

Appendix D**Scenario Outline**

Facility:	BVPS Unit 2	Scenario No. 1	Op Test No.: <u>2LOT19 NRC</u>
Examiners:	_____	Candidates:	SRO
	_____		ATC
	_____		BOP

Initial Conditions: IC ____ (17): 75% power, MOL, Equ. XE Conditions, CB "D" @ 185 steps, RCS boron - 980 ppm.

Turnover: Maintain 75% power.

Critical Tasks:

1. CT-10 (E-0.M) Close Upstream Block PORV MOV.
2. CT-13 (E-0.Q) Manually trip the turbine.
3. CT-43 (FR-H.1.A) Establish Feedwater flow into at least one SG.

Event No.	Malf. No.	Event Type	Event Description
1	XMT-RCS019A	(C,A) ATC, SRO	2RCS-LK459F demand drifts to 0% in automatic, reducing charging flow, requires manual PRZR level control.
2	XMT-MSS053A	(C,A) BOP, SRO (TS) SRO	21C steam generator Feed flow transmitter 2FWS*FT496 drifts low.
3	RCS02A	(C,A) ATC, SRO (TS) SRO	25 gpm RCS letdown line leak. (isolable)
4		(R) ATC (N) BOP, SRO	Management directed Emergency S/D at 2%/min, IAW AOP 2.51.1
5	RCS02A	(M) ALL	520 gpm LOCA on RCS loop B cold leg requiring a reactor trip and safety injection.
6	EHC08A	(C) BOP, SRO	Automatic turbine trip failure, manual trip successful.
7	PMP-AFW001, 2, LOA-AFW022	(M) ALL	Terry turbine and 23A motor driven AFW pumps trip on start. 23B motor driven AFW pump shaft sheared. Crew enters FR-H.1 to restore feedwater via a main feed pump.
8	VLV-RCS034A	(C) ATC, SRO	After re-entry into E-0, MPC fails high, PORV 455C opens and sticks, requires manual closure of block valve and spray valves.
9	PMP-MSC011	(C) BOP, SRO	EDG 2-1 ventilation fan fails to auto start on SI/EDG start.

(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 75% power, MOL, the pressurizer master level controller will fail to zero. The crew will diagnose the indications and IAW AOP 2.4.1, the ATC will manually control PRZR level.

The “C” SG feed flow transmitter, 2FWS*FT496, will then drift low. The BOP will take manual control of feedwater flow and stabilize the plant. The SRO will enter the instrument failure procedure, 2OM-24.4.IF, Attachment 2. SRO will address TS.

A 25 gpm leak will develop on the letdown line outside of CNMT in “A” penetrations area. First indication will be an ALERT on the SLCRS ventilation rad monitor. The crew will then recognize VCT level is decreasing and enter AOP 2.6.7, “Excessive Primary Plant Leakage”, when the ATC isolates letdown, the leak will be isolated. The crew determines that the leak has been isolated and begins efforts to place excess letdown in service.

After the crew has determined that the leak is isolated, Management will direct the crew to S/D at 2%/minute IAW AOP 2.51.1.

After the Reactor power has been lowered to <68%, a 520 gpm LOCA will occur on the “B” loop cold leg. 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.

When “Verifying AFW Status” in E-0, the crew will identify that all auxiliary feedwater pumps have failed, the SRO will transition to FR-H.1. IAW FR-H.1 direction the crew will restore feedwater flow by starting a main feedwater pump. After feed flow is verified, the SRO will return to E-0.

After the crew returns to E-0, the Master Pressure controller will fail high causing PORV 455C and the PRZR spray valves to open. The ATC will identify the failure, unsuccessfully attempt to close the PORV and close the motor operated block valve then close both spray valves.

After returning to E-0, the SRO will determine that the RCS is not intact and transition to E-1. The scenario will be terminated at the lead evaluators discretion after the crew exits E-1.

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

Appendix D**Scenario Outline**

Facility: **BVPS Unit 2** Scenario No. 2 Op Test No.: 2LOT19 NRC
 Examiners: _____ Candidates: _____ SRO
 _____ ATC
 _____ BOP

Initial Conditions: **IC ____ (18):** 100% power, MOL, Equ. XE Conditions, CB "D" @ 230 steps, RCS boron - 890 ppm.

Turnover: Maintain 100% power.

Critical Tasks: **1. CT-2 (E-0.D) Actuate SIS.**
2. CT-12 (E-0.P) Actuate Main steam line isolation.
3. CT-17 (E-2.A) Isolate Faulted SG.

Event No.	Malf. No.	Event Type	Event Description
1	XMT-LDS003A	(C,A) ATC, SRO	VCT level transmitter, 2CHS-LT115 fails low.
2	NIS07B	(C,A) BOP, SRO (TS) SRO	N-36, Instrument power fuse blows, requires removal from service and compensatory actions.
3	CRF03-F6	(C,A) BOP, SRO (TS) SRO	Control Bank D, Rod F06 drops.
4	FLX-CFW33	(M) ALL	C SG feedwater leak inside Containment.
5	VLV-MSS013	(C) ATC, SRO	Condenser steam dump valve 2MSS-PCV106A stuck open, manual main steamline isolation required.
6	PPL05A, PPL05B	(C) ATC, SRO	Automatic safety injection actuation failure.
7	PPL07A	(C) ATC, SRO	Charging/HHSI pump, 2CHS*P21A auto start failure upon SI actuation.
8	CNH-AFW02A	(C) BOP, SRO	2FWE*HCV100B fails to 100%, requires securing AFW pump.
9	PMP-MSC036 PMP-MSC037	(C) BOP, SRO	Leak Collection Filtered Exhaust Fans, 2HVS*FN204A and B, trip on Rx trip, requires manual starting of 2HVS*FN204B.
10			
11			

