Facility: BV2 Date of Examination: _____

Examination Level: RO ☐ SRO ☒ Operating Test Number: _____

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	D	3AD-24: License Maintenance
Conduct of Operations	M	Reactivity Calculation / Shutdown Margin
Equipment Control	N	Review Tagout of AFW Pump
Radiation Control	D	2AD-023: Review/Approve Liquid Waste Discharge
Emergency Plan	M	2AD-015: Classification and PAR

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

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

Facility: BV2 Date of Examination: _____

Examination Level: RO ☒ SRO ☐ Operating Test Number: _____

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	D	3AD-24: License Maintenance
Conduct of Operations	M	Reactivity Calculation / Shutdown Margin
Equipment Control	N	Prepare Tagout of AFW Pump
Radiation Control		
Emergency Plan	N	Emergency Plan Notifications

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

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

Facility: Beaver Valley Unit 2			Date of Examination: 11/06/2017
Exam Level: RO	SRO-I X	SRO-U	Operating Test No.: _____

Control Room Systems:* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U		
System/JPM Title	Type Code*	Safety Function
a. 2CR-542: 001: CRDS, Nuclear Power Generation/ ATWS	A, S, D	1
b. 011: Pressurizer Level Control System, Transfer from manual to automatic, auto fails, transfer back to manual	A, S, N,	2
c. 006 ECCS; 2CR-044; FILL SIS Accumulator A	S, D	3
d.		
e. 006 A.C.; 2CR-023, Hot bus transfer (2B 4kV bus to 2A SSST	S, D	6
f. CVCS LT-115 fail high, manual makeup	S, A,N*	7
g. 008 CCWS; 2CR-157, Pri. Comp. Cooling water pump Test	S, D, L	8
h. CS Manual Actuation; 2CR-657 modified	A, S, M	5
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. 061 Aux Feed sys; 2PL-172: Align Service Water to MDAFW Pump Suction	L, D, E, R*?	4S
j. 2PL-086: Place Instrument Air Bypass Filters in service	D	8
k. ELAP DC Load Shed – one building	N, E	6

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

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

Facility: Beaver Valley Unit 2	Date of Examination: 11/06/2017
Exam Level: RO X SRO-I ☐ SRO-U ☐	Operating Test No.: _____

Control Room Systems:* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U		
System/JPM Title	Type Code*	Safety Function
a. 2CR-542: 001: CRDS, Nuclear Power Generation/ ATWS	A, S, D	1
b. 011: Pressurizer Level Control System, Transfer from manual to automatic, auto fails, transfer back to manual	A, S, N,	2
c. 006 ECCS; 2CR-044; FILL SIS Accumulator A	S, D	3
d. 005 RHRS; 2CR-136, Swap RHS trains	S, D, L*	4P
e. 006 A.C.; 2CR-023, Hot bus transfer (2B 4kV bus to 2A SSST	S, D	6
f. CVCS LT-115 fail high, manual makeup	S, A,N*	7
g. 008 CCWS; 2CR-157, Pri. Comp. Cooling water pump Test	S, D, L	8
h. CS Manual Actuation; 2CR-657 modified	A, S, M	5
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. 061 Aux Feed sys; 2PL-172: Align Service Water to MDAFW Pump Suction	L, D, E, R*?	4S
j. 2PL-086: Place Instrument Air Bypass Filters in service	D	8
k. ELAP DC Load Shed – one building	N, E	6

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

* Type Codes	Criteria for R /SRO-I/SRO-U

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

Facility: Beaver Valley Unit 2 Date of Exam: November 6, 2017

Tier	Group	RO K/A Category Points												SRO-Only Points				
		K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	Total	A2		G*		Total
1. Emergency and Abnormal Plant Evolutions	1	2	3	4	N/A			2	4	N/A		3	18					6
	2	1	1	2				2	1			2	9					4
	Tier Totals	3	4	6				4	5			5	27					10
2. Plant Systems	1	3	3	3	3	2	2	3	2	2	2	3	28					5
	2	1	1	1	1	1	0	1	1	1	1	1	10					3
	Tier Totals	4	4	4	4	3	2	4	3	3	3	4	38					8
3. Generic Knowledge and Abilities Categories		1			2			3			4		10	1	2	3	4	7
		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 outline sections (i.e., except for one category in Tier 3 of the SRO-only section, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 radiation control K/A is allowed if it is replaced by a K/A from another Tier 3 category.)

