

FENOC

FirstEnergy Nuclear Operating Company

BEAVER VALLEY POWER STATION TRAINING SECTION

September 8, 2015

Mr. Peter Presby
USNRC Chief Examiner
USNRC Region 1
2100 Renaissance Blvd, Suite 100
King of Prussia, PA 19406-2713

Beaver Valley Training Center
Examination Outlines
NPD3DOT:3714

Dear Mr. Presby,

Enclosed for your review and approval are the outlines for the Beaver Valley Unit 2 Initial Licensed Operator Examination scheduled to begin December 7, 2015. These outlines are submitted in accordance with NUREG 1021, Operator Licensing Examination Standards for Power Reactors (Revision 10).

The following materials are enclosed:

- Form ES-201-2, Examination Outline Quality Checklist – (Signed)
- Form ES-201-3, Examination Security Agreement (Copy)
- Form ES-301-1, Administrative Topics Outline RO - Rev. 0
- Form ES-301-1, Administrative Topics Outline SRO - Rev. 0
- Form ES-301-2, Control Room/In-Plant Systems Outline RO – Rev. 0
- Form ES-301-2, Control Room/In-Plant Systems Outline SRO-I – Rev. 0
- Form ES-301-4, Simulator Scenario Quality Checklist – Rev. 0 (Unsigned)
- Form ES-301-5, Transient and Event Checklist – Rev. 0 (3 pages)
- Form ES-301-6, Competencies Checklist – Rev. 0
- **RO Written Outline**
 - Form ES-401-2, PWR Examination Outline – RO-Rev. 0 (12 pages)
 - Form ES-401-3, Generic Knowledge and Abilities Outline Tier 3 – RO – Rev. 0 (1 page)
- **SRO Written Outline**
 - Form ES-401-2, PWR Examination Outline – SRO – Rev. 0 (5 pages)
 - Form ES-401-3, Generic Knowledge and Abilities Outline Tier 3 – SRO – Rev. 0 (1 page)
- Form ES-401-4, Record of Rejected K/As – Rev. 0
- Form ES-D-1, Scenario Outline – Rev. 0 (4 – All New)

The unsigned Form ES-301-4, Simulator Scenario Quality Checklist, is being sent to support Form ES-201-2, Examination Outline Quality Checklist. A signed version of this form will be sent with the exam materials.

The Westinghouse developed PWROG Random Generator software was used to generate both the RO and SRO written examination outlines. This software follows the selection process described in ES-401, Attachment 1, Example Systematic Sampling Methodology and the K/A Elimination Guidance provided in ES-401. Replacement K/As were manually selected utilizing this same guidance. Rejected K/As were documented on Form ES-401-4, Record of Rejected K/As.

The expected additions to the Exam Security Agreement are additional Operations Validation Team members.

We request these materials be withheld from public disclosure until after the completion of the exam. If you have any questions, please feel free to contact Tom Gaydosik at 724-682-1884.

Sincerely,

Thomas A. Gaydosik for D. Ronnenberg

Daniel J. Ronnenberg
Superintendent, Nuclear Operations Training

David W. Held

David W. Held
Unit 2 Shift Manager – Facility Reviewer

cc: OPS Letter File
Nuclear Records – Site

TG for LY – exam outlines – 16

TG/LY

Facility: **BVPS UNIT 2 RO**Date of Exam 12/7 thru 12/18/2015

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	2	1	2				1	1			2	9			
	Tier Totals	5	4	5				4	4			5	27			
2. Plant Systems	1	2	2	3	3	3	2	2	3	2	3	3	28			
	2	1	1	1	1	1	1	1	0	1	1	1	10			
	Tier Totals	3	3	4	4	4	3	3	3	3	4	4	38			
3. Generic Knowledge and Abilities Category					1		2		3		4		10			
					2		3		2		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 outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 Radiation Control K/A is allowed if the K/A is replaced by a K/A from another Tier 3 Category).
2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ± 1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points and the SRO-only exam must total 25 points.
3. Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted with justification; operationally important, site-specific systems/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 for guidance regarding the elimination of inappropriate K/A statements.
4. Select topics from as many systems and evolutions as possible; sample every system or evolution in the group before selecting a second topic for any system or evolution.
5. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
7. The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams.
9. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