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

E-0 → E-2 → ES-1.1

After taking the shift at 100% power, MOL, VCT level transmitter, 2CHS-LT115 will fail low causing an auto makeup to occur. The ATC will identify the LT failure and stop the auto makeup IAW AOP 2.4.1 (Process Control Failure), the crew will then respond to the LT failure IAW the Instrument Failure procedure, 2OM-7.4.IF, Attachment 1.

Intermediate Range channel, N-36, instrument power fuse will blow, the crew will enter AOP 2.1.2B, and take the channel out of service, the SRO will evaluate technical specifications.

Bank D control rod, F06 will then drop, the crew will identify the rod drop, IAW AOP 2.1.8 IOA's, the ATC will verify only one rod has dropped. The SRO will direct the BOP to lower turbine load to raise RCS temperature while the SRO reviews applicable technical specifications.

A feedwater leak will occur on the "C" main feedline inside CNMT, the BOP will identify "C" SG feedflow increasing while level is decreasing, the ATC will identify CNMT pressure rising. The SRO will direct the ATC to manually trip the Rx.

While stabilizing the plant in E-0, the crew will identify that a condenser steam dump valve is failed open requiring a manual mainsteam line isolation to be initiated to stop the RCS cooldown.

The crew will identify that SI is required and did not actuate automatically, the ATC will manually initiate safety injection.

The ATC will identify that the "A" HHSI pump failed to auto start on the SI signal and manually start HS*P21A.

The crew will identify the "C" SG as faulted and the SRO will transition to E-2.

The BOP will attempt to pre-emptively isolate feedwater to the "C" SG and identify that the "B" header AFW valve, 2FWE*HCV100B AFW valve is failed open. The SRO will direct the BOP to take compensatory actions IAW EOP attachment A-1.24, step 8.

While the BOP is performing Attachment A-0.11, they will identify that both Leak Collection Filtered Exhaust Fans have tripped and manually starts 2HVS*FN204B

After completing isolation of the "C" SG IAW E-2, the SRO will transition to ES-1.1.

The scenario will be terminated following SI termination in ES-1.1.

Expected procedure flow path is E-0 → E-2 → ES-1.1.

Appendix D

Scenario Outline

Facility: BVPS Unit 2	Scenario No. 3	Op Test No.: <u>2LOT19 NRC</u>
Examiners: _____	Candidates: _____	SRO
_____	_____	ATC
_____	_____	BOP

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

Turnover: Maintain 100% power.

Critical Tasks:

- 1. CT-11 (E-0.O) Close CNMT isolation valves.**
- 2. CT-18 (E-3.A) Isolate ruptured SG.**
- 3. CT-34 (ECA-3.1.B) Initiate RCS cooldown at highest rate but < 100F/hr.**

Event No.	Malf. No.	Event Type	Event Description
1	PMP-SWS006	(C,A) ATC, SRO (TS) SRO	"A" SWS pump trips, requires manual start of standby pump.
2	XMT-MSS043A	(R) ATC (N) BOP/SRO (TS) SRO	Load rejection – VPL failure, Auto Rod insertion failure - requires manual rod insertion 2OM-26.4.X
3	CNH-CFW12	(C,A) BOP, SRO	2FWS*FCV488 fails ASIS in Auto during Load rejection – requires manual control.
4	XMT-RCS031A	(C,A) ATC, SRO (TS) SRO	Pressurizer pressure transmitter 2RCS*PT445 fails high in automatic, 2 PORVs open. 2RCS*PCV455D requires manual closure, 2RCS*PCV456 sticks open, PORV block valve 2RCS*MOV536 fails to close.
5	RCS04A	(M) ALL	Reactor trip causes a 650 gpm 21A SG tube rupture.
6	VLV-MSS011 VLV-MSS012	(C) BOP, SRO	Reheat steam fails to auto isolate on trip - requires closing 2MSS-MOV100A and B.
7	PPL08A, PPL08B	(C) ATC, SRO	Automatic CIA actuation does not occur; manual initiation is required.
8	CNH-PCS07	(C) BOP, SRO	Condenser steam dump controller failed to 0%, ASDVs required for RCS cooldown.
9			
10			
11			

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

E-0 → E-1 → E-3 → ECA-3.1

After taking the shift at 100% power, EOL, the "A" SWS pump, 2SWS*P21A, will trip requiring the crew to place the standby service water pump, 2SWE*P21A, inservice and initiate actions to place the swing pump, 2SWS*P21C in standby. The SRO will evaluate technical specifications.

The valve position limiter will fail to 70% causing a load rejection. The control rods will fail to step in automatically in response to the load rejection. The crew will identify the load rejection and enter AOP 2.35.2, Load Rejection. 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 SRO will evaluate technical specifications.

When the load rejection occurs, the "A" main feed regulating valve, 2FWS-FCV488 will fail ASIS in AUTO, requiring the BOP to manually control the "A" SG level.

