K/A states"… Effects of feedwater introduction on dry S/G". ANO-1 does not have any guidance on feeding a dry S/G following a loss of MFW event. ANO-1's only guidance on feeding a dry S/G is if MFW is used to feed a S/G with an unisolable steam leak (not a MFW leak). The only remaining K/A (AK1.01) does not appear to lead to development of a discriminating question without the question being overly complicated. Replaced with AA2.01 which has high importance values (4.3/4.4).
T1/G1	077 2.4.2	This K/A concerns the knowledge of setpoints associated with EOP entry conditions. This system is also on the SRO exam and development of a question about setpoints could compromise the SRO question. Replaced with K/A 2.1.25 concerning the use of graphs which has an importance rating of 3.9.
T1/G2	003 AK3.09	This K/A states "Recording of group bank position for dropped rod (reference point used to withdraw dropped rod to equal height with other rods in the bank)". Although a dropped rod will be leveled to be equal to the other rods in it's group, ANO-1 does not record the group position therefore a question could not be developed for this K/A. Replaced with K/A AK 3.04 which has a higher importance rating of 3.8. The question developed for this K/A meets the intent of the original K/A.
T2/G1	063 2.1.25	This K/A states: " Ability to interpret reference materials, such as graphs, curves, tables, etc." There are no such references used with the DC electrical distribution system at ANO-1. Replaced with K/A 2.2.42 "Ability to recognize system parameters that are entry-level conditions for Technical Specifications" with an importance rating of 3.9 (same as 2.1.25).
T2/G2	041 A4.06	This K/A concerns "Atmospheric relief valve controllers" which, at ANO-1, are controlled by EFIC, not the Steam Dump control system which is part of ICS. Replaced with A4.08 "Steam dump valves" which meets the intent of the original K/A.
T3	2.4.4	This K/A is the ability to recognize entry level conditions for emergency and abnormal operating procedures. A question could not be developed for this K/A that was not also a system type question. Replaced with K/A 2.4.29, knowledge of the emergency plan.

Facility: Arkansas Nuclear One (Unit 1) Retake Exam Date of Exam: June 2017

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				N/A					N/A				3	3	6
	2													2	2	4
	Tier Totals													5	5	10
2. Plant Systems	1													2	3	5
	2													1 1	1	3
	Tier Totals													4	4	8
3. Generic Knowledge and Abilities Categories		1			2			3			4			1	2	3	4	7
														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). (One Tier 3 Radiation Control K/A is allowed if the K/A 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 associated 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' 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 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

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 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1									
000008 Pressurizer Vapor Space Accident / 3									
000009 Small Break LOCA / 3									
000011 Large Break LOCA / 3									
000015/17 RCP Malfunctions / 4									
000022 Loss of Rx Coolant Makeup / 2					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Reactor Coolant Makeup: AA2.01 Whether charging line leak exists. (CFR 43.5/ 45.13)	3.8	76 1119 New
000025 Loss of RHR System / 4									
000026 Loss of Component Cooling Water / 8									
000027 Pressurizer Pressure Control System Malfunction / 3						X	2.2.36 Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations. (CFR: 41.10 / 43.2 / 45.13)	4.2	77 1113 New
000029 ATWS / 1									
000038 Steam Gen. Tube Rupture / 3									
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4					X		AA2. Ability to determine and interpret the following as they apply to the Steam Line Rupture: AA2.03 Difference between steam line rupture and LOCA (CFR 43.5 / 45.13)	4.7	78 1112 New
000054 (CE/E06) Loss of Main Feedwater / 4									
000055 Station Blackout / 6									
000056 Loss of Off-site Power / 6									
000057 Loss of Vital AC Inst. Bus / 6									
000058 Loss of DC Power / 6						X	2.2.25 Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)	4.2	79 840 Bank
000062 Loss of Nuclear Svc Water / 4									
000065 Loss of Instrument Air / 8					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Instrument Air: AA2.05 When to commence plant shutdown if instrument air pressure is decreasing. (CFR 43.5 / 45.13)	**4.1**	80 1114 New

