

Facility: Beaver Valley Unit 1 ILOT18 Date of Exam: 9/17 through 9/28/2018

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 Evolution	1	3	3	3				3	4			2	18			
	2	1	1	2				2	1			2	9			
	Tier Totals	4	4	5				5	5			4	27			
2. Plant Systems	1	2	3	2	3	3	2	3	3	1	3	3	28			
	2	2	1	0	1	1	1	1	1	1	1	0	10			
	Tier Totals	4	4	2	4	4	3	4	4	2	4	3	38			
3. Generic Knowledge and Abilities Category					1		2		3		4		10			
					2		2		3		3					

- Note:
1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outline sections (i.e., except for one category in Tier 3 of the SRO-only section, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 radiation control K/A is allowed if it is replaced by a K/A from another Tier 3 category.)
 2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ± 1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points, and the SRO-only exam must total 25 points.
 3. Systems/evolutions within each group are identified on the outline. Systems or evolutions that do not apply at the facility should be deleted with justification. Operationally important, site-specific systems/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 for guidance regarding the elimination of inappropriate K/A statements.
 4. Select topics from as many systems and evolutions as possible. Sample every system or evolution in the group before selecting a second topic for any system or evolution.
 5. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
 6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
 7. The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
 8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' IRs for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above. If fuel-handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2. (Note 1 does not apply). Use duplicate pages for RO and SRO-only exams.
 9. For Tier 3, select topics from Section 2 of the K/A catalog and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

3* Generic K/As

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

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

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1(RO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1 [Question 1]	X						EK1 Knowledge of the operational implications of the following concepts as they apply to the reactor trip: EK1.05 Decay power as a function of time (CFR 41.8 / 41.10 / 45.3)	3.3	
000008 (APE 8) Pressurizer Vapor Space Accident / 3 [Question 2]		X					AK2. Knowledge of the interrelations between the Pressurizer Vapor Space Accident and the following: AK2.01 Valves (CFR 41.7 / 45.7)	2.7	
000009 (EPE 9) Small Break LOCA / 3 [Question 3]				X			EA1 Ability to operate and monitor the following as they apply to a small break LOCA: EA1.14 Secondary pressure control (CFR 41.7 / 45.5 / 45.6)	3.4	
000011 (EPE 11) Large Break LOCA / 3 [Question 4]		X					EK2 Knowledge of the interrelations between the and the following Large Break LOCA: EK2.02 Pumps (CFR 41.7 / 45.7)	2.6	
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4 [Question 5]					X		AA2. Ability to determine and interpret the following as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow): AA2.09 When to secure RCPs on high stator temperatures (CFR 43.5 / 45.13)	3.4	
000025 (APE 25) Loss of Residual Heat Removal System / 4 [Question 6]				X			AA1. Ability to operate and / or monitor the following as they apply to the Loss of Residual Heat Removal System: AA1.08 RHR cooler inlet and outlet temperature indicators (CFR 41.7 / 45.5 / 45.6)	2.9	
000026 (APE 26) Loss of Component Cooling Water / 8 [Question 7]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Component Cooling Water: AK3.02 The automatic actions (alignments) within the CCWS resulting from the actuation of the ESFAS (CFR 41.5, 41.10 / 45.6 / 45.13)	3.6	
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3 [Question 8]	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Pressurizer Pressure Control Malfunctions: AK1.01 Definition of saturation temperature (CFR 41.8 / 41.10 / 45.3)	3.1	

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1(RO) Continued

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000038 (EPE 38) Steam Generator Tube Rupture / 3 [Question 9]						X	2.4.20 Knowledge of the operational implications of EOP warnings, cautions, and notes. (CFR: 41.10 / 43.5 / 45.13)	3.8	
000055 (EPE 55) Station Blackout / 6 [Question 10]						X	EA2 Ability to determine or interpret the following as they apply to a Station Blackout: EA2.01 Existing valve positioning on a loss of instrument air system (CFR 43.5 / 45.13)	3.4	
000057 (APE 57) Loss of Vital AC Instrument Bus / 6 [Question 11]						X	2.1.27 Knowledge of system purpose and/or function. (CFR: 41.7)	3.9	
000058 (APE 58) Loss of DC Power / 6 [Question 12]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of DC Power: AK3.01 Use of dc control power by D/Gs (CFR 41.5, 41.10 / 45.6 / 45.1)	3.4	
000062 (APE 62) Loss of Nuclear Service Water / 4 [Question 13]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: AK3.03 Guidance actions contained in EOP for Loss of nuclear service water (CFR 41.4, 41.8 / 45.7)	4.0	
000065 (APE 65) Loss of Instrument Air / 8 [Question 14]						X	AA2. Ability to determine and interpret the following as they apply to the Loss of Instrument Air: AA2.05 When to commence plant shutdown if instrument air pressure is decreasing (CFR: 43.5 / 45.13)	3.4	
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6 [Question 15]	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Generator Voltage and Electric Grid Disturbances: AA1.03 Under-excitation (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8)	3.3	
(W E04) LOCA Outside Containment / 3 [Question 16]				X			EA1. Ability to operate and / or monitor the following as they apply to the (LOCA Outside Containment) EA1.3 Desired operating results during abnormal and emergency situations. (CFR: 41.7 / 45.5 / 45.6)	3.8	

ES-401

PWR Examination Outline

Form ES-401-2

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1(RO) Continued

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
(BW E04; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4 [Question 17]		X					EK2. Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following: EK2.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.7)	3.7	
(W E11) Loss of Emergency Coolant Recirculation / 4 [Question 18]					X		EA2. Ability to determine and interpret the following as they apply to the (Loss of Emergency Coolant Recirculation) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations. (CFR: 43.5 / 45.13)	3.4	
K/A Category Point Totals:	3	3	3	3	4	2	Group Point Total:		18

