

Facility: <u>BV2</u>		Date of Examination: _____
Examination Level: RO <input checked="" type="checkbox"/> SRO <input type="checkbox"/>		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	$\leq 9/\leq 8/\leq 4$	
(E)mergency or abnormal in-plant	$\geq 1/\geq 1/\geq 1$	
(EN)gineered safety feature	$\geq 1/\geq 1/\geq 1$ (control room system)	
(L)ow-Power/Shutdown	$\geq 1/\geq 1/\geq 1$	
(N)ew or (M)odified from bank including 1(A)	$\geq 2/\geq 2/\geq 1$	
(P)revious 2 exams	$\leq 3/\leq 3/\leq 2$ (randomly selected)	
(R)CA	$\geq 1/\geq 1/\geq 1$	
(S)imulator		

Facility: Beaver Valley Unit 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	4-6/4-6 /2-3
(C)ontrol room	
(D)irect from bank	$\leq 9/\leq 8/\leq 4$
(E)mergency or abnormal in-plant	$\geq 1/\geq 1/\geq 1$
(EN)gineered safety feature	$\geq 1/\geq 1/\geq 1$ (control room system)
(L)ow-Power/Shutdown	$\geq 1/\geq 1/\geq 1$
(N)ew or (M)odified from bank including 1(A)	$\geq 2/\geq 2/\geq 1$
(P)revious 2 exams	$\leq 3/\leq 3/\leq 2$ (randomly selected)
(R)CA	$\geq 1/\geq 1/\geq 1$
(S)imulator	

Appendix D**Scenario Outline**

Facility: **BVPS Unit 2** Scenario No. 1 Op Test No.: 2LOT17 NRC
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC-184:** ~90% power, MOL, CB "D" @ 210 steps, RCS boron - 915 ppm.

Turnover: IAW 2OM-52.4.B, Load Follow, Reduce power to remove 2HDH-P22B from service. Control Rods are in Manual due to ongoing MSP.

Critical Tasks:

- 1. Initiate Feed and Bleed IAW FR-H.1 criteria.**
- 2. Restore AFW flow within 10 minutes of EDG start.**
- 3. Start SWE pump before EDG trip due to loss of cooling.**
- 4. Dispatch operator to start EDG prior to step 28 of FR-H.1.**

Event No.	Malf. No.	Event Type	Event Description
1a		(R) ATC (N) BOP, SRO	Reduce power using load follow.
1b		(N) BOP, SRO	Shutdown 2HDH-P22B when discharge flow is zero.
2	CNH-CFW12C	(C,A) BOP, SRO	"B" SG Feedwater flow control valve, 2FWS-FCV488 controller malfunction, requires manual control.
3	SIS02B	(C,A) BOP, SRO (TS) SRO	SIS Accumulator, 2SIS-TK21B gas space leak.
4a	XMT-RCS019A	(C,A) ATC, SRO (TS) SRO	PRZR level transmitter (2RCS*LT460) fails low,
4b		(N) ATC, SRO	Let down restoration using 2OM-7.4.AB.
5	FLX-CFW07	(M) All	Loss of feedwater due to large break on condensate pump discharge header.
6a	SWD01	(M) All	Reactor trip with loss of offsite power, SG safety valves fail open.
6b	DSG01B		2-2 EDG fails to start automatically or from the Control room.
7,8	PMP-AFW001 LOA-AFW022	(M) All	AFW pump failures, requires transition to FR-H.1.
9a 9b	PMP-SWS007 PPL07B	(C) ATC, SRO (C) BOP, SRO	2-2 EDG loading failures after local start, 2SWS*P21B failure, ATC required to start 2SWE*P21B. BOP required to start 2FWE*P23B.

