Facility: Comanche Peak Date of Exam: June 2018

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	3	3	3	N/A			3	3	N/A		3	18					6
	2	1	1	1				2	2			2	9					4
	Tier Totals	4	4	4				5	5			5	27					10
2. Plant Systems	1	3	2	3	3	2	3	2	3	2	2	3	28					5
	2	1	1	0	1	1	1	1	1	1	1	1	10					3
	Tier Totals	4	3	3	4	3	4	3	4	3	3	4	38					8
3. Generic Knowledge and Abilities Categories		1		2		3		4		10		1	2	3	4	7		
		3		3		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.

ES-401 PWR Examination Outline Form ES-401-2

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

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		Ability to determine or interpret the following as they apply to a reactor trip: (CFR 41.7 / 45.5 / 45.6) EA2.06 Occurrence of a reactor trip	4.3	46
000008 (APE 8) Pressurizer Vapor Space Accident / 3									
000009 (EPE 9) Small Break LOCA / 3									
000011 (EPE 11) Large Break LOCA / 3					X		Ability to determine or interpret the following as they apply to a Large Break LOCA: (CFR 43.5 / 45.13) EA2.09 Existence of adequate natural circulation	4.2	41
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4									
000022 (APE 22) Loss of Reactor Coolant Makeup / 2									
000025 (APE 25) Loss of Residual Heat Removal System / 4				X			Ability to operate and / or monitor the following as they apply to the Loss of Residual Heat Removal System: (CFR 41.7 / 45.5 / 45.6) AA1.12 RCS temperature indicators	3.6	47
000026 (APE 26) Loss of Component Cooling Water / 8									
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3				X			Ability to operate and / or monitor the following as they apply to the Pressurizer Pressure Control Malfunctions: (CFR 41.7 / 45.5 / 45.6) AA1.04 Pressure recovery, using emergency-only heaters	3.9	55
000029 (EPE 29) Anticipated Transient Without Scram / 1						X	2.4.6 Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	3.7	53
000038 (EPE 38) Steam Generator Tube Rupture / 3			X				Knowledge of the reasons for the following responses as the apply to the SGTR: (CFR 41.5 / 41.10 / 45.6 / 45.13) EK3.09 Criteria for securing/throttling ECCS	4.1	51
~~000040~~ (APE 40; ~~BW E05; CE E05~~; W E12) ~~Steam Line Rupture - Excessive Heat Transfer~~ Uncontrolled Depressurization of all Steam Generators / 4		X					Knowledge of the interrelations between the (Uncontrolled Depressurization of all Steam Generators) and the following: (CFR: 41.7 / 45.7) EK2.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.4	39
000054 (APE 54; ~~CE E06~~) Loss of Main Feedwater /4	X						Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): (CFR 41.8 / 41.10 / 45.3) AK1.02 Effects of feedwater introduction on dry S/G	3.6	40
000055 (EPE 55) Station Blackout / 6	X						Knowledge of the operational implications of the following concepts as they apply to the Station Blackout: (CFR 41.8 / 41.10 / 45.3) EK1.01 Effect of battery discharge rates on capacity	3.3	43
000056 (APE 56) Loss of Offsite Power / 6						X	2.4.11 Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 43.13)	4.0	44
000057 (APE 57) Loss of Vital AC Instrument Bus / 6						X	2.4.20 Knowledge of the operational implications of EOP warnings, cautions, and notes. (CFR: 41.10 / 43.5 / 45.13)	3.8	48
000058 (APE 58) Loss of DC Power / 6			X				Knowledge of the reasons for the following responses as they apply to the Loss of DC Power: (CFR 41.5,41.10 / 45.6 / 45.1) AK3.01 Use of dc control power by D/Gs	3.4	54

000062 (APE 62) Loss of Nuclear Service Water / 4				X			Ability to operate and / or monitor the following as they apply to the Loss of Nuclear Service Water (SWS): (CFR 41.7 / 45.5 / 45.6) AA1.06 Control of flow rates to components cooled by the SWS	2.9	52
000065 (APE 65) Loss of Instrument Air / 8			X				Knowledge of the reasons for the following responses as they apply to the Loss of Instrument Air: (CFR 41.5,41.10 / 45.6 / 45.13) AK3.08 Actions contained in EOP for loss of instrument air	3.7	45
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6		X					Knowledge of the interrelations between Generator Voltage and Electric Grid Disturbances and the following: (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8) AK2.06 Reactor power	3.9	56
(W E04) LOCA Outside Containment / 3		X					Knowledge of the interrelations between the (LOCA Outside Containment) and the following: (CFR: 41.7 / 45.7) 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.	3.8	49
(W E11) Loss of Emergency Coolant Recirculation / 4	X						Knowledge of the operational implications of the following concepts as they apply to the (Loss of Emergency Coolant Recirculation) (CFR: 41.8 / 41.10 / 45.3) EK1.1 Components, capacity, and function of emergency systems	3.7	42
(~~BW E04~~; W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4					X		Ability to determine and interpret the following as they apply to the (Loss of Secondary Heat Sink) (CFR: 43.5 / 45.13) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations	3.4	50
K/A Category Totals:	3	3	3	3	3	3	Group Point Total:		18

ES-401 PWR Examination Outline Form ES-401-2

Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (RO)

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000001 (APE 1) Continuous Rod Withdrawal / 1	X						Knowledge of the physical connections and/or cause/effect relationships between the CRDS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.04 RCS	3.2	60
000003 (APE 3) Dropped Control Rod / 1									
000005 (APE 5) Inoperable/Stuck Control Rod / 1					X		Ability to determine and interpret the following as they apply to the inoperable/stuck control rod: (CFR: 43.5 / 45.13) AA2.01 Stuck or inoperable rod from in-core and ex-core NIS, incore or loop temperature measurements.	3.3	64
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				X			Ability to operate and / or monitor the following as they apply to the Steam Generator Tube Leak: (CFR 41.7 / 45.5 / 45.6) AA1.03 Loop isolation valves	3.0	63
000051 (APE 51) Loss of Condenser Vacuum / 4						X	2.4.47 Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material. (CFR: 41.10 / 43.5 / 45.12)	4.2	59
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									
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	2.4.1 Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)	4.6	65
000076 (APE 76) High Reactor Coolant Activity / 9									
000078 (APE 78*) RCS Leak / 3									