Pressurizer pressure transmitter 2RCS*PT445 then fails high in automatic, 2 PORVs open. 2RCS*PCV455D requires manual closure, 2RCS*PCV456 sticks open, PORV block valve, 2RCS*MOV536, fails to close.

The SRO will direct the ATC to manually trip the Rx, the Rx trip will cause a 650 gpm SGTR to occur on the "A" SG.

Reheat steam will fail to automatically isolate on the trip along with CIA failing to automatically initiate on the SI signal. The BOP will isolate the reheat steam supply and the ATC will manually initiate CIA.

The SRO will progress thru E-0 then transition to E-1 due to the stuck open/unisolated PORV. Due to the SGTR, the SRO will then transition to E-3, then to ECA-3.1 due to the stuck open/unisolated PORV.

The crew will progress through ECA-3.1 to the point of initiating a cooldown, the steam dump controller will fail to zero requiring the crew to utilize the atmospheric steam dumps to perform the RCS cooldown.

The scenario will be terminated when the crew has initiated a RCS cooldown utilizing the atmospheric steam dumps at < 100 degrees F/hour.

Expected procedure flow path is E-0 → E-1 → E-3 → ECA-3.1.

Facility: Beaver Valley Unit 2Date of Examination: 10/7 thru 10/18, 2019Examination Level **RO** ☒ **SRO** ☐Operating Test Number: BV2LOT19 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (RO A 1.1)	D, R	2.1.23 (4.3) Ability to perform specific system and integrated plant procedures during all modes of plant operation. JPM 2AD-007 Perform an Estimated Critical Position Calculation (RO)
Conduct of Operations (RO A 1.2)	D, R	2.1.7 (4.4) Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. JPM 3AD-003 Perform a Quadrant Power Tilt Ratio Calculation (RO)
Equipment Control (RO A 2)	N, R	2.2.12 (3.7) Knowledge of surveillance procedures. JPM 2AD-057 Perform accident monitoring instrument channel checks (2OST-6.7) (RO)
Radiation Control (RO A 3)	N, R	2.3.4 (3.2) Knowledge of radiation exposure limits under normal or emergency conditions. JPM 3AD-025 Perform a Stay Time Calculation (RO)
Emergency Plan (RO A 4)		NOT EVALUATED

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics (which would require all 5 items).

*Type Codes & Criteria

- (C)ontrol Room, (S)imulator, or Class(R)oom
 (D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes)
 (N)ew or (M)odified from bank (≥ 1)
 (P)revious 2 exams (≤ 1 ; randomly selected)

Facility: Beaver Valley Unit 2Date of Examination: 10/7 thru 10/18, 2019Examination Level **RO** ☐ **SRO** ☒Operating Test Number: BV2LOT19 NRC

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (SRO A 1.1)	D, R	2.1.23 (4.4) Ability to perform specific system and integrated plant procedures during all modes of plant operation. JPM 2AD-011 Review an Estimated Critical Position Calculation. (SRO)
Conduct of Operations (SRO A 1.2)	D, R	2.1.37 (4.6) Knowledge of procedures, guidelines, or limitations associated with reactivity management. JPM 2AD-045 Review a Completed Quadrant Power Tilt Ratio Calculation. (SRO)
Equipment Control (SRO A 2)	D, R	2.2.17 (3.8) Knowledge of the process for managing maintenance activities during power operations, such as risk assessments, work prioritization, and coordination with the transmission system operator. JPM 2AD-041 Perform a Risk Assessment [2FWE*P23A Maintenance] (SRO)
Radiation Control (SRO A 3)	M, R	2.3.4 (3.7) Knowledge of radiation exposure limits under normal or emergency conditions. JPM 2AD-014 Approve Emergency Exposure. (SRO)
Emergency Plan (SRO A 4)	N, R	2.4.40 (4.5) Knowledge of the emergency action level thresholds and classifications. JPM 2AD-059 Classify an Emergency Event – Site Area Emergency (SRO)

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics (which would require all 5 items).

*Type Codes & Criteria

(C)ontrol Room, (S)imulator, or Class(R)oom

(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes)(N)ew or (M)odified from bank (≥ 1)(P)revious 2 exams (≤ 1 ; randomly selected)

Facility: **Beaver Valley Unit 2**Date of Examination: **10/7 thru 10/18, 2019**Exam Level: RO ☒ SRO(I) ☐ SRO(U) ☐Operating Test No.: **BV2LOT19 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	2CR-647, Perform Partial Movement Test (CB-D)	A, D	1
S2	2CR-056, Place Excess Letdown in Service	D	2
S3	2CR-560, Transfer from Hot Leg to Cold Leg Recirculation	A, EN, D, L	3
S4	2CR-713, Start the "A" Reactor Coolant Pump	A, D, L	4P
S5	2CR-020, Transfer from Bypass to Main Feed Regulating Valve	D	4S
S6	2CR-800, Respond to a Loss of Vital Bus 2	A, N	6
S7	2CR-622, Respond to Radiation Monitor Alarm (Leak Collect Vent)	A, D	7
S8	2CR-801, Respond to Acts of Nature - Severe Weather	A, N	9