Emergency and Abnormal Plant Evolutions - Tier 1/Group 2(RO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000001 (APE 1) Continuous Rod Withdrawal / 1 [Question 19]	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Continuous Rod Withdrawal: AK1.07 Effects of power level and control position on flux (CFR 41.8 / 41.10 / 45.3)	3.5	
000036 (APE 36; BW/A08) Fuel-Handling Incidents / 8 [Question 20]						X	2.4.31 Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.2	
000037 (APE 37) Steam Generator Tube Leak / 3 [Question 21]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Steam Generator Tube Leak: AK3.05 Actions contained in procedures for radiation monitoring, RCS water inventory balance, S/G tube failure, and plant shutdown (CFR 41.5,41.10 / 45.6 / 45.13)	3.7	
000051 (APE 51) Loss of Condenser Vacuum / 4 [Question 22]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Condenser Vacuum: AA2.02 Conditions requiring reactor and/or turbine trip (CFR: 43.5 / 45.13)	3.9	
000068 (APE 68; BW A06) Control Room Evacuation / 8 [Question 23]				X			AA1. Ability to operate and / or monitor the following as they apply to the Control Room Evacuation: AA1.11 Emergency borate valve controls and indicators (CFR 41.7 / 45.5 / 45.6)	3.9	
000076 (APE 76) High Reactor Coolant Activity / 9 [Question 24]			X				AK3. Knowledge of the reasons for the following responses as they apply to the High Reactor Coolant Activity AK3.05 Corrective actions as a result of high fission-product radioactivity level in the RCS (CFR 41.5,41.10 / 45.6 / 45.13)	2.9	
BW E08; W E03) LOCA Cooldown—Depressurization / 4 [Question 25]				X			EA1. Ability to operate and / or monitor the following as they apply to the (LOCA Cooldown and Depressurization) EA1.3 Desired operating results during abnormal and emergency situations. (CFR: 41.7 / 45.5 / 45.6)	3.7	

ES-401

PWR Examination Outline

Form ES-401-2

Emergency and Abnormal Plant Evolutions - Tier 1/Group 2(RO) *Continued*

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
(CE A11**; W E08) RCS Overcooling— Pressurized Thermal Shock / 4 [Question 26]						X	2.4.35 Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. (CFR: 41.10 / 43.5 / 45.13)	3.8	
(W E15) Containment Flooding / 5 [Question 27]		X					EK2. Knowledge of the interrelations between the (Containment Flooding) and the following: EK2.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.7)	2.8	
K/A Category Point Totals:	1	1	2	2	1	2	Group Point Total:		9

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 (SF4P RCP) Reactor Coolant Pump [Question 28]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the RCPS: K5.02 Effects of RCP coastdown on RCS parameters (CFR: 41.5 / 45.7)	2.8	
004 (SF1; SF2 CVCS) Chemical and Volume Control [Question 29]											X	2.2.37 Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)	3.6	
004 (SF1; SF2 CVCS) Chemical and Volume Control [Question 30]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the CVCS: K5.29 Reason for sampling for chloride, fluoride, sodium and solids in RCS (CFR: 41.5/45.7)	2.6	
005 (SF4P RHR) Residual Heat Removal [Question 31]				X								K4 Knowledge of RHRS design feature(s) and/or interlock(s) which provide or the following: K4.03 RHR heat exchanger bypass flow control (CFR: 41.7)	2.9	
006 (SF2; SF3 ECCS) Emergency Core Cooling [Question 32]		X										K2 Knowledge of bus power supplies to the following: K2.04 ESFAS-operated valves (CFR: 41.7)	3.6	
007 (SF5 PRTS) Pressurizer Relief/Quench Tank [Question 33]				X								K4 Knowledge of PRTS design feature(s) and/or interlock(s) which provide for the following: K4.01 Quench tank cooling (CFR: 41.7)	2.6	
008 (SF8 CCW) Component Cooling Water [Question 34]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CCWS controls including: A1.01 CCW flow rate (CFR: 41.5 / 45.5)	2.8	
010 (SF3 PZR PCS) Pressurizer Pressure Control [Question 35]		X										K2 Knowledge of bus power supplies to the following: K2.04 Indicator for code safety position (CFR: 41.7)	2.7	
012 (SF7 RPS) Reactor Protection [Question 36]			X									K3 Knowledge of the effect that a loss or malfunction of the RPS will have on the following: K3.01 CRDS (CFR: 41.7 / 45.6)	3.9	

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	#
013 (SF2 ESFAS) Engineered Safety Features Actuation [Question 37]						X						K6 Knowledge of the effect of a loss or malfunction on the following will have on the ESFAS: K6.01 Sensors and detectors (CFR: 41.7 / 45.5 to 45.8)	2.7	
022 (SF5 CCS) Containment Cooling [Question 38]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CCS controls including: A1.01 Containment temperature (CFR: 41.5 / 45.5)	3.6	
022 (SF5 CCS) Containment Cooling [Question 39]		X										K2 Knowledge of power supplies to the following: K2.01 Containment cooling fans (CFR: 41.7)	3.0	
026 (SF5 CSS) Containment Spray [Question 40]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CSS controls including: A1.02 Containment temperature (CFR: 41.5 / 45.5)	3.6	
026 (SF5 CSS) Containment Spray [Question 41]									X			A4 Ability to manually operate and/or monitor in the control room: A4.01 CSS controls (CFR: 41.7 / 45.5 to 45.8)	4.5	
039 (SF4S MSS) Main and Reheat Steam [Question 42]								X				A3 Ability to monitor automatic operation of the MRSS, including: A3.02 Isolation of the MRSS (CFR: 41.5 / 45.5)	3.1	
059 (SF4S MFW) Main Feedwater [Question 43]								X				A2 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: A2.12 Failure of feedwater regulating valves (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.1	
059 (SF4S MFW) Main Feedwater [Question 44]										X		2.1.30 Ability to locate and operate components, including local controls. (CFR: 41.7 / 45.7)	4.4	