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	#
~~W/E04 LOCA Outside Containment / 3~~									
~~W/E11 Loss of Emergency Coolant Recirc. / 4~~									
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									
000077 Generator Voltage and Electric Grid Disturbances / 6						X	2.4.11 Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)	4.2	81 734 MOD
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 (RO / **SRO**)

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									
000003 Dropped Control Rod / 1									
000005 Inoperable/Stuck Control Rod / 1									
000024 Emergency Boration / 1									
000028 Pressurizer Level Malfunction / 2									
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7									
000036 (BW/A08) Fuel Handling Accident / 8					X		AA2. Ability to determine and interpret the following as they apply to the Fuel Handling Incidents: AA2.03 Magnitude of potential radioactive release (CFR: 43.5 / 45.13)	4.2	82 1115 New
000037 Steam Generator Tube Leak / 3									
000051 Loss of Condenser Vacuum / 4									
000059 Accidental Liquid Radwaste Rel. / 9									
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
000067 Plant Fire On-site / 8									
000068 (BW/A06) Control Room Evac. / 8						X	2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 41.10 / 43.5 / 45.2 / 45.6)	4.4	83 1116 New
~~000069 (W/E14) Loss of CTMT Integrity / 5~~									
~~000074 (W/E06&E07) Inad. Core Cooling / 4~~									
000076 High Reactor Coolant Activity / 9									
~~W/E01 & E02 Rediagnosis & SI Termination / 3~~									
~~W/E13 Steam Generator Over-pressure / 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									

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	#
BW/E08; W/E03 LOCA Cooldown - Depress. / 4						X	2.4.41 Knowledge of the emergency action level thresholds and classifications. (CFR: 41.10 / 43.5 / 45.11)	4.6	84 129 Bank
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4					X		EA2. Ability to determine and interpret the following as they apply to the (Natural Circulation Cooldown) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations. (CFR: 43.5 / 45.13)	4.2	85 1118 New
BW/E13&E14 EOP Rules and Enclosures									
~~CE/A11; W/E08 RCS Overcooling - PTS / 4~~									
~~CE/A16 Excess RCS Leakage / 2~~									
~~CE/E09 Functional Recovery~~									
K/A Category Point Totals:					**2**	**2**	**Group Point Total:**		**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 System (RCPS)											X	2.1.7 Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 41.5 / 43.5 / 45.12 / 45.13)	4.7	86 809 Bank 2010
004 Chemical and Volume Control														
005 Residual Heat Removal								X				A2. Ability to (a) predict the impacts of the following malfunctions or operations on the RHRS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 Pressure transient protection during cold shutdown (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.7	87 594 MOD
006 Emergency Core Cooling											X	2.2.40 Ability to apply Technical Specifications for a system. (CFR: 41.10 / 43.2 / 43.5 / 45.3)	4.6	88 1009 Bank 2013
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water														
010 Pressurizer Pressure Control														
012 Reactor Protection														
013 Engineered Safety Features Actuation											X	2.4.6 Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	4.7	89 1117 New
022 Containment Cooling														
~~025 Ice Condenser~~														
026 Containment Spray								X				A2. Ability to (a) predict the impacts of the following malfunctions or operations on the CSS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.08 Safe securing of containment spray (when it can be done) (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.7	90 1075 Repeat 2016
039 Main and Reheat Steam														
059 Main Feedwater														
061 Auxiliary/Emergency Feedwater														
062 AC Electrical Distribution														