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

P1	2PL-016, Transferring Power Supplies for 2HVR-FN201C	D	5
P2	2PL-052, AMSAC System Trouble – PT Failure	D, E	7
P3	2PL-150, Locally Throttle Open AFW Valve During ECA-0.0	D, E, R	4S

@ All RO and SRO control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

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

Facility: Beaver Valley Unit 2Date of Examination: 10/7 thru 10/18, 2019Exam Level: RO ☐ SRO(I) ☒ SRO(U) ☐Operating Test No.: BV2LOT19 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		
S2 2CR-056, Place Excess Letdown in Service	D	2
S3 2CR-560, Transfer from Hot Leg to Cold Leg Recirculation	A, EN, D, L	3
S4 2CR-713, Start the "A" Reactor Coolant Pump	A, D, L	4P
S5 2CR-020, Transfer from Bypass to Main Feed Regulating Valve	D	4S
S6 2CR-800, Respond to a Loss of Vital Bus 2	A, N	6
S7 2CR-622, Respond to Radiation Monitor Alarm (Leak Collect Vent)	A, D	7
S8 2CR-801, Respond to Acts of Nature - Severe Weather	A, N	9

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

P1 2PL-016, Transferring Power Supplies for 2HVR-FN201C	D	5
P2 2PL-052, AMSAC System Trouble – PT Failure	D, E	7
P3 2PL-150, Locally Throttle Open AFW Valve During ECA-0.0	D, E, R	4S

@ All RO and SRO control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

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

Facility: **Beaver Valley Unit 2**Date of Examination: **10/7 thru 10/18, 2019**Exam Level: RO ☐ SRO(I) ☐ SRO(U) ☒Operating Test No.: **BV2LOT19 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		
S2		
S3 2CR-560, Transfer from Hot Leg to Cold Leg Recirculation	A, EN, D, L	3
S4 2CR-713, Start the "A" Reactor Coolant Pump	A, D, L	4P
S5		
S6		
S7		
S8 2CR-801, Respond to Acts of Nature - Severe Weather	A, N	9

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

P1		
P2 2PL-052, AMSAC System Trouble – PT Failure	D, E	7
P3 2PL-150, Locally Throttle Open AFW Valve During ECA-0.0	D, E, R	4S

@ 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 2 2LOT19 RO Date of Exam 10/7/19 – 10/18/19

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

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

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1 [Question 1]	X						EK1 Knowledge of the operational implications of the following concepts as they apply to the reactor trip: EK1.04 Decrease in reactor power following reactor trip (prompt drop and subsequent decay) (CFR 41.8 / 41.10 / 45.3)	3.6	
000008 (APE 8) Pressurizer Vapor Space Accident / 3 [Question 2]		X					AK2. Knowledge of the interrelations between the Pressurizer Vapor Space Accident and the following: AK2.01 Valves (CFR 41.7 / 45.7)	2.7	
000009 (EPE 9) Small Break LOCA / 3 [Question 3]	X						EK1 Knowledge of the operational implications of the following concepts as they apply to the small break LOCA: EK1.01 Natural circulation and cooling, including reflux boiling (CFR 41.8 / 41.10 / 45.3)	4.2	
000011 (EPE 11) Large Break LOCA / 3 [Question 4]						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	
15 (APE 15) Reactor Coolant Pump Malfunctions / 4 [Question 5]						X	2.1.27 Knowledge of system purpose and/or function. (CFR: 41.7)	3.9	
000022 (APE 22) Loss of Reactor Coolant Makeup / 2 [Question 6]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Reactor Coolant Makeup: AK3.05 Need to avoid plant transients (CFR 41.5, 41.10 / 45.6 / 45.13)	3.2	
000025 (APE 25) Loss of Residual Heat Removal System / 4 [Question 7]		X					AK2. Knowledge of the interrelations between the Loss of Residual Heat Removal System and the following: AK2.05 Reactor building sump (CFR 41.7 / 45.7)	2.6	
000026 (APE 26) Loss of Component Cooling Water / 8 [Question 8]				X			AA1. Ability to operate and / or monitor the following as they apply to the Loss of Component Cooling Water: AA1.01 CCW temperature indications (CFR 41.7 / 45.5 / 45.6)	3.1	

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

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000029 (EPE 29) Anticipated Transient Without Scram / 1 [Question 9]				X			EA1 Ability to operate and monitor the following as they apply to an ATWS: EA1.15 AFW system (CFR 41.7 / 45.5 / 45.6)	4.1	
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture—Excessive Heat Transfer / 4 [Question 10]					X		AA2. Ability to determine and interpret the following as they apply to the Steam Line Rupture: AA2.02 Conditions requiring a reactor trip (CFR: 43.5 / 45.13)	4.6	
000054 (APE 54; CE E06) Loss of Main Feedwater / 4 [Question 11]	X						AK1. Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): AK1.02 Effects of feedwater introduction on dry S/G (CFR 41.8 / 41.10 / 45.3)	3.6	
000056 (APE 56) Loss of Offsite Power / 6 [Question 12]						X	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) 056AG2.2.39	3.9	
000062 (APE 62) Loss of Nuclear Service Water / 4 [Question 13]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Nuclear Service Water: AA2.01 Location of a leak in the SWS (CFR: 43.5 / 45.13)	2.9	
000065 (APE 65) Loss of Instrument Air / 8 [Question 14]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Instrument Air: AK3.04 Cross-over to backup air supplies (CFR 41.5, 41.10 / 45.6 / 45.13)	3.0	
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6 [Question 15]				X			AA1. Ability to operate and/or monitor the following as they apply to Generator Voltage and Electric Grid Disturbances: AA1.03 Voltage regulator controls (CFR: 41.5 and 41.10 / 45.5, 45.7, and 45.8)	3.8	
(W E04) LOCA Outside Containment / 3 [Question 16]					X		EA2. Ability to determine and interpret the following as they apply to the (LOCA Outside Containment) EA2.2 Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments. (CFR: 43.5 / 45.13)	3.6	