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	#
061 (SF4S AFW) Auxiliary/Emergency Feedwater [Question 45]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the AFW: K5.01 Relationship between AFW flow and RCS heat transfer (CFR: 41.5 / 45.7)	3.6	
061 (SF4S AFW) Auxiliary/Emergency Feedwater [Question 46]						X						K6 Knowledge of the effect of a loss or malfunction of the following will have on the AFW components: K6.02 Pumps (CFR: 41.7 / 45.7)	2.6	
062 (SF6 ED AC) AC Electrical Distribution [Question 47]											X	2.4.20 Knowledge of the operational implications of EOP warnings, cautions, and notes. (CFR: 41.10 / 43.5 / 45.13)	3.8	
063 (SF6 ED DC) DC Electrical Distribution [Question 48]										X		A4 Ability to manually operate and/or monitor in the control room: A4.01 Major breakers and control power fuses (CFR: 41.7 / 45.5 to 45.8)	2.8	
063 (SF6 ED DC) DC Electrical Distribution [Question 49]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the DC electrical system and the following systems: K1.03 Battery charger and battery (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.9	
064 (SF6 EDG) Emergency Diesel Generator [Question 50]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the ED/G system and the following systems: K1.02 D/G cooling water system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.1	
073 (SF7 PRM) Process Radiation Monitoring [Question 51]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the PRM system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.01 Erratic or failed power supply (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.5	

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	#
076 (SF4S SW) Service Water [Question 52]			X									K3 Knowledge of the effect that a loss or malfunction of the SWS will have on the following: K3.03 Reactor building closed cooling water (CFR: 41.7 / 45.6)	3.5	
076 (SF4S SW) Service Water [Question 53]				X								K4 Knowledge of SWS design feature(s) and/or interlock(s) which provide for the following: K4.01 Conditions initiating automatic closure of closed cooling water auxiliary building header supply and return valves (CFR: 41/7)	2.5	
078 (SF8 IAS) Instrument Air [Question 54]										X		A4 Ability to manually operate and/or monitor in the control room: A4.01 Pressure gauges (CFR: 41.7 / 45.5 to 45.8)	3.1	
103 (SF5 CNT) Containment [Question 55]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the containment system and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations A2.05 Emergency containment entry (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9	
K/A Category Point Totals:	2	3	2	3	3	2	3	3	1	3	3	Group Point Total:		28

Plant Systems

- Tier 2/Group 2(RO)

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 (SF1 CRDS) Control Rod Drive [Question 56]		X										K2 Knowledge of bus power supplies to the following: K2.02 One-line diagram of power supply to trip breakers (CFR: 41.7)	3.6	
011 (SF2 PZR LCS) Pressurizer Level Control [Question 57]				X								K4 Knowledge of PZR LCS design feature(s) and/or interlock(s) which provide for the following: K4.05 PZR level inputs to RPS (CFR: 41.7)	3.7	
015 (SF7 NI) Nuclear Instrumentation [Question 58]						X						K6 Knowledge of the effect of a loss or malfunction on the following will have on the NIS: K6.03 Component interconnections (CFR: 41.7 / 45.7)	2.6	
071 (SF9 WGS) Waste Gas Disposal [Question 59]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Waste Gas Disposal System operating the controls including: A1.06 Ventilation system (CFR: 41.5 / 45.5)	2.5	
040 (SF4S SDS) Steam Pump/Turbine Bypass Control [Question 60]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the SDS: K5.06 Effect of power change on fuel cladding (CFR: 41.5 / 45.7)	2.5	
045 (SF 4S MTG) Main Turbine Generator [Question 61]								X				A2 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: A2.12 Control rod insertion limits exceeded (stabilize secondary) (CFR: 41.5 / 43.5 / 45.3 / 45.5)	2.5	
055 (SF4S CARS) Condenser Air Removal [Question 62]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the CARS and the following systems: K1.06 PRM system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.6	
056 (SF4S CDS) Condensate [Question 63]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the Condensate System and the following systems: K1.03 MFW (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.6	

ES-401

PWR Examination Outline

Form ES-401-2

Plant Systems

- Tier 2/Group 2(RO) Continued

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	#
072 (SF7 ARM) Area Radiation Monitoring [Question 64]									X			A3 Ability to monitor automatic operation of the ARM system, including: A3.01 Changes in ventilation alignment (CFR: 41.7 / 45.5)	2.9	
075 (SF8 CW) Circulating Water [Question 65]										X		A4 Ability to manually operate and/or monitor in the control room: A4.01 Emergency/essential SWS pumps (CFR: 41.7 / 45.5 to 45.8)	3.2	
K/A Category Point Totals:	2	1	0	1	1	1	1	1	1	1	0	Group Point Total:		10

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Category	K/A#	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	G2.1.1	2.1.1 Knowledge of conduct of operations requirements. (CFR: 41.10 / 45.13) [Question 66]	3.8			
	G2.1.23	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) [Question 67]	4.3			
	Subtotal					
2. Equipment Control	G2.2.13	2.2.13 Knowledge of tagging and clearance procedures. (CFR: 41.10 / 45.13) [Question 68]	4.1			
	G2.2.41	2.2.41 Ability to obtain and interpret station electrical and mechanical drawings. (CFR: 41.10 / 45.12 / 45.13) [Question 69]	3.5			
	Subtotal					
3 Radiation Control	G2.3.14	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) [Question 70]	3.4			
	G2.3.15	2.3.15 Knowledge of radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc. (CFR: 41.12 / 43.4 / 45.9) [Question 71]	2.9			
	G2.3.7	2.3.7 Ability to comply with radiation work permit requirements during normal or abnormal conditions. (CFR: 41.12 / 45.10) [Question 72]	3.5			
	Subtotal					
4. Emergency Procedures/ Plan	G2.4.14	2.4.14 Knowledge of general guidelines for EOP usage. (CFR: 41.10 / 45.13) [Question 73]	3.8			
	G2.4.19	2.4.19 Knowledge of EOP layout, symbols, and icons. (CFR: 41.10 / 45.13) [Question 74]	3.4			
	G2.4.45	2.4.45 Ability to prioritize and interpret the significance of each annunciator or alarm. (CFR: 41.10 / 43.5 / 45.3 / 45.12) [Question 75]	4.1			
	Subtotal					
Tier 3 Point Total				10		

