Facility: Arkansas Nuclear One, Unit 2 Date of Exam: February 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	4	N/A			2	4	N/A		3	18			
	2	2	2	0				2	1			2	9			
	Tier Totals	4	5	4				4	5			5	27			
2. Plant Systems	1	3	2	2	3	2	2	3	3	3	3	2	28			
	2	1	0	1	1	1	1	1	1	1	1	1	10			
	Tier Totals	4	2	3	4	3	3	4	4	4	4	3	38			
3. Generic Knowledge and Abilities Categories		3			2			2			3		10			

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 Reactor Trip / 1~~									
~~CE/E02 Reactor Trip Recovery / 1~~									
000008 Pressurizer Vapor Space Accident / 3			X				Knowledge of the reasons for the following responses as they apply to the Pressurizer Vapor Space Accident: (CFR 41.5,41.10 / 45.6 / 45.13) AK3.05 ECCS termination or throttling criteria	4.0	8
000009 Small Break LOCA / 3		X					Knowledge of the interrelations between the small break LOCA and the following: (CFR 41.7 / 45.7) EK2.03 S/Gs	3.0	14
~~000011 Large Break LOCA / 3~~									
000015/17 RCP Malfunctions / 4		X					Knowledge of the interrelations between the Reactor Coolant Pump Malfunctions (Loss of RC Flow) and the following: (CFR 41.7 / 45.7) AK2.07 RCP seals	2.9	13
000022 Loss of Rx Coolant Makeup / 2						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)	3.1	18
000025 Loss of RHR System / 4				X			Ability to operate and/or monitor the following as they apply to the Loss of Residual Heat Removal System: AA1.12 RCS temperature indicators	3.6	10
000026 Loss of Component Cooling Water / 8						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	7
000027 Pressurizer Pressure Control System Malfunction / 3					X		Ability to determine and interpret the following as they apply to the Pressurizer Pressure Control Malfunctions: (CFR: 43.5 / 45.13) AA2.18 Operable control channel	3.4	5
000029 ATWS / 1					X		Ability to determine or interpret the following as they apply to a ATWS: (CFR 43.5 / 45.13) EA2.05 System component valve position indications	3.4	15
~~000038 Steam Gen. Tube Rupture / 3~~									
000040 Steam Line Rupture / 4				X			Ability to operate and / or monitor the following as they apply to the Steam Line Rupture: (CFR 41.7 / 45.5 / 45.6) AA1.08 Normal operating steam parameters, as a function of power	3.6	17

CE/E05 Excess Steam Demand / 4			X				Knowledge of the reasons for the following responses as they apply to the (Excess Steam Demand) (CFR: 41.5 / 41.10, 45.6, 45.13) EK3.1 Facility operating characteristics during transient conditions, including coolant chemistry and the effects of temperature, pressure, and reactivity changes and operating limitations and reasons for these operating characteristics.	3.6	4
000054 Loss of Main Feedwater / 4	X						Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): (CFR 41.8 / 41.10 / 45.3) AK1.01 MFW line break depressurizes the S/G (similar to a steam line break)	4.1	1
CE/E06 Loss of Feedwater / 4		X					Knowledge of the interrelations between the (Loss of Feedwater) and the following: (CFR: 41.7 / 45.7) EK2.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.3	3
000055 Station Blackout / 6						X	2.1.19 Ability to use plant computers to evaluate system or component status. (CFR: 41.10 / 45.12)	3.9	11
000056 Loss of Off-site Power / 6			X				Knowledge of the reasons for the following responses as they apply to the Loss of Offsite Power: (CFR 41.5,41.10 / 45.6 / 45.13) AK3.02 Actions contained in EOP for loss of offsite power	4.4	6
000057 Loss of Vital AC Inst. Bus / 6			X				Knowledge of the reasons for the following responses as they apply to the Loss of Vital AC Instrument Bus: (CFR 41.5,41.10 / 45.6 / 45.13) AK3.01 Actions contained in EOP for loss of vital ac electrical instrument bus	4.1	12
000058 Loss of DC Power / 6					X		Ability to determine and interpret the following as they apply to the Loss of DC Power:(CFR 41.5 / 41.10 / 45.6 / 45.13) AA2.03 DC loads lost; impact on to operate and monitor plant systems.	3.5	9
~~000062 Loss of Nuclear Svc Water / 4~~									
000065 Loss of Instrument Air / 8					X		Ability to determine and interpret the following as they apply to the Loss of Instrument Air: (CFR: 43.5 / 45.13) AA2.05 When to commence plant shutdown if instrument air pressure is decreasing	3.4	16
000077 Generator Voltage and Electric Grid Disturbances / 6	X						Knowledge of the operational implications of the following concepts as they apply to Generator Voltage and Electric Grid Disturbances: (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8) AK1.02 Over-excitation	3.3	2
K/A Category Totals:	2	3	4	2	4	3	Group Point Total:		18

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~~									
~~000003 Dropped Control Rod / 1~~									
~~000005 Inoperable/Stuck Control Rod / 1~~									
000024 Emergency Boration / 1						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)	4.4	23
000028 Pressurizer Level Malfunction / 2		X					Knowledge of the interrelations between the Pressurizer Level Control Malfunctions and the following: (CFR 41.7 / 45.7) AK2.03 Controllers and positioners	2.6	21
000032 Loss of Source Range NI / 7	X						Knowledge of the operational implications of the following concepts as they apply to Loss of Source Range Nuclear Instrumentation: (CFR 41.8 / 41.10 / 45.3) AK1.01 Effects of voltage changes on performance	2.5	26
~~000033 Loss of Intermediate Range NI / 7~~									
000036 Fuel Handling Accident / 8				X			Ability to operate and/or monitor the following as they apply to the Fuel Handling Incidents: AA1.03 Reactor building containment evacuation alarm enable switch	3.6	25
000037 Steam Generator Tube Leak / 3				X			Ability to operate and / or monitor the following as they apply to the Steam Generator Tube Leak: (CFR 41.7 / 45.5 / 45.6) AA1.10 CVCS makeup tank level indicator	2.9	20
000051 Loss of Condenser Vacuum / 4					X		Ability to determine and interpret the following as they apply to the Loss of Condenser Vacuum: (CFR: 43.5 / 45.13) AA2.02 Conditions requiring reactor and/or turbine trip	3.9	22
~~000059 Accidental Liquid RadWaste Rel. / 9~~									
~~000060 Accidental Gaseous Radwaste Rel. / 9~~									
~~000061 ARM System Alarms / 7~~									
000067 Plant Fire On-site / 8	X						Knowledge of the operational implications of the following concepts as they apply to Plant Fire on Site: (CFR 41.8 / 41.10 / 45.3) AK1.01 Fire classifications, by type	2.9	24
~~000068 Control Room Evac. / 8~~									
~~000069 Loss of CTMT Integrity / 5~~									
~~000074 Inad. Core Cooling / 4~~									
000076 High Reactor Coolant Activity / 9						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	27
~~CE/A13 Natural Circulation Operations / 4~~									

CE/A11 RCS Overcooling / 4		X					Knowledge of the interrelations between the (RCS Overcooling) and the following: (CFR: 41.7 / 45.7) EK2.2 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.	3.2	19
~~CE/A16 Excess RCS Leakage / 2~~									
~~CE/E09 Functional Recovery~~									
K/A Category Point Totals:	2	2	0	2	1	2	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 effect of a loss or malfunction on the following will have on the RCPS: (CFR: 41.7 / 45/5) K6.04 Containment isolation valves affecting RCP operation	2.8	46
003 Reactor Coolant Pump					X							Knowledge of the operational implications of the following concepts as they apply to the RCPS: (CFR: 41.5 / 45.7) K5.02 Effects of RCP coastdown on RCS parameters	2.8	37
004 Chemical and Volume Control										X		Ability to manually operate and/or monitor in the control room: (CFR: 41/7 / 45.5 to 45.8) A4.10 Boric acid pumps	3.6	34
004 Chemical and Volume Control				X								Knowledge of CVCS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.07 Water supplies	3.0	42
005 Residual Heat Removal	X											Knowledge of the physical connections and/or cause/effect relationships between the RHRS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.12 Safeguard pumps	3.1	41
006 Emergency Core Cooling				X								Knowledge of ECCS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.08 Recirculation flowpath of reactor building sump	3.4	52
007 Pressurizer Relief/Quench Tank				X								Knowledge of PRTS design feature(s) and/or interlock(s) which provide for the following: Quench tank cooling (CFR: 41.7) K4.01 Quench tank cooling	2.6	39
008 Component Cooling Water		X										Knowledge of bus power supplies to the following: (CFR: 41.7) K2.02 CCW pump, including emergency backup	3.0	30
008 Component Cooling Water			X									Knowledge of the effect that a loss or malfunction of the CCWS will have on the following: (CFR: 41.7 / 45.6) K3.03 RCP	4.1	53

010 Pressurizer Pressure Control										X	2.1.31 Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. (CFR: 41.10 / 45.12)	4.6	49
012 Reactor Protection	X										Knowledge of the physical connections and/or cause/effect relationships between the RPS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.02 125V dc system	3.4	50
012 Reactor Protection								X			Ability to (a) predict the impacts of the following malfunctions or operations on the RPS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5) A2.07 Loss of dc control power	3.2	33
013 Engineered Safety Features Actuation										X	2.4.8 Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)	3.8	44
022 Containment Cooling									X		Ability to monitor automatic operation of the CCS, including: (CFR: 41.7 / 45.5) A3.01 Initiation of safeguards mode of operation	4.1	43
022 Containment Cooling							X				Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CCS controls including: (CFR: 41.5 / 45.5) A1.01 Containment temperature	3.6	36
026 Containment Spray							X				Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CSS controls including: (CFR: 41.5 / 45.5) A1.03 Containment sump level	3.5	28
039 Main and Reheat Steam										X	Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8) A4.04 Emergency feedwater pump turbines	3.8	45
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: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.05 Rupture in MFW suction or discharge line	3.1	35

061 Auxiliary/Emergency Feedwater		X										Knowledge of bus power supplies to the following: (CFR: 41.7) K2.02 AFW electric drive pumps	3.7	51
061 Auxiliary/Emergency Feedwater						X						Knowledge of the effect of a loss or malfunction of the following will have on the AFW components: (CFR: 41.7 / 45.7) K6.02 Pumps	2.6	40
062 AC Electrical Distribution									X			Ability to monitor automatic operation of the ac distribution system, including: (CFR: 41.7 / 45.5) A3.05 Safety-related indicators and controls	3.5	31
063 DC Electrical Distribution							X					Ability to predict and/or monitor changes in parameters associated with operating the DC electrical system controls including: (CFR: 41.5 / 45.5) A1.01 Battery capacity as it is affected by discharge rate	2.5	55
064 Emergency Diesel Generator								X				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: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.07 Consequences of operating under/over-excited	2.5	48
073 Process Radiation Monitoring					X							Knowledge of the operational implications as they apply to concepts as they apply to the PRM system: (CFR: 41.5 / 45.7) K5.03 Relationship between radiation intensity and exposure limits	2.9	54
076 Service Water									X			Ability to monitor automatic operation of the SWS, including: (CFR: 41.7 / 45.5) A3.02 Emergency heat loads	3.7	47
076 Service Water			X									Knowledge of the effect that a loss or malfunction of the SWS will have on the following: (CFR: 41.7 / 45.6) K3.07 ESF loads	3.7	29
078 Instrument Air										X		Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8) A4.01 Pressure gauges	3.1	38