ES-401		PWR Examination Outline						Form ES-401-2	
Emergency and Abnormal Plant Evolutions - Tier 1/Group 1(RO) Continued									
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
(BW E04; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4 [Question 17]		X					EK2. Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following: EK2.2 Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. (CFR: 41.7 / 45.7)	3.9	
(W E11) Loss of Emergency Coolant Recirculation / 4 [Question 18]			X				EK3. Knowledge of the reasons for the following responses as they apply to the (Loss of Emergency Coolant Recirculation) EK3.4 RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated. (CFR: 41.5 / 41.10, 45.6, 45.13)	3.6	
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	#
000036 (APE 36; BW/A08) Fuel-Handling Incidents / 8 [Question 19]						X	2.1.32 Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	3.8	
000037 (APE 37) Steam Generator Tube Leak / 3 [Question 20]			X				AK3. Knowledge of the reasons for the following responses as they apply to the Steam Generator Tube Leak: AK3.06 Normal operating precautions to preclude or minimize SGTR (CFR 41.5, 41.10 / 45.6 / 45.13)	3.6	
000051 (APE 51) Loss of Condenser Vacuum / 4 [Question 21]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Condenser Vacuum: AA2.02 Conditions requiring reactor and/or turbine trip (CFR: 43.5 / 45.13)	3.9	
000059 (APE 59) Accidental Liquid Radwaste Release / 9 [Question 22]		X					AK2. Knowledge of the interrelations between the Accidental Liquid Radwaste Release and the following: AK2.01 Radioactive-liquid monitors (CFR 41.7 / 45.7)	2.7	
000069 (APE 69; W E14) Loss of Containment Integrity / 5 [Question 23]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Containment Integrity: AA2.01 Loss of containment integrity (CFR: 43.5 / 45.13)	3.7	
(W E01 & E02) Rediagnosis & SI Termination / 3 [Question 24]			X				EK3. Knowledge of the reasons for the following responses as they apply to the (SI Termination) EK3.2 Normal, abnormal and emergency operating procedures associated with (SI Termination). (CFR: 41.5 / 41.10, 45.6, 45.13)	3.3	
(BW E08; W E03) LOCA Cooldown—Depressurization / 4 [Question 25]				X			EA1. Ability to operate and / or monitor the following as they apply to the (LOCA Cooldown and Depressurization) EA1.2 Operating behavior characteristics of the facility. (CFR: 41.7 / 45.5 / 45.6)	3.7	

ES-401

PWR Examination Outline

Form ES-401-2

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

EAPE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
000074 (EPE 74; W E06 & E07) Inadequate Core Cooling / 4 [Question 26]	X						EK1. Knowledge of the operational implications of the following concepts as they apply to the (Degraded Core Cooling) EK1.2 Normal, abnormal and emergency operating procedures associated with (Degraded Core Cooling). (CFR: 41.8 / 41.10, 45.3)	3.5	
(W E16) High Containment Radiation /9 [Question 27]				X			EA1. Ability to operate and / or monitor the following as they apply to the (High Containment Radiation) EA1.2 Operating behavior characteristics of the facility. (CFR: 41.7 / 45.5 / 45.6)	2.9	
K/A Category Point Totals:	1	1	2	2	2	1	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 (SF4P RCP) Reactor Coolant Pump [Question 28]		X										K2 Knowledge of bus power supplies to the following: K2.02 CCW pumps (CFR: 41.7)	2.5	
004 (SF1; SF2 CVCS) Chemical and Volume Control [Question 29]				X								K4 Knowledge of CVCS design feature(s) and/or interlock(s) which provide for the following: K4.05 Interrelationships and design basis, including fluid flow splits in branching networks (e.g., charging and seal injection flow) (CFR: 41.7)	3.3	
005 (SF4P RHR) Residual Heat Removal [Question 30]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the RHRS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 Pressure transient protection during cold shutdown (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.5	
006 (SF2; SF3 ECCS) Emergency Core Cooling [Question 31]						X						K6 Knowledge of the effect of a loss or malfunction on the following will have on the ECCS: K6.01 BIT/borated water sources (CFR: 41.7 / 45.7)	3.4	
007 (SF5 PRTS) Pressurizer Relief/Quench Tank [Question 32]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PRTS controls including: A1.03 Monitoring quench tank temperature (CFR: 41.5 / 45.5)	2.6	
007 (SF5 PRTS) Pressurizer Relief/Quench Tank [Question 33]			X									K3 Knowledge of the effect that a loss or malfunction of the PRTS will have on the following: K3.01 Containment (CFR: 41.7 / 45.6)	3.3	
008 (SF8 CCW) Component Cooling Water [Question 34]										X		A4 Ability to manually operate and/or monitor in the control room: A4.07 Control of minimum level in the CCWS surge tank (CFR: 41.7 / 45.5)	2.9	
010 (SF3 PZR PCS) Pressurizer Pressure Control [Question 35]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the PZR PCS and the following systems: K1.08 PZR LCS (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.2	
010 (SF3 PZR PCS) Pressurizer Pressure Control [Question 36]						X						K6 Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: K6.03 PZR sprays and heaters (CFR: 41.7 / 45.7)	3.2	