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

G* Generic K/As

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

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

ES-401	PWR Examination Outline							Form ES-401-2
Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (**RO**/SRO)								
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1					X		EA2.02 Ability to determine or interpret the following as applied to Rx trip: Proper actions to be taken if the automatic safety functions have not occurred	4.3/4.6	1
000008 (APE 8) Pressurizer Vapor Space Accident / 3			X				AK3.04: Knowledge of the reasons for RCP tripping requirements as they apply to the Pressurizer Vapor Space Accident	4.2/4.6	2
000009 (EPE 9) Small Break LOCA / 3						X	G2.4.6: Knowledge of EOP mitigation strategies.	3.7/4.7	3
000011 (EPE 11) Large Break LOCA / 3				X			EA1.06: Ability to operate and monitor the D/Gs as they apply to a Large Break LOCA	4.2/4.2	4
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4		X					AK2.07: Knowledge of the interrelations between the Reactor Coolant Pump Malfunctions (Loss of RC Flow) and the RCP seals	2.9/2.9	5
000022 (APE 22) Loss of Reactor Coolant Makeup / 2									
000025 (APE 25) Loss of Residual Heat Removal System / 4					X		AA2.05: Ability to determine and interpret the limitations on LPI flow and temperature rates of change as they apply to the Loss of Residual Heat Removal System	3.1/3.5	6
000026 (APE 26) Loss of Component Cooling Water / 8						X	G2.2.38: Knowledge of conditions and limitations in the facility license	3.6/4.5	7
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3									
000029 (EPE 29) Anticipated Transient Without Scram / 1						X	G2.4.49: Ability to perform without reference to procedures those actions that require immediate operation of system components and controls.	4.6/4.4	8
000038 (EPE 38) Steam Generator Tube Rupture / 3					X		EA2.04: Ability to determine or interpret radiation levels (MREM/hr) as they apply to a SGTR	3.9/4.2	9
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture—Excessive Heat Transfer / 4		X					AK2.02: Knowledge of the interrelations between the Steam Line Rupture and sensors and detectors	2.6/2.6	10
000054 (APE 54; CE E06) Loss of Main Feedwater /4									
000055 (EPE 55) Station Blackout / 6			X				EK3.01: Knowledge of the reasons for the length of time for which battery capacity is designed as it applies to the Station Blackout	2.7/3.4	11
000056 (APE 56) Loss of Offsite Power / 6					X		AA2.75: Ability to determine and interpret CVCS makeup as it applies to the Loss of Offsite Power	3.0/3.2	12
000057 (APE 57) Loss of Vital AC Instrument Bus / 6									
000058 (APE 58) Loss of DC Power / 6	X						AK1.01: Knowledge of the operational implications of the battery charger equipment and instrumentation as they apply to Loss of DC Power	2.8/3.1	13
000062 (APE 62) Loss of Nuclear Service Water / 4			X				AK3.03: Knowledge of the reasons for the guidance actions contained in EOP for loss of nuclear service water as they apply to the Loss of Nuclear Service Water	4.0/4.2	14
000065 (APE 65) Loss of Instrument Air / 8			X				AK3.03: Knowledge of the reasons for the knowing effects on plant operation of isolating certain equipment from instrument air as they apply to the Loss of Instrument Air	2.9/3.4	15

000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6	X						AK1.01: Knowledge of the operational implications of the definition of terms: volts, watts, amps, VARs, power factor as they apply to Generator Voltage and Electric Grid Disturbances	3.3/3.5	16
(W E04) LOCA Outside Containment / 3				X			EA1.1: Ability to operate and / or monitor components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features as they apply to the (LOCA Outside Containment)	4.0/4.0	17
(W E11) Loss of Emergency Coolant Recirculation / 4		X					EK2.2: Knowledge of the interrelations between the (Loss of Emergency Coolant Recirculation) and the facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility	3.9/4.3	18
(BW E04; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4									
K/A Category Totals:	2	3	4	2	4	3	Group Point Total:		18