G* Generic K/As

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					EK2 Knowledge of the interrelations between a reactor trip and the following: EK2.03 Reactor trip status panel (CFR 41.7 / 45.7)	3.5	1
000008 Pressurizer (PZR) Vapor Space Accident (Relief Valve Stuck Open) / 3 [Question 2]	X						AK1 Knowledge of the operational implications of the following concepts as they apply to a Pressurizer Vapor Space Accident: AK1.01 Thermodynamics and flow characteristics of open or leaking Valves (CFR 41.8 / 41.10 / 45.3)	3.2	1
000015/000017 Reactor Coolant Pump (RCP) Malfunctions / 4 [Question 3]		X					AK2 Knowledge of the interrelations between the Reactor Coolant Pump Malfunctions (Loss of RC Flow) and the following: AK2.07 RCP seals (CFR 41.7 / 45.7)	2.9	1
000022 Loss of Reactor Coolant Makeup / 2 [Question 4]	X						AK1 Knowledge of the operational implications of the following concepts as they apply to Loss of Reactor Coolant Makeup: AK1.03 Relationship between charging flow and PZR level (CFR 41.8 / 41.10 / 45.3)	3.0	1
000025 Loss of Residual Heat Removal System (RHRS) / 4 [Question 5]					X		AA2 Ability to determine and interpret the following as they apply to the Loss of Residual Heat Removal System: AA2.04 Location and isolability of leaks (CFR: 43.5 / 45.13)	3.3*	1
000026 Loss of Component Cooling Water (CCW) / 8 [Question 6]			X				AK3 Knowledge of the reasons for the following responses as they apply to the Loss of Component Cooling Water: AK3.03 Guidance actions contained in EOP for Loss of CCW (CFR 41.5,41.10 / 45.6 / 45.13)	4.0	1
000027 Pressurizer Pressure Control System (PZR PCS) Malfunction / 3 [Question 7]						X	2.1.28 Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)	4.1	1
000029 Anticipated Transient Without Scram (ATWS) / 1 [Question 8]		X					EK2 Knowledge of the interrelations between the and the following an ATWS: EK2.06 Breakers, relays, and disconnects (CFR 41.7 / 45.7)	2.9*	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 Steam Generator Tube Rupture (SGTR) / 3 [Question 9]			X				EK3 Knowledge of the reasons for the following responses as they apply to the SGTR: EK3.03 Automatic actions associated with high radioactivity in S/G sample lines (CFR 41.5 / 41.10 / 45.6 / 45.13)	3.6*	1
000054 Loss of Main Feedwater (MFW) / 4 [Question 10]					X		AA2 Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW): AA2.02 Differentiation between loss of all MFW and trip of one MFW pump (CFR: 43.5 / 45.13)	4.1	1
000055 Loss of Offsite and Onsite Power (Station Blackout) / 6 [Question 11]						X	2.4.18 Knowledge of the specific bases for EOPs. (CFR: 41.10 / 43.1 / 45.13)	3.3	1
000056 Loss of Offsite Power / 6 [Question 12]	X						AK1 Knowledge of the operational implications of the following concepts as they apply to Loss of Offsite Power: AK1.01 Principle of cooling by natural convection (CFR 41.8 / 41.10 / 45.3)	3.7	1
000057 Loss of Vital AC Electrical Instrument Bus / 6 [Question 13]					X		AA2 Ability to determine and interpret the following as they apply to the Loss of Vital AC Instrument Bus: AA2.03 RPS panel alarm annunciators and trip indicators (CFR: 43.5 / 45.13)	3.7	1
000062 Loss of Nuclear Service Water / 4 [Question 14]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: AK3.04 Effect on the nuclear service water discharge flow header of a loss of CCW (CFR 41.4, 41.8 / 45.7)	3.5	1
000065 Loss of Instrument Air / 8 [Question 15]						X	2.4.4 Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.5	1
000077 Generator Voltage and Electric Grid Disturbances / 6 [Question 16]				X			AA1 Ability to operate and/or monitor the following as they apply to Generator Voltage and Electric Grid Disturbances: AA1.04 Reactor controls (CFR: 41.5 and 41.10 / 45.5, 45.7, and 45.8)	4.1	1

ES-401		PWR Examination Outline						Form ES-401-2	
Emergency and Abnormal Plant Evolutions - Tier 1/Group 1(RO) <i>Continued</i>									
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
W/E11 Loss of Emergency Coolant Recirculation / 4 [Question 17]				X			EA1 Ability to operate and / or monitor the following as they apply to the (Loss of Emergency Coolant Recirculation) EA1.3 Desired operating results during abnormal and emergency situations (CFR: 41.7 / 45.5 / 45.6)	3.7	1
W/E12 Uncontrolled Depressurization of all Steam Generators /4 [Question 18]				X			EA1 Ability to operate and / or monitor the following as they apply to the (Uncontrolled Depressurization of all Steam Generators) EA1.2 Operating behavior characteristics of the facility. (CFR: 41.7 / 45.5 / 45.6)	3.6	1
K/A Category Point Totals:	3	3	3	3	3	3	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	#
000033 Loss of Intermediate Range Nuclear Instrumentation / 7 [Question 19]	X						AK1 Knowledge of the operational implications of the following concepts as they apply to Loss of Intermediate Range Nuclear Instrumentation: AK1.01 Effects of voltage changes on performance (CFR 41.8 / 41.10 / 45.3)	2.7	1
000059 Accidental Liquid Radwaste Release / 9 [Question 20]					X		AA2 Ability to determine and interpret the following as they apply to the Accidental Liquid Radwaste Release: AA2.02 The permit for liquid radioactive-waste release (CFR: 43.5 / 45.13)	2.9	1
000067 Plant fire on site / 9 [Question 21]			X				AK3 Knowledge of the reasons for the following responses as they apply to the Plant Fire on Site: AK3.04 Actions contained in EOP for plant fire on site (CFR 41.5,41.10 / 45.6 / 45.13)	3.3	1
000068 Control Room Evacuation / 8 [Question 22]		X					AK2 Knowledge of the interrelations between the Control Room Evacuation and the following: AK2.02 Reactor trip system (CFR 41.7 / 45.7)	3.7	1
000069 Loss of Containment Integrity / 5 [Question 23]			X				AK3 Knowledge of the reasons for the following responses as they apply to the Loss of Containment Integrity: AK3.01 Guidance contained in EOP for loss of containment integrity (CFR 41.5,41.10 / 45.6 / 45.13)	3.8*	1
W/E02 SI Termination / 3 [Question 24]						X	2.4.21 Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. (CFR: 41.7 / 43.5 / 45.12)	4.0	1
W/E03 LOCA Cooldown and Depressurization / 4 [Question 25]	X						EK1 Knowledge of the operational implications of the following concepts as they apply to the (LOCA Cooldown and Depressurization) EK1.2 Normal, abnormal and emergency operating procedures associated with (LOCA Cooldown and Depressurization). (CFR: 41.8 / 41.10 / 45.3)	3.6	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/E07 Saturated Core Cooling / 4 [Question 26]				X			EA1 Ability to operate and / or monitor the following as they apply to the (Saturated Core Cooling) EA1.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.5 / 45.6)	3.6	1
W/E13 Steam Generator Overpressure / 4 [Question 27]						X	2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 41.10 / 43.5 / 45.2 / 45.6)	4.3	1
K/A Category Point Totals:	2	1	2	1	1	2	Group Point Total:		9