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Tier	Group	SRO K/A Category Points												SRO ONLY Points		
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	TOTAL	A2	G*	TOTAL
1. Emergency & Abnormal Plant Evolutions	1													3	3	6
	2													2	2	4
	Tier Totals													5	5	10
2. Plant Systems	1													3	2	5
	2													1	1	3
	Tier Totals													5	3	8
3. Generic Knowledge and Abilities Category														1	2	3
														2	2	1
														4	7	

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 5. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
 6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
 7. The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
 8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' IRs for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above. If fuel-handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2. (Note 1 does not apply). Use duplicate pages for RO and SRO-only exams.
 9. For Tier 3, select topics from Section 2 of the K/A catalog and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

G* Generic K/As

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

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1(SRO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1 [Question 76]					X		EA2 Ability to determine or interpret the following as they apply to a reactor trip: EA2.04 If reactor should have tripped but has not done so, manually trip the reactor and carry out actions in ATWS EOP (CFR 41.7 / 45.5 / 45.6)	4.6	
000011 (EPE 11) Large Break LOCA / 3 [Question 77]					X		EA2 Ability to determine or interpret the following as they apply to a Large Break LOCA: EA2.14 Actions to be taken if limits for PTS are violated (CFR 43.5 / 45.13) 011EA2.14	4.0	
000025 (APE 25) Loss of Residual Heat Removal System / 4 [Question 78]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Residual Heat Removal System: AA2.06 Existence of proper RHR overpressure protection (CFR: 43.5 / 45.13)	3.4	
000026 (APE 26) Loss of Component Cooling Water / 8 [Question 79]					X		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)	4.2	
000056 (APE 56) Loss of Offsite Power / 6 [Question 80]					X		2.4.50 Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 41.10 / 43.5 / 45.3)	4.0	
000062 (APE 62) Loss of Nuclear Service Water / 4 [Question 81]					X		2.1.28 Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)	4.1	
K/A Category Point Totals:					3	3	Group Point Total:		6

ES-401

PWR Examination Outline

Form ES-401-2

Emergency and Abnormal Plant Evolutions - Tier 1/Group 2(SRO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000003 (APE 3) Dropped Control Rod / 1 [Question 82]						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	
000028 (APE 28) Pressurizer (PZR) Level Control Malfunction / 2 [Question 83]						X	2.4.50 Ability to verify system alarm setpoints and operate controls identified in the alarm response manual. (CFR: 41.10 / 43.5 / 45.3)	4.0	
000068 (APE 68; BW A06) Control Room Evacuation / 8 [Question 84]						X	AA2. Ability to determine and interpret the following as they apply to the Control Room Evacuation: AA2.06 RCS pressure (CFR: 43.5 / 45.13)	4.3	
(BW E09; CE A13**; W E09 & E10) Natural Circulation/4 [Question 85]						X	EA2. Ability to determine and interpret the following as they apply to the (Natural Circulation with Steam Void in Vessel with/without RVLIS) EA2.2 Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments. (CFR: 43.5 / 45.13)	3.9	
K/A Category Point Totals:					2	2	Group Point Total:		4

Plant Systems

- Tier 2/Group 1(SRO)

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 (SF4P RCP) Reactor Coolant Pump [Question 86]												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 the transmission system operator. (CFR: 41.10 / 43.5 / 45.11)	4.1	
007 (SF5 PRTS) Pressurizer Relief/Quench Tank [Question 87]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the P S; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.04 Overpressurization of the waste gas vent header (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9	
010 (SF3 PZR PCS) Pressurizer Pressure Control [Question 88]												X 2.2.38 Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)	4.5	
015 (SF5 CSS) Containment Spray [Question 89]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the CSS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.08 Safe securing of containment spray when it can be done (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.7	
073 (SF7 PRM) Process Radiation Monitoring [Question 90]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the PRM system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 Detector failure (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.2	
K/A Category Point Totals:								3			2	Group Point Total:		5

ES-401

PWR Examination Outline

Form ES-401-2

Plant Systems

- Tier 2/Group 2(SRO)

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	#
034 (SF8 FHS) Fuel-Handling Equipment [Question 91]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Fuel Handling System controls including: A1.01 Load limits (CFR: 41.5 / 45.5)	3.2	
072 (SF7 ARM) Area Radiation Monitoring [Question 92]											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	
086 Fire Protection [Question 93]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the Fire Protection System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.03 Inadvertent actuation of the FPS due to circuit failure or welding (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9	
K/A Category Point Totals:							1	1			1	Group Point Total:		3

Facility: Beaver Valley Unit 1 1LOT18Date of Exam: 9/17 through 9/28/2018

Category	K/A#	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	G2.1.32	2.1.32 Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12) [Question 94]			4.0	
	G2.1.4	2.1.4 Knowledge of individual licensed operator responsibilities related to shift staffing, such as medical requirements, "no-solo" operation, maintenance of active license status, 10CFR55, etc. (CFR: 41.10 / 43.2) [Question 95]			3.8	
	Subtotal					2
2. Equipment Control	G2.2.17	2.2.17 Knowledge of the process for managing maintenance activities during power operations, such as risk assessments, work prioritization, and coordination with the transmission system operator. (CFR: 41.10 / 43.5 / 45.13) [Question 96]			3.8	
	G2.2.35	2.2.35 Ability to determine Technical Specification Mode of Operation. (CFR: 41.7 / 41.10 / 43.2 / 45.13) [Question 97]			4.5	
	Subtotal					2
3. Radiation Control	G2.3.7	2.3.7 Ability to comply with radiation work permit requirements during normal or abnormal conditions. (CFR: 41.12 / 45.10) [Question 98]			3.6	
	Subtotal					1
4. Emergency Procedures/ Plan	G2.4.1	2.4.1 Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13) [Question 99]			4.8	
	G2.4.9	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) [Question 100]			4.2	
	Subtotal					2
Tier 3 Point Total						7