(W E01 ~~& E02~~) Rediagnosis & ~~SI Termination~~ / 3		X					Knowledge of the interrelations between the (Reactor Trip or Safety Injection/Rediagnosis) and the following: (CFR: 41.7 / 45.7) 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.	3.5	57
(W E13) Steam Generator Overpressure / 4									
(W E15) Containment Flooding / 5				X			Ability to operate and / or monitor the following as they apply to the (Containment Flooding) (CFR: 41.7 / 45.5 / 45.6) EA1.2 Operating behavior characteristics of the facility.	2.7	61
(W E16) High Containment Radiation /9					X		EA2. Ability to determine and interpret the following as they apply to the (High Containment Radiation) (CFR: 43.5 / 45.13) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations.	2.9	62
(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			X				Knowledge of the reasons for the following responses as they apply to the (Natural Circulation with Steam Void in Vessel with/without RVLIS) (CFR: 41.5 / 41.10, 45.6 / 45.13) 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.	3.4	58
(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:	1	1	1	2	2	2	Group Point Total:		9

ES-401 PWR Examination Outline Form ES-401-2
Plant Systems—Tier 2/Group 1 (RO)

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									Knowledge of the effect that a loss or malfunction of the RCPS will have on the following: (CFR: 41.7 / 45.6) K3.03 Feedwater and emergency feedwater	2.8	25
004 (SF1; SF2 CVCS) Chemical and Volume Control						X						Knowledge of the effect of a loss or malfunction on the following CVCS components: (CFR: 41.7 / 45.7) K6.17 Flow paths for emergency boration	4.4	15
005 (SF4P RHR) Residual Heat Removal								X				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: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.04 RHR valve malfunction	2.9	23
006 (SF2; SF3 ECCS) Emergency Core Cooling					X							Knowledge of the operational implications of the following concepts as they apply to ECCS: (CFR: 41.5 / 45.7) K5.05 Effects of pressure on a solid system	3.4	10
007 (SF5 PRTS) Pressurizer Relief/Quench Tank					X							Knowledge of the operational implications of the following concepts as the apply to PRTS: (CFR: 41.5 / 45.7) K5.02 Method of forming a steam bubble in the PZR	3.1	7
008 (SF8 CCW) Component Cooling Water										X		Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5) A4.07 Control of minimum level in the CCWS surge tank	2.9	13
010 (SF3 PZR PCS) Pressurizer Pressure Control		X										Knowledge of bus power supplies to the following: (CFR: 41.7) K2.03 Indicator for PORV position	2.8	11
012 (SF7 RPS) Reactor Protection							X					Ability to predict and/or monitor Changes in parameters (to prevent exceeding design limits) associated with operating the RPS controls including: (CFR: 41.5 / 45.5) A1.01 Trip setpoint adjustment	2.9	4
013 (SF2 ESFAS) Engineered Safety Features Actuation	X											Knowledge of the physical connections and/or cause-effect relationships between the ESFAS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.15 MFW System	3.4	27
022 (SF5 CCS) Containment Cooling											X	2.2.44 Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions. (CFR: 41.5 / 43.5 / 45.12)	4.2	19
025 (SF5 ICE) Ice Condenser														
026 (SF5 CSS) Containment Spray				X								Knowledge of CSS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.05 Prevention of material from clogging nozzles during recirculation	2.8	22

039 (SF4S MSS) Main and Reheat Steam			X									Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: (CFR: 41.7 / 45.6) K3.06 SDS	2.8	9
059 (SF4S MFW) Main Feedwater			X									Knowledge of the effect that a loss or malfunction of the MFW will have on the following: (CFR: 41.7 / 45.6) K3.02 AFW system	3.6	21
061 (SF4S AFW) Auxiliary/Emergency Feedwater						X						~~Knowledge of the operational implications of the following concepts as the apply to the AFW: (CFR: 41.5 / 45.7)~~ ~~K5.03 Pump head effects when control valve is shut~~ Knowledge of the effect of a loss or malfunction of the following will have on the AFW components: (CFR: 41.7 / 45.7) K6.02 Pumps	2.6	24
062 (SF6 ED AC) AC Electrical Distribution									X			Ability to monitor automatic operation of the ac distribution system, including: (CFR: 41.7 / 45.5) A3.04 Operation of inverter (e.g., precharging synchronizing light, static transfer)	2.7	8
063 (SF6 ED DC) DC Electrical Distribution		X										Knowledge of bus power supplies to the following: (CFR: 41.7) K2.01 Major DC loads	2.9	5
064 (SF6 EDG) Emergency Diesel Generator								X				Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.18 Consequences of premature opening of breaker under load	2.6	17
073 (SF7 PRM) Process Radiation Monitoring	X											Knowledge of the physical connections and/or cause-effect relationships between the PRM system and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.01 Those systems served by PRMs	3.6	28
076 (SF4S SW) Service Water								X				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: (CFR: 41.5 / 43.5 / 45/3 / 45/13) A2.01 Loss of SWS	3.5	6
078 (SF8 IAS) Instrument Air				X								Knowledge of IAS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.01 Manual/automatic transfers of control	2.7	3
103 (SF5 CNT) Containment	X											Knowledge of the physical connections and/or cause-effect relationships between the containment system and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.02 Containment isolation/containment integrity	3.9	26
053 (SF1; SF4P ICS*) Integrated Control														

003 (SF4P RCP) Reactor Coolant Pump						X						Knowledge of the effect of a loss or malfunction on the following will have on the RCPS: (CFR: 41.7 / 45/5) K6.14 Starting requirements	2.6	14
006 (SF2; SF3 ECCS) Emergency Core Cooling				X								Knowledge of ECCS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.13 Reset of containment isolation	3.8	18
013 (SF2 ESFAS) Engineered Safety Features Actuation										X		Ability to monitor automatic operation of the ESFAS including: (CFR: 41.7 / 45.5) A3.01 Input channels and logic	3.7	12
026 (SF5 CSS) Containment Spray							X					Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CSS controls including: (CFR: 41.5 / 45.5) ~~A1.04 Containment humidity~~ A1.03 Containment Sump Level	3.5	16
059 (SF4S MFW) Main Feedwater									X			Ability to monitor automatic operation of the MFW, including: (CFR: 41.7 / 45.5) A3.02 Programmed levels of the S/G	2.9	2
064 (SF6 EDG) Emergency Diesel Generator											X	~~2.2.37 Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)~~ 2.2.12 Knowledge of surveillance procedures. (CFR 41.10 / 45.13)	3.7	20
076 (SF4S SW) Service Water											X	2.1.32 Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	3.8	1
K/A Category Point Totals:	3	2	3	3	2	3	2	3	2	2	3	Group Point Total:		28

ES-401 PWR Examination Outline Form ES-401-2

Plant Systems—Tier 2/Group 2 (RO)