ES-401	PWR Examination Outline							Form ES-401-2	
Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (**RO**/SRO)									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000001 (APE 1) Continuous Rod Withdrawal / 1									
000003 (APE 3) Dropped Control Rod / 1									
000005 (APE 5) Inoperable/Stuck Control Rod / 1									
000024 (APE 24) Emergency Boration / 1				X			AA1.16: Ability to operate and / or monitor the T-ave meters as they apply to Emergency Boration	3.3/3.2	19
000028 (APE 28) Pressurizer (PZR) Level Control Malfunction / 2						X	G2.4.46: Ability to verify that the alarms are consistent with the plant conditions.	4.2/4.2	20
000032 (APE 32) Loss of Source Range Nuclear Instrumentation / 7		X					AK2.01: Knowledge of the interrelations between the Loss of Source Range Nuclear Instrumentation and the power supplies, including proper switch positions	2.7/3.1	21
000033 (APE 33) Loss of Intermediate Range Nuclear Instrumentation / 7									
000036 (APE 36; BW/A08) Fuel-Handling Incidents / 8									
000037 (APE 37) Steam Generator Tube Leak / 3			X				AK3.06: Knowledge of the reasons for the normal operating precautions to preclude or minimize SGTR as they apply to the Steam Generator Tube Leak	3.6/4.1	22
000051 (APE 51) Loss of Condenser Vacuum / 4						X	G2.4.11: Knowledge of abnormal condition procedures.	4.0/4.2	23
000059 (APE 59) Accidental Liquid Radwaste Release / 9									
000060 (APE 60) Accidental Gaseous Radwaste Release / 9									
000061 (APE 61) Area Radiation Monitoring System Alarms / 7			X				AK3.02: Knowledge of the reasons for the guidance contained in alarm response for ARM system as they apply to the Area Radiation Monitoring (ARM) System Alarms	3.4/3.6	24
000067 (APE 67) Plant Fire On Site / 8									
000068 (APE 68; BW A06) Control Room Evacuation / 8									
000069 (APE 69; W E14) Loss of Containment Integrity / 5									
000074 (EPE 74; W E06 & E07) Inadequate Core Cooling / 4					X		EA2.03: Ability to determine or interpret the availability of turbine bypass valves for cooldown as they apply to Inadequate Core Cooling	3.8/4.1	25
000076 (APE 76) High Reactor Coolant Activity / 9				X			AA1.04: Ability to operate and/or monitor the failed fuel-monitoring equipment as they apply to the High Reactor Coolant Activity	3.2/3.4	26
000078 (APE 78*) RCS Leak / 3									
(W E01 & E02) Rediagnosis & SI Termination / 3									
(W E13) Steam Generator Overpressure / 4									
(W E15) Containment Flooding / 5									
(W E16) High Containment Radiation /9	X						EK1.3: Knowledge of the operational implications of the annunciators and conditions indicating signals, and remedial actions associated with the (High Containment Radiation) as they apply to the (High Containment Radiation)	3.0/3.3	27

(BW A01) Plant Runback / 1									
(BW A02 & A03) Loss of NNI-X/Y/7									
(BW A04) Turbine Trip / 4									
(BW A05) Emergency Diesel Actuation / 6									
(BW A07) Flooding / 8									
(BW E03) Inadequate Subcooling Margin / 4									
(BW E08; W E03) LOCA Cooldown—Depressurization / 4									
(BW E09; CE A13**; W E09 & E10) Natural Circulation/4									
(BW E13 & E14) EOP Rules and Enclosures									
(CE A11**; W E08) RCS Overcooling—Pressurized Thermal Shock / 4									
(CE A16) Excess RCS Leakage / 2									
(CE E09) Functional Recovery									
(CE E13*) Loss of Forced Circulation/LOOP/Blackout / 4									
K/A Category Point Totals:									9/4
	1	1	2	2	1	2	Group Point Total:		

