

Facility: BVPS UNIT 1 RO Date of Exam 10/31 thru 11/18/2016

Tier	Group	RO K/A Category Points												SRO ONLY Points			
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	TOTAL	A2	G*	TOTAL	
1. Emergency & Abnormal Plant Evolutions	1	3	3	3				3	3			3	18				
	2	1	2	1				2	2			1	9				
	Tier Totals	4	5	4				5	5			4	27				
2. Plant Systems	1	3	2	3	3	2	2	2	3	2	3	3	28				
	2	1	0	1	1	1	1	1	1	1	1	1	10				
	Tier Totals	4	2	4	4	3	3	3	4	3	4	4	38				
3. Generic Knowledge and Abilities Category					1		2		3		4		10				
					2		3		3		2						

Note:

- 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).
- 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.
- 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.
- 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.
- 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.
- Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
- 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.
- 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.
- 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						Form ES-401-2	
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 Reactor Trip / 1 [Question 1]				X			EA1 Ability to operate and monitor the following as they apply to a reactor trip: EA1.07 MT/G trip; verification that the MT/G has been tripped (CFR 41.7 / 45.5 / 45.6)	4.3	1
000008 Pressurizer Vapor Space Accident / 3 [Question 2]						X	2.1.20 Ability to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)	4.6	1
000009 Small Break LOCA / 3 [Question 3]					X		EA2 Ability to determine or interpret the following as they apply to a small break LOCA: EA2.11 - Containment temperature, pressure, and humidity (CFR 43.5 / 45.13)	3.8	1
000011 Large Break LOCA / 3 [Question 4]					X		EA2 Ability to determine or interpret the following as they apply to a Large Break LOCA: EA2.07 - That equipment necessary for functioning of critical pump water seals is operable (CFR 43.5 / 45.13)	3.2?	1
0015/000017 RCP Malfunctions / 4 [Question 5]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow) : AK3.03 - Sequence of events for manually tripping reactor and RCP as a result of an RCP malfunction (CFR 41.5,41.10 / 45.6 / 45.13)	3.7	1
000022 Loss of Rx Coolant Makeup / 2 [Question 6]	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Loss of Reactor Coolant Makeup: AK1.02 - Relationship of charging flow to pressure differential between charging and RCS (CFR 41.8 / 41.10 / 45.3)	2.7	1
000025 Loss of RHR System / 4 [Question 7]		X					AK2. Knowledge of the interrelations between the Loss of Residual Heat Removal System and the following: AK2.03 - Service water or closed cooling water pumps (CFR 41.7 / 45.7)	2.7	1
000027 Pressurizer Pressure Control System Malfunction / 3 [Question 8]		X					AK2. Knowledge of the interrelations between the Pressurizer Pressure Control Malfunctions and the following: AK2.03 - Controllers and positioners (CFR 41.7 / 45.7)	2.6	1

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	#
000029 ATWS / 1 [Question 9]					X		EA2 Ability to determine or interpret the following as they apply to a ATWS: EA2.05 - System component valve position indications (CFR 43.5 / 45.13)	3.4*	1
000038 Steam Gen. Tube Rupture / 3 [Question 10]					X		2.4.34 - Knowledge of RO tasks performed outside the main control room during an emergency and the resultant operational effects. (CFR: 41.10 / 43.5 / 45.13)	4.2	1
000056 Loss of Off-site Power / 6 [Question 11]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Offsite Power: AK3.02 - Actions contained in EOP for loss of offsite power (CFR 41.5,41.10 / 45.6 / 45.13)	4.4	1
000058 Loss of DC Power / 6 [Question 12]	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Loss of DC Power: AK1.01 - Battery charger equipment and instrumentation (CFR 41.8 / 41.10 / 45.3)	2.8	1
000062 Loss of Nuclear Svc Water / 4 Question 13]				X			AA1. Ability to operate and / or monitor the following as they apply to the Loss of Nuclear Service Water (SWS): AA1.07 - Flow rates to the components and systems that are serviced by the SWS; interactions among the components (CFR 41.7 / 45.5 / 45.6)	2.9	1
000065 Loss of Instrument Air / 8 [Question 14]				X			AA1. Ability to operate and / or monitor the following as they apply to the Loss of Instrument Air: AA1.03 - Restoration of systems served by instrument air when pressure is regained (CFR 41.7 / 45.5 / 45.6)	2.9	1
W/E04 LOCA Outside Containment / 3 [Question 15]			X				EK3. Knowledge of the reasons for the following responses as they apply to the (LOCA Outside Containment) EK3.2 - Normal, abnormal and emergency operating procedures associated with (LOCA Outside Containment). (CFR: 41.5 / 41.10, 45.6, 45.13)	3.4	1

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	#	
W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4 [Question 16]	X						EK1. Knowledge of the operational implications of the following concepts as they apply to the (Loss of Secondary Heat Sink) EK1.3 - Annunciators and conditions indicating signals, and remedial actions associated with the Loss of Secondary Heat Sink (CFR: 41.8 / 41.10, 45.3)	3.9	1	
W/E11 Loss of Emergency Coolant Recirc. / 4 [Question 17]		X					EK2. Knowledge of the interrelations between the (Loss of Emergency Coolant Recirculation) and the following: 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 (CFR: 41.7 / 45.7)	3.9	1	
W/E12 - Uncontrolled Depressurization of all Steam Generators / 4 [Question 18]						X	2.4.2 - Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)	4.5	1	
Category Point Totals:	3	3	3	3	3	3	Group Point Total:	18		