103 Containment	X										Knowledge of the physical connections and/or cause/effect relationships between the containment system and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.08 SIS, including action of safety injection reset	3.6	32
K/A Category Point Totals:	3	2	2	3	2	2	3	3	3	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~~														
002 Reactor Coolant				X								Knowledge of RCS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.05 Detection of RCS leakage	3.8	62
011 Pressurizer Level Control								X				Ability to (a) predict the impacts of the following malfunctions or operations on the PZR LCS and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (41.5 / 43.5 / 45.3 / 45.13) A2.01 Excessive letdown	3.2	60
~~014 Rod Position Indication~~														
~~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							X					Ability to predict and/or monitor changes in parameters to prevent exceeding design limits) associated with operating the Containment Purge System controls including: (CFR: 41.5 / 45.5) A1.02 Radiation levels	3.4	59
~~033 Spent Fuel Pool Cooling~~														
~~034 Fuel Handling Equipment~~														
035 Steam Generator						X						Knowledge of the effect of a loss or malfunction on the following will have on the S/GS: (CFR: 41.7 / 45.7) K6.01 MSIVs	3.2	57
041 Steam Dump/Turbine Bypass Control											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)	4.3	64
045 Main Turbine Generator										X		Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8) A4 06 Turbine stop valves	2.8	63
~~055 Condenser Air Removal~~														
~~056 Condensate~~														

068 Liquid Radwaste									X			Ability to monitor automatic operation of the Liquid Radwaste System including: (CFR: 41.7 / 45.5) A3.02 Automatic isolation	3.6	65
~~071 Waste Gas Disposal~~														
072 Area Radiation Monitoring					X							Knowledge of the operational implications of the following concepts as they apply to the ARM system: (CFR: 41.5 / 45.7) K5.01 Radiation theory, including sources, types, units, and effects	2.7	61
075 Circulating Water	X											Knowledge of the physical connections and/or cause/effect relationships between the circulating water system and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.01 SWS	2.5	56
~~079 Station Air~~														
086 Fire Protection			X									Knowledge of the effect that a loss or malfunction of the Fire Protection System will have on the following: (CFR: 41.7 / 45.6) K3.01 Shutdown capability with redundant equipment	2.7	58
K/A Category Point Totals:	1	0	1	1	1	1	1	1	1	1	1	Group Point Total:		10

Facility:		Date of Exam:				
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	69		
	2.1.17	Conduct of Operations - Ability to make accurate, clear, and concise verbal reports. (CFR: 41.10 / 45.12 / 45.13)	3.9	75		
	2.1.44	Knowledge of RO duties in the control room during fuel handling, such as responding to alarms from the fuel handling area, communication with the fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentation. (CFR: 41.10 / 43.7 / 45.12)	3.9	67		
	2.1.					
	Subtotal			3		
2. Equipment Control	2.2.13	Knowledge of tagging and clearance procedures. (CFR: 41.10 / 45.13)	4.1	66		
	2.2.41	Ability to obtain and interpret station electrical and mechanical drawings. (CFR: 41.10 / 45.12 / 45.13)	3.5	68		
	2.2.					
	Subtotal			2		
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	74		
	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	71		
	2.3.					
	2.3.					
	Subtotal			2		
4. Emergency Procedures / Plan	2.4.14	Knowledge of general guidelines for EOP usage. (CFR: 41.10 / 45.13)	3.8	72		
	2.4.31	Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.2	73		
	2.4.45	Ability to prioritize and interpret the significance of each annunciator or alarm. (CFR: 41.10 / 43.5 / 45.3 / 45.12)	4.1	70		
	2.4.					
	Subtotal			3		
Tier 3 Point Total				10		

RO Exam Rejected K/As

ES-401 **ANO Unit 2 2017 RO Exam Record of Rejected K/As** **Form ES-401-4**

Tier / Group	Randomly Selected K/A	Reason for Rejection
Random Selection Method – For the RO exam, the random selection grouping for each rejected K&A is described in the "Reason for Rejection" near the bottom of the statement. The process was to take the K&A numbers or System numbers as described in the "Reason for Rejection" and write these down on slips of paper, place in a bowl and randomly select the new K&A/System numbers from the bowl.		
Tier 1 **Group 1** **QID# 9**	**058 AK1.01 (Original)** **Loss of DC Power** **Knowledge of the operational implications of the following concepts as they apply to Loss of DC Power: - Battery charger equipment and instrumentation.** **058 AA2.03 (New)** **Loss of DC Power** **Ability to determine and interpret the following as they apply to the Loss of DC Power: - DC loads lost; impact on to operate and monitor plant systems.**	**Rejected due to oversampling of this topic on the previous 2 Unit 2 NRC License Exams. This K&A is specific to the Battery Charger indications and was selected for the 2015 NRC Exam as QID #15 and the same topic covered on the 2014-2 retake NRC Exam as QID# 43. Initially Selected 058 AK1.02 (The only other AK1 K&A for Loss of DC Power) as a replacement K&A for QID#09 on the 2017 RO/SRO exam; However the importance rating for RO was 2.0 so it was rejected. All the AK2 K&As for Loss of DC Power were also less than 2.5 RO Importance rating. Therefore K&A 058 AA2.03 was randomly selected as a replacement for QID#9. The RO Outline was updated in RED. 058 AA2.03 was randomly selected from 058 AK3, AA1, and AA2 K&As for Loss of DC Power.**
Tier 1 **Group 1** **QID# 10**	**025 AK3.01 (Original)** **Loss of RHR System** **Knowledge of the reasons for the following responses as they apply to the Loss of Residual Heat Removal System: - Shift to alternate flowpath.** **025 AA1.12 (New)** **Loss of RHR System** **Ability to operate and/or monitor the following as they apply to the Loss of Residual Heat Removal System: - RCS temperature indicators.**	**Rejected due to oversampling of this topic on the previous 2 Unit 2 NRC License Exams. The only direction to shift to the alternate train of RHR is based on a high radiation alarm on the Service Water outlets of the in-service RHR HX indicating an RCS Leak into SW. The Loss of RHR procedure directs shifting to the alternate HX for this condition. This topic was covered on the 2014-2 Retake NRC exam as QID#7 and the 2015 NRC Exam as QID #77 and a modified version of the 2015 question is being used on the 2017 SRO Exam QID#77. Therefore K&A 025 AA1.12 was randomly selected as a replacement K&A for QID#10 on the 2017 RO/SRO exam. The RO Outline was updated in RED. Randomly selected AA1.12 from the group of AA1 K&As for Loss of RHR System 025. Randomly selected from the AA1 K&A group to provide more balance out the RO Sample Plan between the K3 and A1 K&As.**

RO Exam Rejected K/As

Tier 1 **Group 2** **QID# 23**	**033 2.1.7 (original)** **Loss of Intermediate Range NI (Original)** **Conduct of Operations - Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.** **024 2.1.7 (New)** **Emergency Boration** **Conduct of Operations - Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.**	**ANO Unit 2 does not have a true Intermediate Range NI that is separate from the Power Range Excore Nuclear Instrumentation. Intermediate Range Power is read from the middle chamber of 3 stacked fission chambers in each of the 4 Excore Nuclear Instruments. We send this signal to a Log scale instrument to read intermediate range reactor power. Thus a loss of this middle chamber is also a loss of the whole Power Range NI Excore channel and the indications and mitigating actions are the same. Therefore, Generic K&A 2.1.7 was kept but the system rejected due to not being applicable to ANO Unit 2. System 024 "Emergency Boration" was randomly selected for QID#23 from all the other Tier 1 Group 2 Systems with the exception of the ones selected for the SRO Exam (Inadequate Core Cooling, Continuous Rod Withdrawal, Dropped Control Rod, and Loss of Containment Integrity). The RO Outline was updated in RED.**
Tier 1 **Group 2** **QID# 25**	**036 AK3.02 (Original)** **Fuel Handling Accident** **Knowledge of the reasons for the following responses as they apply to the Fuel Handling Incidents: - Interlocks associated with fuel handling equipment.** **036 AA1.03 (New)** **Fuel Handling Accident** **Ability to operate and/or monitor the following as they apply to the Fuel Handling Incidents: - Reactor building containment evacuation alarm enable switch.**	**Rejected due to ROs at ANO do not perform the Refueling Machine Operator function. This K&A would be more of an SRO Only Question. Therefore K&A 036 AA1.03 was randomly selected as a replacement for QID#25: K&A 036 AA1.03 was randomly selected from the '4' AA1 K&As for System 036 Fuel Handling Accident to more balance out the RO Sample Plan. The RO Outline was updated in RED.**

RO Exam Rejected K/As

Tier 2 **Group 1** **QID# 39**	**007 K5.02 (Original)** **PRT/Quench Tank** **Knowledge of the operational implications of the following concepts as they apply to the PRTS: - Method of forming a steam bubble in the PZR.** **007 K4.01 (New)** **PRT/Quench Tank** **Knowledge of PRTS design feature(s) and/or interlock(s) which provide for the following: - Quench tank cooling.**	**Rejected due to oversampling of this topic on the previous 2 Unit 2 NRC License Exams. This K&A match and topic were covered on the last 2 NRC exams given on Unit 2. QID #32 on the 2014-2 Exam and QID #33 on the 2015 Unit 2 NRC exam. Therefore K&A 007 K4.01 was randomly selected as a replacement K&A for QID#39 on the 2017 RO/SRO exam. The RO Outline was updated in RED. There were no other K5 K&As for this system that were > 2.5 Importance Rating for an RO; therefore, K4.01 was randomly selected from the 007 K2, K3, K4, and K6 K&As for the PRT/QT System that had an importance rating of > 2.5 for ROs. K1 K&As for this system were not sampled due to the higher amount of K1 K&As selected for Tier 2 thus maintaining the balance of the sample plan.**
Tier 2 **Group 1** **QID# 52**	**006 K4.14 (Original)** **Emergency Core Cooling** **Knowledge of ECCS design feature(s) and/or interlock(s) which provide for the following: - Cross-connection of HPI/LPI/SIS.** **006 K4.08 (New)** **Emergency Core Cooling** **Knowledge of ECCS design feature(s) and/or interlock(s) which provide for the following: - Recirculation flowpath of reactor building sump.**	**Rejected this K&A as ANO Unit 2 does not have a design feature or interlock that will cross tie the HPI/LPI/SIP Pump piping. The 4 HPI injection MOVs on each pump tie into 4 common RCS injection lines but this is a normal lineup and requires no action or interlock to make this happen. The LPI and Containment Spray pumps can be cross-connected for RHR but this question has already been asked on this exam. Therefore, K&A 006 K4.08 was randomly selected for a replacement K&A for QID#52. K&A 006 K4.08 was randomly selected from the 006 K4 K&As for System 006 Emergency Core Cooling system to maintain the balance of the sample plan. The RO Outline was updated in RED.**