Facility: Beaver Valley Unit 1 1LOT18Date of Exam: 9-17 through 9/28/2018

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	000025 AA1.22	Question 6; Residual Heat Removal (RHRS) is not used as Low Pressure Injection at Beaver Valley, therefore there is no tie between RWST and the RHR system. NRC Chief Examiner randomly selected AA1.08 as a replacement.
1/2	000036 2.4.34	Question 20; There are no RO tasks performed outside the main control room during an emergency and the resultant operational effects during a Fuel-Handling Incident. NRC Chief Examiner randomly selected 2.4.31 as a replacement.
1/2	000037 AK3.10	Question 21; There are no automatic actions associated with high radioactivity in S/G sample lines at BV1. NRC Chief Examiner randomly selected AK3.05 as a replacement.
2/1	022 A1.02	Question 38; BV1 does not operate containment cooling based on containment pressure. NRC Chief Examiner randomly selected A1.01 as a replacement.
2/1	073 A2.02	Question 51; Reselect due to oversampling/duplicate K/A with question 90. NRC Chief Examiner randomly selected A2.01 as a replacement.
2/2	028 A1.02	Question 59; Unable to write a discriminatory question on Hydrogen purge control, and the Hydrogen Recombiners are Retired In Place. NRC Chief Examiner randomly selected system 071 and A1.06 as a replacement.
1/1	000025 AA2.05	Question 78; Residual Heat Removal (RHRS) is not used as Low Pressure Injection at Beaver Valley, therefore there are no limitations on LPI flow and temperature rates of change. NRC Chief Examiner randomly selected AA2.06 as a replacement.
1/1	000026 2.4.49	Question 79; Loss of Component Cooling Water has no immediate actions required and the K/A is RO required knowledge. NRC Chief Examiner randomly selected 2.4.47 as a replacement.
1/2	000003 2.4.21	Question 82; Dropped Control Rod has no ties to the generic K/A, status of the safety functions, therefore we cannot write a discriminatory question. NRC Chief Examiner randomly selected 2.4.46 as a replacement.
2/1	026 A2.01	Question 89; We cannot write a discriminatory question regarding Containment Spray and the response to Reflux boiling pressure spike when first going on recirculation. NRC Chief Examiner randomly selected A2.08 as a replacement.
1/1	062 2.1.28	Question 81; Unable to write a discriminatory question regarding Loss of Nuclear Service Water - Knowledge of the purpose and function of major system components and controls. NRC Chief Examiner randomly selected 2.1.23 as a replacement.

Facility: Beaver Valley Unit 1Date of Examination: 9/17 thru 9/28, 2018Examination Level **RO** ☒ **SRO** ☐Operating Test Number: BV1LOT18 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (RO A 1.1)	D, R	2.1.7 (4.4) Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. JPM 1AD-030 Calculate The RCS Initial Void Volume And Final Void Volume (IAW 10M-6.4.Q, "Response To Void In Reactor Vessel") (RO)
Conduct of Operations (RO A 1.2)	M, R	2.1.4 (3.3) Knowledge of individual licensed operator responsibilities related to shift staffing, such as medical requirements, "no-solo" operation, maintenance of active license status, 10CFR55, etc. JPM 3AD-023 Determine if License Status is Maintained Active (RO)
Equipment Control (RO A 2)	D, R	2.2.37 (3.6) Ability to determine operability and/or availability of safety related equipment. JPM 1AD-027 Complete Surveillance of RHR Pump (RO)
Radiation Control (RO A 3)	D, R	2.3.11 (3.8) Ability to control radiation releases. JPM 1AD-010 Determine GW Storage Tank Discharge Bleed Flow Rate (RO)
Emergency Plan (RO A 4)		NOT EVALUATED

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics (which would require all 5 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: Beaver Valley Unit 1Date of Examination: 9/17 thru 9/28, 2018Examination Level RO ☐ SRO ☒Operating Test Number: BV1LOT18 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (SRO A 1.1)	N, R	2.1.7 (4.7) Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. JPM 1AD-032 Review The RCS Initial Void Volume And Final Void Volume (IAW 10M-6.4.Q, "Response To Void In Reactor Vessel") and then Determine the Vent Time. (SRO)
Conduct of Operations (SRO A 1.2)	M, R	2.1.4 (3.8) Knowledge of individual licensed operator responsibilities related to shift staffing, such as medical requirements, "no-solo" operation, maintenance of active license status, 10CFR55, etc. JPM 3AD-024 Evaluate Operators Work History to Determine if License Status is Active (SRO)
Equipment Control (SRO A 2)	D, R	2.2.37 (4.6) Ability to determine operability and/or availability of safety related equipment. JPM 1AD-026 Review/Approve Completed Surveillance of RHR Pump (SRO)
Radiation Control (SRO A 3)	D, R	2.3.11 (4.3) Ability to control radiation releases. JPM 1AD-023 Review/Approve LW Discharge (SRO)
Emergency Plan (SRO A 4)	D, R	2.4.30 (4.1) 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 the transmission system operator. JPM 1AD-020 Determine Event Notification Times (SRO)

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics (which would require all 5 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: Beaver Valley Unit 1Date of Examination: 9/17 thru 9/28, 2018Exam Level: RO ☒ SRO(I) ☐ SRO(U) ☐Operating Test No.: BV1LOT18 NRCControl Room Systems[@] (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U)

System / JPM Title	Type Code*	Safety Function
S1 - Raise Reactor Power To 10^{-8} Amps (1CR-640)	A, D, L, S	1
S2 - Align SI Pumps for Hot/Cold Leg Recirculation (1CR-570)	A, D, EN, L, S	2
S3 - Depressurize the RCS During Natural Circulation Cooldown (1CR-554)	A, D, L, S	3
S4 - Isolate a Faulted Steam Generator via Att 1.2-Y AFW Valve Failure (1CR-715 NEW)	A, N, L, S	4S
S5 - Verify CIB Valve Alignment (1CR-045)	D, EN, L, S	5
S6 - Synchronize and Load EDG No. 2 (1CR-024)	D, L, S	6
S7 - Respond to an Intermediate Range Malfunction (1CR-106)	D, L, S	7
S8 - Respond to a Loss of Secondary Component Cooling Water (1CR-557 NEW)	A, N, S	8