ES-401		PWR Examination Outline						Form ES-401-2		
Emergency and Abnormal Plant Evolutions - Tier 1/Group 2(RO)										
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#	
000036 Fuel Handling Accident / 8 [Question 19]				X			AA1. 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 (CFR 41.7 / 45.5 / 45.6)	3.5	1	
000061 ARM System Alarms / 7 [Question 20]					X		AA2. Ability to determine and interpret the following as they apply to the Area Radiation Monitoring (ARM) System Alarms: AA2.02 - Normal radiation intensity for each ARM system channel (CFR: 43.5 / 45.13)	2.9	1	
000068 Control Room Evac. / 8 [Question 21]				X			AA1. Ability to operate and / or monitor the following as they apply to the Control Room Evacuation: AA1.22 - Flow control valve for RCS charging header (CFR 41.7 / 45.5 / 45.6)	4.0	1	
000076 High Reactor Coolant Activity / 9 [Question 22]			X				AK3. Knowledge of the reasons for the following responses as they apply to the High Reactor Coolant Activity : AK3.06 - Actions contained in EOP for high reactor coolant activity (CFR 41.5,41.10 / 45.6 / 45.13)	3.2	1	
W/E02 SI Termination / 3 [Question 23]						X	2.4.20 - Knowledge of operational implications of EOP warnings, cautions, and notes. (CFR: 41.10 / 43.5 / 45.13)	3.8	1	
W/E07 Saturated Core Cooling / 4 [Question 24]		X					EK2. Knowledge of the interrelations between the (Saturated Core Cooling) and the following: 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 (CFR: 41.7 / 45.7)	3.5	1	
W/E13 Steam Generator Over-pressure / 4 [Question 25]		X					EK2. Knowledge of the interrelations between the (Steam Generator Overpressure) 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)	3.0	1	

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	#
W/E14 Loss of CTMT Integrity / 5 [Question 26]	X						EK1. Knowledge of the operational implications of the following concepts as they apply to the (High Containment Pressure) EK1.1 - Components, capacity, and function of emergency systems (CFR: 41.8 / 41.10, 45.3)	3.3	1
W/E16 High Containment Radiation / 9 [Question 27]					X		EA2. Ability to determine and interpret the following as they apply to the (High Containment Radiation) EA2.2 - Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments (CFR: 43.5 / 45.13)	3.0	1
K/A Category Point Totals:	1	2	1	2	2	1	Group Point Total:	9	

ES-401		PWR Examination Outline											Form ES-401-2	
Plant Systems											- Tier 2/Group 1(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	#
003 Reactor Coolant Pump [Question 28]		X										K2. Knowledge of bus power supplies to the following: K2.02 - CCW pumps (CFR: 41.7)	2.5*	1
003 Reactor Coolant Pump [Question 29]										X		A4 Ability to manually operate and/or monitor in the control room: A4.05 - RCP seal leakage detection instrumentation (CFR: 41.7 / 45.5 to 45.8)	3.1	1
004 Chemical and Volume Control [Question 30]			X									K3 Knowledge of the effect that a loss or malfunction of the CVCS will have on the following: K3.08 - RCP seal injection (CFR: 41.7/45/6)	3.6	1
005 Residual Heat Removal [Question 31]						X						K6 Knowledge of the effect of a loss or malfunction on the following will have on the RHRS: K6.03 - RHR heat exchanger (CFR: 41.7 / 45.7)	2.5	1
006 Emergency Core Cooling [Question 32]				X								K4 Knowledge of ECCS design feature(s) and/or interlock(s) which provide for the following: K4.14 - Cross-connection of HPI/LPI/SIS (CFR: 41.7)	3.9	1
007 Pressurizer Relief/Quench Tank [Question 33]	X											K1 Knowledge of the physical connections and/or cause effect relationships between the PRTS and the following systems: K1.01 - Containment system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.9	1
007 Pressurizer Relief/Quench Tank [Question 34]									X			A3 Ability to monitor automatic operation of the PRTS, including: A3.01 - Components which discharge to the PRT (CFR: 41.7 / 45.5)	2.7*	1
008 Component Cooling Water [Question 35]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.03 - High/low CCW temperature (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.0	1

ES-401		PWR Examination Outline											Form ES-401-2		
		Plant Systems											- Tier 2/Group 1(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	#
010 Pressurizer Pressure Control [Question 36]						X							K5 Knowledge of the operational implications of the following concepts as the apply to the PZR PCS: K5.01 - Determination of condition of fluid in PZR, using steam tables (CFR: 41.5 / 45.7)	3.5	1
010 Pressurizer Pressure Control [Question 37]												X	2.4.31 - Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.2	1
012 Reactor Protection [Question 38]		X											K1 Knowledge of the physical connections and/or cause effect relationships between the RPS and the following systems: K1.02 - 125V dc system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.4	1
013 Engineered Safety Features Actuation [Question 39]										X			A3 Ability to monitor automatic operation of the ESFAS including: A3.01 - Input channels and logic (CFR: 41.7 / 45.5)	3.7*	1
022 Containment Cooling [Question 40]									X				A2 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: A2.01 - Fan motor over-current (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.5	1
026 Containment Spray [Question 41]					X								K4 Knowledge of CSS design feature(s) and/or interlock(s) which provide for the following: K4.09 - Prevention of path for escape of radioactivity from containment to the outside (interlock on RWST isolation after swapover) (CFR: 41.7)	3.7*	1
039 Main and Reheat Steam [Question 42]												X	2.2.38 - Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13)	3.6	1
039 Main and Reheat Steam [Question 43]				X									K3 Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: K3.06 – SDS (CFR: 41.7 / 45.6)	2.8*	1
059 Main Feedwater [Question 44]								X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the MFW controls including: A1.03 - Power level restrictions for operation of MFW pumps and valves. (CFR: 41.5 / 45.5)	2.7*	1