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 System (RCPS) [Question 28]		X										K2 Knowledge of bus power supplies to the following: K2.01 RCPS (CFR: 41.7)	3.1	1
004 Chemical and Volume Control System [Question 29]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the CVCS: K5.14 Reduction process of gas concentration in RCS: vent accumulated non-condensable gases from PZR bubble space, depressurized during cooldown or by alternately heating and cooling (spray) within allowed pressure band (drive more gas out of solution) (CFR: 41.5/45.7)	2.5	1
005 Residual Heat Removal System (RHRS) [Question 30]		X										K2 Knowledge of bus power supplies to the following: K2.03 RCS pressure boundary motor-operated valves (CFR: 41.7)	2.7*	1
006 Emergency Core Cooling System (ECCS) [Question 31]									X			A3 Ability to monitor automatic operation of the ECCS, including: A3.07 RHR pumps (CFR: 41.7 / 45.5)	3.6*	1
006 Emergency Core Cooling System (ECCS) [Question 32]				X								K4 Knowledge of ECCS design feature(s) and/or interlock(s) which provide for the following: K4.01 Cooling of centrifugal pump bearings (CFR: 41.7)	2.6	1
007 Pressurizer Relief Tank/Quench Tank System (PRTS) [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	1
008 Component Cooling Water System (CCWS) [Question 34]											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
008 Component Cooling Water System (CCWS) [Question 35]			X									K3 Knowledge of the effect that a loss or malfunction of the CCWS will have on the following: K3.03 RCP	4.1	1
010 Pressurizer Pressure Control System (PZR PCS) [Question 36]									X			A3 Ability to monitor automatic operation of the PZR PCS, including: A3.02 PZR pressure (CFR: 41.7 / 45.5)	3.6	1

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	#
012 Reactor Protection System (RPS) [Question 37]						X						K6 Knowledge of the effect of a loss or malfunction of the following will have on the RPS: K6.02 Redundant channels (CFR: 41.7 / 45.7)	2.9	1
013 Engineered Safety Features Actuation System (ESFAS) [Question 38]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the ESFAS: K5.02 Safety system logic and reliability (CFR: 41.5 / 45.7)	2.9	1
022 Containment Cooling System (CCS) [Question 39]								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: A2.04 Loss of service water (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9*	1
022 Containment Cooling System (CCS) [Question 40]										X		A4 Ability to manually operate and/or monitor in the control room: A4.05 Containment readings of temperature, pressure, and humidity system. (CFR: 41.7 / 45.5 to 45.8)	3.8	1
026 Containment Spray System (CSS) [Question 41]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CSS controls including: A1.01 Containment pressure (CFR: 41.5 / 45.5)	3.9	1
026 Containment Spray System (CSS) [Question 42]											X	2.2.12 Knowledge of surveillance procedures. (CFR: 41.10 / 45.13)	3.7	1
039 Main and Reheat Steam System (MRSS) [Question 43]			X									K3 Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: K3.03 AFW pumps. (CFR: 41.7 / 45.6)	3.2*	1
039 Main and Reheat Steam System (MRSS) [Question 44]											X	2.4.1 Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)	4.6	1