In-Plant Systems[@] (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)

P1 - Startup the Wide Range Hydrogen Analyzer (1PL-047)	D, E	5
P2 - AMSAC System Trouble – FT Failure (1PL-148)	D, E	7
P3 - Verification of Cold Leg Recirculation Components (1PL-028)	D, E, R	2

[@] All RO and SRO control room (and in-plant) systems must be different and serve different safety functions; all 5 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	$\leq 9 / \leq 8 / \leq 4$
(E)mergency or abnormal in-plant	$\geq 1 / \geq 1 / \geq 1$
(EN)gineered safety feature	$\geq 1 / \geq 1 / \geq 1$ (control room system)
(L)ow-power / Shutdown	$\geq 1 / \geq 1 / \geq 1$
(N)ew or (M)odified from bank including 1(A)	$\geq 2 / \geq 2 / \geq 1$
(P)revious 2 exams	$\leq 3 / \leq 3 / \leq 2$ (randomly selected)
(R)CA	$\geq 1 / \geq 1 / \geq 1$
(S)imulator	

Facility: **Beaver Valley Unit 1**Date of Examination: **9/17 thru 9/28, 2018**Exam Level: RO ☐ SRO(I) ☒ SRO(U) ☐Operating Test No.: **BV1LOT18 NRC**

Control Room Systems® (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U)

System / JPM Title	Type Code*	Safety Function
S1 - Raise Reactor Power To 10^{-8} Amps (1CR-640)	A, D, L, S	1
S2 - Align SI Pumps for Hot/Cold Leg Recirculation (1CR-570)	A, D, EN, L, S	2
S3 - Depressurize the RCS During Natural Circulation Cooldown (1CR-554)	A, D, L, S	3
S4 - Isolate a Faulted Steam Generator via Att 1.2-Y AFW Valve Failure (1CR-NEW)	A, N, L, S	4S
S6 - Synchronize and Load EDG No. 2 (1CR-024)	D, L, S	6
S7 - Respond to an Intermediate Range Malfuction (1CR-106)	D, L, S	7
S8 - Respond to a Loss of Secondary Component Cooling Water (1CR-NEW)	A, N, S	8

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

P1 - Startup the Wide Range Hydrogen Analyzer (1PL-047)	D, E	5
P2 - AMSAC System Trouble – FT Failure (1PL-148)	D, E	7
P3 - Verification of Cold Leg Recirculation Components (1PL-028)	D, E, R	2

@ All RO and SRO control room (and in-plant) systems must be different and serve different safety functions; all 5 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	$\leq 9 / \leq 8 / \leq 4$
(E)mergency or abnormal in-plant	$\geq 1 / \geq 1 / \geq 1$
(EN)gineered safety feature	$\geq 1 / \geq 1 / \geq 1$ (control room system)
(L)ow-power / Shutdown	$\geq 1 / \geq 1 / \geq 1$
(N)ew or (M)odified from bank including 1(A)	$\geq 2 / \geq 2 / \geq 1$
(P)revious 2 exams	$\leq 3 / \leq 3 / \leq 2$ (randomly selected)
(R)CA	$\geq 1 / \geq 1 / \geq 1$
(S)imulator	

Appendix D

Scenario Outline

Facility: **BVPS Unit 1** Scenario No. 1 Op Test No.: **1LOT18 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC ____ (10):** 100% power, BOL, Equ. XE Conditions, CB "D" @ 230 steps, RCS boron - ____ ppm.

Turnover: Maintain 100% power.
 PCV-1RC-456 isolated due to seat leakage, block valve closed. TS 3.4.11, Condition A
 FW-P-3A Out of service, TS 3.7.5, Condition B

Critical Tasks:

1. CT-11 (E-0.O) Close CNMT isolation valves
2. CT-16 (E-1.C) Stop RCP's
3. CT-51 (FR-S.1.B) Start Auxiliary Feedwater pumps
4. CT-52 (FR-S.1.C) Initiate negative reactivity

Event No.	Malf. No.	Event Type	Event Description
1	AUX13G (0 0)	(C) BOP, SRO (TS) SRO	VS-F-4A spurious trip, requires BOP to start VS-F-4B.
2	PRS06A (0 0) 100 60	(I) ATC, SRO (TS) SRO	LT-1RC-459 drifts high, requires ATC to place alternate channel in service..
3	TUR15 (0 0) 78 10	(C) ATC, SRO (TS) SRO	Turbine valve position limiter fails low, causes ~ 100 mw load reduction. ATC required to Borate RCS.
4	FWM09C (7 0) 25 0	(C) BOP, SRO	"C" SG Feedwater valve, FCV-1FW-498, begins oscillating, requiring BOP to manually control level.
5	TUR03E (0 0) 15 8	(C) BOP, SRO	Turbine high bearing vibration requires crew to manually trip the unit.
6	CRF12A CRF12B	(M) ALL	Failure of Automatic and manual Reactor trip from the control room requires entry into FR-S.1.
7	CRF02A (5 0)	(C) ATC, SRO	Control Rod automatic insertion failure, ATC must manually insert control rods.
8	INH20 INH21 INH35 INH36	(C) BOP, SRO	All Aux Feedwater pumps fail to automatically start, requires BOP to start AFW pumps.
9	SIS08	(M) ALL	1200 gpm LOCA occurs on "B" Loop
10	INH49	(C) BOP, SRO	Train "A" CIA fails to automatically actuate.
11	VLV-SEA10 (0 0) 100	(C) ATC, SRO	MOV-1CH-381 fails to automatically close on CIA signal

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

E-0 → FR-S.1 → E-0 → E-1 → ES-1.2

After taking the shift at 100% power, BOL, Leak Collection Exhaust fan, 1VS-F-4A, will trip, the crew will respond using the ARP which will direct the BOP to manually start 1VS-F-4B. The SRO will address applicable TS and License Requirements Manual.