RO Exam Rejected K/As

Tier 2 **Group 2** **QID# 60**	**079 A2.01 (Original)** **Station Air** **Ability to (a) predict the impacts of the following malfunctions or operations on the SAS and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: - Cross-connection with IAS.** **011 A2.01 (New)** **PZR Level Control** **Ability to (a) predict the impacts of the following malfunctions or operations on the PZR LCS and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: - Excessive letdown.**	**Rejected this K&A and system because there is no cross-connection between Station Air and Instrument Air. There are Instrument Air Crossties between Unit 1 and Unit 2 but a question has already been added to the exam concerning this knowledge and it is not Station Air. All the 079 Station Air K&As that are > 2.5 importance rating deal with the cross-connection between Station Air and Instrument Air. Therefore, the A2.01 K&A was kept but system 011 Pressurizer Level Control System was randomly selected. This system was randomly selected from all the Tier 2/Group2 systems that had not been selected already on the RO or SRO 2017 Exam Outline. The RO Outline was updated in RED.**
Tier 2 **Group 2** **QID# 64**	**027 2.1.23 (Original)** **Containment Iodine Removal** **Conduct of Operations - Ability to perform specific system and integrated plant procedures during all modes of plant operation.** **041 2.1.23 (New)** **Steam Dump/Turbine Bypass Control** **Conduct of Operations - Ability to perform specific system and integrated plant procedures during all modes of plant operation**	**Rejected this K&A as the Containment Iodine Removal system on ANO Unit 2 has been abandoned in place and no longer used. Instead, three chemical baskets in the Unit 2 Containment Basement add the chemicals to the containment spray water recirculating in the sump post-accident to scrub iodine form the building atmosphere as the containment spray system sprays down the building. Therefore, the Generic K&A 2.1.23 was kept but system 041 Steam Dump/Turbine Bypass Control was randomly selected. This system was randomly selected from all the Tier 2/Group2 systems that had not been selected already on the RO or SRO 2017 Exam Outline. The RO Outline was updated in RED.**

RO Exam Rejected K/As

Tier 3 **QID# 66**	**Generic 2.2.15 (Original)** **Equipment Control** **Ability to determine the expected plant configuration using design and configuration control documentation, such as drawings, line-ups, tagouts, etc.** **Generic 2.2.13 (New)** **Knowledge of tagging and clearance procedures.**	**This K&A description lends itself to development of an admin JPM instead of a written test item because it requires a reference and potentially more than one answer. Based on this and the number of open reference/ test items already developed (6), This K&A was added to the RO Admin JPM Exam Outline to develop a JPM and rejected from the written exam. Therefore, Generic K&A 2.2.13 was randomly selected. This K&A was randomly selected from all the Generic 2.2 Conduct of Operations K&As that are not already on the RO or SRO sample plans for the 2017 NRC Exam The RO Outline was updated in RED.**
Tier 3 **QID# 75**	**Generic 2.1.9 (Original)** **Conduct of OPS** **Ability to direct personnel activities inside the Control Room** **Generic 2.1.17 (New)** **Ability to make accurate, clear, and concise verbal reports.**	**Rejected this K&A as this is an SRO function and not a credible K&A to generate a RO level NRC exam question from. Therefore, Generic K&A 2.1.17 was randomly selected. This K&A was randomly selected from all the Generic 2.1 Conduct of Operations K&As that are not already on the RO or SRO sample plans for the 2017 NRC Exam. The RO Outline was updated in RED.**

Facility: Arkansas Nuclear One, Unit 2 Date of Exam: February 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													3	2	5
	2													1	2	3
	Tier Totals															8
3. Generic Knowledge and Abilities Categories														2	2	1	2	7

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 Reactor Trip / 1~~									
~~CE/E02 Reactor Trip Recovery / 1~~									
~~000008 Pressurizer Vapor Space Accident / 3~~									
000009 Small Break LOCA / 3						X	2.4.30 Knowledge of events related to system operation/status that must be reported to internal organizations or external agencies, such as the State, the NRC, or transmission system operator. (CFR: 41.10 / 43.5 / 45.11)	4.1	81
~~000011 Large Break LOCA / 3~~									
~~000015/17 RCP Malfunctions / 4~~									
~~000022 Loss of Rx Coolant Makeup / 2~~									
000025 Loss of RHR System / 4					X		Ability to determine and interpret the following as they apply to the Loss of Residual Heat Removal System: AA2.04 Location and isolability of leaks.	3.6	77
~~000026 Loss of Component Cooling Water / 8~~									
~~000027 Pressurizer Pressure Control System Malfunction / 3~~									
~~000029 ATWS / 1~~									
~~000038 Steam Gen. Tube Rupture / 3~~									
~~000040 Steam Line Rupture / 4~~									
CE/E05 Excess Steam Demand / 4						X	2.4.9 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)	4.2	76
~~000054 Loss of Main Feedwater / 4~~									
~~CE/E06 Loss of Feedwater / 4~~									
~~000055 Station Blackout / 6~~									
000056 Loss of Off-site Power / 6						X	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. (CFR: 41.7 / 43.5 / 45.12)	4.6	79
000057 Loss of Vital AC Inst. Bus / 6					X		Ability to determine and interpret the following as they apply to the Loss of Vital AC Instrument Bus: (CFR: 43.5 / 45.13) AA2.18 The indicator, valve, breaker, or damper position which will occur on a loss of power	3.1	80

000058 Loss of DC Power / 6					X		Ability to determine and interpret the following as they apply to the Loss of DC Power: (CFR: 43.5 / 45.13) AA2.03 DC loads lost; impact on ability to operate and monitor plant systems	3.9	78
~~000062 Loss of Nuclear Svc Water / 4~~									
~~000065 Loss of Instrument Air / 8~~									
~~000077 Generator Voltage and Electric Grid Disturbances / 6~~									
K/A Category Totals:					3	3	Group Point Total:		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~~									
~~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 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 Control Room Evac. / 8~~									
000069 Loss of CTMT Integrity / 5					X		Ability to determine and interpret the following as they apply to the Loss of Containment Integrity: (CFR: 43.5 / 45.13) AA2.02 Verification of automatic and manual means of restoring integrity	4.4	82
000074 Inad. Core Cooling / 4						X	2.2.40 Ability to apply Technical Specifications for a system. (CFR: 41.10 / 43.2 / 43.5 / 45.3)	4.7	85
000076 High Reactor Coolant Activity / 9					X		Ability to determine and interpret the following as they apply to the High Reactor Coolant Activity: AA2.02 Corrective actions required for high fission product activity in RCS	3.4	83
~~CE/A13 Natural Circulation Operations / 4~~									
~~CE/A11 RCS Overcooling / 4~~									
CE/A16 Excess RCS Leakage / 2						X	2.2.44 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	84
~~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											X	2.4.6 Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	4.7	86
~~004 Chemical and Volume Control~~														
005 Residual Heat Removal								X				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: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.03 RHR pump/motor malfunction	3.1	88
~~006 Emergency Core Cooling~~														
~~007 Pressurizer Relief/Quench Tank~~														
~~008 Component Cooling Water~~														
010 Pressurizer Pressure Control											X	2.4.11 Knowledge of abnormal condition procedures.	4.0	87
~~012 Reactor Protection~~														
~~013 Engineered Safety Features Actuation~~														
022 Containment Cooling								X				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: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.04 Loss of service water	3.2	90
026 Containment Spray								X				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: A2.07 Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit	3.9	89
~~039 Main and Reheat Steam~~														
~~059 Main Feedwater~~														
~~061 Auxiliary/Emergency Feedwater~~														
~~062 AC Electrical Distribution~~														
~~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:							3			2	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~~														
~~015 Nuclear Instrumentation~~														
016 Non-Nuclear Instrumentation											X	2.2.12 Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)	4.1	93
~~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~~														
035 Steam Generator											X	2.4.18 Knowledge of the specific bases for EOPs. CFR: 41.10 / 43.1 / 45.13)	4.0	92
~~041 Steam Dump/Turbine Bypass Control~~														
045 Main Turbine Generator								X				Ability to (a) predict the impacts of the following malfunctions or operation on the MT/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5) A2.12 Control rod insertion limits exceeded (stabilize secondary)	2.8	91
~~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~~														
K/A Category Point Totals:								1			2	Group Point Total:		3

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.20	Ability to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)			4.6	98
	2.1.41	Knowledge of the refueling process. (CFR: 41.2 / 41.10 / 43.6 / 45.13)			3.7	94
	2.1.					
	2.1.					
	Subtotal					2
2. Equipment Control	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)			4.6	100
	2.2.11	Knowledge of the process for controlling temporary design changes. (CFR: 41.10 / 43.3 / 45.13)			3.3	96
	2.2.					
	Subtotal					2
3. Radiation Control	2.3.4	2.3.4 Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)			3.7	95
	~~2.3.5~~	~~Ability to use radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc. (CFR: 41.11 / 41.12 / 43.4 / 45.9)~~				
	2.3.					
	2.3.					
	Subtotal					1
4. Emergency Procedures / Plan	~~2.4.35~~	~~Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. (CFR: 41.10 / 43.5 / 45.13)~~				
	~~2.4.47~~	~~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)~~				
	2.4.27	Knowledge of "fire in the plant" procedures. (CFR: 41.10 / 43.5 / 45.13)			3.9	97
	2.4.44	Knowledge of emergency plan protective action recommendations. | (CFR: 41.10 / 41.12 / 43.5 / 45.11)			4.4	99
	Subtotal					2
Tier 3 Point Total						7

SRO Exam Rejected K/As

ES-401 **ANO Unit 2 2017 SRO Exam Record of Rejected K/As** **Form ES-401-4**

Tier / Group	Randomly Selected K/A	Reason for Rejection
Random Selection Method – For the SRO exam I used a 3 chip method. In the case of a rejected KA or system I would divide the remaining unused items into thirds then assign the chips 1-3. I would randomly select a chip discarding 2/3 of the items. I would continue this process until 1, 2 or 3 items remained then assign the chips and make the final selection.		
Tier 1 **Group 1** **QID #77**	(Original) 026 Loss of Component Cooling Water Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: A2.02 The cause of possible CCW loss (New) 025 Loss of RHR AA2.04 Location and Isolability of leaks	026, Loss of Component Cooling Water (A2.02) – I was rejected due to over-sampling as stated below. There are 3 questions already on the exam related to the CCW system. Randomly selected Loss of RHR and AA2.04. QID-7 - 2.4.4, ability to recognize abnormal indications QID-53 - K3.03 loss of CCW on RCPs QID-84 – 2.2.44 Pressure boundary leak into the CCW system. Randomly selected Loss of RHR and AA2.04. SRO outline is updated in red.
Tier 1 **Group 1** **QID #80**	(Original) AA2.10 Turbine load limiter control (New) AA2.18 The indicator, valve, breaker, or damper position which will occur on a loss of power	AA2.10 Turbine Load Limiter. Rejected because there is no connection between Loss of Vital Instrument AC and the Turbine Load Limiter. Randomly selected AA2.18 from the remaining AA2s within 057, Loss of Vital AC Inst. Bus. SRO outline is updated in red.