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 (SF1 CRDS) Control Rod Drive														
002 (SF2; SF4P RCS) Reactor Coolant														
011 (SF2 PZR LCS) Pressurizer Level Control					X							Knowledge of the operational implications of the following concepts as they apply to the PZR LCS: (CFR: 41.5 / 45.7) K5.06 Indicated charging flow: seal flow plus actual charging flow	2.9	29
014 (SF1 RPI) Rod Position Indication								X				Ability to (a) predict the impacts of the following malfunctions or operations on the RPIS; and (b) based on those on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.06 Loss of LVDT	2.6	30
015 (SF7 NI) Nuclear Instrumentation														
016 (SF7 NNI) Nonnuclear Instrumentation				X								Knowledge of NNIS design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7) K4.01 Reading of NNIS channel values outside control room	2.8	32
017 (SF7 ITM) In Core Temperature Monitor														
027 (SF5 CIRS) Containment Iodine Removal	X											Knowledge of the physical connections and/or cause-effect relationships between the CIRS and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.01 CSS	3.4	37
028 (SF5 HRPS) Hydrogen Recombiner and Purge Control														
029 (SF8 CPS) Containment Purge														
033 (SF8 SFPCS) Spent Fuel Pool Cooling											X	2.1.27 Knowledge of system purpose and/or function. (CFR: 41.7)	3.9	33
034 (SF8 FHS) Fuel Handling Equipment														
035 (SF 4P SG) Steam Generator						X						Knowledge of the effect of a loss or malfunction on the following will have on the S/GS: (CFR: 41.7 / 45.7) K6.03 S/G level detector	2.6	34
041 (SF4S SDS) Steam Dump/Turbine Bypass Control							X					Ability to predict or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SDS controls including: A1.01 Tave, verification above low/low set point	2.9	35
045 (SF 4S MTG) Main Turbine Generator														
055 (SF4S CARS) Condenser Air Removal														
056 (SF4S CDS) Condensate														
068 (SF9 LRS) Liquid Radwaste														
071 (SF9 WGS) Waste Gas Disposal										X		Ability to manually operate and/or monitor in the control room: (CFR: 41.7 / 45.5 to 45.8) A4.09 Waste gas release rad monitors	3.3	38
072 (SF7 ARM) Area Radiation Monitoring														

075 (SF8 CW) Circulating Water		X										Knowledge of bus power supplies to the following: (CFR: 41.7) K2.03 Emergency/essential SWS pumps	2.6	36
079 (SF8 SAS**) Station Air														
086 Fire Protection									X			Ability to monitor automatic operation of the Fire Protection System including: (CFR: 41.7 / 45.5) A3.02 Actuation of the FPS	2.9	31
050 (SF 9 CRV*) Control Room Ventilation														
K/A Category Point Totals:	1	1	0	1	1	1	1	1	1	1	1	Group Point Total:		10

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.31	Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup. (CFR: 41.10 / 45.12)	4.6	70		
	2.1.34	Knowledge of primary and secondary plant chemistry limits. (CFR: 41.10 / 43.5 / 45.12)	2.7	73		
	2.1.38	Knowledge of the station's requirements for verbal communications when implementing procedures. (CFR: 41.10 / 45.13)	3.7	72		
	Subtotal					
2. Equipment Control	2.2.22	Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)	4.0	71		
	2.2.42	Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (CFR: 41.7 / 41.10 / 43.2 / 43.3 / 45.3)	3.9	67		
	2.2.43	Knowledge of the process used to track inoperable alarms. (CFR: 41.10 / 43.5 / 45.13)	3.0	75		
	Subtotal					
3. Radiation Control	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)	2.9	69		
	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)	2.9	66		
	Subtotal					
4. Emergency Procedures/Plan	2.4.11	Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)	4.0	74		
	2.4.25	Knowledge of fire protection procedures. (CFR: 41.10 / 43.5 / 45.13)	3.3	68		
	Subtotal					
Tier 3 Point Total				10		7

Facility: Comanche Peak Date of Exam: June 2018

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	2		2		4
	Tier Totals												27	5		5		10
2. Plant Systems	1												28	3		2		5
	2												10	0	2	1		3
	Tier Totals												38	5		3		8
3. Generic Knowledge and Abilities Categories		1			2			3			4		10	1	2	3	4	7
														2	2	1	2	

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

G* Generic K/As

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

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

ES-401 PWR Examination Outline Form ES-401-2

Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (SRO)

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1									
000008 (APE 8) Pressurizer Vapor Space Accident / 3									
000009 (EPE 9) Small Break LOCA / 3					X		Ability to determine or interpret the following as they apply to a small break LOCA: (CFR 43.5 / 45.13) EA2.29 CVCS pump indicating lights for determining pump status	3.4	77
000011 (EPE 11) Large Break LOCA / 3									
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4						X	2.2.38 Knowledge of conditions and limitations in the facility license (CFR 41.7/41.10/43.1/45.13)	4.5	76
000022 (APE 22) Loss of Reactor Coolant Makeup / 2					X		Ability to determine and interpret the following as they apply to the Loss of Reactor Coolant Makeup: (CFR 43.5/ 45.13) AA2.02 Charging pump problems	3.7	79
000025 (APE 25) Loss of Residual Heat Removal System / 4									
000026 (APE 26) Loss of Component Cooling Water / 8						X	2.4.18 Knowledge of the specific bases for EOPs. (CFR: 41.10 / 43.1 / 45.13)	4.0	81
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3						X	2.2.40 Ability to apply technical specifications for a system (CFR: 41.10 / 43.2 / 43.5 / 45.3)	4.7	80
000029 (EPE 29) Anticipated Transient Without Scram / 1									
000038 (EPE 38) Steam Generator Tube Rupture / 3									
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture-Excessive Heat Transfer / 4									
000054 (APE 54; CE E06) Loss of Main Feedwater /4									
000055 (EPE 55) Station Blackout / 6									
000056 (APE 56) Loss of Offsite Power / 6									
000057 (APE 57) Loss of Vital AC Instrument Bus / 6									
000058 (APE 58) Loss of DC Power / 6									
000062 (APE 62) Loss of Nuclear Service Water / 4									
000065 (APE 65) Loss of Instrument Air / 8									
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6									
(W E04) LOCA Outside Containment / 3									
(W E11) Loss of Emergency Coolant Recirculation / 4					X		Ability to determine and interpret the following as they apply to the (Loss of Emergency Coolant Recirculation) (CFR: 43.5 / 45.13) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations.	4.2	78
(BW E04; W E05) Inadequate Heat Transfer-Loss of Secondary Heat Sink / 4									
K/A Category Totals:					3	3	Group Point Total:		6