LT-1RC-459 will then drift high. The ATC will recognize the failure and respond IAW AOP 1.4.1 IOA's to remove the failed channel from service. The SRO will transition to the Instrument Failure procedure, 1OM-6.4.IF and direct the ATC complete the removal of the 459 channel from service. and then review applicable Technical Specifications in effect for the failed level transmitter.

A malfunction will then occur with the turbine valve position limiter causing a load rejection, in response to the load rejection, control rods will auto insert bringing in the Bank D low alarm, requiring the ATC to Borate the RCS and withdraw control rods to clear the alarm.

At the same time, a malfunction will occur with the "C" main feed regulating valve, FCV-1FW-498, causing oscillations in the "C" SG level requiring the BOP to manually stabilize and control level. The SRO will enter AOP 1.35.2, "Load Rejection," to stabilize the plant and address DNB technical specifications

A main turbine bearing #5 will exhibit high vibrations, at 15 mils the ARP for A7-104, probable cause 5 will require a unit trip.

The ATC will unsuccessfully attempt to trip the reactor from BB-B and BB-A.

The SRO will enter FR-S.1 with the ATC and BOP performing the IOA's.

1 minute after Emergency boration flow is established in FR-S.1, if the crew previously dispatched an operator locally trip the reactor, the reactor will be locally tripped. The ATC will verify reactor power is <5% after which the SRO will return to E-0.

1 min. after the local Rx trip, a 1200 gpm LOCA will occur on the B loop resulting in an automatic SI actuation.

Additional malfunctions that occur during the ATWS condition are that all available Aux feed water pumps fail to automatically start, all can be manually started. (1FW-P3A was OOS on turnover)

The safety injection that occurred will fail to actuate the train "A" CIA signal, and MOV-1CH-381 (a train "B" CIA valve) will fail to automatically close. The crew will be required to isolate the containment penetration via either manually actuating Train "A" CIA or manually closing MOV-1CH-381.

After returning to E-0, the SRO will determine that the RCS is not intact and transition to E-1. The scenario will be terminated at the lead evaluators discretion after the crew transitions to ES-1.2 and initiates a RCS Cooldown to Cold Shutdown.

Expected procedure flow path is E-0 → FR-S.1 → E-0 → E-1 → ES-1.2.

Appendix D

Scenario Outline

Facility: **BVPS Unit 1** Scenario No. 2 Op Test No.: **1LOT18 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC ____ (29):** 100% power, EOL, Equ. XE Conditions, CB "D" @ 230 steps, RCS boron - ____ ppm.

Turnover: Maintain 100% power.
 PCV-1RC-456 isolated due to seat leakage, block valve closed. TS 3.4.11, Condition A
 1FW-P-3A Out of service, TS 3.7.5, Condition B
 Control Rods are in manual due to a circuit malfunction, I&C is investigating the problem using work order instructions, automatic rod control is not available.

Critical Tasks: **1. E-0.D Manually actuate 1 train of Safety Injection**
2. FR-H.1.A Establish feed flow to SG before Feed and Bleed is required
3. E-2.A Isolate faulted SG

Event No.	Malf. No.	Event Type	Event Description
1	PRS12 (0 0) 85 45 ASIS	(I) ATC, SRO (TS) SRO	Master Pressure controller drifts to 85%, requires ATC to manually control RCS pressure.
2	IOR X121027L (12 0) ON	(TS) SRO	Auto Stop Oil Pressure Switch, PS-1TB-417, fails
3	AUX02A	(C) BOP, SRO	"A" Station air compressor trips, "B" fails to auto start – BOP manually starts "B" air compressor, Diesel Air compressor fails to auto start but will start locally.
4	MSS18C (0 0) 2.5E5 300 0	(R) ATC (N) BOP, SRO	"C" SG Atmospheric valve fails open causes Rx overpower, requires power reduction.
5	CRF04BV (2 2) 1 CRF04BT (2 4) 1	(C) ATC, SRO	2 Rods drop during power reduction – requires manual Rx trip.
6	TRG 3 'IMF MSS18C (0 0) 6E5'	(M) ALL	"C" SG Steam Break in turbine building occurs on Rx trip – requires Safety Inj.
7	SIS10A SIS10B	(C) ATC, SRO	Automatic SI fails to actuate – requires manual actuation.
8	VLV-MSS18 100	(C) BOP, SRO	"C" SG Mainsteam line isolation valve fails to auto close.
9	VLV-SGB17 100 VLV-SGB18 100 VLV-SGB19 100	(C) BOP, SRO	SG Sample valves fail to auto close, TV-1SS-117A,B,C
10	FWM11C (4 30) FWM11A (0 0)	(M) ALL	Loss of all Aux Feedwater flow, requires entry into FR-H.1

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

0 → FR-H.1 → E-0 → E-2.

After taking the shift at 100% power, the Master Pressure controller will fail to 85% causing the PRZR spray valves to open. IAW AOP 1.4.1, the ATC will close the spray valves to stabilize RCS pressure. The ATC will manually control PRZR pressure for the remainder of the scenario. The SRO will address Technical Specifications for DNB.

An Auto Stop Oil Pressure Switch, PS-1TB-417, will then fail, the crew will identify the failure and the SRO will evaluate applicable Technical Specifications for the failure.

The "A" station air compressor will trip with an auto start failure of the "B" station air compressor. The SRO will direct activities in accordance with AOP 1.34.1, "Loss of Station Instrument Air", the BOP will manually start the "B" station air compressor.

The "C" steam generator Atmospheric steam dump valve, PCV-1MS-101C, will fail open causing the RCS temperature to decrease and an increase in Rx power. The crew will recognize the increase in power and reduce power. If necessary, Operations management will direct the crew to lower Rx power to 90% while maintenance can attempt to isolate the flow path.

The crew will identify the failed valve and attempt to close the valve from the control room. After the failed closure attempt, the crew will dispatch an operator to locally isolate or take actions to locally close the valve, all attempts to isolate the leak will not be successful.