ES-401		PWR Examination Outline											Form ES-401-2	
		Plant Systems											- Tier 2/Group 1(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	#
061 Auxiliary/Emergency Feedwater [Question 45]						X						K6 Knowledge of the effect of a loss or malfunction of the following will have on the AFW components: K6.01 - Controllers and positioners (CFR: 41.7 / 45.7)	2.5	1
062 AC Electrical Distribution [Question 46]				X								K4 Knowledge of ac distribution system design feature(s) and/or interlock(s) which provide for the following: K4.03 - Interlocks between automatic bus transfer and breakers (CFR: 41.7)	2.8*	1
063 DC Electrical Distribution [Question 47]										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*	1
063 DC Electrical Distribution [Question 48]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the DC electrical systems; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.01 – Grounds (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.5	1
064 Emergency Diesel Generator [Question 49]		X										K2 Knowledge of bus power supplies to the following: K2.01 - Air compressor (CFR: 41.7)	2.7*	1
073 Process Radiation Monitoring [Question 50]					X							K5 Knowledge of the operational implications as they apply to concepts as they apply to the PRM system: K5.01 - Radiation theory, including sources, types, units, and effects (CFR: 41.5 / 45.7)	2.5	1
076 Service Water [Question 51]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SWS controls including: A1.02 - Reactor and turbine building closed cooling water temperatures (CFR: 41.5 / 45.5)	2.6*	1

ES-401		PWR Examination Outline										Form ES-401-2		
		Plant Systems										- Tier 2/Group 1(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	#
076 Service Water [Question 52]											X	2.1.27 - Knowledge of system purpose and/or function. (CFR: 41.7)	3.9	1
078 Instrument Air [Question 53]											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	1
078 Instrument Air [Question 54]			X									K3 Knowledge of the effect that a loss or malfunction of the IAS will have on the following: K3.02 - Systems having pneumatic valves and controls (CFR: 41.7 / 45.6)	3.4	1
103 Containment [Question 55]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the containment system and the following systems: K1.01 - CCS (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.6	1
K/A Category Point Totals:	3	2	3	3	2	2	2	3	2	3	3	Group Point Total:		28

ES-401		PWR Examination Outline											Form ES-401-2	
		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	#
011 Pressurizer Level Control [Question 56]								X				A2 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: A2.10 - Failure of PZR level instrument - high (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.4	1
014 Rod Position Indication [Question 57]										X		A4 Ability to manually operate and/or monitor in the control room: A4.01 - Rod selection control (CFR: 41.7 / 45.5 to 45.8)	3.3	1
016 Non-nuclear Instrumentation [Question 58]									X			A3 Ability to monitor automatic operation of the NNIS, including: A3.02 – Relationship between meter readings and actual parameter value (CFR: 41.7 / 45.5)	2.9*	1
017 In-core Temperature Monitor [Question 59]						X						K6 Knowledge of the effect of a loss or malfunction of the following ITM system components: K6.01 - Sensors and Detectors (CFR: 41.7 / 45.7)	2.7	1
027 Containment Iodine Removal [Question 60]	X											K1 Knowledge of the physical connections and/or cause effect relationships between the CIRS and the following systems: K1.01 – CSS (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.4*	1
029 Containment Purge [Question 61]			X									K3 Knowledge of the effect that a loss or malfunction of the Containment Purge System will have on the following: K3.02 - Containment entry (CFR: 41.7 / 45.6)	2.9*	1
055 Condenser Air Removal [Question 62]										X		2.4.34 - Knowledge of RO tasks performed outside the main control room during an emergency and the resultant operational effects. (CFR: 41.10 / 43.5 / 45.13)	4.2	1
071 Waste Gas Disposal [Question 63]				X								K4 Knowledge of design feature(s) and/or interlock(s) which provide for the following: K4.03 - Tank loop seals (CFR: 41.7)	2.5*	1

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 Area Radiation Monitoring [Question 64]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the ARM system: K5.02 - Radiation intensity changes with source distance (CFR: 41.5 / 45.7)	2.5	1
086 Fire Protection [Question 65]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Fire Protection System operating the controls including: A1.01 - Fire header pressure (CFR: 41.5 / 45.5)	2.9	1
K/A Category Point Totals:	1	0	1	1	1	1	1	1	1	1	1	Group Point Total:		10

Facility: BVPS UNIT 1 RO Date of Exam 10/31 thru 11/18/2016

Category	K/A#	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.19	Ability to use plant computers to evaluate system or component status. (CFR: 41.10 / 45.12) [Question 66]	3.9	1		
	2.1.25	Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 45.12) [Question 67]	3.9	1		
	Subtotal			2		
2. Equipment Control	2.2.25	Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2) [Question 68]	3.2	1		
	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) [Question 69]	3.1	1		
	2.2.43	Knowledge of the process used to track inoperable alarms. (CFR: 41.10 / 43.5 / 45.13) [Question 70]	3.0	1		
	Subtotal			3		
3. Radiation Control	2.3.7	Ability to comply with radiation work permit requirements during normal or abnormal conditions. (CFR: 41.12 / 45.10) [Question 71]	3.5	1		
	2.3.11	Ability to control radiation releases. (CFR: 41.11 / 43.4 / 45.10) [Question 72]	3.8	1		
	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) [Question 73]	3.2	1		
	Subtotal			3		
4. Emergency Procedures/ Plan	2.4.6	Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13) [Question 74]	3.7	1		
	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) [Question 75]	4.2	1		
	Subtotal			2		
Tier 3 Point Total				10		

Facility: BVPS UNIT 1 SRO Date of Exam 10/31 thru 11/18/2016

Tier	Group	RO K/A Category Points												SRO ONLY Points		
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	TOTAL	A2	G*	TOTAL
1. Emergency & Abnormal Plant Evolutions	1													3	3	6
	2													2	2	4
	Tier Totals													5	5	10
2. Plant Systems	1													3	2	5
	2													0	2	1
	Tier Totals													5	3	8
3. Generic Knowledge and Abilities Category														1	2	3
														2	2	4

Note:

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- 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.
- 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.
- Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
- 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.
- 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.
- 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						Form ES-401-2		
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	#	
000026 Loss of Component Cooling Water / 8 [Question 76]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: AA2.04 - The normal values and upper limits for the temperatures of the components cooled by CCW (CFR: 43.5 / 45.13)	2.9*	1	
000040 Steam Line Rupture – Excessive Heat Transfer / 4 [Question 77]					X		2.4.41 - Knowledge of the emergency action level thresholds and classifications. (CFR: 41.10 / 43.5 / 45.11)	4.6	1	
000054 Loss of Main Feedwater / 4 [Question 78]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW): AA2.08 - Steam flow-feed trend recorder (CFR: 43.5 / 45.13)	3.3*	1	
000055 Station Blackout / 6 [Question 79]					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	1	
000057 Loss of Vital AC Inst. Bus / 6 [Question 80]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Vital AC Instrument Bus: AA2.02 - Core flood tank pressure and level indicators (CFR: 43.5 / 45.13)	3.8*	1	
000077 Generator Voltage and Electric Grid Disturbances / 6 [Question 81]					X		2.4.31 - Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.1	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	#	
000060 Accidental Gaseous Radwaste Rel. /9 [Question 82]						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	1	
000074 Inad. Core Cooling / 4 [Question 83]						X	EA2 Ability to determine or interpret the following as they apply to Inadequate Core Cooling: EA2.08 - The effect of turbine bypass valve operation on RCS temperature and pressure (CFR 43.5 / 45.13)	4.6*	1	
W/E01 Rediagnosis / 3 [Question 84]						X	EA2. Ability to determine and interpret the following as they apply to the (Reactor Trip or Safety Injection Rediagnosis) EA2.1 - Facility conditions and selection of appropriate procedures during abnormal and emergency operations (CFR: 43.5 / 45.13)	4.0	1	
W/E10 Natural Circ. / 4 [Question 85]						X	2.1.20 - Ability to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)	4.6	1	
κA Category Point Totals:					2	2	Group Point Total:		4	

ES-401		PWR Examination Outline										Form ES-401-2		
		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	#
004 Chemical and Volume Control [Question 86]											X	2.4.8 - Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)	4.5	1
008 Component Cooling Water [Question 87]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 - High/low surge tank level (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.5	1
059 Main Feedwater [Question 88]											X	2.4.6 - Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	4.7	1
061 Auxiliary/Emergency Feedwater [Question 89]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the AFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 - Loss of air to steam supply valve (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.6*	1
103 Containment [Question 90]								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 A2.01 - Integrated leak rate test (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.6*	1
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	#
015 Nuclear Instrumentation [Question 91]											X	2.2.25 - Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)	4.2	1
035 Steam Generator [Question 92]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the GS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.06 - Small break LOCA (CFR: 41.5 / 43.5 / 45.3 / 45.5)	4.6	1
041 Steam Dump/Turbine Bypass Control [Question 93]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the SDS; and (b) based on those predictions or mitigate the consequences of those malfunctions or operations: A2.02 - Steam valve stuck open (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.9	1
K/A Category Point Totals:								2			1	Group Point Total:		3

Facility: BVPS UNIT 1 SRO Date of Exam 10/31 thru 11/18/2016

Category	K/A#	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	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 94]			3.8	1
	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 95]			4.4	1
	Subtotal					2
2. Equipment Control	2.2.35	Ability to determine Technical Specification Mode of Operation. (CFR: 41.7 / 41.10 / 43.2 / 45.13) [Question 96]			4.5	1
	2.2.37	Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12) [Question 97]			4.6	1
	Subtotal					2
3. Radiation Control	2.3.6	Ability to approve release permits. (CFR: 41.13 / 43.4 / 45.10) [Question 98]			3.8	1
	2.3.13	Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 43.4 / 45.9 / 45.10) [Question 99]			3.8	1
	Subtotal					2
4. Emergency Procedures/ Plan	2.4.5	Knowledge of the organization of the operating procedures network for normal, abnormal, and emergency evolutions. (CFR: 41.10 / 43.5 / 45.13) [Question 100]			4.3	1
	Subtotal					1
Tier 3 Point Total						7

Facility: <u>BVPS Unit 1</u> Date of Exam <u>10/31 thru 11/18/2018</u> Operating Test No.: <u>BV1LOT16 NRC</u>		
Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	000011 EA2.02	Question #4; There is no interface between Safety Injection and Residual Heat Removal (RHRS) at Beaver Valley. Randomly selected 000011 EA2.07 as a replacement.
1/1	W/E04 EK3.1	Question #15; Unable to write a discriminatory question due to the limited scope of the LOCA Outside Containment procedure. Randomly selected W/E EK3.2 as a replacement.
2/1	007 K5.02	Question #33; The PRT is not used to form a steam bubble in the PZR. Randomly selected 007 K1.01 as a replacement. Outside K5 due to importance ratings were <2.5.
2/1	022 A2.06	Question #40; Beaver Valley does not have Containment Cooling System (CCS) pumps. Randomly selected 022 A2.01 as a replacement.
2/1	059 A1.07	Question #44; Beaver Valley Main Feedwater pumps are motor driven pumps and do not have variable speed control. Randomly selected 059 A1.03 as a replacement.
2/1	073 K5.02	Question #50; K5.02 - Radiation intensity changes with source distance. Reselected due to oversampling. K/A was similar to Q64. Randomly selected 073 K5.01 as a replacement.
2/2	011 A2.08	Question #56; Pressurizer level is not compensated at Beaver Valley. Randomly selected 011 A2.10 as a replacement.
2/2	027 K2.01	Question #60; Containment Iodine Removal fans are no longer used at Beaver Valley. Randomly selected 027 K1.01 as a replacement.
2/2	086 A1.02	Question #65; Beaver Valley does not have a fire water storage tank which has design limits which are monitored by the control room staff. The tank is used for fire protection outside the protected area. Randomly selected 086 A1.01 as a replacement.
1/1 SRO	000077 2.4.1	Question #81; Unable to write a discriminatory SRO level question for Knowledge of EOP entry conditions and immediate action steps. Randomly selected 000077 G2.4.31 as a replacement.
1/2 SRO	W/E10 2.1.32	Question #85; Reselected due to overlap with Audit Exam. Randomly selected W/E10 G2.1.20 as a replacement.