ES-401 PWR Examination Outline Form ES-401-2

Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (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		Ability to determine and interpret the following as they apply to the Emergency Boration: A2.05 amount of boron to add to achieve required SDM	3.9	83
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					X		Ability to determine and interpret the following as they apply to the Loss of Intermediate Range Nuclear Instrumentation: (CFR: 43.5 / 45.13) AA2.11 Loss of compensating voltage	3.4	84
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									
000060 (APE 60) Accidental Gaseous Radwaste Release / 9									
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						X	G2.2.22 Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)	4.7	82
(WE01 & E02) Rediagnosis & SI Termination / 3									
(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						X	2.2.44 Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions. (CFR: 41.5 / 43.5 / 45.12)	4.4	85
(CE A16) Excess RCS Leakage / 2									
(CE E09) Functional Recovery									
(CE E13*) Loss of Forced Circulation/LOOP/Blackout / 4									
K/A Category Point Totals:					2	2	Group Point Total:		4

ES-401 PWR Examination Outline Form ES-401-2
Plant Systems—Tier 2/Group 1 (SRO)

System # / Name	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														
008 (SF8 CCW) Component Cooling Water														
010 (SF3 PZR PCS) Pressurizer Pressure Control								X				Ability to (a) predict the impacts of the following malfunctions or operations on the PZR PCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.03 PORV failures	4.2	87
012 (SF7 RPS) Reactor Protection														
013 (SF2 ESFAS) Engineered Safety Features Actuation														
022 (SF5 CCS) Containment Cooling											X	2.2.37 Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)	4.6	88
025 (SF5 ICE) Ice Condenser														
026 (SF5 CSS) Containment Spray														
039 (SF4S MSS) Main and Reheat Steam														
059 (SF4S MFW) Main Feedwater														
061 (SF4S AFW) Auxiliary/Emergency Feedwater														
062 (SF6 ED AC) AC Electrical Distribution														
063 (SF6 ED DC) DC Electrical Distribution														
064 (SF6 EDG) Emergency Diesel Generator											X	2.1.32 Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	4.0	86
073 (SF7 PRM) Process Radiation Monitoring														
076 (SF4S SW) Service Water								X				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: (CFR: 41.5 / 43.5 / 45/3 / 45/13) A2.02 Service water header pressure	3.1	90
078 (SF8 IAS) Instrument Air														
103 (SF5 CNT) Containment								X				Ability to (a) predict the impacts of the following malfunctions or operations on the containment system and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.05 Emergency containment entry	3.9	89

053 (SF1; SF4P ICS*) Integrated Control													
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	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 (SF1 CRDS) Control Rod Drive														
002 (SF2; SF4P RCS) Reactor Coolant														
011 (SF2 PZR LCS) Pressurizer Level Control														
014 (SF1 RPI) Rod Position Indication														
015 (SF7 NI) Nuclear Instrumentation														
016 (SF7 NNI) Nonnuclear Instrumentation														
017 (SF7 ITM) In-Core Temperature Monitor								X				Ability to a) predict the impacts of the following malfunctions or operations on the ITM system; and b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations A2.02 Core Damage	4.1	93
027 (SF5 CIRS) Containment Iodine Removal														
028 (SF5 HRPS) Hydrogen Recombiner and Purge Control								X				Malfunctions or operations on the HRPS; and (b) based on those predictions, use procedures to correct, control or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.03 The hydrogen air concentration in excess of limit flame propagation or detonation with resulting equipment damage in containment	4.0	92
029 (SF8 CPS) Containment Purge														
033 (SF8 SFPCS) Spent Fuel Pool Cooling														
034 (SF8 FHS) Fuel-Handling Equipment														
035 (SF 4P SG) Steam Generator														
041 (SF4S SDS) Steam Dump/Turbine Bypass Control														
045 (SF 4S MTG) Main Turbine Generator														
055 (SF4S CARS) Condenser Air Removal														
056 (SF4S CDS) Condensate														
068 (SF9 LRS) Liquid Radwaste														
071 (SF9 WGS) Waste Gas Disposal														
072 (SF7 ARM) Area Radiation Monitoring											X	2.4.8 Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)	4.5	91
075 (SF8 CW) Circulating Water														
079 (SF8 SAS**) Station Air														
086 Fire Protection														
050 (SF 9 CRV*) Control Room Ventilation														
K/A Category Point Totals:								2			1	Group Point Total:		3

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.1	Knowledge of conduct of operations requirements (CFR: 41.10 / 43.5 / 45.13)			4.2	98
	2.1.29	Knowledge of how to conduct system lineups, such as valves, breakers, switches, etc. (CFR: 41.10 / 43.5 / 45.12 / 45.1)			4.0	94
	Subtotal					
2. Equipment Control	2.2.7	Knowledge of the process for conducting special or infrequent tests (CFR: 41.10 / 43.3 / 45.13)			3.6	99
	2.2.11	Knowledge of the process for controlling temporary design changes (CFR: 41.10 / 43.3)			3.3	96
	Subtotal					
3. Radiation Control	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)			3.1	95
	Subtotal					
4. Emergency Procedures/Plan	2.4.20	Knowledge of the operational implications of EOP warnings, cautions, and notes. (CFR: 41.10 / 43.5 / 45.13)			4.3	100
	2.4.22	Knowledge of the bases for prioritizing safety functions during abnormal/emergency operations (CFR: 41.10 / 43.5 / 45.12)			4.4	97
	Subtotal					
Tier 3 Point Total				10		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
2 / 1	022 / 2.4.44	2.4.4 swap to 2.4.44 for Q19 due to NRC exam question writer request (inability to write a valid question at proper level with 3 good distracters)
2 / 1	061 / K6.02	K5.03 swap to K6.02 for Q24 due to NRC exam question writer request (inability to write a valid question at proper level with 3 good distracters)
2 / 1	026 / A1.03	A1.04 swap to A1.03 for Q16 due to NRC exam question writer request (inability to write a valid question at proper level with 3 good distracters)
2 / 1	064 / 2.2.37	2.2.37 swap to 2.2.12 for Q20 due to NRC exam question writer request (inability to write a valid question at proper level with 3 good distracters)
SRO Exam		
		No changes of KAs performed

Facility: Comanche Peak NPP **Date of Examination:** 06-11-18

Examination Level: RO ■ SRO ☐ **Operating Test Number:** NRC

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations RA(1) K/A Importance:	M	KA: 2.1.23 Determine Loss of RHR Time Limitations (modified from RA2-March 2009)
Conduct of Operations RA(2) K/A Importance:	N	KA: 2.2.12 Calculate RCS Leakrate
Equipment Control RA(3) K/A Importance:	N	KA: 2.1.23 Perform a Heat Balance
Radiation Control RA(4) K/A Importance:	D	KA: 2.3.12 Determine Radiation doses during system alignment (RA4 June 2014)
Emergency Plan		Not sampled