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

E-0 → FR-H.1

Appendix D

Scenario Outline

Facility: **BVPS Unit 2** Scenario No. 2 Op Test No.: **2LOT17 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC-185 (18): 100% power, MOL, equilibrium Xe, CB "D" @ 229 steps, RCS boron - 890 ppm.**

Turnover: **Maintain 100% power,
 2CHS*P21A inservice, 2CHS*P21B in standby.
 2CHS*P22B inservice, 2CHS*P22A in standby.
 2SWS*P21C inservice on 2DF bus due to failure of 2SWS*P21B.**

Critical Tasks: **1. Start EDG locally and start SWS pump before EDG fails due to loss of cooling.
 2. Closes PORV block valve prior to exiting ECA-0.0.
 3. Performs correct procedure transition from ECA-0.0.
 4. Crew manually trips the reactor from the Control room before FR-S.1 entry.**

Event No.	Malf. No.	Event Type	Event Description
1a	IMF XMT-MSS027A	(N) BOP, SRO	2MSS*PT101C fails high causing 2SVS*PCV101C to fail open, Rx power increases requiring power reduction.
1b	IMF CNH-MSS04A	(TS) SRO	During manual closure attempt, 2SVS*PCV101C fails at 90%, requires local isolation.
2a	NIS03D	(I,A) ATC, SRO	N-44 fails ↑ auto rod ↓ (AOP 2.1.3)
2b		(N) BOP, SRO (TS) SRO	Removes N-44 from service (AOP 2.2.1C)
3	HIV01E	(C,A) ATC, SRO (TS) SRO	AE 4KV bus fault, (AOP 2.36.2) requires ATC to start standby charging pump.
4		(R) ATC (N) BOP, SRO	TS required Shutdown.
5	VLV-MSS005	(M) All	Spurious closure of Main steam isolation valve.
6	PPL01A,B	(C) ATC, SRO	Automatic reactor trip failure, requires crew to manually trip the reactor from the Control Room.
7	PPL10A,B	(C) BOP, SRO	Automatic Main steam line isolation failure, requires BOP to manually isolate main steam lines.
8	SWD01 DSG01B	(M) All	Loss of all AC upon transfer to offsite power, requires entry into ECA-0.0, 2-2 EDG starts and trips on overspeed.
9	XMT-RCS030A	(C) ATC, SRO	Master Pressure Controller, 2RCS*PK444A fails high in Auto causing PORV 455C to fails open, MOV block valve is de-energized until EDG is restored.
10	PPL07B	(C) BOP, SRO	2SWS*P21C fails to auto load after EDG is restored, requires manual start.

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

E-0 → ECA-0.0 → ECA-0.2

Appendix D**Scenario Outline****2L17N3**

Facility: **BVPS Unit 2** Scenario No. 3 Op Test No.: **2LOT17 NRC**
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC-186 (17): 75% power, MOL, equilibrium Xe, CB "D" @ 189 steps, RCS boron - 980 ppm.**

Turnover: **Maintain 75% power,**

Critical Tasks:

- 1. Crew manually trips the Turbine before entry into ECA-2.1 (CT-13)**
- 2. Crew manually opens high head SI isolation valves. (CT-6)**
- 3. Crew isolates feed flow into and steam flow from ruptured SG (CT-18)**

Event No.	Malf. No.	Event Type	Event Description
1	XMT-MSS047A	(I,A) BOP, SRO (TS) SRO	2MSS*PT476 drifts low, "A" SG steam pressure.
2	RCS04B	(C, A) ATC, SRO (TS) SRO	B SG Tube Leak (AOP 2.6.4).
3		(R) ATC BOP, SRO	Shift Manager cues crew to shut down the plant, if crew does not make determination.
4	EHC08	(C,A) BOP, SRO	Turbine Vibrations require turbine trip. Crew trips Reactor and Turbine fails to automatically trip, requiring manual turbine trip. (CT-13)
5	IMF CRF08-H14 IMF CRF08-P8	(C, A) ATC	Two stuck rods, requiring emergency boration
6	RCS04B	(M) All	B SGTR 550 gpm occurs after emergency boration flow
7	VLV-SIS025 VLV-SIS070	(C, A) ATC	2SIS*MOV867A and 2SIS*MOV867B fail to open on SI signal, requiring manual operation to ensure high head SI flow (CT-6)
8	VLV-AFW025 VLV-AFW028	(C) BOP, SRO	"B" SG steam supply to 2FWE*P22 failed open, (2MSS*SOV105B and 105E) (CT-18)
9	MSS02B	(M) All	Break occurs between MSIVs and Containment (Fault) when MSIV close, requires transition to E-2 → E-3 → ECA-3.1.