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 1 (RO/SRO)												Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
003 (SF4P RCP) Reactor Coolant Pump									X			A3.05: Ability to monitor automatic operation of the RCPS, including RCP lube oil and bearing lift pumps	2.7/2.6	28
004 (SF1; SF2 CVCS) Chemical and Volume Control						X						K6.07: Knowledge of the effect of a loss or malfunction on the following CVCS components: Heat exchangers and condensers	2.7/2.8	29
005 (SF4P RHR) Residual Heat Removal					X						X	K5.05: Knowledge of the operational implications of the plant response during "solid plant": pressure change due to the relative incompressibility of water as they apply the RHRS	2.7/3.1	30
												G2.2.42: Ability to recognize system parameters that are entry-level conditions for Technical Specifications.	3.9/4.6	31
006 (SF2; SF3 ECCS) Emergency Core Cooling	X											K1.07: Knowledge of the physical connections and/or cause-effect relationships between the ECCS and the MFW system	2.9/3.3	32
007 (SF5 PRTS) Pressurizer Relief/Quench Tank					X							K5.02: Knowledge of the operational implications of the method of forming a steam bubble in the pressurizer as the apply to Pressurizer Relief Tank System	3.1/3.4	33
008 (SF8 CCW) Component Cooling Water	X						X					K1.02: Knowledge of the physical connections and/or cause-effect relationships between the CCWS and the Loads cooled by CCWS	3.3/3.4	35
												A1.04: Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CCWS controls including surge tank level.	3.1/3.2	36
010 (SF3 PZR PCS) Pressurizer Pressure Control				X								K4.01: Knowledge of Pressurizer Pressure Control System design feature(s) and/or interlock(s) which provide for the spray valve warm-up	2.7/2.9	37
012 (SF7 RPS) Reactor Protection			X						X			K3.03: Knowledge of the effect that a loss or malfunction of the RPS will have on the steam dump system (SDS)	3.1/3.3	38
												A3.05: Ability to monitor automatic operation of the RPS, including single and multiple channel trip indicators	3.6/3.7	39
013 (SF2 ESFAS) Engineered Safety Features Actuation				X		X						K4.13: Knowledge of the Engineered Safety Features Actuation System (ESFAS) design feature(s) and/or interlock(s) which provide for the MFW isolation/reset.	3.7/3.9	40
												K6.01: Knowledge of the effect of a loss or malfunction on the sensors and detectors will have on the ESFAS	2.7/3.1	41

022 (SF5 CCS) Containment Cooling								X				A2.03: Ability to (a) predict the impacts of fan motor thermal overload/high-speed operation on the CCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of fan motor thermal overload/high-speed operation	2.6/3.0	42
025 (SF5 ICE) Ice Condenser														
026 (SF5 CSS) Containment Spray		X						X				AK2.1: Knowledge of bus power supplies to the Containment Spray pumps A2.04: Ability to (a) predict the impacts of the failure of spray pump on the CCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of the Failure of spray pump when first going on recirculation.	3.4/3.6 3.7/4.1	43 44
039 (SF4S MSS) Main and Reheat Steam										X		A4.07: Ability to manually operate and/or monitor in the control room the steam dump valves	2.8/2.9	45
059 (SF4S MFW) Main Feedwater			X									K3.02: Knowledge of the effect that a loss or malfunction of the MFW will have on the AFW system	3.6/3.7	46
061 (SF4S AFW) Auxiliary/Emergency Feedwater	X											K1.07 knowledge of physical connections or cause/effect relationships between AFW and emergency water source.	3.6/3.8	47
062 (SF6 ED AC) AC Electrical Distribution							X					A1.01: Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ac distribution system controls including significance of D/G load limits	3.4/3.8	48
063 (SF6 ED DC) DC Electrical Distribution											X	G2.2.39: Knowledge of less than or equal to one hour Technical Specification action statements for systems.	3.9/4.5	49
064 (SF6 EDG) Emergency Diesel Generator		X		X								K2.03: Knowledge of bus power supplies to control power K4.01: Knowledge of ED/G system design feature(s) and/or interlock(s) which provide for trips while loading the ED/G (frequency, voltage, speed)	3.2/3.6 3.8/4.1	50 51
073 (SF7 PRM) Process Radiation Monitoring										X		A4.01: Ability to manually operate and/or monitor effluent release in the control room	3.9/3.9	52
076 (SF4S SW) Service Water		X										K2.08: Knowledge of bus power supplies to the ESF-actuated MOVs.	3.1/3.3	53
078 (SF8 IAS) Instrument Air			X									K3.02: Knowledge of the effect that a loss or malfunction of the Instrument Air System (IAS) will have on systems having pneumatic valves and controls.	3.4/3.6	54
103 (SF5 CNT) Containment							X				 X	A1.01: Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the containment system controls including containment pressure, temperature, and humidity. G2.4.4: Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures	3.7/4.1 4.5/4.7	55 34
053 (SF1; SF4P ICS*) Integrated Control														