SRO Exam Rejected K/As

Tier / Group	Randomly Selected K/A	Reason for Rejection
Tier 1 **Group 2** **QID #83**	(Original) 003 Dropped Control Rod Ability to determine and interpret the following as they apply to the Dropped Control Rod: AA2.05 Interpretation of computer in-core TC map for dropped rod location (New) 076 High Reactor Coolant Ability to determine and interpret the following as they apply to the High Reactor Coolant Activity: AA2.02 Corrective actions required for high fission product activity in RCS	003 Dropped Control Rod. (AA2.05) I was not able to develop SRO level question for this KA. I reviewed the remaining available AA2s, they were system knowledge and better suited to an RO level question. At this point I felt it was prudent to choose a different system because QID #91 identified A2.12 “Control rod insertion limits exceeded…” as the tested ability. I believe this would have created an overlap or double jeopardy issue. Randomly selected 076, High Reactor Coolant, and an associated A2 from the remaining un-selected APEs. SRO outline is updated in red.

SRO Exam Rejected K/As

Tier / Group	Randomly Selected K/A	Reason for Rejection
Tier 1 Group 2 QID #84	(Original) 001 Continuous Rod Withdrawal (New) CE/A16 Excess RCS Leakage	001 Continuous Rod Withdrawal – I was not able to develop a discriminating SRO level question for this system. The only real actions are either go to standby or trip the reactor; I could not develop plausible distractors. I randomly selected CE/A16, from the remaining un-selected APEs and retained 2.2.44. SRO outline is updated in red.
Tier 2 Group 1 QID #87	(Original) 2.4.50 Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (New) 2.4.11 Knowledge of abnormal condition procedures.	2.4.50 Ability to verify system alarm setpoints and operate controls identified in the alarm response manual is better suited to an RO level question. I was not able to develop an SRO level question that met this KA. I randomly selected another 2.4 from the unselected generic 2.4s. SRO outline is updated in red.

SRO Exam Rejected K/As

Tier 2 Group 1 QID #89	(Original) 059 Main FW 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: A2.11 Failure of feedwater control system (New) 026 Cntmt. Spray 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: A2.07 Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit	059, Main Feedwater, specifically as it relates to failure of the FWCS (A2.11) is almost exclusively an RO function. The RO uses the Annunciator Corrective Action (ACA) to perform mitigating actions. The SRO serves mostly as an oversight function. For these reasons I was not able to develop an SRO level question. I randomly selected 026 Containment Spray from the un-selected systems and an associated A2 to maintain the balance of the sample plan. SRO outline is updated in red.

SRO Exam Rejected K/As

Tier / Group	Randomly Selected K/A	Reason for Rejection
Tier 2 Group 2 QID #92	(Original) 056 Condensate (New) 035 Steam Generator	056, Condensate - Unable to develop an SRO level question that included both 2.4.18 (EOP bases) and the Condensate system. This also has an overlap issue with QID-3 and one of the scenarios. I randomly selected 035 Steam Generator from the remaining systems that would be found in the EOPs. Retained 2.4.18. SRO outline is updated in red.
Tier 2 Group 2 QID #93	(Original) 027 Containment Iodine Removal (New) O16 Non-Nuclear Instrumentation 2.2.12 Knowledge of surveillance procedures.	027 Containment Iodine Removal (2.4.34) - Rejected because this is a passive system and I would not be able to create SRO level questions. I randomly selected 016 from the remaining un-selected systems. Also randomly selected a 2.2 Generic to create more balance the original sample plan included 8 – (2.4s) and only 1- (2.2) selected in Tiers 1 and 2. SRO outline is updated in red.
Tier 3 QID #96	(Original) 2.3.5 Ability to use radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc. (New) 2.2.11 Knowledge of the process for controlling temporary design changes.	2.3.5, Ability to use radiation monitoring…. I was not able to develop an SRO level question for this KA. Since the outline only had 1 generic selected within the 2.2 area I included these in the random selection process and selected 2.2.11. SRO outline is updated in red.

SRO Exam Rejected K/As

Tier / Group	Randomly Selected K/A	Reason for Rejection
Tier 3 **QID #97**	(Original) 2.4.35 Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. (New) 2.4.27 Knowledge of "fire in the plant" procedures.	2.4.35, Knowledge of AO actions in field… I was not able to develop an SRO level question for this KA. Every question I attempted to write became a system knowledge quiz. Randomly selected 2.4.27 SRO outline is updated in red.
Tier 3 **QID #99**	(Original) 2.4.47 Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material. (New) 2.4.44 Knowledge of emergency plan protective action recommendations	2.4.47, diagnose and recognize trends using CR references. I was not able to develop a "Generic" SRO level question; everything I tried became a system knowledge or control board operation question. Randomly selected 2.4.44. SRO outline is updated in red.

Facility: Arkansas Nuclear One Unit 2 Date of Examination: 02/13/2017

Examination Level: RO X SRO ☐ Operating Test Number: 2017-1

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
A1. Conduct of Operations 2.1.43 RO (4.1)	D/R	Perform a dilution calculation A2JPM-NRC-ADMIN-CVCS6
A2. Conduct of Operations 2.1.20 RO (4.6)	N/R	Perform Azimuthal Power Tilt calculation using the CPC System A2JPM-NRC-ADMIN-AZTILT
A3. Equipment Control 2.2.15 RO (3.9)	N/R	Perform identification of boundary isolations and electrical power to tagout a Boric Acid Makeup Pump A2JPM-NRC-ADMIN-HCRD2
A4. Radiation Control 2.3.15 RO (2.9)	P/R	Determine Condenser off gas radiation monitor setting. A2JPM-NRC-ADMIN-CRADMON
Emergency Plan		

NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).

* Type Codes & Criteria:
(C)ontrol room, (S)imulator, or Class(R)oom
(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes)
(N)ew or (M)odified from bank (≥ 1)
(P)revious 2 exams (≤ 1; randomly selected)

Facility: Arkansas Nuclear One Unit 2 Date of Examination: 02/13/2017

Examination Level: RO ☐ SRO X Operating Test Number: 2017-1

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
A5. Conduct of Operations 2.1.43 SRO (4.3)	D/R	Review dilution calculation A2JPM-NRC-ADMIN-CVCS7
A6. Conduct of Operations 2.1.20 SRO (4.6)	N/R	Perform Azimuthal Power Tilt calculation using the CPC System A2JPM-NRC-ADMIN-AZTILTSRO
A7. Equipment Control 2.2.37 SRO (4.6)	D/R	Determine CREVS TS/TRM applicability and any required actions. A2JPM-NRC-ADMIN-CREVSTS
A8. Radiation Control 2.3.14 SRO (3.8)	P/R	Approve administration of Potassium Iodide A2JPM-NRC-ADMIN-KI2
A9. Emergency Plan 2.4.41 SRO (4.6)	N/R	Determine Emergency Action Level (Time Critical JPM) A2JPM-NRC-ADMIN-EAL25

NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).

* Type Codes & Criteria:
(C)ontrol room, (S)imulator, or Class(R)oom
(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes)
(N)ew or (M)odified from bank (≥ 1)
(P)revious 2 exams (≤ 1; randomly selected)

Facility: Arkansas Nuclear One Unit 2 Date of Examination: 02/13/2017

Exam Level: RO X SRO-I ☐ SRO-U ☐ Operating Test No.: 2017-1

Control Room Systems:* 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U

System / JPM Title	Type Code*	Safety Function
S1. A2JPM-NRC-EOP07 062 A4.01; RO-3.3 / SRO-3.1 Energize 2A-4 during a LOOP.	A/M/EN/L/S	6 Electrical
S2. A2JPM-NRC-RCS02 A13 AA1.3; RO-3.2 / SRO-3.8 Operate the RCS to collapse RCS Voids	A/L/D/S	3 Pressure Control
S3. A2JPM-NRC-H2003 028 A4.01; RO-4.0 / SRO-4.0 Start up a Hydrogen Recombiner	P/S	5 Containment
S4. A2JPM-NRC-CCW01 008 A4.01; -- RO 3.3 / SRO3.1 Secure CCW system using EOP.	D/L/S	8 Plant Service systems
S5. A2JPM-NRC-SIT08 006 A1.13; RO-3.5 / SRO-3.7 Lower Safety Injection Tank level	D/EN/S	2 Inventory Control
S6. A2JPM-NRC-CEA05 001 A2.03; RO-3.5 / SRO-4.2 Perform control element assembly exercise	A/D/S	1 Reactivity control
S7. A2JPM-RO-RCP04 003 A2.02; RO-3.7 / SRO-3.9 Perform a normal RCP shutdown.	A/D/L/S	4 Heat Removal Primary
S8. A2JPM-RO-AOP04 015 A2.02; RO-3.1 / SRO-3.5 Disable B channel excore nuclear instrumentation.	D/L/S	7 Instrumentation
Plant Systems* (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
P1. A2JPM-NRC-AUAVD 041 A2.03: RO-2.8 / SRO-3.1 Operate "A" Upstream Atmospheric Dump Valve locally	D/E/L	4 Heat Removal Secondary
P2. A2JPM-NRC-IA04 065 AA2.01; RO-2.9 / SRO-3.2 Respond to lowering Instrument Air pressure.	A/E/N	8 Plant Service systems
P3. A2JPM-NRC-69REL2 068 A4.02 RO-3.2 / SRO-3.1 Perform a release of 2T-69A Boric Acid Condensate Tank	D/R	9 Radioactivity Release

* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all five SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(EN)gineered safety feature	≥1 / ≥1 / ≥ 1 (control room system)
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Facility: Arkansas Nuclear One Unit 2 Date of Examination: 02/13/2017

Exam Level: RO ☐ SRO-I ☐ SRO-U X Operating Test No.: 2017-1

Control Room Systems:* 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U

System / JPM Title	Type Code*	Safety Function
S1. A2JPM-NRC-EOP07 062 A4.01; RO-3.3/SRO-3.1 Energize 2A-4 during a LOOP.	A/M/EN/L/S	6 Electrical
S2. A2JPM-NRC-RCS02 A13 AA1.3; RO-3.2/SRO-3.8 Operate the RCS to collapse RCS Voids	A/L/D/S	3 Pressure Control
S3.		
S4.		
S5.		
S6.		
S7.		
S8.		