Facility: Beaver Valley Unit 1Date of Examination: 10/31 thru 11/18 2016Examination Level **RO** ☒ **SRO** ☐Operating Test Number BV1LOT16 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (RO A 1.1)	D, R	2.1.25 (3.9) Ability to interpret reference materials, such as graphs, curves, tables, etc. JPM 1AD-001 Calculating a Shutdown Margin Following a Stuck Rod
Conduct of Operations (RO A 1.2)	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-003 Perform a Quadrant Power Tilt Ratio Calculation
Equipment Control (RO A 2)	N, R	2.2.41 (3.5) Ability to obtain and interpret station electrical and mechanical drawings. JPM 1AD-040 Identify Isolation Boundary Points on Plant VOND
Radiation Control (RO A 3)	D, R	2.3.7 (3.5) Ability to comply with radiation work permit requirements during normal or abnormal conditions. JPM 1AD-012 Select RWP and Determine Maximum Allowable Stay Time
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: 10/31 thru 11/18 2016Examination Level **RO** ☐ **SRO** ☒Operating Test Number BV1LOT16 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (SRO A 1.1)	D, R	2.1.20 (4.6) Ability to interpret and execute procedure steps. JPM 1AD-029 Prepare Partial OST [1OST-1.1] for Performance
Conduct of Operations (SRO A 1.2)	D, 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-009 Review a Quadrant Power Tilt Ratio Calculation
Equipment Control (SRO A 2)	N, R	2.2.41 (3.9) Ability to obtain and interpret station electrical and mechanical drawings. JPM 1AD-039 Identify Isolation Boundary Points on Plant VOND, then determine diesel operability
Radiation Control (SRO A 3)	D, R	2.3.4 (3.7) Knowledge of radiation exposure limits under normal or emergency conditions. JPM 1AD-038 Determine Emergency Exposure Authorization Limits
Emergency Plan (SRO A 4)	D, R	2.4.44 (4.4) Knowledge of emergency plan protective action recommendations. JPM 1AD-037 Determine Protective Action Recommendations (Part 1)

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 1**Date of Examination: **10/31/ thru 11/18 2016**Exam Level: RO ☒ SRO(I) ☐ SRO(U) ☐Operating Test No.: **BV1LOT16 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 – Withdraw Shutdown Bank "A" (1CR-085)	S, M, L	1
S2 - Perform Manual Makeup to the Charging Pump Suction (1CR-581)	S, D, A	2
S3 - Depressurize RCS During SGTR (1CR-638)	S, D, A	3
S4 - Respond to a Loss of the RHR System (1CR-694)	S, M, L, A	4P
S5 - Transfer from Bypass to Main Feed Regulating Valve (1CR-520)	S, D, A	4S
S6 - Manually Actuate CIB (1CR-578)	S, D, A, EN	5
S7 - Transfer Bus 1AE From Emergency To Normal Feed (1CR-097)	S, D	6
S8 – Verify CREVs Isolation (1CR-662)	S, N, A	7

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

P1 - Vent the Charging Pump Suction Header (1PL-057)	R, D, EN, P	2
P2 - Startup the Dedicated Auxiliary Feedwater Pump [FW-P-4] (1PL-007)	D, E	4S
P3 - Locally Start the No. 1 Emergency Diesel Generator (1PL-606)	D, E, EN	6

@ 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 1Date of Examination: 10/31/ thru 11/18 2016Exam Level: RO ☐ SRO(I) ☒ SRO(U) ☐Operating Test No.: BV1LOT16 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 – Withdraw Shutdown Bank "A" (1CR-085)	S, M, L	1
S2 - Perform Manual Makeup to the Charging Pump Suction (1CR-581)	S, D, A	2
S3 - Depressurize RCS During SGTR (1CR-638)	S, D, A	3
S5 - Transfer from Bypass to Main Feed Regulating Valve (1CR-520)	S, D, A	4S
S6 - Manually Actuate CIB (1CR-578)	S, D, A, EN	5
S7 - Transfer Bus 1ae From Emergency To Normal Feed (1CR-097)	S, D	6
S8 – Verify CREVs Isolation (1CR-662)	S, N, A	7

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

P1 - Vent the Charging Pump Suction Header (1PL-057)	R, D, EN, P	2
P2 - Startup the Dedicated Auxiliary Feedwater Pump [FW-P-4] (1PL-007)	D, E	4S
P3 - Locally Start the No. 1 Emergency Diesel Generator (1PL-606)	D, E, EN	6

@ 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
1L16N1

Facility: **BVPS Unit 1** Scenario No. 1 Op Test No.: **BV1LOT16 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC-62 (17):** 67% power, MOL, Equ. XE Conditions, CB "D" @ 177 steps,
 RCS boron - 985 ppm, 1FW-P-3A OOS

Turnover: Maintain 67% power.