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	#
063 DC Electrical Distribution														
064 Emergency Diesel Generator														
073 Process Radiation Monitoring														
076 Service Water														
078 Instrument Air														
103 Containment														
K/A Category Point Totals:								**2**			**3**	**Group Point Total:**		**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														
002 Reactor Coolant														
011 Pressurizer Level Control														
014 Rod Position Indication								X				A2. Ability to (a) predict the impacts of the following malfunctions or operations on the RPIS; and (b) based on those on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.03 Dropped rod (CFR: 41.5 / 43.5 / 45.3 / 45.13)	4.1	91 841 Bank 2011
015 Nuclear Instrumentation														
016 Non-Nuclear Instrumentation														
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling														
034 Fuel Handling Equipment	X											K1. Knowledge of the physical connections and/or cause effect relationships between the Fuel Handling System and the following systems: K1.02 RHRS (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.2	92 1120 New
035 Steam Generator														
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator														
055 Condenser Air Removal														
056 Condensate														
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring														
075 Circulating Water														
079 Station Air														
086 Fire Protection											X	2.2.40 Ability to apply Technical Specifications for a system. (CFR: 41.10 / 43.2 / 43.5 / 45.3)	4.7	93 1110 New

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	#
K/A Category Point Totals:	**1**							**1**			**1**	**Group Point Total:**		**3**

Facility: **ANO, Unit 1** Date of Exam: **June 2017**

Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.	2.1.37 Knowledge of procedures, guidelines, or limitations associated with reactivity management. (CFR: 41.1 / 43.6 / 45.6)			4.6	94 1109 New
	2.1.	2.1.34 Knowledge of primary and secondary plant chemistry limits. (CFR: 41.10 / 43.5 / 45.12)			3.5	95 1108 New
	Subtotal					2
2. Equipment Control	2.2.	2.2.7 Knowledge of the process for conducting special or infrequent tests. (CFR: 41.10 / 43.3 / 45.13)			3.6	96 486 (2016) Repeat
	2.2.	2.2.14 Knowledge of the process for controlling equipment configuration or status. (CFR: 41.10 / 43.3 / 45.13)			4.3	97 1107 New
	Subtotal					2
3. Radiation Control	2.3.	2.3.12 Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 45.9 / 45.10)			3.7	98 1018 (2013) Bank
	Subtotal					1
4. Emergency Procedures / Plan	2.4.	2.4.28 Knowledge of procedures relating to a security event (non-safeguards information). (CFR: 41.10 / 43.5 / 45.13)			4.1	99 0880 New
	2.4.	2.4.44 Knowledge of emergency plan protective action recommendations. (CFR: 41.10 / 41.12 / 43.5 / 45.11)			4.4	100 359 (1999) Bank
	Subtotal					2
Tier 3 Point Total						**7**

Tier / Group	Randomly Selected K/A	Reason for Rejection
T1/G1	058 2.2.47	This K/A states: "Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material." This K/A does not lead to development of an appropriate SRO level question for this system (Loss of DC Power) due to a lack of reference material other than the loss of DC power AOP. Replaced with K/A 2.2.25: "Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits."
T1/G1	065 AA2.08	This K/A states: "Ability to determine and interpret the following as they apply to the Loss of Instrument Air: Failure modes of air-operated equipment." This K/A does not lead to development of an appropriate SRO level question since it involves mere system knowledge. Replaced with K/A AA2.05.
T1/G1	022 AA2.02	This K/A concerns: "Charging pump problems " but was unable to develop a discriminating SRO Only question since charging pump problems are easily diagnosed. Replaced with K/A AA2.01 which entails diagnosing charging line leaks.
T2/G1	006 A2.13	This K/A states: "… Inadvertent SIS actuation". This K/A does not lead to development of an appropriate SRO level question since there is only one procedure for an inadvertent ESAS actuation (1203.053) which has no transitions to other procedures except the Reactor Trip EOP. Replaced with generic K/A 2.2.40 "Ability to apply Technical Specifications for a system."
3	2.4.9	This K/A is about low power implications in accident mitigation strategies. An SRO only question could not be developed for this K/A without it being a systems question. Replaced with 2.4.28 "knowledge of procedures related to a security event".
3	2.4.18	This K/A is the "knowledge of the specific bases for EOPs". An SRO Only question could not be developed for this question which was not also RO knowledge or was system based. Replaced with 2.4.44 "knowledge of emergency plan protective action recommendations".