In-Plant Systems* (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)

P1. A2JPM-NRC-AUAVD 041 A2.03: RO-2.8/SRO-3.1 Operate "A" Upstream Atmospheric Dump Valve locally	D/E/L	4 Heat Removal Secondary
P2. A2JPM-NRC-IA04 065 AA2.01; RO-2.9/SRO-3.2 Respond to lowering Instrument Air pressure.	A/E/N	8 Plant Service systems
P3. A2JPM-NRC-69REL2 068 A4.02 RO-3.2/SRO-3.1 Perform a release of 2T-69A Boric Acid Condensate Tank	D/R	9 Radioactivity Release

* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all five SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for RO / SRO-I / SRO-U
A)lternate path	4-6 / 4-6 / 2-3
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(EN)gineered safety feature	≥1 / ≥1 / ≥ 1 (control room system)
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Facility: Arkansas Nuclear One Unit 2 Date of Exam: 02/13/2017 Operating Test No.: 2017-1

APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4 (spare)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP		R	I	U
RO (1,5,7) **X** SRO-I ☐ SRO-U ☐	RX		4									*		1	1	1	0
	NOR						4			1				1	1	1	1
	I/C		2,5,8				1,3,7			3,5,8		2,4,5,7		6	4	4	2
	MAJ		6,7				6			6,7		6		3	2	2	1
	TS													0	0	2	2
RO (2,6,8) **X** SRO-I ☐ SRO-U ☐	RX					4			3					1	1	1	0
	NOR			1									1	1	1	1	1
	I/C			3,4,9		2,5			2,4				3,4,8	5	4	4	2
	MAJ			6,7		6			6,7				6	3	2	2	1
	TS													0	0	2	2
RO ☐ SRO-I ☐ SRO-U **X** (1)	RX													0	1	1	0
	NOR	1			4			1			1			2	1	1	1
	I/C	2,3,4,5,8,9			1,2,3,5,7			2,3,4,5,8			2,3,4,5,7,8			11	4	4	2
	MAJ	6,7			6			6,7			6			3	2	2	1
	TS	3,4			1,3			2,4			3,4			4	0	2	2
RO ☐ SRO-I ☐ SRO-U **X** (2)	RX													0	1	1	0
	NOR	1			4			1			1			2	1	1	1
	I/C	2,3,4,5,8,9			1,2,3,5,7			2,3,4,5,8			2,3,4,5,7,8			10	4	4	2
	MAJ	6,7			6			6,7			6			3	2	2	1
	TS	3,4			1,3			2,4			3,4			4	0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES-D-1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the "at-the-controls" (ATC) and "balance-of-plant" (BOP) positions. Instant SROs (SRO-I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO-I *additionally* serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or *controlled* abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional instrument or component malfunctions on a one-for-one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right-hand columns.

4. For licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO-I applicants in either the ATC or BOP position to best evaluate the SRO-I in manipulating plant controls.

*The reactivity event for scenario #4 has been replaced with an additional I/C malfunction.

Facility: Arkansas Nuclear One Unit 2 Date of Exam: 02/13/2017 Operating Test No.: 2017-1

APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4 (spare)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP		R	I	U
RO (3) **X** SRO-I ☐ SRO-U ☐	RX		4			4						*		1	1	1	0
	NOR									1				1	1	1	1
	I/C		2,5,8			2,5				3,5,8		2,4,5,7		5	4	4	2
	MAJ		6,7			6				6,7		6		3	2	2	1
	TS													0	0	2	2
RO (4) **X** SRO-I ☐ SRO-U ☐	RX								3					1	1	1	0
	NOR			1			4						1	1	1	1	1
	I/C			3,4,9			1,3,7		2,4				3,4,8	5	4	4	2
	MAJ			6,7			6		6,7				6	3	2	2	1
	TS													0	0	2	2
RO (9) **X** SRO-I ☐ SRO-U ☐	RX		4			4						*		1	1	1	0
	NOR									1				1	1	1	1
	I/C		2,5,8			2,5				3,5,8		2,4,5,7		6	4	4	2
	MAJ		6,7			6				6,7		6		4	2	2	1
	TS													0	0	2	2
RO ☐ SRO-I ☐ SRO-U **X (3)**	RX													0	1	1	0
	NOR	1			4			1			1			2	1	1	1
	I/C	2,3,4,5,8,9			1,2,3,5,7			2,3,4,5,8			2,3,4,5,7,8			11	4	4	2
	MAJ	6,7			6			6,7			6			4	2	2	1
	TS	3,4			1,3			2,4			3,4			4	0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES-D-1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the "at-the-controls" (ATC) and "balance-of-plant" (BOP) positions. Instant SROs (SRO-I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO-I *additionally* serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or *controlled* abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional instrument or component malfunctions on a one-for-one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right-hand columns.

4. For licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO-I applicants in either the ATC or BOP position to best evaluate the SRO-I in manipulating plant controls.

*The reactivity event for scenario #4 has been replaced with an additional I/C malfunction.

Facility: Arkansas Nuclear One Unit 2 Date of Exam: 02/13/2017 Operating Test No.: 2017-1

APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4 (spare)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP		R	I	U
RO (10) **X**	RX					4			3					1	1	1	0
SRO-I ☐	NOR			1									1	1	1	1	1
	I/C			3,4,9		2,5			2,4				3,4,8	5	4	4	2
SRO-U ☐	MAJ			6,7		6			6,7				6	4	2	2	1
	TS													0	0	2	2
RO ☐	RX														1	1	0
SRO-I ☐	NOR														1	1	1
	I/C														4	4	2
SRO-U ☐	MAJ														2	2	1
	TS														0	2	2
RO ☐	RX														1	1	0
SRO-I ☐	NOR														1	1	1
	I/C														4	4	2
SRO-U ☐	MAJ														2	2	1
	TS														0	2	2
RO ☐	RX														1	1	0
SRO-I ☐	NOR														1	1	1
	I/C														4	4	2
SRO-U ☐	MAJ														2	2	1
	TS														0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES-D-1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the “at-the-controls” (ATC) and “balance-of-plant” (BOP) positions. Instant SROs (SRO-I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO-I *additionally* serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or *controlled* abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional instrument or component malfunctions on a one-for-one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant’s competence count toward the minimum requirements specified for the applicant’s license level in the right-hand columns.

4. For licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO-I applicants in either the ATC or BOP position to best evaluate the SRO-I in manipulating plant controls.

Facility: ANO-2	Scenario #1 (New)	Op-Test No.: 2017-1

Examiners:	Operators:

Initial Conditions: ~69%, MOL, RED Train Maintenance Week. RWT on recirc.

Turnover:

Reactor power band 68 to 70% for 500KV line maintenance (Mabelvale line). 260 EFPD. EOOS indicates 'Minimal Risk'. RED Train Maintenance Week.

Scheduled evolution: Place the 'B' Component Cooling Water (CCW) pump in service and secure 'C' CCW pump for Maintenance using section 18 of 2104.028, Component Cooling Water System Operations.

Event No.	Malf. No.	Event Type*	Event Description
1		N (BOP) N (SRO)	Place the 'B' Component Cooling Water (CCW) pump in service and secure 'C' CCW pump. **OP-2104.028, Component Cooling Water System Operations.**
2	CVC2P36CSS	C (ATC) C (SRO)	Charging pump, 2P36C, sheared shaft **OP-2203.036, Loss of Charging AOP.**
3	DI_C40_S73B K04-H01 K07-H01	C (BOP) C (SRO) TS (SRO)	Inadvertent Recirculation Actuation Signal (RAS). **OP-2203.040, Inadvertent RAS AOP.**
4	SEISMIC CV0336	R (ATC) C (BOP) C (SRO) TS (SRO)	Earthquake (Natural emergencies AOP) that requires a shutdown (>.1g) and 2P-7A Emergency Feedwater (EFW) pump overspeed trip mechanism fails. **OP-2203.008, Natural Emergencies AOP.**
5	DI_HS_4930_1 CVC2P39ANAS CVC2P39BNAS	C (ATC) C (SRO)	2CV-4930 boration valve fails to automatically open and 2P-39A and 2P-39B boric acid makeup pumps fail to start automatically. **OP-2104.003, Chemical Addition**
6	MTGTRIPLOCKO	M (ALL)	Turbine trip causing a reactor trip. **OP-2202.001, Standard Post Trip Actions (SPTAs) EOP**
7	MFWPMPBTRP EFW2P7BFLT EFWROOMB	M (ALL)	2P-1B Main Feedwater (MFW) pump trip, 2P-7B Emergency Feedwater (EFW) motor fault, causing a loss of Feedwater. **OP-2202.006, Loss of Feedwater EOP**
8	CEA02STUCK CEA07STUCK CV4873	C (ATC) C (SRO)	Control Element Assemblies (CEA's) 2 and 7 will remain withdrawn requiring emergency boration. The Volume Control Tank (VCT) outlet valve will not close. **OP-2202.010 Standard Attachments.**
9	AFW2P75LO	C (BOP) C (SRO)	2P-75 AFW pump trips due loss of lube oil. **OP-2202.006, Loss of Feedwater EOP**
End Point	Feedwater is restored to at least one Steam Generator		

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

Target Quantitative Attributes (Section D.5.d)	Actual Attributes
Malfunctions after EOP entry (1-2)	2
Abnormal Events (2-4)	3
Major Transients (1-2)	2
EOPs entered requiring substantive actions (1-2)	1
EOP contingencies requiring substantive actions (0-1)	0
Critical Tasks (2-3)	2

Critical Task	Justification	
Commence Emergency boration IAW 2202.010 Standard Attachment Exhibit 1 by the completion of SPTAs.	Meeting the SFSCs prevents core damage and minimizes radiological releases to the environment, ultimately protecting the health and safety of the public. The SFSCs assume that all but one CEA is fully inserted and that the reactor is subcritical by a certain amount (required shutdown margin or SDM).	• CE EPGB Simulator CTs: CT-01, Establish Reactivity Control (SPTA-01) • TS 3.1.1.1 Shutdown margin.
Restore Feedwater prior to both SG levels reaching 70" wide range.	Without feedwater, the SG being steamed will eventually boil dry, RCS heat removal will cease, and the reactor core will begin overheating (core melt potential). Thus, it is essential to steam and feed at least one SG to continue to remove RCS decay heat.	• CE EPGB Simulator CTs: CT-08, Establish RCS Heat Removal (LOAF-02) • EOP 2202.006 Loss of Feedwater EOP • EOP 2202.006 Loss of Feedwater EOP Tech Guide

Scenario #1 Objectives

1) Evaluate individual ability to shift running Component Cooling Water (CCW) pumps
2) Evaluate individual response to a Charging Pump Shaft Shear.
3) Evaluate individual response to a seismic event (Natural Emergencies).
4) Evaluate individual response to an Emergency Feedwater (EFW) pump over speed trip.
5) Evaluate individual response to an Inadvertent Recirculation Actuation Signal (RAS).
6) Evaluate individual and crew's response to a turbine trip.
7) Evaluate individual and crew's ability to restore feedwater using Loss of Feedwater EOP.
8) Evaluate individual response to Control Element Assemblies (CEAs).
9) Evaluate individual response to 2P-75 Auxiliary Feedwater (AFW) pump trips.