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, 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: Comanche Peak NPP **Date of Examination:** 06-11-18

Examination Level: RO ☐ SRO ■ **Operating Test Number:** NRC

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations SA(5) K/A Importance:	N	KA 2.1.42 Determine Close Contact Fuel Assembly Movement
Conduct of Operations SA(6) K/A Importance:	N	KA 2.1.23 Review Calculated RCS Leakrate for LCO entry Conditions (New)
Equipment Control SA(7) K/A Importance:	N	KA 2.1.23 Perform Heat Balance (SRO-Only) (New)
Radiation Control SA(8) K/A Importance:	M	KA 2.3.6 Approve a Release Permit (Modified from SA4-March 2009)
Emergency Plan SA(9) K/A Importance:	N	KA 2.1.4 Determine the Correct Emergency Declaration

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, 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)

CPNPP 2018-06 Initial Exam
NRC Admin JPM Description

RO

(RA1) **Determine Loss of RHR Time Limitations (mod from RA2-March 2009)**
Demonstrate the ability to CALCULATE the time to saturation, the time to core uncover, and containment closure time during loss of RHR using ABN-104, "Residual Heat Removal System Malfunction."

(RA2) **Calculate RCS Leakrate (New)**
Demonstrate the ability to DETERMINE the total calculated RCS leakage by completing up to step 8.4.5l of OPT-303-1, UNIT 1 "REACTOR COOLANT SYSTEM WATER INVENTORY CALCULATION."

(RA3) **Perform a Heat Balance (New)**
Demonstrate the ability calculate the current power level for Unit 1 using OPT-309, "Unit Calorimetric," starting at step 8.2.2.9.

(RA4) **Determine Radiation doses during system alignment (RA4 June 2014)**
Demonstrate the ability CALCULATE the dose received when performing the system alignment both without and without dose for two crews using STA-657, "ALARA Job Planning/Debriefing."

SRO

(SA5) **Determine Close Contact Fuel Assemble Movement (New)**
Demonstrate the ability to DETERMINE the types of Close Contact movement to be performed for the next 3 Fuel Assemblies in accordance with procedure RFO-302, "Handling of Fuel Assemblies," current fuel reload sequence plan, and a map of all core locations showing currently loaded fuel assembly locations.

(SA6) **Review Calculated RCS Leakrate for LCO entry Conditions (New)**
Demonstrate the ability review the attached surveillance data for accuracy, re perform incorrect calculations, verify against provided data, and determine LCO entry condition and actions, using procedure OPT-303-1, "Unit 1 Reactor Coolant System Water Inventory," and Technical Specifications.

(SA7) **Perform Heat balance (SRO-Only) (New)**
Demonstrate the ability to use procedure OPT-309, Section 8.2, "Manual Calorimetric Calculation," make corrections as necessary and adjust power range instruments as required.

(SA8) **Approve a Release Permit (Mod from SA4 2009)**
Demonstrate the ability to use procedure STA 603, "Control of Station Radioactive Effluents," to review the Containment Release Permit and apply Technical Specifications.

(SA9) **Determine the Correct Emergency Declaration (New)**

Demonstrate the ability to use Comanche Peak Emergency Action Level Charts to determine correct Emergency Action Level for the given plant conditions.

Facility: Comanche Peak NPP Date of Examination: 06-11-18

Exam Level: RO ■ SRO-I ☐ SRO-U ☐ Operating Test No.: NRC

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. (S1) Perform RCS dilution at Power (RO1301)	S, D	1
b. (S2) Transfer ECCS System from Inj Phase to CL Recirc Phase	S, N, A, L, EN, E	2
c. (S3) Determine Pressurizer heater Operability	S, D, L	3
d. (S4) Start RCP 1-04 (modified from RO1102D)	S, M, A, L	4P
e. (S5) Verify Containment Spray Flow	S, N, A, L, EN, E	5
f. (S6) Transfer 1EA2 bus from DG 1-02 to XST2 (mod. from RO4215A)	S, M	6
g. (S7) CCW pipe rupture-Trip Rx, Trip RCPs (Time Critical)	S, N, A, E	8
h. (S8) Respond to Radioactive Gas Release (R04103A)	S, D, A, E	9
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. (P1) Refill Unit 2 CCW surge tank locally during loss of Instrument Air (Time Critical)	N, E, L, R	8
j. (P2) Locally respond to MG set trouble	N, A, R	1
k. (P3) Align Emergency Air to RHR Control Valves during Loss of Instrument Air (A06411)	D, E, L, R	2

* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions, all 5 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 RO/SRO-I/SRO-U
(A)lternate Path	4-6 / 4-6 / 2-3
(C)ontrol Room	
(D)irect from Bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(EN) gineered Safety Features	≥ 1 / ≥ 1 / ≥ 1 (control room system)
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Facility: Comanche Peak NPP Date of Examination: 06-11-18

Exam Level: RO ☐ SRO-I ■ SRO-U ☐ Operating Test No.: NRC

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. (S1) Perform RCS dilution at Power (RO1301)	S, D	1
b. (S2) Transfer ECCS System from Inj Phase to CL Recirc Phase	S, N, A, L, EN, E	2
c. (S3) Determine Pressurizer heater Operability	S, D, L	3
d. (S4) Start RCP 1-04 (modified from RO1102D)	S, M, A, L	4P
e. (S5) Verify Containment Spray Flow	S, N, A, L, EN, E	5
f. (S6) Transfer 1EA2 bus from DG 1-02 to XST2 (mod. from RO4215A)	S, M	6
g.		
h. (S8) Respond to Radioactive Gas Release (R04103A)	S, D, A, E	9
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. (P1) Refill Unit 2 CCW surge tank locally during loss of Instrument Air (Time Critical)	N, E, L, R	8
j. (P2) Locally respond to MG set trouble	N, A, R	1
k. (P3) Align Emergency Air to RHR Control Valves during Loss of Instrument Air (A06411)	D, E, L, R	2

* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions, all 5 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 RO/SRO-I/SRO-U
(A)lternate Path	4-6 / 4-6 / 2-3
(C)ontrol Room	
(D)irect from Bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(EN) gineered Safety Features	≥ 1 / ≥ 1 / ≥ 1 (control room system)
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Facility: Comanche Peak NPP Date of Examination: 06-11-18