The ATC will insert the control rods in response to the turbine load reduction, when bank D lowers to less than 215 steps, 2 rods will drop during the rod insertion, the immediate actions of AOP 1.1.8, "Rod Inoperability", will be taken and the reactor will be manually tripped due to more than 1 rod being dropped. When the reactor is tripped, the "A", "B" and "AE" 4kv buses will become de-energized on the transfer to offsite power.

Upon the Rx trip, a steam header break will occur in the turbine building. An automatic steamline isolation will occur, however the "C" Mainsteam line isolation valve will fail to automatically close requiring the BOP to manually close it. The fault will also result in an SI being required, however, Safety Injection will not automatically actuate, requiring manual actuation to initiate SI flow.

Aux Feedwater malfunctions will occur such that the turbine driven pump, FW-P-2 trips on start, FW-P-3B will not start and 1FW-P-3A was OOS on turnover.

The crew will enter E-0 on the reactor trip, and then enter FR-H-1 due to no auxiliary feed water being available. After Feedwater has been established using either the dedicated Feedwater pump, FW-P-4 or either Main feed pump, the crew will return to E-0 and progress to diagnose the "C" SG as being faulted and enter E-2 to isolate the "C" SG.

The scenario will be terminated when the crew determines transition to ES-1.1 is appropriate.

Expected procedure flow path is E-0 → FR-H.1 → E-0 → E-2.

Appendix D**Scenario Outline**

Facility: **BVPS Unit 1** Scenario No. 3 Op Test No.: **1LOT18 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC** ____: ~4% power, EOL, Xe increasing, CB "D" @ ____ steps, RCS boron - ____ ppm.

Turnover:

Continue power increase IAW reactivity plan and commence turbine roll.
 PCV-1RC-456 isolated due to seat leakage, block valve closed. TS 3.4.11, Condition A

Critical Tasks:

- 1. E-3.A Isolate Ruptured SG**
- 2. E-3.B Establish/maintain RCS temperature**
- 3. ECA-3.3.A Terminate Safety Injection**

Event No.	Malf. No.	Event Type	Event Description
1	N/A	(R) ATC (N) SRO	Raise power
2	N/A	(N) BOP, SRO	Startup "B" EHC pump, 1LO-M-9B, shutdown "A" EHC pump, 1LO-M-9A.
3	BST-CCW006 1 CCW3A	(C) BOP, SRO (TS) SRO	"A" CCR pump trips, Auto start failure of "B" CCR pump.
4	CND01 (0 0) 100	(C) BOP, SRO	MOV-1CN-105 spuriously opens
5	PRS08E (8 0) 2500 15	(I) ATC, SRO (TS) SRO	PT-1RC-445 fails high, PORV's 455D & 456 open, ATC required to manually close PORV, PCV-1RC-455D
6	RCS10B (0 0) 30 RCS08B (7 3)	(C) ATC, SRO	"B" RCP high vibration and trip – will require manual Rx trip
7	RCS03B (1 0) 450	(M) - ALL	"B" SG - 425 gpm tube rupture
8	VLV-SGB01,02,03	(C) BOP, SRO	SG BD isolation failure, requires manual valve closure.
9	MSS08A (0 0) 100	(C) BOP, SRO	Steam dump, PCV-1MS-106A fails open following cooldown during E-3. Crew required to isolate steam lines and control RCS temperature via atmospheric steam dumps
10	PRS09A (2 120) 0 PRS09B (2 120) 0 IOR X0710970	(C) ATC, SRO	PRZR spray valves and remaining PORV fail to open during depressurization in E-3, will require transition to ECA-3.3

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

E-0 → E-3 → ECA-3.3

The crew will assume the shift at ~4% power with instructions to raise power in accordance with the reactivity plan and 1OM-52.4.A., Additionally, the turnover includes direction to place the "B" EHC pump, 1LO-M-9B, in service and place the "A" EHC pump, 1LO-M-9A in standby.

After the power increase is commenced and Mode 1 is declared. The "A" CCR pump will then trip due to a faulty breaker with a failure of the "B" to auto start. The crew will enter AOP 1.15.1. The BOP will manually start the "B"; the crew will dispatch an operator to place the "C" pump in service on the "AE" 4kv bus. The SRO will then address Technical Specifications.

The Condenser Hotwell Hi Level Bypass valve, MOV-1CN-105, will then spuriously open causing condenser hotwell level to drop. The crew will respond to the low level alarm using the Alarm Response procedure and, diagnose, identify and close MOV-1CN-105.

PT-1RC-445 will fail high causing PORV 455D and 456 to open, (per turnover, 456 previously isolated with block valve closed.) The ATC will be required to manually close PORV, PCV-1RC-455D IAW AOP 1.4.1 immediate operator actions. The US will enter AOP 1.4.1 and then transition to 1OM-6.4.IF, Attachment 2 and determine applicable Tech Spec actions.

The "B" RCP will then show signs of high vibration, the crew will respond using AOP 1.6.8, "Abnormal RCP Operation". After diagnosing and monitoring, the vibration will increase in severity to the point where the RCP will trip. Since the plant is less than 30% power, the RCP trip will not cause an automatic Rx trip. The crew will identify the loss of the RCP and manually trip the reactor.

As a result of the reactor trip a 425 gpm SGTR occurs on the "B" SG. The crew will progress through E-0 and diagnose the "B" SG as ruptured and transition to E-3. While the crew is isolating the "B" SG, the BOP will identify that the Blowdown valve will not close and procedurally close the backup cnmt isolation valve. Following the cooldown to target temperature, Condenser Steam Dump valve, PCV-1MS-106A will fail open, the crew will identify the failure and isolate the mainstream lines and stabilize temperature using the "A" and "C" SG atmospheric steam dump valves.

When the crew attempts to depressurize the RCS, the spray valves will not function, nor will the PRZR PORV's, 456 was previously isolated on turnover – block valve will not open, 455D CS was placed in "CLOSE" per event 5, valve will not open. 455C will fail to open via control switch, crew will then transition to ECA-3.3.

The scenario is terminated when the crew establishes a normal charging flow path in ECA-3.3.

Expected procedure flow path is E-0 → E-3 → ECA-3.3.