K/A Category Point Totals:	3	3	3	3	2	2	3	2	2	2	3	Group Point Total:		28

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 2 (**RO**/SRO)											Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 (SF1 CRDS) Control Rod Drive		X										K2.05: Knowledge of bus power supplies to the M/G sets	3.1/3.5	56
002 (SF2; SF4P RCS) Reactor Coolant														
011 (SF2 PZR LCS) Pressurizer Level Control										X		A4.03: Ability to manually operate and/or monitor PZR heaters in the control room	3.3/3.1	57
014 (SF1 RPI) Rod Position Indication							X					A1.04: Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RPIS controls, including axial and radial power distribution.	3.5/3.8	58
015 (SF7 NI) Nuclear Instrumentation														
016 (SF7 NNI) Nonnuclear Instrumentation														
017 (SF7 ITM) In-Core Temperature Monitor								X				A2.01: Ability to (a) predict the impacts of the thermocouple open and short circuits on the ITM system; and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of thermocouple open and short circuits.	3.1/3.5	59
027 (SF5 CIRS) Containment Iodine Removal														
028 (SF5 HRPS) Hydrogen Recombiner and Purge Control														
029 (SF8 CPS) Containment Purge														
033 (SF8 SFPCS) Spent Fuel Pool Cooling				X								K4.03: Knowledge of design feature(s) and/or interlock(s) which provide for anti-siphon devices	2.6/2.9	61
034 (SF8 FHS) Fuel-Handling Equipment											X	G2.1.27: Knowledge of system purpose and/or function.	3.9/4.0	62
035 (SF 4P SG) Steam Generator					X							K5.03: Knowledge of operational implications of the shrink and swell concept as the apply to the S/Gs.	2.8/3.1	63
041 (SF4S SDS) Steam Dump/Turbine Bypass Control			X									K3.02: Knowledge of the effect that a loss or malfunction of the SDS will have on the RCS.	3.8/3.9	60
045 (SF 4S MTG) Main Turbine Generator														
055 (SF4S CARS) Condenser Air Removal														
056 (SF4S CDS) Condensate														
068 (SF9 LRS) Liquid Radwaste									X			A3.02: Ability to monitor automatic operation of the Liquid Radwaste System including automatic isolation.	3.6/3.6	64
071 (SF9 WGS) Waste Gas Disposal														
072 (SF7 ARM) Area Radiation Monitoring	X											K1.05: Knowledge of the physical connections and/or cause- effect relationships between the ARM system and the Main and Reheat Steam System	2.8/2.9	65
075 (SF8 CW) Circulating Water														

079 (SF8 SAS**) Station Air														
086 Fire Protection														
050 (SF 9 CRV*) Control Room Ventilation														
K/A Category Point Totals:														
	1	1	1	1	1	0	1	1	1	1	1	Group Point Total:		10

Facility: Beaver Valley Unit 2		Date of Exam: November 6, 2017				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.13	Knowledge of facility requirements for controlling vital/controlled access.	2.5	66		
	2.1.3	Knowledge of shift or short-term relief turnover practices.	3.7	67		
	2.1.					
	2.1.					
	2.1.					
	2.1.					
	Subtotal			2		
2. Equipment Control	2.2.13	Knowledge of tagging and clearance procedures.	4.1	68		
	2.2.6	Knowledge of the process for making changes to procedures.	3.0	69		
	2.2.12	Knowledge of surveillance procedures.	3.7	70		
	2.2.					
	2.2.					
	2.2.					
	Subtotal			3		
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions	3.2	71		
	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.	3.2	72		
	2.3.					
	2.3.					
	2.3.					
	2.3.					
	Subtotal			2		
4. Emergency Procedures/Plan	2.4.25	Knowledge of fire protection procedures.	3.3	73		
	2.4.17	Knowledge of EOP terms and definitions.	3.9	74		
	2.4.29	Knowledge of the emergency plan.	3.1	75		
	2.4.					
	2.4.					
	2.4.					
	Subtotal			3		
Tier 3 Point Total			Tier 3 Point Total		10	7

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Tier	Group	RO K/A Category Points												SRO-Only Points								
		K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	Total	A2		G*		Total				
1. Emergency and Abnormal Plant Evolutions	1				N/A					N/A			18	3		3		6				
	2												9	3		1		4				
	Tier Totals												27	6		4		10				
2. Plant Systems	1												28	2		3		5				
	2												10		1	2		3				
	Tier Totals												38	3		5		8				
3. Generic Knowledge and Abilities Categories		1		2		3		4		10				1	2	3	4	7				
														2	2	1	2					

Note: 1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outline sections (i.e., except for one category in Tier 3 of the SRO-only section, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 radiation control K/A is allowed if it is replaced by a K/A from another Tier 3 category.)