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	#
059 Main Feedwater (MFW) System [Question 45]										X		A4 Ability to manually operate and monitor in the control room: A4.01 MFW turbine trip indication (CFR: 41.7 / 45.5 to 45.8)	3.1*	1
059 Main Feedwater (MFW) System [Question 46]								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: A2.01 Feedwater actuation of AFW system (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.4*	1
061 Auxiliary / Emergency Feedwater (AFW) System [Question 47]					X							K5 Knowledge of the operational implications of the following concepts as the apply to the AFW: K5.02 Decay heat sources and magnitude (CFR: 41.5 / 45.7)	3.2	1
062 AC Electrical Distribution System [Question 48]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the ac distribution system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.08 Consequences of exceeding voltage limitations (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.7	1
063 DC Electrical Distribution System [Question 49]	X											K1 Knowledge of the physical connections and/or cause effect relationships between the DC electrical system and the following systems: K1.02 AC electrical system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.7	1
064 Emergency Diesel Generator (ED/G) System [Question 50]						X						K6 Knowledge of the effect of a loss or malfunction of the following will have on the ED/G system: K6.07 Air receivers (CFR: 41.7 / 45.7)	2.7	1
073 Process Radiation Monitoring (PRM) System [Question 51]			X									K3 Knowledge of the effect that a loss or malfunction of the PRM system will have on the following: K3.01 Radioactive effluent releases (CFR: 41.7 / 45.6)	3.6	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 System (SWS) [Question 52]							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	
078 Instrument Air System (IAS) [Question 53]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the IAS and the following systems: K1.03 Containment air (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.3*	1	
103 Containment System [Question 54]				X								K4 Knowledge of containment system design feature(s) and/or interlock(s) which provide for the following: K4.01 Vacuum breaker protection (CFR: 41.7)	3.0*	1	
103 Containment System [Question 55]										X		A4 Ability to manually operate and/or monitor in the control room: A4.09 Containment vacuum system (CFR: 41.7 / 45.5 to 45.8)	3.1*	1	
K/A Category Point Totals:	2	2	3	3	3	2	2	3	2	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 Control Rod Drive System [Question 56]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CRDS controls including: A1.04 PZR level and pressures (CFR: 41.5 / 45.5)	3.7	1
002 Reactor Coolant System (RCS) [Question 57]									X			A3 Ability to monitor automatic operation of the RCS, including: A3.03 Pressure, temperatures, and flows (CFR: 41.7 / 45.5)	4.4	1
011 Pressurizer Level Control System (PZR LCS) [Question 58]						X						K6 Knowledge of the effect of a loss or malfunction on the following will have on the PZR LCS: K6.05 Function of PZR level gauges as post accident monitors (CFR: 41.7 / 45.7)	3.1	1
028 Hydrogen Recombiner and Purge Control System (HRPS) [Question 59]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the HRPS: K5.01 Explosive hydrogen concentration (CFR: 41.5 / 45.7)	3.4	1
030 Containment Purge System (CPS) [Question 60]			X									K3 Knowledge of the effect that a loss or malfunction of the Containment Purge System will have on the following: K3.01 Containment parameters (CFR: 41.7 / 45.6)	2.9	1
034 Fuel Handling Equipment System (FHES) [Question 61]	X											K1 Knowledge of the physical connections and/or cause effect relationships between the Fuel Handling System and the following systems: K1.04 NIS (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.6	1
035 Steam Generator System (S/GS) [Question 62]				X								K4 Knowledge of S/GS design feature(s) and/or interlock(s) which provide for the following: K4.05 Amount of reserve water in S/G (CFR: 41.7)	2.9	1
045 Main Turbine Generator (MT/G) System [Question 63]										X		A4 Ability to manually operate and/or monitor in the control room: A4.01 Turbine valve indicators (throttle, governor, control, stop, intercept), alarms, and annunciators (CFR: 41.7 / 45.5 to 45.8)	3.1	1

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 (ARM) System [Question 64]											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	1
075 Circulating Water System [Question 65]		X										K2 Knowledge of bus power supplies to the following: K2.03 Emergency/essential SWS pumps (CFR: 41.7)	2.6*	1
K/A Category Point Totals:	1	1	1	1	1	1	1	0	1	1	1	Group Point Total:		10

Facility: BVPS UNIT 2 RODate of Exam 12/7 thru 12/18/2015

Category	K/A#	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.29	Knowledge of how to conduct system lineups, such as valves, breakers, switches, etc. (CFR: 41.10 / 45.1 / 45.12) [Question 66]	4.1	1		
	2.1.45	Ability to identify and interpret diverse indications to validate the response of another indication. (CFR: 41.7 / 43.5 / 45.4) [Question 67]	4.3	1		
	Subtotal			2		
2. Equipment Control	2.2.6	Knowledge of the process for making changes to procedures. (CFR: 41.10 / 43.3 / 45.13) [Question 68]	3.0	1		
	2.2.15	Ability to determine the expected plant configuration using design and configuration control documentation, such as drawings, line-ups, tag-outs, etc. (CFR: 41.10 / 43.3 / 45.13) [Question 69]	3.9	1		
	2.2.39	Knowledge of less than or equal to one hour Technical Specification action statements for systems. (CFR: 41.7 / 41.10 / 43.2 / 45.13) [Question 70]	3.9	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		
	2.3.13	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 72]	3.4	1		
	Subtotal			2		
4. Emergency Procedures/ Plan	2.4.6	Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13) [Question 73]	3.7	1		
	2.4.25	Knowledge of fire protection procedures. (CFR: 41.10 / 43.5 / 45.13) [Question 74]	3.3	1		
	2.4.39	Knowledge of RO responsibilities in emergency plan implementation. (CFR: 41.10 / 45.11) [Question 75]	3.9	1		
	Subtotal			3		
Tier 3 Point Total				10		