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 (SF7 RPS) Reactor Protection [Question 37]	X											K1 Knowledge of the physical connections and/or cause effect relationships between the RPS and the following systems: K1.06 T/G (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.1	
012 (SF7 RPS) Reactor Protection [Question 38]				X								K4 Knowledge of RPS design feature(s) and/or interlock(s) which provide for the following: K4.09 Separation of control and protection circuits (CFR: 41.7)	2.8	
013 (SF2 ESFAS) Engineered Safety Features Actuation [Question 39]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the ESFAS: K5.01 Definitions of safety train and ESF channel (CFR: 41.5 / 45.7)	2.8	
013 (SF2 ESFAS) Engineered Safety Features Actuation [Question 40]						X						K6 Knowledge of the effect of a loss or malfunction on the following will have on the ESFAS: K6.01 Sensors and detectors (CFR: 41.7 / 45.5 to 45.8)	2.7	
022 (SF5 CCS) Containment Cooling [Question 41]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the CCS and the following systems: K1.04 Chilled water (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.9	
026 (SF5 CSS) Containment Spray [Question 42]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the CSS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.07 Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.6	
026 (SF5 CSS) Containment Spray [Question 43]										X		A4 Ability to manually operate and/or monitor in the control room: A4.01 CSS controls (CFR: 41.7 / 45.5 to 45.8)	4.5	
039 (SF4S MSS) Main and Reheat Steam [Question 44]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the MRSS controls including: A1.10 Air ejector PRM (CFR: 41.5 / 45.5)	2.9	

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	#	
039 (SF4S MSS) Main and Reheat Steam [Question 45]									X			A3 Ability to monitor automatic operation of the MRSS, including: A3.02 Isolation of the MRSS (CFR: 41.5 / 45.5)	3.1		
059 (SF4S MFW) Main Feedwater [Question 46]										X		A4 Ability to manually operate and monitor in the control room: A4.03 Feedwater control during power increase and decrease (CFR: 41.7 / 45.5 to 45.8)	2.9		
061 (SF4S AFW) Auxiliary/Emergency Feedwater [Question 47]					X							K5 Knowledge of the operational implications of the following concepts as the apply to the AFW: K5.01 Relationship between AFW flow and RCS heat transfer (CFR: 41.5 / 45.7)	3.6		
062 (SF6 ED AC) AC Electrical Distribution [Question 48]				X								K4 Knowledge of ac distribution system design feature(s) and/or interlock(s) which provide for the following: K4.07 One-line diagram of 4kV to 480V distribution, including sources of normal and alternative power (CFR: 41.7)	2.7		
063 (SF6 ED DC) DC Electrical Distribution [Question 49]		X										K2 Knowledge of bus power supplies to the following: K2.01 Major DC loads (CFR: 41.7)	2.9		
064 (SF6 EDG) Emergency Diesel Generator [Question 50]									X			A3 Ability to monitor automatic operation of the ED/G system, including: A3.05 Operation of the governor control of frequency and voltage control in parallel operation (CFR: 41.7 / 45.5)	2.8		
073 (SF7 PRM) Process Radiation Monitoring [Question 51]							X					A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PRM system controls including: A1.01 Radiation levels (CFR: 41.5 / 45.7)	3.2		

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 (SF4S SW) Service Water [Question 52]											X	2.4.31 Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.2	
078 (SF8 IAS) Instrument Air [Question 53]			X									K3 Knowledge of the effect that a loss or malfunction of the IAS will have on the following: K3.02 Systems having pneumatic valves and controls (CFR: 41.7 / 45.6)	3.4	
103 (SF5 CNT) Containment [Question 54]											X	2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 43.5 / 45.12)	3.9	
103 (SF5 CNT) Containment [Question 55]			X									K3 Knowledge of the effect that a loss or malfunction of the containment system will have on the following: K3.02 Loss of containment integrity under normal operations (CFR: 41.7 / 45.6)	3.8	
K/A Category Point Totals:	3	2	3	3	2	3	3	2	2	3	2	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	#
002 (SF2; SF4P RCS) Reactor Coolant [Question 56]					X							K5 Knowledge of the operational implications of the following concepts as they apply to the RCS: K5.11 Relationship between effects of the primary coolant system and the secondary coolant system (CFR: 41.5 / 45.7)	4.0	
011 (SF2 PZR LCS) Pressurizer Level Control [Question 57]		X										K2 Knowledge of bus power supplies to the following: K2.02 PZR heaters (CFR: 41.7)	3.1	
015 (SF7 NI) Nuclear Instrumentation [Question 58]							X					A1 Ability to predict and/or monitor changes in parameters to prevent exceeding design limits) associated with operating the NIS controls including: A1.02 SUR (CFR: 41.5 / 45.5)	3.5	
016 (SF7 NNI) Nonnuclear Instrumentation [Question 59]									X			A3 Ability to monitor automatic operation of the NNIS, including: A3.01 Automatic selection of NNIS inputs to control systems (CFR: 41.7 / 45.5)	2.9	
033 (SF8 SFPCS) Spent Fuel Pool Cooling [Question 60]								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: A2.03 Abnormal spent fuel pool water level or loss of water level (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.1	
034 (SF8 FHS) Fuel-Handling Equipment [Question 61]						X						K6 Knowledge of the effect of a loss or malfunction on the following will have on the Fuel Handling System: K6.02 Radiation monitoring systems (CFR: 41.7 / 45.7)	2.6	
071 (SF9 WGS) Waste Gas Disposal [Question 62]			X									K3 Knowledge of the effect that a loss or malfunction of the Waste Gas Disposal System will have on the following: K3.05 ARM and PRM systems (CFR: 41.7 / 45.6)	3.2	
072 (SF7 ARM) Area Radiation Monitoring [Question 63]										X		A4 Ability to manually operate and/or monitor in the control room: A4.01 Alarm and interlock setpoint checks and adjustments (CFR: 41.7 / 45.5 to 45.8)	3.0	