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

E-0 → ES-0.1 → E-0 → E-3 → E-2 → E-3 → ECA-3.1

Appendix D

Scenario Outline

2L17N4

Facility: **BVPS Unit 2** Scenario No.: 4 Op-Test No.: 2LOT17 NRC

Examiners: _____ Operators: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC187 (B/U IC-172)** 4.9% power, BOL, CB "D" @ 110 steps, RCS Boron – 1750 ppm

Turnover: Raise power to 10-14% and load the turbine generator in accordance with procedure for plant startup

Critical Tasks:

1. **Start the Turbine Driven AFP before transition out of E-0 (CT-4)**
2. **Manually initiating containment isolation phase A (CT-11)**
3. **Manually trip the RCPs (CT-16)**

Event No.	Malf. No.	Event Type*	Event Description
1		(R) ATC (N) SRO	Raise power 10-14%
2	XA4i028L	(C,A) ATC	Blender fails to stop after dilution is complete.
3	VLV-CFW022	(I, A) BOP	Hotwell level high dump valve, 2CNS-MOV105 spuriously opens, requires closing valve.
4	NIS07B	(I,A) ATC (TS) SRO	N36, Intermediate Range power fuse blows
5	RCS02A	(C,A) ATC (TS) SRO	"A" Loop RCS Leak, AOP 2.6.7, TS
6	CNH-CHS01A VLV-CHS013	(C,A) ATC	2CHS*FCV122 fails to fully close, requires closing of 289 & use of 2CHS*HCV186
7	RCS02A	M	"A" loop, SBLOCA ramps in, requires manual reactor trip
8	VLV-AFW024 thru VLV-AFW029	(C,A) BOP	Turbine driven AFW pump auto start failure
9	PPL08B VLV-SEA015 VLV-CAS002, 004	(C,A), BOP	Containment Isolation phase A Train B fails to actuate. Various Train A valves fail to automatically close

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

Procedure Flowpath: E-0→ E-1→ ES-1.2

The crew will take the shift at 4.9% power with instructions to raise power to 10-14% to place the Turbine in service IAW the reactivity plan and 2OM-52.4A. The ATC will initiate a dilution and withdraw the rods. No malfunctions will occur until the desired power increase is observed.

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 Evolution	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	
	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	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.

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	

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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	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	2.1.1 3	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	2.2.1 3	Knowledge of tagging and clearance procedures.	4.1	68		
	2.2.6	Knowledge of the process for making changes to procedures.	3.0	69		
	2.2.1 2	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		
	2.3.1 2	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	2.4.2 5	Knowledge of fire protection procedures.	3.3	73		
	2.4.1 7	Knowledge of EOP terms and definitions.	3.9	74		
	2.4.2 9	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

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				N/A					N/A			18	3		3	6
	2												9	3		1	4
	Tier Totals													27	6		4
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.

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

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															

[illegible]

								1		2	Group Point Total:		3
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Facility: Beaver Valley Unit 2			Date of Exam: November 6, 2017			
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.3 5	Knowledge of fuel handling responsibilities of SROs			3.9	94
	2.1.3 4	Knowledge of primary and secondary plant chemistry limits			3.5	95
	2.1.					
	2.1.					
	2.1.					
	2.1.					
	Subtotal					
2. Equipment Control	2.2.3 6	Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations.			4.2	96
	2.2.1 2	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	2.4.4 2	Knowledge of emergency response facilities			3.8	99
	2.4.2 2	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

[illegible]

Facility: <u>BV2</u>		Date of Examination: _____
Examination Level: RO <input type="checkbox"/> SRO <input checked="" type="checkbox"/>		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)