Critical Tasks: **1. CT-2 (E-0.D)** Crew manually actuates at least 1 train of SIS
2. CT-51 (FR-S.1.B) Crew starts AFW pumps
3. CT-52 (FR-S.1.C) Crew inserts negative reactivity

Event No.	Malf. No.	Event Type	Event Description
1	PRS06A	(I,A) ATC, SRO (TS) SRO	Pressurizer level transmitter, 1RC-LT-459 drifts low.
2	XMT-MSS021A	(I,A) BOP, SRO (TS) SRO	PT-1MS-446 fails low.
3	CHS03	(C,A) ATC, SRO	Isolable 25 gpm RCS leak on letdown line. (AOP 1.6.7)
4	FWM01A	(R) ATC (C,A) BOP, SRO	Main feedwater pump trip, requires turbine runback and manual rod insertion.
5	GEN01, CRF12A, 12B	(M) ALL	Spurious Gen Trip with auto & manual Rx trip failures (ATWS)
6	IOR X06i068C	(C) ATC, SRO	MOV-1CH-350 failed closed
7	INH20,21,36	(C) BOP, SRO	All AFW pumps fail to auto start
8	RCS02A	(M) ALL	950 gpm LOCA
9	VLV-MSS03,04	(C) BOP, SRO	Reheat steam failure to auto isolate.
10	SIS10A, SIS10B	(C) ATC, SRO	Automatic SI actuation failure

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

E-0 → FR-S.1 → E-0 → E-1 → Terminate after evaluating SI termination criteria.

After taking the shift at 67% power with AFW pump, 1FW-P-3A OOS, Pressurizer level transmitter, 1RC-LT-459 will drift low. The crew will diagnose the indications and IAW AOP 1.4.1, Process Control Failure, remove the failed channel from service and ensure the plant is stable, the SRO will transition to the instrument failure procedure for further channel actions and will address Tech Specs for the failed channel.

The non-selected Turbine First Stage pressure transmitter, 1MS-PT-446 will fail low. IAW the instrument failure procedure, the crew will take action to transfer the condenser steam dump control to "Steam Pressure" mode. The SRO will address Tech Specs for the failed channel.

An isolable 25 gpm leak will then occur on the letdown line, the crew will enter AOP 1.6.7, Excessive Primary Plant Leakage, to evaluate leak rate and leak location. The crew will determine the leak rate is >10 gpm and is isolable.

The "A" Main feed pump will then trip, the crew will enter AOP 1.24.1, Loss of Main Feedwater, and determine that a power reduction to <52% is required. The crew will reduce power IAW AOP 1.24.1.

When reactor power lowers to < 61%, the Main Unit Generator will spuriously trip. The reactor will fail to automatically trip as expected due to the MUG trip. The crew will identify the automatic Rx trip failure. The SRO will direct the crew to manually trip the Rx and perform IOA's of E-0. The ATC will attempt to manually trip the Rx which will also fail. The SRO will direct the crew to perform IOA's for FR-S.1, Response to Nuclear Power Generation – ATWS. The control rods will fail to automatically insert, the ATC will place the Rod Control system in manual and begin inserting rods. When control bank "D" inserts to <150 steps, an "Urgent Failure" will occur in the Rod control system, stopping all rod motion. When the crew attempts to align the Emergency Boration flowpath, the Emergency Boration Valve, MOV-1CH-350, will fail to open. The crew will align an alternate boration flow path by aligning the Charging pump suction to the RWST. At the lead evaluator's discretion, when an emergency boration flowpath is aligned, the reactor will be locally tripped via a field operator if dispatched.

Additionally, all available AFW pumps will fail to automatically start, the BOP will start the Turbine Driven AFW pump and the "B" Motor driven AFW pump. The BOP will recognize that Reheat steam failed to automatically isolate on the Turbine Trip and manually close, MOV-1MS-100A and 100B.

When the Rx is locally tripped and verified, the crew will transition back to E-0, Reactor Trip Response, coincident with the local Rx trip, a 950 gpm LOCA will occur on the "A" Loop cold leg,

While performing the IOA's of E-0, the crew will recognize that RCS pressure and level are reducing and that conditions require a Safety Injection which failed to automatically actuate. The crew will actuate SI and continue in E-0. The crew will progress thru E-0 and transition to E-1 after diagnosing that containment pressure and sump level are not consistent with pre-event values.

The scenario will be terminated after the crew has evaluated SI termination criteria in E-1.

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

Appendix D**Scenario Outline****1L16N2**

Facility:	BVPS Unit 1	Scenario No. 2	Op Test No.:	BV1LOT16 NRC
Examiners:	_____	Candidates:	_____	SRO
	_____		_____	ATC
	_____		_____	BOP

Initial Conditions: **IC-64 (18):** 100% power, MOL, Equ. XE Conditions, CB "D" @ 228 steps, RCS boron - 870 ppm. 1FW-P-3A OOS

Turnover: Maintain 100% power.

Critical Tasks:

- 1. CT-18 (E-3.A)** Crew isolates ruptured SG
- 2. CT-19 (E-3.B)** Crew establishes/maintains temperature
- 3. CT-20 (E-3.C)** Crew depressurizes RCS to meet SI termination criteria

Event No.	Malf. No.	Event Type	Event Description
1	XMT-MSS039A	(I,A) BOP, SRO	"C" SG, selected Main steam flow transmitter, 1MS-FT-494 fails low, requires manual control of feedwater and placing alternate channel in service.
2	PRS08D	(I,A) ATC, SRO (TS) SRO	PRZR pressure control transmitter, PT-1RC- 444 fails high, requires closing PORV and manual PRZR pressure control.
3	RCS03A	(C,A) ATC, SRO (TS) SRO	22 gpm SG Tube leak on "A" SG. (AOP 1.6.4)
4		(R) ATC (N) BOP, SRO	SG tube leak requires plant S/D IAW AOP 1.51.1.
5	RCS03A	(M) ALL	650 gpm SGTR occurs on "A" SG during S/D.
6	INH40	(C) ATC, SRO	"B" HHSI pump auto start failure on SI.
7	VLV-SGB01,02,03	(C) BOP, SRO	SG BD isolation failure, requires manual valve closure.
8	MSS08C	(C) BOP, SRO	Condenser steam dump fails open following cooldown, requires Main steam line isolation.