ES-401		PWR Examination Outline										Form ES-401-2		
		Plant Systems										- Tier 2/Group 2(RO) Continued		
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
079 (SF8 SAS**) Station Air [Question 64]				X								K4 Knowledge of SAS design feature(s) and/or interlock(s) which provide for the following: K4.01 Cross-connect with IAS (CFR: 41.7)	2.9	
086 Fire Protection [Question 65]	X											K1 Knowledge of the physical connections and/or cause-effect relationships between the Fire Protection System and the following systems: K1.02 Raw service water (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.7	
K/A Category Point Totals:	1	1	1	1	1	1	1	1	1	1	0	Group Point Total:		10

Facility: BVPS Unit 2 2LOT19 RODate of Exam 10/7/19 – 10/18/19

Category	K/A#	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	G2.1.29	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			
	G2.1.5	2.1.5 Ability to use procedures related to shift staffing, such as minimum crew complement, overtime limitations, etc. (CFR: 41.10 / 43.5 / 45.12) [Question 67]	2.9			
	G2.1.6	2.1.6 Ability to manage the control room crew during plant transients. (CFR: 41.10 / 43.5 / 45.12 / 45.13) [Question 68]	3.8			
	Subtotal		3			
2. Equipment Control	G2.2.13	2.2.13 Knowledge of tagging and clearance procedures. (CFR: 41.10 / 45.13) [Question 69]	4.1			
	G2.2.6	2.2.6 Knowledge of the process for making changes to procedures. (CFR: 41.10 / 43.3 / 45.13) [Question 70]	3.0			
	Subtotal		2			
3. Radiation Control	G2.3.5	2.3.5 Ability to use radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc. (CFR: 41.11 / 41.12 / 43.4 / 45.9) [Question 71]	2.9			
	G2.3.7	2.3.7 Ability to comply with radiation work permit requirements during normal or abnormal conditions. (CFR: 41.12 / 45.10) [Question 72]	3.5			
	Subtotal		2			
4. Emergency Procedures/ Plan	G2.4.1	2.4.1 Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13) [Question 73]	4.6			
	G2.4.22	2.4.22 Knowledge of the bases for prioritizing safety functions during abnormal/emergency operations. (CFR: 41.7 / 41.10 / 43.5 / 45.12) [Question 74]	3.6			
	G.2.4.3	2.4.3 Ability to identify post-accident instrumentation. (CFR: 41.6 / 45.4) [Question 75]	3.7			
	Subtotal		3			
Tier 3 Point Total			10	10		

Facility: BVPS Unit 2 2LOT19 SRODate of Exam 10/7/19 – 10/18/19

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

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	#
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3 [Question 76]					X		AA2. Ability to determine and interpret the following as they apply to the Pressurizer Pressure Control Malfunctions: AA2.06 Conditions requiring plant shutdown (CFR: 43.5 / 45.13)	3.9	
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture—Excessive Heat Transfer / 4 [Question 77]						X	2.1.32 Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	4.0	
000055 (EPE 55) Station Blackout / 6 [Question 78]					X		EA2 Ability to determine or interpret the following as they apply to a Station Blackout: EA2.04 Instruments and controls operable with only dc battery power available (CFR 43.5 / 45.13)	4.1	
000057 (APE 57) Loss of Vital AC Instrument Bus / 6 [Question 79]						X	2.2.37 Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)	4.6	
000058 (APE 58) Loss of DC Power / 6 [Question 80]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of DC Power: AA2.01 That a loss of dc power has occurred; verification that substitute power sources have come on line (CFR: 43.5 / 45.13)	4.1	
(BW E04; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4 [Question 81]						X	2.1.20 Ability to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)	4.6	
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	#
000001 (APE 1) Continuous Rod Withdrawal / 1 [Question 82]					X		AA2. Ability to determine and interpret the following as they apply to the Continuous Rod Withdrawal AA2.05 Uncontrolled rod withdrawal, from available indications (CFR: 43.5 / 45.13)	4.6	
000060 (APE 60) Accidental Gaseous Radwaste Release / 9 [Question 83]						X	2.2.37 Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)	4.6	
000032 (APE 32) Loss of Source Range Nuclear Instrumentation / 7 [Question 84]					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Source Range Nuclear Instrumentation: AA2.03 Expected values of source range indication when high voltage is automatically removed. (CFR: 43.5 / 45.13)	3.1	
(W E15) Containment Flooding / 5 [Question 85]						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	
Category Point Totals:					2	2	Group Point Total:		4