Facility: BVPS UNIT 2 SRODate of Exam 12/7 thru 12/18/2015

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	3
	Tier Totals													5	3	8	
3. Generic Knowledge and Abilities Category																	
				1	2	3	4										
				2	1	2	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(SRO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000009 Small Break LOCA / 3 [Question 76]					X		EA2 Ability to determine or interpret the following as they apply to a small break LOCA: EA2.05 The time available for action before PZR is empty, given the rate of decrease of PZR level (CFR 43.5 / 45.13)	3.9	1
000011 Large Break LOCA / 3 [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
000040 Steam Line Rupture / 4 [Question 78]					X		AA2 Ability to determine and interpret the following as they apply to the Steam Line Rupture: AA2.05 When ESFAS systems may be secured (CFR: 43.5 / 45.13)	4.5	1
000058 Loss of DC Power / 6 [Question 79]						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
4 LOCA Outside Containment / 3 [Question 80]						X	2.4.11 Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)	4.2	1
W/E05 Loss of Secondary Heat Sink / 4 [Question 81]					X		EA2 Ability to determine and interpret the following as they apply to the (Loss of Secondary Heat Sink) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations. (CFR: 43.5 / 45.13)	4.4	1
K/A Category Point Totals:					3	3	Group Point Total:		6

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 Dropped Control Rod / 1 [Question 82]						X	2.2.36 Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations. (CFR: 41.10 / 43.2 / 45.13)	4.2	1
000024 Emergency Boration / 1 [Question 83]						X	2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 41.10 / 43.5 / 45.2 / 45.6)	4.4	1
W/E06 Degraded Core Cooling / 4 [Question 84]					X		EA2 Ability to determine and interpret the following as they apply to the (Degraded Core Cooling) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations. (CFR: 43.5 / 45.13)	4.2	1
W/E09 Natural Circulation Operations / 4 [Question 85]					X		EA2 Ability to determine and interpret the following as they apply to the (Natural Circulation Operations) EA2.2 Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments. (CFR: 43.5 / 45.13)	3.8	1
K/A Category Point Totals:	0	0	0	0	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 Reactor Coolant Pump System (RCPS) [Question 86]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the RCPS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 Conditions which exist for an abnormal shutdown of an RCP in comparison to a normal shutdown of an RCP (CFR: 41.5 / 43.5 / 45.3 / 45/13)	3.9	1
004 Chemical and Volume Control System [Question 87]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the CVCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.33 Fact that isolating cation demineralizer stops boron dilution and enables restoration of normal boron concentration (CFR: 41.5 / 43/5 / 45/3 / 45/5)	3.3	1
013 Engineered Safety Features Action System (ESFAS) [Question 88]											X	2.4.1 Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)	4.8	1
076 Service Water System (SWS) [Question 89]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the SWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 Service water header pressure (CFR: 41.5 / 43.5 / 45/3 / 45/13)	3.1	1
078 Instrument Air System (IAS) [Question 90]											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)	4.1	1
K/A Category Point Totals:								3			2	Group Point Total:		5

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	#
033 Spent Fuel Pool Cooling System (SFPCS) [Question 91]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the Spent Fuel Pool Cooling System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.01 Inadequate SDM (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.5	1
041 Steam Dump System (SDS)/Turbine Bypass Control [Question 92]											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
079 Station Air System (SAS) [Question 93]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the SAS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.01 Cross-connection with IAS (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.2	1
K. Category Point Totals:								2			1	Group Point Total:		3

Facility: BVPS UNIT 2 SRODate of Exam 12/7 thru 12/18/2015

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
	2.1.36	Knowledge of procedures and limitations involved in core alterations. (CFR: 41.10 / 43.6 / 45.7) [Question 95]			4.1	1
	Subtotal					2
2. Equipment Control	2.2.42	Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (CFR: 41.7 / 41.10 / 43.2 / 43.3 / 45.3) [Question 96]			4.6	1
	Subtotal					1
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10) [Question 97]			3.7	1
	2.3.11	Ability to control radiation releases. (CFR: 41.11 / 43.4 / 45.10) [Question 98]			4.3	1
	Subtotal					2
4. Emergency Procedures/ Plan	2.4.29	Knowledge of the emergency plan. (CFR: 41.10 / 43.5 / 45.11) [Question 99]			4.4	1
	2.4.44	Knowledge of emergency plan protective action recommendations. (CFR: 41.10 / 41.12 / 43.5 / 45.11) [Question 100]			4.4	1
	Subtotal					2
Tier 3 Point Total						7

[illegible]