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

E-0 → E-3

After taking the shift at 100% power with AFW pump, 1FW-P-3A OOS., the "C" SG selected Steam flow transmitter will fail low requiring the BOP to take manual feedwater control IAW AOP 1.4.1, Process Control Failure. After the plant has been stabilized, the SRO will transition to the instrument failure procedure and direct placing the alternate steam flow channel in service, Feedwater control will then be returned to automatic.

The controlling PRZR pressure channel, PT-1RC-444 will drift high causing RCS pressure to lower due to the pressurizer spray valves and a PORV opening. The crew will initially respond IAW AOP 1.4.1, identify the failure and close the spray valves and PORV, the SRO will then transition to 1OM-6.4.IF, attachment 2 to address the failed channel. The ATC controls PRZR pressure by manually operating the PRZR heaters and spray valves, or manual control of the PRZR pressure master controller. The SRO will address applicable TS entered due to the instrument failure.

Subsequently, a 22 gpm SG tube leak will develop on the "A" SG. AOP 1.6.4 will be entered and the leak will be quantified. Due to the leak rate, AOP 1.6.4 will provide direction to enter Mode 3 IAW AOP 1.51.1. The SRO will address Technical Specifications which also will require Mode 3 entry.

The crew will initiate an emergency shutdown IAW AOP 1.51.1, when Rx power is reduced to <94%, the tube leak will become a 650 gpm tube rupture. The crew will identify degrading plant parameters and the SRO will direct a pre-emptive reactor trip and enter E-0.

An automatic Safety Injection will occur upon the Rx trip, the "B" HHSI pump will fail to automatically start on the SI signal, the ATC will identify the failure and manually start the pump. Additionally, the steam generator blowdown system will fail to automatically isolate requiring the BOP to identify and isolate the SG Blowdown system.

The crew will proceed thru E-0, perform diagnostics and determine that indications of a SGTR exist, the SRO will transition to E-3 to take actions to address the tube rupture.

After the crew identifies the "A" SG as the ruptured SG and isolates it, a target temperature will be determined and a cooldown commenced. A condenser steam dump valve will fail open during the cooldown, when the cooldown to target temperature is reached, the BOP will identify the failed open steam dump and report it to the crew. The SRO will direct the BOP to manually close the Main steam line isolation valves, requiring the BOP to stabilize RCS temperature using the "B" and "C" SG atmospheric steam dump valves.

The scenario will be terminated when the crew terminates SI and establishes a normal charging flow alignment IAW E-3.

Expected procedure flow path is E-0 → E-3

Appendix D

Scenario Outline

1L16N3

Facility: **BVPS Unit 1** Scenario No. 3 Op Test No.: **BV1LOT16 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC-66(5): ~5% power, BOL, CB "D" @ 109 steps, RCS boron - 1750 ppm.**

Turnover: Raise Rx power and place turbine online.

Critical Tasks:

1. **CT-1 (E-0.A)** Crew manually trips the reactor.
2. **CT-24 (E-0.C)** Energize 1 AC emer bus
3. **CT-9 (E-0.L)** Establish flow from RPRW pump

Event No.	Malf. No.	Event Type	Event Description
1		(R) ATC (N) SRO	Power increase to > P-10.
2	FWM08B	(C,A) BOP, SRO	"B" Bypass feed regulating valve fails asis in Auto. Requires manual control
3	CHS22 X06D088M	(C,A) ATC, SRO	Failure of FCV-1CH-122 controller, requires manual control of PRZR lvl.
4		(N) BOP, SRO	Startup standby Turbine plant River water pump
5	NIS08B	(C,A) BOP, SRO (TS) SRO	N-42 Instrument power fuse blown. (>P6 and < P10)
6	XMT-CNM004A	(TS) SRO	CH 2, CNMT Pressure transmitter fails High, PT-1LM-100B
7	SIS10B	(M) All	Inadvertent Train "B" SI with Rx trip failure.
8		(C,A) ATC, SRO	Manual Rx trip
9	EPS04E, 04F INH53, 54	(C) BOP, SRO	Loss of 1AE and 1DF 4kv Busses on Rx trip w/ EDG auto start failures.
10	INH32, 33	(C) BOP, SRO	Reactor plant River water pump auto start failures on Sequencer, requires manually starting WR-P-1A and 1B.
11	CHS21A	(C) ATC, SRO	Letdown isolation on SI unable to be recovered due to failure of LCV-1CH-460A, requires Excess letdown.

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

E-0 → ES-1.1

The crew will assume the shift at approximately 5% (4.8%) power with instructions to raise power to place the turbine online IAW the reactivity plan and 1OM-52.4.A. The ATC will initiate a dilution and withdraw control rods.

After the power has raised to >5.5%, "B" SG Bypass Feed regulating valve will fail asis in Auto, failure will become evident as Rx power continues to be raised, the BOP will be required to identify the malfunction and take action to control FCV-1FW-489 in manual IAW AOP 1.4.1 Process Control Failure. Additionally, at >5.5% Rx power, FCV-1CH-122 will fail closed in Auto, the ATC will be required to identify the failure and manually control FCV-1CH-122 IAW AOP 1.4.1, to maintain PRZR level

A field operator will then report that the "A" Turbine Plant River Water pump, has a significant oil leak and needs to be shutdown. IAW 1OM-30.4.N, Standby Turbine Plant River Water Pump Startup, the BOP will startup 1WR-P-6B and shutdown 1WR-P-6A.

An instrument power fuse will then blow for Power Range Nuclear instrument, N-42. The crew will identify the N-42 blown fuse failure and the SRO will enter AOP 1.2.1C, Power Range Channel Malfunction, and direct the BOP to remove the failed channel from service. The SRO will address Tech Specs for the failed instrument.

After the crew has removed N42 from service, CH 2 containment pressure transmitter, PT-1LM-100B fails high. The SRO will enter 1OM-1.4.IF and review the Technical Specifications. The SRO will then contact I&C to trip the applicable bistables.