Plant Systems

- Tier 2/Group 1(SRO)

System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
003 (SF4P RCP) Reactor Coolant Pump [Question 86]											X	2.1.20 Ability to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)	4.6	
061 (SF4S AFW) Auxiliary/Emergency Feedwater [Question 87]											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	
063 (SF6 ED DC) DC Electrical Distribution [Question 88]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the DC electrical systems; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.02 Loss of ventilation during battery charging (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.1	
076 (SF4S SW) Service Water [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: A2.01 Loss of SWS (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.7	
078 (SF8 IAS) Instrument Air [Question 90]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the IAS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.01 Air dryer and filter malfunctions (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9	
K/A Category Point Totals:								3			2	Group Point Total:		5

ES-401		PWR Examination Outline										Form ES-401-2		
Plant Systems												- Tier 2/Group 2(SRO)		
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
014 (SF1 RPI) Rod Position Indication [Question 91]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the RPIS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.01 Loss of offsite power (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.3	
035 (SF 4P SG) Steam Generator [Question 92]								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the SG; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.04 Steam flow/feed mismatch (CFR: 41.5 / 43.5 / 45.3 / 45.5)	3.8	
001 (SF1 CRDS) Control Rod Drive [Question 93]											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	
K/A Category Point Totals:								2			1	Group Point Total:		3

Facility: BVPS Unit 2 2LOT19 SRODate of Exam 10/7/19 – 10/18/19

Category	K/A#	Topic	RO		SRO Only	
			IR	#	IR	#
1. Conduct of Operations	G2.1.35	2.1.35 Knowledge of the fuel-handling responsibilities of SROs. (CFR: 41.10 / 43.7) [Question 94]			3.9	
	Subtotal					
2. Equipment Control	G2.2.19	2.2.19 Knowledge of maintenance work order requirements. (CFR: 41.10 / 43.5 / 45.13) [Question 95]			3.4	
	G2.2.35	2.2.35 Ability to determine Technical Specification Mode of Operation. (CFR: 41.7 / 41.10 / 43.2 / 45.13) [Question 96]			4.5	
	Subtotal					
3. Radiation Control	G2.3.15	2.3.15 Knowledge of radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc. (CFR: 41.12 / 43.4 / 45.9) [Question 97]			3.1	
	G2.3.12	2.3.12 Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 45.9 / 45.10) [Question 98]			3.7	
	Subtotal					
4. Emergency Procedures/ Plan	G2.4.11	2.4.11 Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13) [Question 99]			4.2	
	G2.4.42	2.4.42 Knowledge of emergency response facilities. (CFR: 41.10 / 45.11) [Question 100]			3.8	
	Subtotal					
Tier 3 Point Total						7

Facility: Beaver Valley Unit 2 2LOT19Date of Exam: 10/7 through 10/18/2018

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	000026 AA1.04	Question 8; There is no CRDM high temperature monitoring system, or ability to monitor CRDM temperatures available at Beaver Valley, therefore there is no tie between Loss of Component Cooling Water and CRDM system high temperature. NRC Chief Examiner randomly selected 000026 AA1.01 as a replacement.
2/1	078 K3.03	Question 53; Beaver Valley 1 & 2 do not have cross tied air systems. NRC Chief Examiner randomly selected 078 K3.02 as a replacement.
2/1	103 2.4.30	Question 54; Knowledge of events related to system operation/status that must be reported to internal organizations or external agencies, such as the State, the NRC, or the transmission system operator is not a RO Task at Beaver Valley. NRC Chief Examiner randomly selected 103 G2.1.25 as a replacement.
2/1	103 K3.03	Question 55; Loss of containment integrity under refueling operations overlaps with question 23, K/A 069 AA2.01 Loss of containment integrity. Also, Tech Spec 3.6.1 require that Containment be operable in modes 1-4, and Tech Spec 3.9.3 for Containment Penetrations is only required to be operable when moving recently irradiated fuel. BV procedures do not authorize movement of recently irradiated fuel. NRC Chief Examiner randomly selected 103 K3.02 as a replacement.
2/2	086 K1.03	Question 65; There are no physical connections and/or cause-effect relationships between Fire Protection system and the AFW system at Beaver Valley. NRC Chief Examiner randomly selected 086 K1.02 as a replacement.
1/1	000057 2.4.49	Question 79; Loss of Vital AC Instrument Bus has no immediate actions required and the K/A is RO required knowledge. NRC Chief Examiner randomly selected 000057 G2.2.37 as a replacement.
1/2	000061 AA2.02	Question 84; Area Radiation Monitoring System - Normal radiation intensity for each ARM system channel overlaps with questions 51 and 63 due to oversampling. NRC Chief Examiner randomly selected new system 000032 AA2.03 as a replacement.
2/2	068 A2.04	Question 92; Liquid Radwaste - Failure of automatic isolation overlaps with question 22 for the auto isolation of a liquid discharge, and question 83 for correcting the problem and maintaining the question at an SRO level. Due to oversampling, the NRC Chief Examiner randomly selected new system 035 A2.04 as a replacement.