Facility: Beaver Valley Unit 2Date of Examination: 12/7 thru 12/18 2015Examination Level **RO** ☒ **SRO** ☐Operating Test Number BV2LOT15 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (RO A 1.1)	D, R	2.1.43 (4.1) Ability to use procedures to determine the effects on reactivity of plant changes, such as reactor coolant system temperature, secondary plant, fuel depletion, etc. JPM 2AD-016 Plot and Evaluate 1/M Data
Conduct of Operations (RO A 1.2)	N, 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)	N, R	2.2.41 (3.5) Ability to obtain and interpret station electrical and mechanical drawings. JPM 2AD-048 Determine Isolation Boundary Points and Mark on Plant VOND
Radiation Control (RO A 3)	D, R	2.3.11 (3.8) Ability to control radiation releases. JPM 2AD-010 Determine GW Storage Tank Discharge Bleed Flow Rate
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 2Date of Examination: 12/7 thru 12/18 2015Examination Level **RO** ☐ **SRO** ☒Operating Test Number BV2LOT15 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (SRO A 1.1)	D, R	2.1.43 (4.3) Ability to use procedures to determine the effects on reactivity of plant changes, such as reactor coolant system temperature, secondary plant, fuel depletion, etc. JPM 2AD-019 Plot and Evaluate 1/M Data and Determine Required Actions
Conduct of Operations (SRO A 1.2)	N, 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)	N, R	2.2.41 (3.9) Ability to obtain and interpret station electrical and mechanical drawings. JPM 2AD-049 Identify Isolation Boundary Points and Mark on Plant VOND then Identify Method of Plant Configuration Control
Radiation Control (SRO A 3)	M, R	2.3.4 (3.7) Knowledge of radiation exposure limits under normal or emergency conditions. JPM 2AD-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 2AD-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: <u>BVPS UNIT 2</u>	Date of Examination: <u>12/7/15 thru 12/18/15</u>	
Exam Level: RO <input checked="" type="checkbox"/> SRO(I) <input type="checkbox"/> SRO(U) <input type="checkbox"/>	Operating Test No.: <u>BV2LOT15 NRC</u>	
Control Room Systems® (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U)		
System / JPM Title	Type Code*	Safety Function
S1 - Transfer to Hot Leg Recirculation (2CR-570)	S, D, EN	3
S2 - Discharge Steam Generator Blowdown Evaporator Test Tank [2SGC-TK23A] to Unit 2 Cooling Tower Blowdown. (2CR-660)	S, N, A	9
S3 - Rod Control Assembly Partial Movement Test - (Rods continue to move during performance of the test) (2CR-747)	S, N, A	1
S4 - Batch to the Refuel Water Storage Tank (2CR-537)	S, D	2
S5 - Perform QPTR Alarm Test (2CR-144)	S, D	7
S6 - Respond to Containment Air Recirculation Fan High Vibration Alarm (2CR-661)	S, N, A	5
S7 - Perform a Hot Bus Transfer (2CR-523)	S, D, A	6
S8 - Start A Reactor Coolant Pump (2CR-513)	S, D, A, L	4P
In-Plant Systems® (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
P1 - Uninterruptible Power Supply [UPS*VITBS2-3(4)] Shutdown (2PL-021)	D	6
P2 - Reset the Terry Turbine Trip Throttle Valve (2PL-004)	D, R	4S
P3 - Place the Diesel Air Compressor in Service (2PL-031)	D, E	8
@ 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: BVPS UNIT 2Date of Examination: 12/7/15 thru 12/18/15Exam Level: RO ☐ SRO(I) ☒ SRO(U) ☐Operating Test No.: BV2LOT15 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 - Transfer to Hot Leg Recirculation (2CR-570)	S, D, EN	3
S2 - Discharge Steam Generator Blowdown Evaporator Test Tank [2SGC-TK23A] to Unit 2 Cooling Tower Blowdown. (2CR-660)	S, N, A	9
S3 - Rod Control Assembly Partial Movement Test - (Rods continue to move during performance of the test) (2CR-747)	S, N, A	1
S4 - Batch to the Refuel Water Storage Tank (2CR-537)	S, D	2
S6 - Respond to Containment Air Recirculation Fan High Vibration Alarm (2CR-661)	S, N, A	5
S7 - Perform a Hot Bus Transfer (2CR-523)	S, D, A	6
S8 - Start A Reactor Coolant Pump (2CR-513)	S, D, A, L	4P

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

P1 - Uninterruptible Power Supply [UPS*VITBS2-3(4)] Shutdown (2PL-021)	D	6
P2 - Reset the Terry Turbine Trip Throttle Valve (2PL-004)	D, R	4S
P3 - Place the Diesel Air Compressor in Service (2PL-031)	D, E	8

@ 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****2L15N1**

Facility: **BVPS Unit 2** Scenario No. 1 Op Test No.: **BV2LOT15 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC-142(15):** 48% power, MOL, Equ. XE Conditions, CB "D" @ 158 steps, RCS boron - 558 ppm.

Turnover: Maintain 48% power.

Critical Tasks:

1. **CT-10 (E-0.M)** Crew closes PORV block MOV
2. **CT-13 (E-0.Q)** Crew manually trips turbine
3. **CT-43 (FR-H.1.A)** Crew establishes feedwater flow

Event No.	Malf. No.	Event Type	Event Description
1	XMT-RCS019A	(I,A) ATC, SRO (TS) SRO	Pressurizer level transmitter, 2RCS*LT459 drifts low.
2	XMT-MSS053A	(I,A) BOP, SRO (TS) SRO	2MSS*PT496 fails low over 30 sec, requires manual control of 2FWS*FCV498.
3	RCS02A	(C,A) ATC, SRO (TS) SRO	30 gpm RCS leak (unisolable)
		(R) ATC (N) BOP, SRO	Ops management directed Emergency Shutdown, AOP 2.51.1.
5	RCS02A	(M) ALL	400 gpm loop A LOCA , requires manual Rx trip
6	EHC08A	(C) BOP, SRO	Auto main Turbine trip failure
7	VLV-RCS034A	(C) ATC, SRO	2RCS*PCV456 lifts/fails to reseal on Rx trip, requires manual closure of MOV block valve, 2RCS*MOV536.
8	PMP-AFW001, 2, LOA-AFW022	(M) ALL	Loss of all feed, Entry into FR-H.1, success path - main feed
9	VLV- MSC104,105,106	(C) ATC, SRO	2SSR-AOV117A, B, C, SG BD sample line auto isolation failure

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

E-0 → FR-H.1 → E-0 → E-1

After taking the shift at 48% power, Pressurizer level transmitter, 2RCS-LT459 will drift low. The crew will diagnose the indications and IAW AOP 2.4.1, 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 channel 3, "C" SG steam pressure transmitter, 2MSS*PT496, will then drift low, the crew will recognize the SG level perturbation and IAW AOP 2.4.1, the BOP will place the controller for 2FWS*FCV498 in manual and will restore SG level, the SRO will transition to the instrument failure procedure for additional channel removal actions and will address Tech Specs for the failed instrument.