Exam Level: RO ☐ SRO-I ☐ SRO-U ■ Operating Test No.: NRC

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.		
b. (S2) Transfer ECCS System from Inj Phase to CL Recirc Phase	S, N, A, L, EN, E	2
c.		
d.		
e. (S5) Verify Containment Spray Flow	S, N, A, L, EN, E	5
f.		
g.		
h. (S8) Respond to Radioactive Gas Release (R04103A)	S, D, A, E	9
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. (P1) Refill Unit 2 CCW surge tank locally during loss of Instrument Air (Time Critical)	N, E, L, R	8
j.		
k. (P3) Align Emergency Air to RHR Control Valves during Loss of Instrument Air (A06411)	D, E, L, R	2

* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions, all 5 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 RO/SRO-I/SRO-U
(A)lternate Path	4-6 / 4-6 / 2-3
(C)ontrol Room	
(D)irect from Bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(EN) gineered Safety Features	≥ 1 / ≥ 1 / ≥ 1 (control room system)
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Control Room Systems JPMs

(S1) **Perform RCS dilution at Power (Bank)**
Demonstrate the ability to manually dilute the VCT with 100 gallons to restore Tave to Tref within 0.25°F. Dilution rate is be 100 gpm using SOP-104A, REACTOR MAKEUP AND CHEMICAL CONTROL SYSTEM, Section 5.2.2.

(S2) **Transfer ECCS System from Inj Phase to CL Recirc Phase (New)**
Demonstrate the ability to realign for single train ECCS recirculation per EOS-1.3A with the 'B' RHR pump supplying both trains CCP's and SIPs suction source. During the alignment the applicant must recognize and take appropriate actions for pump cavitation.

(S3) **Determine Pressurizer Heater Operability (Bank)**
Demonstrate the ability to determine the operability of all four Pressurizer Heater groups by performing Step 5.3.1 of IPO-001A, "Plant Heatup from Cold Shutdown to Hot Standby."

(S4) **Start Reactor Coolant Pump 1-04 (Modified)**
Demonstrate the ability to start RCP 1-01 per SOP-108A, "Reactor Coolant Pump" Section 5.1, recognize sustained high amps, and secure the pump.

(S5) **Verify Containment Spray Flow (New)**
Demonstrate the ability to Verify Containment Spray Not Required in accordance with Step 7 of EOP-0.0A, Reactor Trip or Safety Injection," realize that it is required, then initiate it and realign equipment that did not align correctly.

(S6) **Transfer 1EA2 bus from DG 1-02 to XST2 (Modified)**
Demonstrate the ability to transfer power from DG 1-02 to XST2 for Bus 1EA2 per SOP-609A, "Diesel Generator System," Section 5.7.

(S7) **CCW pipe rupture-Trip Rx, Trip RCPs (New) (Time Critical)**
Demonstrate the ability recognize a CCW pipe rupture during a pump swap starting with SOP 502A, "Component Cooling Water System," entering ABN-502, CCW System Malfunctions, then tripping the reactor and all four reactor coolant pumps (in that order) within 10 minutes of losing CCW to the pumps.

(S8) **Respond to Radioactive Gas Release (Bank)**
Demonstrate the ability to respond to the RED (High) Radiation condition per ABN-902, "Release of Radioactive/Toxic Gas," and recognize that control room ventilation did not realign for the required conditions of high radiation as required. Establish Train B Control Room ventilation for Emergency recirculation.

In Plant Systems JPMs

(P1) **Refill Unit 2 CCW surge tank locally during loss of Inst. Air (New) (Time Critical)**
Demonstrate the ability to simulate restoring the Unit 2 CCW Surge Tank level to within the normal operating band by manually controlling the makeup valve in accordance with ABN-301, “Loss of Instrument Air,” within 30 minutes.

(P2) **Locally Respond to MG Trouble (New)**
Demonstrate the ability to respond to MG trouble alarms locally using ABN-712, “Rod Control System Malfunction,” and simulate adjusting voltages of both MG sets to within specifications.

(P3) **Align Emergency Air to RHR Control Valves during Loss of Instrument Air (Bank)**
Demonstrate the ability to align an emergency source of Instrument Air to Unit 2 per ABN-104, “Residual Heat Removal System Malfunction,” Attachment 14.

Scenario Event Description
CPNPP 2018 NRC Scenario 1

Facility:	CPNPP 1 & 2	Scenario No.:	1	Op Test No.:	CPNPP 2018 NRC
Examiners:		Operators:			

Initial Conditions: Unit 1 is stable at 2 - 3% Reactor Power. MFW Pump 1A is in service. EHC pumps A & C are running. EHC Pump B is out of service. BOL Boron is 1669 ppm (by sample).

Turnover: Warmup and synchronization of the turbine generator planned per IPO-003A, Power Operations Section 5.1, Warmup and Synchronization of the Turbine Generator. Power Ramp is on hold due to awaiting Core Performance updated reactivity projections for power ascension.

Critical Tasks:
- CT-1 Trip reactor coolant pumps within 5 minutes upon a loss of Subcooling per EOP-0.0A, Reactor Trip or Safety Injection OR EOP-1.0A, Loss of Reactor or Secondary Coolant.
- CT-2 Establish long term core cooling by establishing ECCS flow in Cold Leg Recirculation prior to reaching RWST Empty per EOS-1.3A, Transfer to Cold Leg Recirculation.

Event No.	Malf. No.	Event Type*	Event Description
1	RP06C	C (RO, SRO) TS (SRO)	Loop 3 N16 Channel (1-JI-431A/B) Fails High LCO 3.3.1.E, Reactor Trip System Instrumentation
2	DIED 1B41 DITCHS 6552	C (BOP,SRO)	Loss of 1B4, EHC Pump C Fails to Auto Restart
3	(COND)	C (BOP, SRO)	SG 1-02 FW BYP Controller Failure, 1-LK-560 Demand Fails to 0% in Auto
4	FW13A DIFWHS2450A	C (BOP, SRO) TS (SRO)	Inadvertent Start of MDAFW Pump 1-01 and Inadvertent Opening of TDAFW Pump Steam Supply Valve 1-HS-2452-1 LCO 3.7.5, Auxiliary Feedwater (AFW) System
5	RD06 D12	M (RO,BOP, SRO)	Ejected Control Rod D12, Control Bank D
6	SS02A1 SS02A2	C (RO, SRO)	Main Steamlines Fail to Isolate on Containment Pressure HI-2
7	FW38B	C (BOP)	Steam Generator 1-02 FWIV Fails to Auto Close

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

Actual	Target Quantitative Attributes
7	Total malfunctions (5-8)
2	Malfunctions after EOP entry (1-2)
4	Abnormal events (2-4)
1	Major transients (1-2)
4	EOPs entered/requiring substantive actions (1-2)
2	EOP contingencies requiring substantive actions (0-2)
2	Critical tasks (2-3)

SCENARIO 1 SUMMARY

Event 1
The first event is a failure of Loop 3 N16 channel, 1-JI-431A/B high. The crew will enter ABN-704, Tc/N-16 Instrumentation Malfunction, Section 2.0, Tc/N-16 Instrumentation Malfunction. The crew will take actions to defeat the failed channel. The SRO will refer to Technical Specifications.