Scenario #1 NARRATIVE

Simulator session begins with the plant at ~70% power steady state.

When the crew has completed their control room walk down and brief, the BOP should shift CCW pumps, securing 'B' and placing 'C' in service.

After the CCW pumps have been shifted, and cued by lead examiner, Charging pump, 2P-36C, will exhibit signs of a shaft shear. The SRO will enter the Loss of Charging AOP. The ATC will check for a suction source and discharge flow path. The CRS will direct the ATC to isolate letdown and place all charging pumps in stop. The crew will direct a NLO to check for gas binding. No gas binding will be found and the NLO will report that 2P-36C has a shaft shear. The CRS will direct the ATC to restore charging with a backup charging pump then restore letdown. [Site OE: CR-ANO-2-2015-0432, 2P-36A charging pump stopped running, CR-ANO-2-2001-0685, 2P-36C tripped.].

When the crew has restored Charging and Letdown and cued by the lead examiner, an inadvertent Recirculation Actuation Signal (RAS) will occur. The SRO should enter and commence taking action of the Inadvertent RAS AOP. The BOP will override and close the inside CNTMT sump suction isolation valves. The crew will check that Service Water is still aligned to Component Cooling Water (CCW) and Auxiliary Cooling Water (ACW). The SRO should also enter Tech Spec 3.0.3 for CNTMT spray and 3.5.2 for ECCS components. The SRO may have to enter Tech Spec 3.5.4 and TRM 3.1.8 for RWT level. [Industry OE: SEN 268 Invalid Safety Injection with Failure to Reset, Site OE: CR-ANO-2-2013-005 Inadvertent SIAS, CCAS, And CIAS.]

Scenario #1 NARRATIVE (continued)

When the crew has closed the CNTMT sump suction valve and entered the appropriate Tech Specs or at the lead examiner's cue, a seismic event will occur. The crew should determine that an earthquake has occurred and enter the natural emergencies AOP. Emergency Feedwater (EFW) pump 2P-7A trip mechanism fails and cannot be reset. The SRO should enter Tech Spec 3.7.1.2 for (1) Inoperable EFW pump. The crew will verify that the seismic class 2 purification system is isolated from the RWT. They will dispatch NLO to asses the plant for damage. The crew will also commence a shutdown due to exceeding the design basis earthquake. When the ATC starts boration, 2CV-4930 boration valve will fail to automatically open and 2P-39A boric acid makeup (BAM) pump will fail to automatically start. The ATC will manually start the BAM pump and open 2CV-4930 boration valve. [Industry OE: IER L2-12-12 Greater than Design Basis Earthquake results in a Loss of Off-Site Power and Reactor Scram.]

When the crew has commenced a plant shutdown, entered the appropriate Tech Spec or cued by the lead examiner, the turbine will trip. The SRO will direct the reactor to be tripped, due to RCS pressure rising. The Reactor may trip automatically prior to the crew manually tripping the reactor. The SRO should enter and direct the actions of SPTAs. Two CEAs will remain withdrawn and the ATC will commence emergency boration to maintain Shutdown Margin. When EFAS is actuated 2P-7B EFW pump flange will wet the motor and cause a motor fault. Also, 2P-1B MFW pump will trip causing a loss of feedwater.. The SRO should diagnose and enter Loss of Feedwater EOP. [Site OE: CR-ANO-2-2002-2173, Reactor Trip due to turbine trip. Industry OE: SEN134 Failure of Control Rods to Fully insert.]

The SRO will complete the initial actions of the Loss of Feedwater EOP to conserve inventory, then determine that AFW is the highest prioritized source of feedwater. The BOP will start the AFW pump and it will trip based on a loss of Lube Oil. The crew will transition to the next highest prioritized source of feedwater 2P-1A Main Feedwater pump and restore feedwater using Main Feedwater. [Industry OE: SOER 86-01 Reliability of PWR Auxiliary Feedwater systems]

Facility: ANO-2	Scenario #2 (New)	Op-Test No.: 2017-1
Examiners:	Operators:	

Initial Conditions:
100% MOL, All Engineered Safety Features systems are in standby. RED Train Maintenance Week.

Turnover:
100%. 260 EFPD. EOOS indicates 'Minimal Risk'. RED Train Maintenance Week.

Evolution scheduled: Drain Containment Sump to 50% level. Steps 20.1.1 and 20.1.2 of OP-2104.014 have been completed.

Event No.	Malf. No.	Event Type*	Event Description
1	XSI2LT56412	I (BOP) I (SRO) TS (SRO)	Containment sump level indicator fails during normal drain evolution. **OP-2104.014, LRW and BMS Operations**
2	XCV2LT4861	I (ATC) I (SRO)	Volume Control Tank level instrument fails low resulting in Refueling Water Tank being aligned to Coolant Charging Pump suction. **OP-2203.012L Annunciator 2K12 Corrective Action.**
3	XRC2PT46012	I (BOP) I (SRO) TS (SRO)	RCS narrow range pressure transmitter fails high. **OP-2203.012D Annunciator 2K04 Corrective Action.**
4		R (ATC) N (BOP) N (SRO)	System Dispatcher call with a request to reduce power ~ 150 MWe within 30 min. **OP-2203.054 Abnormal Grid.** **OP-2203.053 Rapid Power Reduction.**
5	CVCPRESS	C (ATC) C (SRO)	Letdown flow and pressure oscillations. **OP-2203.012L Annunciator 2K12 Corrective Action.**
6	CV10101 MS1002	M (ALL)	'A' Steam Generator MSIV 2CV-1010-1 fails closed and a Main Steam Safety fails open causing an Excess Steam Demand on 'A' S/G. **OP-2202.001, Standard Post Trip Actions (SPTAs) EOP**
7	CV1051	C (BOP) C (SRO)	Upstream ADV 2CV-1051 fails open. **OP-2105.008, Steam Dump and Bypass Control System operations.**
End Point	Post ESD Blowdown RCS temperature and RCS pressure have been stabilized within the PT limits		

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

Target Quantitative Attributes (Section D.5.d)	Actual Attributes
Malfunctions after EOP entry (1-2)	1
Abnormal Events (2-4)	4
Major Transients (1-2)	1
EOPs entered requiring substantive actions (1-2)	1
EOP contingencies requiring substantive actions (0-1)	0
Critical Tasks (2-3)	2

Critical Task	Justification	
Stabilize and control RCS temperature after the ESD blowdown terminates. RCS Tc must be limited to less than 80 degree F heatup.	Rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates do not exceed the design assumptions and satisfy the stress limits for cyclic operation. Also, If RCS heatup is allowed after SG blowdown, the RCS could over pressurize and result in lifting PZR and SG safeties. These pressure stresses added to thermal stresses of rapid cooldown could present PTS concerns.	• CE EPGB Simulator CTs: CT-07, Establish RCS temperature Control (SPTA-07, ESDE-05) • TS 3.4.9.1 RCS Pressure/Temperature Limits
Maintain RCS pressure within the Pressure-Temperature limits of 200°F and 30°F Margin to Saturation throughout implementation of SPTAs and Excess Steam Demand EOP.	RCS pressure must be maintained in these limits to allow natural circulation of the RCS and prevent over pressurizing the RCS boundary. If the failure of 2CV-1051 goes undetected 200°F will be exceeded.	• CE EPGB Simulator CTs: CT-05, Establish RCS Pressure Control • EOP 2202.005 Excess Steam Demand EOP.

Scenario #2 Objectives

1) Evaluate individual response to a failure of a Containment sump level transmitter.
2) Evaluate individual response to the VCT level transmitter failure.
3) Evaluate individual response to a failure of a RCS narrow range pressure transmitter.
4) Evaluate individual ability to perform a rapid power reduction in plant power.
5) Evaluate individual response to a failure of Letdown pressure controller.
6) Evaluate individual response to a failed closed Main Steam Isolation Valve.
7) Evaluate crew's ability to mitigate an Excess Steam Demand Outside containment.
8) Evaluate individual response to and Atmosphere Dump valve failure.

SCENARIO #2 NARRATIVE

When the crew has completed their control room walk down and brief, The BOP will drain the Containment sump to the Auxiliary building sump using the normal drain method. When level lowers below ~60% the containment sump level indicator will fail high. The BOP should secure the containment sump drain. The SRO will determine that Tech Spec 3.4.6.1 is applicable and will enter Tech Spec 3.4.6.1 action b. [Site OE: CR-ANO-2-1993-1669, CR-ANO-2-2003-071, Failed Containment sump level indicator.]

After the SRO has entered the appropriate Tech Spec, secured containment sump drain or cued by lead examiner, one of the Volume Control Tank level transmitters, 2LT-4861, will fail low. The crew will respond to VCT low low level alarm, 2K12 G5. This will result in the VCT outlet valve to the charging pump suction closing and the Refueling Water tank (RWT) suction to the charging pumps opening. RCS temperature and pressure will lower due to boration until the ATC opens VCT outlet valve manually and closes the RWT valve manually.

After the Crew has realigned Charging pump suction to the VCT or at the lead examiner's cue, the 'B' narrow range Pressurizer pressure safety channel pressure instrument, 2PT-4601-2, will fail high. This will trip one of the four PPS trip channels for High Pressurizer pressure, Linear Power Density (LPD), and Departure from Nucleate Boiling (DNBR). RPS channel trip/pre-trip, and channel 'B' operator insert (2C03) trip and pre-trip lights will be lit for High Pressurizer pressure, and trip lights without pre-trip lights for LPD and DNBR. The SRO will refer to the ACA 2203.012D and tech specs 3.3.1.1 for guidance. The BOP will place Channel 'B' PPS in bypass for point 3, 4, & 5, for maintenance and trouble shooting. The crew will have one hour to place these points in bypass before exceeding the tech spec LCO. [Site OE: CR-ANO-2-2013-1721, Pressurizer pressure narrow range failed low.]