2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ±1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points, and the SRO-only exam must total 25 points.

3. Systems/evolutions within each group are identified on the outline. Systems or evolutions that do not apply at the facility should be deleted with justification. Operationally important, site-specific systems/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 for guidance regarding the elimination of inappropriate K/A statements.

4. Select topics from as many systems and evolutions as possible. Sample every system or evolution in the group before selecting a second topic for any system or evolution.

5. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.

6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.

7. The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.

8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' IRs for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above. If fuel-handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2. (Note 1 does not apply). Use duplicate pages for RO and SRO-only exams.

9. For Tier 3, select topics from Section 2 of the K/A catalog and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

G* Generic K/As

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

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

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

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1									
000008 (APE 8) Pressurizer Vapor Space Accident / 3									
000009 (EPE 9) Small Break LOCA / 3									
000011 (EPE 11) Large Break LOCA / 3									
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4						X	2.4.35 Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects.	3.8/4.0	76
000022 (APE 22) Loss of Reactor Coolant Makeup / 2									
000025 (APE 25) Loss of Residual Heat Removal System / 4									
000026 (APE 26) Loss of Component Cooling Water / 8									
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3									
000029 (EPE 29) Anticipated Transient Without Scram / 1					X		EA2.09 Ability to determine or interpret the occurrence of a main turbine/reactor trip as it applies to an ATWS	4.4/4.5	77
000038 (EPE 38) Steam Generator Tube Rupture / 3									
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture—Excessive Heat Transfer / 4									
000054 (APE 54; CE E06) Loss of Main Feedwater /4						X	2.4.6 Knowledge of EOP mitigation strategies.	3.7/4.7	78
000055 (EPE 55) Station Blackout / 6									
000056 (APE 56) Loss of Offsite Power / 6									
000057 (APE 57) Loss of Vital AC Instrument Bus / 6									
000058 (APE 58) Loss of DC Power / 6						X	2.4.11 Knowledge of abnormal condition procedures	4.0/4.2	79
000062 (APE 62) Loss of Nuclear Service Water / 4					X		AA2.01 Ability to determine and interpret the location of a leak in the SWS as it applies to the Loss of Nuclear Service Water	2.9/3.5	80
000065 (APE 65) Loss of Instrument Air / 8									
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6									
(W E04) LOCA Outside Containment / 3									
(W E11) Loss of Emergency Coolant Recirculation / 4					X		EA2.1 Ability to determine and interpret facility conditions and selection of appropriate procedures during abnormal and emergency operations as it applies to Loss of Emergency Coolant Recirculation.	3.4/4.2	81
(BW E04; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4									

K/A Category Totals:					3	3	Group Point Total:		6

ES-401	PWR Examination Outline							Form ES-401-2	
	Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (RO/**SRO**)								
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000001 (APE 1) Continuous Rod Withdrawal / 1									
000003 (APE 3) Dropped Control Rod / 1					X		AK2.05 Knowledge of the interrelations between the Dropped Control Rod and control rod drive power supplies and logic circuits	2.5/2.8	82
000005 (APE 5) Inoperable/Stuck Control Rod / 1									
000024 (APE 24) Emergency Boration / 1									
000028 (APE 28) Pressurizer (PZR) Level Control Malfunction / 2									
000032 (APE 32) Loss of Source Range Nuclear Instrumentation / 7									
000033 (APE 33) Loss of Intermediate Range Nuclear Instrumentation / 7									
000036 (APE 36; BW/A08) Fuel-Handling Incidents / 8									
000037 (APE 37) Steam Generator Tube Leak / 3									
000051 (APE 51) Loss of Condenser Vacuum / 4									
000059 (APE 59) Accidental Liquid Radwaste Release / 9					X		AK2.02 Knowledge of the interrelations between the Accidental Liquid Radwaste Release and Radioactive-liquid monitors	2.7/2.8	83
000060 (APE 60) Accidental Gaseous Radwaste Release / 9						X	G2.4.30: Knowledge of which events related to system operations/status should be reported to outside agencies	2.2/3.6	84
000061 (APE 61) Area Radiation Monitoring System Alarms / 7									
000067 (APE 67) Plant Fire On Site / 8									
000068 (APE 68; BW A06) Control Room Evacuation / 8									
000069 (APE 69; W E14) Loss of Containment Integrity / 5									
000074 (EPE 74; W E06 & E07) Inadequate Core Cooling / 4									
000076 (APE 76) High Reactor Coolant Activity / 9									
000078 (APE 78*) RCS Leak / 3									
(W E01 & E02) Rediagnosis & SI Termination / 3					X		EA2.1 Ability to determine and interpret facility conditions and selection of appropriate procedures during abnormal and emergency operations as it applies to SI termination.	3.3/4.2	85
(W E13) Steam Generator Overpressure / 4									
(W E15) Containment Flooding / 5									
(W E16) High Containment Radiation /9									
(BW A01) Plant Runback / 1									
(BW A02 & A03) Loss of NNI-X/Y/7									
(BW A04) Turbine Trip / 4									