Event 2
The second event is a loss of the 6.9 KV incoming breaker 1B4-1. Crew response will be per ABN-602, Response to a 6900/480V System Malfunction, Section 6.0, Non-Safeguards 480V Bus uB1/ uB2/ uB3/ uB4 Fault. The crew will re-energize the bus from the alternate feeder breaker. EHC pump C will fail to auto start on bus power restoration and the crew will take actions to restart the pump.

Event 3
The third event is a failure of 1-LK-560, SG 2 FW BYP CTRL to 0% demand in automatic. The BOP may take manual control of the controller and restore feedwater flow to SG 2 per ODA-102 or per the guidance of ALM-0081A, window 2.12, SG 2 Level Deviation.

Event 4
The fourth event is a Train A AMSAC fault causing an auto start of MDAFWP 1-01 and inadvertent opening of the Train A steam supply, 1-HS-2452-1 to the TDAFWP. The BOP operator may take the failed steam supply, 1-HS-2452-1 to Stop or Pull-Out per ODA-102 and follow up with the appropriate ALM response. AFW flow from the TDAFWP and 1-01 MDAFWP can also be stopped by closure of the AFW flow control valves. The crew will follow up with actions from ABN-305, Auxiliary Feedwater System Malfunction, Section 6.0, Inadvertent Turbine Driven AFW Pump Start (Steam Supply VLV Fails Open). The SRO will refer to Technical Specifications.

Events 5, 6, & 7
The major will be an Ejected Control Rod LOCA. The crew will trip the Reactor, initiate Safety Injection, and perform the Immediate Actions of EOP-0.0A, Reactor Trip or Safety Injection.

The Reactor Trip is complicated by a failure of 1-HS-2135, FWIV 2 to automatically close. The valve must be manually closed by placing the Control Board handswitch in the close position.

The rod ejection LOCA is complicated by a failure of the Main Steamlines to automatically isolate on HI-2 Containment Pressure of 6.2 psig. The MSLI must be manually performed by an operator on the Control Board.

The crew will transition from EOP-0.0A, Reactor Trip or Safety Injection to EOP-1.0A, Loss of Reactor or Secondary Coolant. Tripping RCPs within 5 minutes upon loss of subcooling is identified as Critical Task 1.

The crew will transition from EOP-1.0A, Loss of Reactor or Secondary Coolant to FRZ-0.1A, Response to High Containment Pressure when containment pressure reaches 18.2 psig (HI-3) rising. Upon completion of FRZ-0.1A, the crew must enter FRP-0.1A, Response to Imminent Pressurized Thermal Shock Condition. When RWST level reaches the Lo-Lo level of 33%, the crew will transition to EOS-1.3A, Transfer to Cold Leg Recirculation.

Terminating Criteria
Scenario will be terminated when the crew has completed aligning ECCS for Cold Leg Recirculation to satisfy CT-2, or at the discretion of the lead Examiner.

Risk Significance:

- Failure of risk significant systems prior to trip: MDAFWP 1-01 and TDAFWP Steam Supply
- Risk significant core damage sequence: Ejected Control Rod D12
- Risk significant operator actions: Stopping RCPs on loss of subcooling
  Manual closure of FWIV 2
  Manually actuate a MSLI

Critical Task Determination

Critical Task	Safety Significance	Cueing	Measurable Performance Indicators	Performance Feedback
CT-1 Trip reactor coolant pumps within 5 minutes upon a loss of Subcooling per EOP-0.0A, Reactor Trip or Safety Injection OR EOP-1.0A Loss of Reactor or Secondary Coolant.	Take one or more actions that would prevent a challenge to plant safety. FSAR II.K.3.5; WCAP-9584; WOG ERG Generic Issue for RCP Trip / Restart.	Procedurally driven from EOP-0.0A and EOP-1.0A Foldout pages. Availability of Subcooling indication both on meters and computer.	The operator will secure ALL RCPs using the handswitches on CB-05.	Indication of pump stop including light indication, flow and motor current.
CT-2 Establish long term core cooling by establishing ECCS flow in Cold Leg Recirculation prior to reaching RWST Empty per EOS-1.3A, Transfer to Cold Leg Recirculation.	Maintain core cooling by supplying suction source from the containment sumps after the RWST is depleted.	RWST LO-LO level alarm in and RWST level indication <33%, Containment Sump levels >808 ft. 3".	RHR pumps running, 1/1-8804A/B open suction header crosstied, RWST suctions to RHR pumps closed.	Monitor component positions and ECCS flows, RWST level and RCS parameters.

NOTE: (Per NUREG-1021, Appendix D) If an operator or the Crew significantly deviates from or fails to follow procedures that affect the maintenance of basic safety functions, those actions may form the basis of a CT identified in the post-scenario review.

Facility:	CPNPP 1 & 2	Scenario No.:	3	Op Test No.:	June 2018 NRC
Examiners:	_____	Operators:	_____		

Initial Conditions: 100% power EOL – RCS Boron is 6 ppm (by sample).

Turnover: Maintain steady state power conditions. Alternate Trains of Control Room Ventilation per SOP-802, Control Room Ventilation. All other OWI-409 equipment rotations are complete for Work Week 3.

Critical Tasks:

CT-1 - Place EDG 1-01 in Pull-Out per ABN-602, Response to a 6900/480V System Malfunction before EDG 1-01 has run unloaded for a total 15 minutes without cooling water flow.

CT-2 - Manually initiate Emergency Boration per ABN-107, Emergency Boration, due to a loss of DRPI, prior to exiting EOS-0.1A, Reactor Trip Response.

CT-3 - After a Loss of all Onsite and Offsite Power, restore power from an Offsite source per ABN-601, Response to a 138/345 KV System Malfunction and ECA-0.0A, Loss of All AC Power prior to completion of SG Depressurization in ECA-0.0A.