After the 'B' channel PPS points have been bypassed or at the lead examiner's cue, The Dispatcher will call the Control Room with a Transmission Loading Relief (TLR) to reduce plant output by ~150 MWe. The SOC will also report that all limits of EN-DC-199 are still met. If Contacted, Unit 1 will be unable to maneuver due to a planned refueling outage. The SRO will enter Abnormal Grid and Rapid Power Reduction and commence a power reduction to comply with the dispatcher's request. [Site OE: CR-ANO-C-2014-1142, CR-ANO-C-2014-03353, Dispatcher required power reductions]

After the ATC has completed the required reactivity manipulation and cued by lead the examiner, letdown pressure and flow will commence oscillating. The ATC should recognize this oscillation. The ATC will place letdown back pressure and letdown flow controllers in manual and stabilize flow and pressure. [Site OE: CR-ANO-2-2016-1648, Letdown oscillations.]

Once letdown flow/back pressure is being controlled manually and cued by the lead examiner, 2CV-1010-1 'A' Steam Generator Main Steam Isolation Valve will fail closed. The crew will verify the reactor is tripped. [Industry OE: SER 8-82, Inadvertent MSIV closure.]

The Crew will implement Standard Post Trip Actions (SPTA), OP 2202.001. Main Steam Safety Valve (MSSV) will lift and then the setpoint will drift due to the castle nut backing off. The Crew will manually actuate Main Steam Isolation Signal (MSIS) or verify that a Main Steam Isolation signal automatically actuates. The Crew will secure and/or verify that Emergency Feedwater (EFW) is not feeding 'A' Steam generator. The ATC will secure two Reactor coolant Pumps when RCS pressure goes below 1400 psia. The SRO will diagnose Excess Steam Demand (ESD) EOP 2202.005. The SRO will direct the BOP to maintain post blowdown temperature and the ATC to maintain post blowdown RCS pressure. The crew will restore Service Water to Component Cooling Water. [PRA item # 9 restore service water to CCW] [Industry OE for Excess Steam Demand, SOER 82-7, Reactor Vessel Pressurized Thermal Shock.]

When the BOP aligns for 'B' Steam Generator pressure control, 2CV-1051 Atmospheric Dump Valve (ADV) will fail open. The BOP should recognize it and use the ADV MOV isolation valve 2CV-1052 to control 'B' Steam Generator pressure. [Site OE: CR-ANO-2-1988-0215, CR-ANO-2-1989-157, ADV failure.]

Facility: ANO-2	Scenario No.: 3 (New)	Op-Test No.: 2017-1

Examiners:	Operators:

Initial Conditions: ~100 % MOL, All Engineered Safety Features systems are in standby. RED Train Maintenance Week. Alternate AAC diesel OOS for maintenance.

Turnover:

100%. 260 EFPD. EOOS indicates 'Minimal Risk'. RED Train Maintenance Week. Alternate AAC Diesel tagged for Maintenance.

Evolution scheduled: Pump the Reactor Drain Tank.

Event No.	Malf. No.	Event Type*	Event Description
1		N (BOP) N (SRO)	Pump the Reactor Drain Tank. **OP-2103.007, Quench Tank and RDT Operations**
2	XRCCHAPLVL	I (ATC) I (SRO) TS (SRO)	'A' Pressurizer Level channel fails low. **OP-2203.028, Pressurizer System Malfunction AOP**
3	CWS2P3BFLT	R (ATC) C (BOP) C (SRO)	'B' Circulating Water pump trip. **OP-2203.019, Loss of Condenser Vacuum AOP**
4	RCLOCATCA	C (ATC) C (SRO) TS (SRO)	A 7 gpm LOCA starts on the 'A' RCS cold leg. **OP-2203.016, Excess RCS leakage AOP**
5	XFW2TE0361	I (BOP) I (SRO)	Main Feedwater pump (MFWP) Lube oil controller temperature input fails. **OP-2203.012C, Annunciator 2K03 Corrective Action**
6	BUS2A1 FAILSU3	M (ALL)	2A-1 4160 Volt vital bus lockout, which will propagate to a Startup Transformer #3 (SU#3) lockout. (LOOP) **OP-2202.001, Standard Post Trip Actions (SPTAs) EOP**
7	EDGDG1OIL EDG2OS	M (ALL)	#1 Emergency Diesel Generator (EDG) loss of lube oil, and #2 EDG will overspeed trip on start. (Station Blackout) **OP-2202.009, Functional Recovery EOP**
8	ESFEFAS12 ESFEFAS22	C (BOP) C (SRO)	2CV-1026-2 does not respond to (Emergency Feedwater Actuation Signal) EFAS. 2CV-1076-2 does not respond to EFAS.
End Point	Power is restored to a vital bus and feedwater aligned to at least on Steam Generator		

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

Target Quantitative Attributes (Section D.5.d)	Actual Attributes
Malfunctions after EOP entry (1-2)	1
Abnormal Events (2-4)	4
Major Transients (1-2)	2
EOPs entered requiring substantive actions (1-2)	1
EOP contingencies requiring substantive actions (0-1)	1
Critical Tasks (2-3)	3

Critical Task	Justification	
Energize at least one vital AC bus prior to Margin to Saturation lowering below 30 degrees F.	Without any AC power available for ESF pumps, the ability to maintain the plant in a safe state is severely degraded since no makeup water can be added to the RCS for inventory control purposes.	• CE EPGB Simulator CTs: CT-03, Energize at least one vital AC bus. (MVA-03) • EOP 2202.009 Functional Recovery EOP. • ANO-2 SAR table 8.3.7, Reg Guide 1.155 and DCP 92-2011.
Maintain RCS pressure within the Pressure-Temperature limits of 200°F and 30°F Margin to Saturation and less than 2500 psia by performing any of the flowing : • Controlling PZR heaters, • Controlling charging and/or HPSI flow once power is restored.	Loss of RCS pressure control low will result in a loss of RCS subcooling. Once subcooling is lost, pressurizer level is no longer a valid indication of RCS mass inventory, and a reactor head void can form, both of which complicate the event recovery. Uncontrolled void growth could result in eventual core uncovery and fuel damage.	• CE EPGB Simulator CTs: CT-06, Establish RCS Pressure Control (PC-01) • EOP 2202.009 Functional Recovery EOP.
Restore Feedwater prior to both SG levels reaching 70” wide range.	Without feedwater, the SG being steamed will eventually boil dry, RCS heat removal will cease, and the reactor core will begin overheating (core melt potential). Thus, it is essential to steam and feed at least one SG to continue to remove RCS decay heat.	• CE EPGB Simulator CTs: CT-08, Establish RCS Heat Removal (HR-01) • EOP 2202.009 Functional Recover EOP • EOP 2202.006 Loss of Feedwater EOP Tech Guide

Scenario #3 Objectives

1) Evaluate individual ability to pump the Reactor Drain Tank.
2) Evaluate individual response to a failure of PZR level control channel failing low.
3) Evaluate individual response to a trip of the “B” Circ Water pump.
4) Evaluate individual response to an Excess RCS leakage event.
5) Evaluate individual response to Feedwater pump Lube oil controller temperature failure.
6) Evaluate individual response to a 2A-1 bus lockout and Startup Transformer #3 (SU#3) lockout.
7) Evaluate crew’s and individual ability to perform standard post trip actions.
8) Evaluate crew’s ability to respond to a Station Blackout out using Functional Recovery EOP.
9) Evaluate individual response to a failure of EFW MOV’s to respond to Emergency Feedwater Actuation Signal (EFAS).

SCENARIO #3 NARRATIVE

Simulator session begins with the plant at 100% power steady state.

When the crew has completed their control room walk down and brief, the BOP will pump the Reactor Drain Tank (RDT) to the online hold up tank. The BOP will pump the RDT from 50% level until the RDT pump cutout on low level at approximately 20.8%.

When the crew has pumped the Reactor Drain Tank or at the lead examiner’s cue, the ‘A’ Pressurizer level channel will fail low causing letdown to go to minimum, all pressurizer heaters to de-energize, all backup charging pumps to start and actual pressurizer level will rise. The SRO will enter Pressurizer Systems Malfunction AOP, OP 2203.028. The ATC will place letdown in manual to control flow and pressurizer level. The ATC will then select the unaffected pressurizer level channel for control of letdown, charging, and pressurizer heater control. After the unaffected pressurizer level channel is selected the ATC will restore letdown control to automatic. The SRO will enter Tech Spec 3.3.3.6 Post Accident Instrumentation. [Site OE: CR-ANO-2-2011-1575, Pressurizer level transmitter failed low due to a reference line failure.]

When the ATC has placed letdown in automatic or at the lead examiner’s cue, the ‘B’ Circulating Water pump will trip causing a reduction in Main Condenser vacuum. The SRO will enter Loss of Condenser Vacuum, 2203.019. The BOP will verify Condenser vacuum less than 7 inches HG Abs. The SRO will direct the ATC to commence emergency boration from a Boric Acid Makeup tank to lower reactor power. The SRO will direct the BOP to lower turbine load to maintain condenser vacuum within the acceptable region described in the AOP. When condenser vacuum has started to improve and is within the acceptable region of the AOP attachment, emergency boration and CEA insertion will be secured. The crew should then prepare to commence a controlled down power to restore condenser vacuum less than 5.15 inches HG Abs. [Site OE: CR-ANO-2-2003-1142, ‘A’ Circulating Water Pump Failure.]

SCENARIO #3 NARRATIVE (continued)

When condenser vacuum has been stabilized or at the lead examiner's cue, a 7 gpm RCS leak will start. The SRO will enter the excess RCS leakage AOP, OP 2203.016. ATC and BOP will perform RCS Leak rate determinations. The SRO will enter Tech Spec 3.4.6.2. The SRO will direct the ATC to maintain pressurizer level within 5% of set point by starting additional charging pumps as needed. The SRO will also direct the ATC to isolate letdown to determine the leak location. After the crew has determined the leak is not in letdown, they will restore letdown and the crew will commence a plant shutdown. [Industry OE: SEN-220, SEN-216, & SEN-182, RCS leakage events.]

The Main Feedwater pump (MFWP) Lube oil controller temperature input fails at the same time as the Circulating water pump trip. Temperatures will trend up and ~ 24 minutes of the input fails the rising temperature will cause 2K03 "TURB BRG OIL TEMP HI" to alarm. BOP refers to OP-2203.012C (D-8), Annunciator 2K03 Corrective Actions and will determine the input to the Lube oil temperature controller has failed. The BOP will to take manual control of the MFWP Lube Oil temperature 2TIC-5283 and restore Lube oil temperature to ~ 115 degrees F.