A non-isolable 30 gpm leak will then occur on the "A" loop, the crew will enter AOP 2.6.7, Excessive Primary Plant Leakage, to evaluate leak rate and leak location. The crew will determine the leak rate is greater than 10 gpm and is not isolable. The SM will report to the SRO that due to the leakage, management directs an immediate plant shutdown IAW AOP 2.51.1 at 2% per minute.

When reactor power lowers to < 42%, the RCS leak will increase to 400 gpm. The crew will identify degrading plant parameters and the SRO will direct a pre-emptive reactor trip and enter E-0. The turbine will fail to automatically trip due to the reactor trip, the BOP will manually trip the turbine.

Additionally, PORV, 2RCS*PCV456 will fail 20% open on the reactor trip. The ATC will identify the open PORV, attempt to close it, recognize that the PORV did not close and close the block valve, 2RCS*MOV536 to isolate the stuck open PORV.

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. While performing the actions of FR-H.1, the ATC will identify that the SG blowdown sample valves failed to automatically close and will manually close 2SSR*AOV117A, B & C.

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.

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 when the crew "Checks if SI Flow Should be Reduced" and determines plant conditions support SI termination and transition to ES-1.1.

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

Appendix D**Scenario Outline****2L15N2**

Facility:	BVPS Unit 2	Scenario No. 2	Op Test No.: <u>BV2LOT15 NRC</u>
Examiners:	_____	Candidates:	_____
	_____		_____
	_____		_____
			SRO
			ATC
			BOP

Initial Conditions: **IC-143 (10):** 100% power, BOL, Equ. XE Conditions, CB "D" @ 227 steps, RCS boron - 1100 ppm.

Turnover: Maintain current plant conditions

Critical Tasks:

- 1. CT-6 (E-0.I)** Crew establishes SIS Flow
- 2. CT-52 (FR-S.1.C)** Crew inserts negative reactivity
- 3. CT-17 (E-2.A)** Crew isolates the faulted SG

Event No.	Malf. No.	Event Type	Event Description
1	XMT-MSS043A	(R) ATC (N) BOP/SRO	Load rejection – VPL failure, 2OM-26.4.X
2	GEN02	(C,A) BOP/SRO	MUG Voltage regulator overexcitation failure.
3	XMT-RCS030A	(I,A) ATC/SRO SRO T.S.	2RCS*PT444 drifts HIGH, PRZR pressure decreases, manual control of PRZR pressure required.
4	FLX-CFW33	(M) ALL SRO T.S.	2800 gpm Feedwater leak inside CNMT on "C" SG. CNMT pressure rises above TS allowable prior to trip.
5	PPL01A PPL01B	(M) ALL	ATWS – Failure of auto/manual Rx trip.
6	CRF01A	(C) ATC/SRO	Control Rods require manual insertion.
7	VLV-SIS069 VLV-SIS070	(C) ATC, SRO	2SIS*MOV867A and 2SIS*MOV867B auto open failure.
8	VLV-MSC021, 023, 024, 025	(C) BOP/SRO	"B" Train Hydrogen Analyzer fails to automatically start on SIS signal.
9	VLV-AFW014	(C) BOP/SRO	AFW valve, 2FWE*HCV100B, fails to close from the CR.

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

E-0 → FR-S.1 → E-0 → E-2

After taking the shift at 100% power, the valve position limiter will fail to 70% causing a load rejection. The control rods will initially insert in response to the load rejection but will stop moving at 217 steps. The crew will initially respond with AOP 2.1.3, Unexpected Control Rod Movement, and then transition to AOP 2.35.2, Load Rejection, after the load rejection is diagnosed. The crew will stabilize the plant after which the BOP will be directed to use procedure 2OM-26.4.X, Recovering Turbine Governor Valves from the Valve Position Limiter, to remove the turbine from the valve position limiter.

The MUG, main unit generator, voltage regulator will then fail causing an over excitation of the MUG, IAW AOP 2.4.1, Process Control Failure, the BOP will place the voltage regulator to "OFF" and correct the over excitation by manually adjusting the "base adjust".

The controlling PRZR pressure channel, 2RCS*PT444 will drift high causing RCS pressure to lower due to the pressurizer spray valves/PORV's opening. The crew will initially respond IAW AOP 2.4.1, identify the failure and close the spray valves/PORV's, the SRO will then transition to 2OM-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.

A ramped 2800 gpm feedwater leak on the "C" SG inside of containment causing containment pressure to rise above TS allowable, the crew will investigate and diagnose a feedwater leak inside containment. The SRO will direct a pre-emptive reactor trip due to the leak. The reactor will fail to trip from the control room. The SRO will direct the ATC and BOP to perform the IOA's of FR-S.1, "Response to Nuclear Power Generation – ATWS. The control rods will require manual insertion by the ATC. The reactor will be tripped via a local operator after being dispatched and the crew will return to E-0.