(BW A05) Emergency Diesel Actuation / 6										
(BW A07) Flooding / 8										
(BW E03) Inadequate Subcooling Margin / 4										
(BW E08; W E03) LOCA Cooldown—Depressurization / 4										
(BW E09; CE A13**; W E09 & E10) Natural Circulation/4										
(BW E13 & E14) EOP Rules and Enclosures										
(CE A11**; W E08) RCS Overcooling—Pressurized Thermal Shock / 4										
(CE A16) Excess RCS Leakage / 2										
(CE E09) Functional Recovery										
(CE E13*) Loss of Forced Circulation/LOOP/Blackout / 4										
K/A Category Point Totals:										
					3	1	Group Point Total:		4	

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 1 (RO/**SRO**)											Form ES-401-2		
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
003 (SF4P RCP) Reactor Coolant Pump														
004 (SF1; SF2 CVCS) Chemical and Volume Control														
005 (SF4P RHR) Residual Heat Removal														
006 (SF2; SF3 ECCS) Emergency Core Cooling														
007 (SF5 PRTS) Pressurizer Relief/Quench Tank								X				A2.01 Ability to (a) predict the impacts of a stuck-open PORV or code safety on the PRTS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of a stuck-open PORV or code safety.	3.9/4.2	86
008 (SF8 CCW) Component Cooling Water														
010 (SF3 PZR PCS) Pressurizer Pressure Control														
012 (SF7 RPS) Reactor Protection											X	2.4.41 Knowledge of the Emergency Action Level thresholds and classifications.	2.9/4.6	87
013 (SF2 ESFAS) Engineered Safety Features Actuation											X	2.2.37 Ability to determine operability and/or availability of safety related equipment.	3.6/4.6	88
022 (SF5 CCS) Containment Cooling												.		
025 (SF5 ICE) Ice Condenser														
026 (SF5 CSS) Containment Spray														
039 (SF4S MSS) Main and Reheat Steam														
059 (SF4S MFW) Main Feedwater								X				A2.11 Ability to (a) predict the impacts of the failure of feedwater control system on the MFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of the failure of feedwater control system	3.0/3.3	90
061 (SF4S AFW) Auxiliary/Emergency Feedwater														
062 (SF6 ED AC) AC Electrical Distribution											X	G2.2.22 Knowledge of LCOs and safety limits	4.04.7	89
063 (SF6 ED DC) DC Electrical Distribution														
064 (SF6 EDG) Emergency Diesel Generator														
073 (SF7 PRM) Process Radiation Monitoring														
076 (SF4S SW) Service Water														
078 (SF8 IAS) Instrument Air														

103 (SF5 CNT) Containment														
053 (SF1; SF4P ICS*) Integrated Control														
K/A Category Point Totals:								2			3	Group Point Total:		5