After control of the MFWP Lube Oil temperature has been established, or at the lead examiner's discretion 2A-1 Non-Vital 4160V bus will lockout and cause a Startup Transformer #3 (SU#3) lockout (this will de-energize non-vital busses but Offsite power will be available to be restored from Startup #2 Transformer) the crew will manually trip the reactor due the in-ability to maintain Steam Generator levels. The crew will then commence Standard Post Trip Actions. #1 EDG will fail shortly after it starts due to a loss of lube oil, and #2 EDG will overspeed trip on start and not be able to be reset. This will cause a station blackout. The SRO should diagnose Functional Recovery EOP due to the blackout and RCS leak. Also when EFAS actuates 2CV-1026-2 and 2CV-1076-2 EFW flow control valves will fail to automatically respond. The crew should manually open 2CV-1026-2 and 2CV-1076-2 and allow the series EFW valve to control SG level.[PRA item #6, Manually open EFW discharge valves to SG A or SG B] [Site OE: IER L2-14-46 Multiply Electrical Faults result in Explosion and transformer and Auto scram. Industry OE: SER 3-10 Electrical fault complicated by equipment failures, SOER 86-0: Reliability of PWR Auxiliary Feedwater Systems]

The SRO will enter Functional Recovery EOP, complete the entry section, and then direct actions using MVAC-1 to restore power from Startup Transformer #2 (SU#2). Once power is restored the crew should commence a cooldown due to the RCS leak.

Facility: ANO-2	Scenario No.: 4 (Modified)	Op-Test No.: 2017-1

Examiners:	Operators:

Initial Conditions: ~4% MOL; All Engineered Safety Features systems are in standby. RED Train Maintenance Week.

Turnover: ~4%. 260 EFPD. EOOS indicates 'Minimal Risk'. RED Train Maintenance Week. Steam Bypass valve in auto local setpoint of 1000 psia. Reactor power was reduced to ~4% for Turbine CV EH leak repair and DEFAS cabinet repair. Power is being maintained at 3 to 5%.

Evolution scheduled: Shift loop 1 Service Water return from the Emergency Cooling Pond (ECP) to the Lake Dardanelle.

Event No.	Malf. No.	Event Type*	Event Description
1		N (BOP) N (SRO)	Shift Loop 1 Service Water return from the Emergency Cooling Pond (ECP) to the Lake Dardanelle. **OP-2104.029, Service Water System Operations**
2	CV4816	C (ATC) C (SRO)	Letdown flow control valve 2CV-4816 will fail closed. **OP-2203.012L, Annunciator 2K12 Corrective Action** **OP-2104.002, Chemical and Volume Control.**
3	XSG2PT10411	I (BOP) I (SRO) TS (SRO)	2PT-1041-1 SG-A pressure detector fails low. **OP-2203.012D, Annunciator 2K04 Corrective Action** **OP-2105.001, CPC/CEAC Operations**
4	DI_C40_S72B ESFCIAS1 K04-C01 K07-C01	C(BOP) C(ATC) C(SRO) TS(SRO)	Inadvertent Containment Isolation Actuation Signal (CIAS) on the Green Train. **OP-2203.039, Inadvertent CIAS**
5	RCP2P32DUPP RCP2P32DMID	C (ATC) C (SRO)	Two seals on 'D' RCP fail **OP-2203.025, RCP Emergencies**
6	RCP2P32DLOW RCLOCATCD	M (ALL)	Third 'D' RCP seal fails and a 180 gpm RCS leak starts. **OP-2202.001, SPTAs,** **OP-2202.003, Loss of Coolant Accident**
7	CVC2P36ASIAS CVC2P36CSIAS CVC2P36LOLVL	C (ATC) C (SRO)	Backup Charging pumps fail to start on low level or SIAS **OP-2202.010, Standard Attachments.**
8	SIS2P89ASS	C (BOP) C (SRO)	2P-89A High Pressure Safety Injection (HPSI) pump shaft shear. **OP-2202.010, Standard Attachments.**
End Point	RCS cooldown commenced IAW the LOCA EOP.		

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

Target Quantitative Attributes (Section D.5.d)	Actual Attributes
Malfunctions after EOP entry (1-2)	2
Abnormal Events (2-4)	4
Major Transients (1-2)	1
EOPs entered requiring substantive actions (1-2)	1
EOP contingencies requiring substantive actions (0-1)	0
Critical Tasks (2-3)	3

Critical Task	Justification	
Component Cooling Water (CCW) to RCPs must be restored within 10 minutes of the loss of cooling water.	Exceeding operating limits has the potential to degrade the RCS pressure boundary. RCPs should be maintained in an available condition for last-resort use if needed. If RCPs are allowed to operate for 10 minutes without CCW flow. OP-1015.050 requires RCPs not meeting operating limits to be secured within 10 minutes.	• 1015.050 Time Critical Operation action program, Attachment C • CE EPGB Simulator CTs: CT-23, Trip any RCP exceeding operating limits (LOCA-04) • AOP OP-2203.039 Inadvertent CIAS.
Commence an RCS cooldown within 30 minutes of entry into OP-2202.003, LOCA EOP.	Cooling down and depressurizing the RCS removes decay heat and lowers the DP at the break, slowing the leak rate and reducing makeup volume required. SDC entry conditions are also required for long-term cooling.	• CE EPGB Simulator CTs: CT-20, Cool down and depressurize RCS (LOCA-09) • CR-ANO-2-2010-948, Critical task criteria
'D' RCP must be secured within 10 min of the reactor trip.	The out-of-limits condition could result in shaft seal damage, and then shaft seal failure could result in increased RCS leakage out the seal to the containment atmosphere, which would worsen the event severity.	• 1015.050 Time Critical Operation action program, Attachment C • CE EPGB Simulator CTs: CT-23, Trip any RCP exceeding operating limits. • CR-ANO-2-2010-948, Critical task criteria

Scenario #4 Objectives

1) Evaluate individual ability to shift Service Water returns.
2) Evaluate individual response to a failure a letdown flow control valve.
3) Evaluate individual response to a failure of Steam Generator pressure transmitter.
4) Evaluate individual response to a failure of a Containment Isolation Actuation Isolation signal.
5) Evaluate individual response to Reactor Coolant Pump seal failures.
6) Evaluate individual and crews ability to mitigate a Loss of Coolant Accident.
7) Evaluate individual ability to monitor operation of Engineered Safety Features equipment and respond to Back up Charging pumps fail to start on low level or SIAS.
8) Evaluate individual ability to monitor operation of Engineered Safety Features equipment and respond to a High Pressure Safety Injection pump Shaft Shear.

SCENARIO #4 NARRATIVE

Simulator session begins with the plant at ~4% power. [Site OE: CR-ANO-2-2016-1993 EH Leak causes power reduction and manual turbine trip. ICES # 323174]

When the crew has completed their control room walk down and brief, the BOP will shift Loop 1 Service Water return from the ECP to Lake Dardanelle using OP-2104.029 Service Water System Operations.

After the BOP has shifted the Loop 1 Service Water returns from the ECP to Lake Dardanelle, the letdown flow control valve 2CV-4816 will fail closed. The ATC will recognize that the flow control valve has failed closed and use the Annunciator Corrective action and Chemical Volume control procedure to shift letdown flow control valve and restore letdown. [Site OE: CR-ANO-2-2014-347, 2CV-4816 would not respond to an open command from the control room.]

When letdown has been placed back in service or when cued by lead examiner, the ‘A’ Steam Generator pressure safety channel pressure instrument, 2PT-1041-1, will fail low. This will trip one of the four PPS channels for low SG pressure trip. Alarms for RPS channel trip/pre-trip, MSIS pre-trip and channel ‘A’ operator insert (2C03) trip and pre-trip light will be lit. The SRO will refer to the ACA 2203.012D and enter tech specs 3.3.1.1, 3.3.2.1, 3.3.3.5, and 3.3.3.6. The BOP will place Channel ‘A’ PPS in bypass for point 11 SG pressure low, point 19 SG1 delta-P high, and point 20 SG2 delta-P. The crew will have one hour to place these points in bypass before exceeding the tech spec LCO. [Site OE: CR-ANO-2-1988-0025, CR-ANO-2-1994-398, Steam Generator pressure transmitter failed low.]

SCENARIO #4 NARRATIVE (continued)

When the appropriate Tech spec has been entered and 'A' PPS channel is placed in bypass and cued by lead examiner; An Inadvertent Containment Isolation will occur on the green train causing the green train CCW to RCPs valve and the Main Chilled water to containment valves to close. The SRO will enter Inadvertent CIAS AOP, OP 2203.039. The crew should restore Component Cooling Water (CCW) to RCPs. The SRO will enter Tech Spec 3.6.3.1. for the overridden Containment Isolation valve. The ATC will cycle charging pump to control pressurizer level. The crew should minimize CEA movement due to the loss of cooling. The BOP will start all containment coolers and align Service Water to maintain Containment temperature and pressure in the required band. The SRO should call for maintenance assistance to correct inadvertent green train Containment isolation. [Industry OE: SEN 268 Invalid Safety Injection with Failure to Reset, Site OE: CR-ANO-2-2013-005 Inadvertent SIAS, CCAS, And CIAS.]

When the actions of inadvertent CIAS have been completed or at the lead examiners cue 'D' RCP seals will fail. The SRO should enter the RCP emergencies AOP, 2203.025 due to the first failed seal. The SRO will contact operations management and continue plant operation based on their recommendation. When the second seal fails the Crew should trip the reactor and secure 'D' RCP. The crew may also secure 'A' or 'B' RCP to balance RCS flows. [Time critical operator action per OP-1015.050 Time Critical Operator action program secure RCP exceeding operating limits] [Industry OE: SER 36-80 Byron Jackson Reactor Coolant Pump Seal Failure, SOER 82-5, RCP Seal Failures]

The Crew will implement Standard Post Trip Actions (SPTA) EOP, 2202.001. During SPTAs, the third seal on 'D' RCP will fail and a Loss of Coolant Accident will commence. The crew may actuate SIAS and CCAS due to the RCS leak. The crew will restore service water to Component Cooling water (CCW). The CRS should direct Steam Generator pressure be lowered using Auto Local control of the Steam Dump Bypass Control System (SDBCS) to maintain MTS as RCS pressure lowers. [PRA item # 9 restore service water to CCW] [Site OE: CR-ANO-2-2013-2254, SDBCS Master controller would not control in automatic]

The SRO will diagnose either an Excess RCS leakage and enter Excess RCS leakage AOP, 2203.016, or if SIAS is actuated diagnose Loss of Coolant Accident (LOCA). If Excess RCS is diagnosed the SRO should implement the floating step for leakage greater than 44 gpm then actuate SIAS and CCAS and re-diagnose LOCA. The ATC should recognize the backup charging pump fail to start on low level and SIAS. The ATC will start the backup charging pumps. The crew should determine that 2P-89A HPSI pump has degraded discharge pressure, and start 2P-89C. The ATC will commence cool down of the RCS and control RCS pressure to restore pressurizer level. The BOP will override Service Water to Component Cooling Water and Auxiliary Cooling Water. [Industry OE: SEN-220, SEN-216, & SEN-182, RCS leakage events.]