SIS will automatically actuate due to high containment pressure. Upon SIS actuation, 2SIS*MOV867A and 2SIS*MOV867B will fail to automatically open, the ATC will manually open valves to initiate SIS injection flow.

Additionally, the "B" train Hydrogen Analyzer will fail to automatically start due to the SI signal, the BOP will manually start the "B" Hydrogen Analyzer.

The crew will progress thru E-0, diagnose a faulted SG and transition to E-2, Faulted Steam Generator Isolation.

When the BOP attempts to isolate Aux feedwater flow to the "C" SG, it will be identified that 2FWE*HCV100B will fail to close from the Control Room. The BOP will take contingency actions using EOP Attachment A-1.24, AFW Throttle Valve Failure, to isolate AFW flow to the faulted "C" SG.

After the crew has completed isolation of the faulted SG, plant conditions will support SI termination, the crew will transition to ES-1.1, SI Termination, at which time the scenario will be terminated.

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

Appendix D**Scenario Outline****2L15N4**

Facility: **BVPS Unit 2** Scenario No. 4 Op Test No.: **BV2LOT15 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC 145:** 4.8% power, MOL, Rx S/U in progress, CB "D" @ 105 steps, RCS boron - 1349 ppm.

Turnover: Raise power to 15% to S/U main turbine IAW 2OM-52.4.A.

Critical Tasks:

1. **CT-11 (E-0.O)** Cnmt isolation
2. **CT-18 (E-3.A)** Crew isolates ruptured SG
3. **CT-19 (E-3.B)** Crew establishes/maintains RCS temperature
4. **CT-20 (E-3.C)** Crew depressurizes RCS to meet SI termination criteria

Event No.	Malf. No.	Event Type	Event Description
1		(R) ATC (N) SRO	Normal power increase to 15% IAW 2OM-52.4.A
2	CNH-CFW11	(C,A) BOP/SRO	2FWS*FCV479, Bypass Feedwater valve controller fails as is in AUTO, requires manual operation.
3	PMP-CHS002	(C,A) ATC/SRO SRO (TS)	2CHS*P21B, Charging/ HHSI pump shaft seizure.
4	XMT-MSC038A	SRO (TS)	2LMS*PT952, CNMT Pressure transmitter fails high
5	PPL02A	(M) ALL	Spurious Rx trip
6	RCS04B	(M) ALL	21B SG 520 gpm Tube Rupture
7	PPL07B	(C) ATC/SRO	2CHS*P21C, Charging / HHSI auto start failure
8	VLV-SEA015	(C) BOP/SRO	Train B CIA failure with 2CHS*MOV378 failing to auto close
9	VLV- RCS032,33,34	(C) ATC/SRO	PRZR PORV fails to close when opened for RCS depressurization in E-3, requires isolation.

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

E-0 → ES-0.1 → E-0 → E-3

The crew will take the shift at 4.8% power with instructions to raise power to 15% IAW the reactivity plan to S/U the main turbine. The following malfunctions will occur as power is raised.

After power is >5% and a dilution has been performed, the "B" Charging/ HHSI pump will experience a shaft seizure. The crew will respond with AOP 2.7.1, Loss of Charging or Letdown, and start the standby charging pump after isolating charging and letdown. The crew will dispatch operators to place the spare charging pump 2CHS*P21C in service on the 2DF bus. The SRO will address the applicable TS.

Also occurring at 5% power, the "A" bypass feedwater regulating valve controller will fail as is. As power rises, the controller problem will become evident requiring the BOP to manually control "A" SG level IAW AOP 2.4.1, Process Control Failure.

At 8% reactor power, Containment Pressure Transmitter, 2LMS*PT952, will fail high. The SRO will enter the instrument failure procedure and address the applicable TS.

When the reactor reaches 10% power, a spurious reactor trip will occur, the crew will enter E-0, Reactor Trip and Safety Injection. The crew will determine SI is not actuated nor required and transition to ES-0.1, Reactor Trip Response.

5 minutes after the reactor trip occurs a 520 gpm SGTR, steam generator tube rupture, will occur on the "B" SG. The crew will note that plant parameters are degrading and IAW ES-0.1, left hand page direction, actuate SI and return to E-0. The crew will diagnose a SGTR has occurred and will transition to E-3, Steam Generator Tube Rupture.

2CHS*P21C will fail to automatically start from the SIS but will start when the ATC attempts a manual start.

The safety injection actuation will fail to actuate the train "B" CIA signal, and train "A" CIA valve, 2CHS*MOV378 will fail to automatically close. While performing attachment A-0.11, Verification of Automatic Actions, the BOP will recognize the failure and isolate the containment penetration via either manually actuating Train "B" CIA or manually closing 2CHS*MOV378.

The crew will progress thru E-3, when a PORV is opened to depressurize the RCS it will fail to close, the ATC will then close the applicable MOV block valve to isolate the stuck open PORV.

The scenario will be terminated after the crew establishes a normal charging flowpath in E-3.

Expected procedure flow path is E-0 → ES-0.1 → E-0 → E-3