ES-401	PWR Examination Outline Plant Systems—Tier 2/Group 2 (RO/**SRO**)												Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 (SF1 CRDS) Control Rod Drive														
002 (SF2; SF4P RCS) Reactor Coolant														
011 (SF2 PZR LCS) Pressurizer Level Control														
014 (SF1 RPI) Rod Position Indication								X				A2.06 Ability to (a) predict the impacts of the loss of LVDT; and (b) based on those on those predictions, use procedures to correct, control, or mitigate the consequences of the loss of LVDT	2.6/3.0	91
015 (SF7 NI) Nuclear Instrumentation														
016 (SF7 NNI) Nonnuclear Instrumentation														
017 (SF7 ITM) In-Core Temperature Monitor											X	2.2.22 Knowledge of limiting conditions for operations and safety limits.	4.0/4.7	92
027 (SF5 CIRS) Containment Iodine Removal														
028 (SF5 HRPS) Hydrogen Recombiner and Purge Control														
029 (SF8 CPS) Containment Purge														
033 (SF8 SFPCS) Spent Fuel Pool Cooling														
034 (SF8 FHS) Fuel-Handling Equipment														
035 (SF 4P SG) Steam Generator														
041 (SF4S SDS) Steam Dump/Turbine Bypass Control														
045 (SF 4S MTG) Main Turbine Generator														
055 (SF4S CARS) Condenser Air Removal														
056 (SF4S CDS) Condensate														
068 (SF9 LRS) Liquid Radwaste														
071 (SF9 WGS) Waste Gas Disposal														
072 (SF7 ARM) Area Radiation Monitoring														
075 (SF8 CW) Circulating Water														
079 (SF8 SAS**) Station Air														
086 Fire Protection											X	2.4.11 Knowledge of abnormal condition procedures.	4.0/4.2	93
050 (SF 9 CRV*) Control Room Ventilation														
K/A Category Point Totals:														

								1			2	Group Point Total:		3

Facility: Beaver Valley Unit 2		Date of Exam: November 6, 2017				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.35	Knowledge of fuel handling responsibilities of SROs			3.9	94
	2.1.34	Knowledge of primary and secondary plant chemistry limits			3.5	95
	2.1.					
	2.1.					
	2.1.					
	2.1.					
	Subtotal					
2. Equipment Control	2.2.36	Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations.			4.2	96
	2.2.12	Knowledge of surveillance procedures.			4.1	97
	2.2.					
	2.2.					
	2.2.					
	2.2.					
	Subtotal					
3. Radiation Control	2.3.7	Ability to comply with radiation work permit requirements during normal or abnormal conditions.			3.6	98
	2.3.					
	2.3.					
	2.3.					
	2.3.					
	2.3.					
	Subtotal					
4. Emergency Procedures / Plan	2.4.42	Knowledge of emergency response facilities			3.8	99
	2.4.22	Knowledge of the bases for prioritizing safety functions during abnormal/emergency operations			4.4	100
	2.4.					
	2.4.					
	2.4.					
	2.4.					
	Subtotal					
Tier 3 Point Total				10	7	7

Tier/Group	Randomly Selected K/A	Reason for Rejection

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1 #12	056 AA2.25	Overlaps with already written question #46. Reselecting in same system and selected AA2.75
1/2 #20	028 G2.1.19	Reselecting on basis of overlap with operating test scenarios. Selecting a new generic in the same system. Selected G2.4.46
2/1 #34	007 G2.4.4	Overlaps with already written question #86. There are several questions on PRTs. Randomly Reselecting a new system in same tier/group that hasn't been selected twice with a generic. Selected 103 Containment G2.4.4
2/1 #44	026 CS A3.01	Reselecting based on the overlap with an operating test JPM. Reselected in the same system. Only other A3 K/A (A3.02) would also overlap with JPM. JPM is to align CS system. Therefore reselected in A2 due to being light in A2 and heavy in A3→randomly reselected A2.01
2/1 #54	078 K3.03	BV cannot cross tie units. Reselecting within the same system and K/A category. Randomly reselected K3.02
2/2 #60	028 K3.01	Hydrogen recombiners are retired in place and only have purgers. Randomly Reselected system 075 Circulating Water K3.07 due to it being the only one ≥2.5
1/2 #84	060 G2.1.25	Not an SRO function. Randomly re-selected another generic to be G2.4.41 on the same system.
2/2 #92	075 G2.2.22	There is no LCO or safety limit for Circulating water. Used this K/A on a random sampling of the remaining eligible Tier 2 Group systems and used it on 017 In-Core Temperature Monitor.
2/1 #44	026 A2.01	Not operationally valid. Too difficult to write a question for. Randomly reselected A2.04
2/2 #60	075 K3.07	Circulating Water does not have any inputs into ESFAS. Reselected System 041 Steam Dump/Turbine Bypass Control K3.02
1/2 #84	060 G2.4.41	G2.4.41 was already used on question 87 and too similar of a question. Reselected G2.4.30
1/2 #83	059 AK 2.01	Gas monitor KA in Liquid Waste system
2/2 #89	022 G 2.2.3	Multi Unit license KA, NA BV2
1/1 #1	007 EA 2.05	Seen in every sim scenario
2/1 #47	061 K 1.10	No connection between AFW and diesel fuel oil