After the SRO has determined the appropriate Technical Specifications for the CNMT pressure channel, a spurious Train "B" Safety Injection signal will occur with an automatic Rx trip failure. The crew will recognize the automatic Rx trip failure and the SRO will direct the ATC to manually trip the Rx and perform the IOA's of E-0.

Upon the Rx trip, both Emergency 4Kv buses will deenergize with auto start failures of both Emergency Diesel Generators. The BOP will start an EDG IAW E-0 IOA's (RNO actions).

Upon EDG start, each respective River water pump will fail to auto start via sequencer, the crew will identify the auto start failure and start each RW pump.

The crew will continue progressing thru E-0 and perform diagnostic steps and determine that no accident has occurred and plant conditions support Termination of Safety Injection and transition to ES-1.1. LCV-1CH-460A fails closed upon the SI signal and will not be able to be reopened requiring the crew to place Excess letdown in service.

The scenario will be terminated when the crew establishes Excess letdown flow.
Expected procedure flow path is E-0 → ES-1.1

Appendix D**Scenario Outline****1L16N5**

Facility: **BVPS Unit 1** Scenario No. 5 Op Test No.: **BV1LOT16 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC- 68 (10):** 100% power, BOL, Equ. XE Conditions, CB "D" @ 228 steps, RCS boron - 1210 ppm, 1FW-P-3A OOS

Turnover: Maintain 100% power.

Critical Tasks:

1. **CT-10 (E-0.M)** Crew closes upstream PORV Block valve.
2. **CT-11 (E-0.O)** Crew closes CNMT isolation valves.
3. **CT-43 (FR-H.1.A)** Crew establishes feedwater flow before feed and bleed required.

Event No.	Malf. No.	Event Type	Event Description
1	CHS20B	(I,A) ATC, SRO	VCT Level Transmitter, 1CH-LT-112 fails low causing auto makeup to occur.
2	FWM14B	(C,A) BOP, SRO	"A" Feedwater flow transmitter fails high, requires manual control of Feedwater control valve and placing alternate channel in service and return to auto control.
3	NIS03D	(C,A) ATC, SRO (TS) SRO	N44 failed high, control rods automatically insert. (AOP 1.1.3)
4		(N) BOP, SRO (TS) SRO	N44 removal from service. (AOP 1.2.1C)
5	CRF04	(C,A) BOP, SRO (TS) SRO	Dropped Rod, requires turbine load reduction (AOP 1.1.8)
6	CRF04BP	(C,A) ATC, SRO	2 nd Dropped Rod, requires manual Rx trip.
7		(M) ALL	Reactor Trip
8	PRS08E	C) ATC, SRO	1RC-PT-445 fails high on Rx trip, PORVs open, requires closing Block valves.
9	INH49 VLV-SEA09	(C) BOP, SRO	Train "B" CIA Actuation failure with MOV-1CH-378 (Trn A) auto close failure.
10		(M) ALL	Loss of ALL Feedwater – FR-H.1 with main feed pump recovery.

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

E-0 → FR-H.1 → E-0

After taking the shift at 100% power with AFW pump 1FW-P-3A OOS, VCT level transmitter, 1CH-LT-112 will fail low causing an automatic Makeup to occur. The ATC will diagnose the indications and IAW AOP 1.4.1, Process Control Failure, turn the blender off to stop the makeup and ensure the plant is stable, the SRO will transition to the instrument failure procedure for further channel actions.

The channel 3, "A" SG feed flow transmitter, FT-1FW-477, will then drift high, the crew will recognize the SG level perturbation and IAW AOP 1.4.1, the BOP will place the controller for 1FW-FCV-478 in manual and restore SG level, the SRO will transition to the instrument failure procedure for additional channel removal actions and place the alternate channel in service, the BOP will then return 1FW-FCV-478 to automatic control.

Power Range Nuclear instrument, N-44 will then fail high causing the control rods to automatically insert. The crew will perform the Immediate Operator Actions for AOP 1.1.3, Unexpected Control Rod Movement. The ATC will identify the N-44 failure and place the rods in manual. The SRO will then transition to AOP 1.2.1C, Power Range Channel Malfunction, and direct the BOP to remove the failed channel from service. The SRO will address Tech Specs for the failed instrument.

A control rod will then drop, the crew will enter AOP 1.1.8 for an Inoperable Rod. Due to the magnitude of the RCS temperature drop, the crew will be required to lower power to restore RCS temperature. The SRO will address Tech Specs for the dropped rod.

After the crew has completed a power reduction and stabilized the plant, a 2nd control rod will drop. The ATC will recognize that 2 control rods are now dropped. Due to 2 dropped rods, IAW AOP 1.1.8 IOA's, the SRO will direct the ATC to manually trip the Rx and enter E-0.

When the Rx is manually tripped, 1RC-PT-445 will fail high causing 2 PORV's to open resulting in a Safety Injection signal, the ATC will recognize the open PORV's with lowering RCS and manually close the valves.

The safety injection that occurred as a result of the PORV's opening, will fail to actuate the train "B" CIA signal, and MOV-1CH-378 (a train "A" CIA valve) will fail to automatically close. The crew will be required to isolate the containment penetration via either manually actuating Train "B" CIA or manually closing MOV-1CH-378.

On the trip, the turbine driven AFW pump, 1FW-P-2 will start but not produce any flow, the remaining available motor driven AFW pump, 1FW-P-3B will start but will trip when the SI Manual actuation PB's are depressed. When "Verifying AFW Status" in E-0, the crew will identify that all auxiliary feedwater pumps have failed, the SRO will transition to FR-H.1.

IAW FR-H.1 direction the crew will restore feedwater flow by starting a main feedwater pump. After feed flow is verified, the SRO will return to E-0 at which point the scenario will be terminated.

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