Event No.	Malf. No.	Event Type*	Event Description
1		N (BOP)	Alternate Trains of Control Room Ventilation per SOP-802, Control Room Ventilation, Section 5.3.10 to Train A in service
2	RD03H8	C (RO, SRO) R (BOP) TS (SRO)	Dropped Rod – Control Rod H8 LCO 3.1.4, Rod Group Alignment Limits LCO 3.4.1, RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits (if applicable)
3	FW14A TC09G	C (BOP, SRO) R (RO) TS (SRO)	Heater Drain Pump 1-01 Trip, Main Turbine fails to Auto Runback – Manual Runback required LCO 3.1.6, Control Bank Insertion Limits
4	ED05H	C (RO, BOP, SRO) TS (SRO)	Phase-to-Phase Ground on Safeguard Bus 1EA1 LCO 3.4.1, RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits (if applicable) LCO 3.7.5, Auxiliary Feedwater (AFW) System LCO 3.8.9, Distribution Systems - Operating.
5	ED01	M (RO, BOP, SRO)	Loss of Offsite Power
6	EAR454	C (RO)	Loss of 1C1 to C14 (DRPI Failure)
7	EG07B	M (RO, BOP, SRO)	EDG 1-02 Overspeed Trip, Loss of Onsite Power after Emergency Boration complete

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

Actual	Target Quantitative Attributes
7	Total malfunctions (5-8)
2	Malfunctions after EOP entry (1-2)
4	Abnormal events (2-4)
2	Major transients (1-2)
2	EOPs entered/requiring substantive actions (1-2)
1	EOP contingencies requiring substantive actions (0-2)
3	Critical tasks (2-3)

SCENARIO 3 SUMMARY

Event 1
The BOP will perform a normal evolution to alternate Trains of Control Room Ventilation per SOP-802, Control Room Ventilation, Section 5.3.10, Alternating Trains of Control Room Ventilation. Control Room Ventilation will be alternated to Train A in service per OWI-409, Equipment Rotation Program in accordance with Work Week 3. All other equipment rotations have been completed for the week.

Event 2
The next event will be a Dropped Control Rod. The Control Rod in the center of the core, H8, will drop to the bottom of the core. The crew will respond in accordance with ABN-712, Rod Control System Malfunction, Section 3.0, Dropped or Misaligned Rod in Mode 1 or 2. The RO will place Control Rods in Manual per the ABN. When the SRO has referenced Technical Specifications and the crew is awaiting input from Core Performance as to which recovery method will be used, the next malfunction will be inserted.

Event 3
The next event is a trip of Heater Drain Pump 1-01. The Main Turbine will fail to automatically runback and the Control Rods will still be in Manual from the previous event. The crew will manually initiate a Main Turbine Runback to 700 MW and either manually drive Control Rods or place Control Rods in auto and allow them to insert. The crew will respond in accordance with ABN-302, Feedwater, Condensate, Heater Drain System Malfunction, Section 4.0, Heater Drain Pump Trip. The SRO will refer to Technical Specifications for Control Bank Insertion Limits

Event 4
The next event will be a Phase-to-Phase Ground on Safeguards Bus 1EA1. The crew will respond in accordance with ABN-602, Response to a 6900/480V System Malfunction, Section 2.0, 6.9 KV Bus Fault (Modes 1, 2, 3, and 4). The crew will maintain Reactor Power less than 100% by reducing Main Turbine load due to a start of the TDAFWP. The RO will be required to start CCP 1-02 as CCP 1-01 will be de-energized on the loss of 1EA1. The BOP operator must place DG 1-01 in Pull-Out within 15 minutes of the DG starting and running unloaded with no cooling water to satisfy the first Critical Task of the scenario. The SRO will refer to Technical Specifications.

Event 5 & 6
The first major event is a Loss of Offsite Power which causes a Reactor Trip and a Loss of DRPI. DG 1-02 will start and power Safeguards Bus 1EA2. The crew will enter EOP-0.0A, Reactor Trip or Safety Injection. The Reactor Operator must Emergency Borate due to the Loss of DRPI per ABN-107, Emergency Boration to satisfy the second Critical Task. The crew will transition to EOS-0.1A, Reactor Trip Response after completion of the Immediate Operator Actions of EOP-0.0A.

Event 7
The second major event will be a trip of DG 1-02 on overspeed. The DG will trip after the RO has completed Emergency Boration and the crew has transitioned to EOS-0.1A. The crew will respond in accordance with ECA-0.0A, Loss of All AC Power. The BOP and the US will attempt to restore power and when power cannot be restored the US will direct the BOP to perform actions of ABN-601, Response to a 138/345 KV System Malfunction, Section 6.0, Loss of All Offsite and Onsite AC Power. The US and the RO will continue performing actions of ECA-0.0A while the BOP separately performs actions of ABN-601. After preparations for power restoration of ABN-601 are complete, the Transmission Grid Operator will contact CPNPP and inform that Offsite Power is available.

Terminating Criteria

The scenario will be terminated when the crew has restored Offsite Power to CPNPP and satisfied the third Critical Task.

Risk Significance:

• Failure of risk important system prior to trip:	86-1 Lockout on Safeguards Bus 1EA1 Control Rod H8 Drops to Core Bottom
• Risk significant core damage sequence:	Loss of Offsite Power and a failure of either DG to power its associated Safeguards Bus continually
• Risk significant operator actions:	Disabling DG 1-01 when running with no cooling water Emergency Boration for a Loss of DRPI Restoring Offsite Power after a complete Loss of Offsite and Onsite Power to the unit

Critical Task Determination

Critical Task	Safety Significance	Cueing	Measurable Performance Indicators	Performance Feedback
Place EDG 1-01 in Pull-Out per ABN-602, Response to a 6900/480V System Malfunction before EDG 1-01 has run unloaded for a total 15 minutes without cooling water flow.	Take one or more actions that would prevent a challenge to plant safety	DG 1-01 running with Voltage / Frequency indicated on CB-11 and no cooling water flow available from SSW Pump 1-01 because Safeguards Bus 1EA1 is de-energized.	Place CS-1DG1E, DG 1 EMER STOP/START handswitch in PULL-OUT at CB-11.	DG Voltage and Frequency will lower to 0 as indicated on F-1EG1, DG 1 FREQ and V-1EG1, DG 1 VOLT at CB-11 indicating the DG has been shutdown.
Manually initiate Emergency Boration per ABN-107, Emergency Boration, due to a loss of DRPI, prior to exiting EOS-0.1A, Reactor Trip Response.	Incorrect reactivity control (such as failure to initiate emergency boration or the SLC system or to manually insert control rods)	A complete Loss of Digital Rod Position Indication when Offsite Power is lost to the Unit. DRPI will be dark at CB-07 with no direct ability to verify all rods inserted into the core.	Initiate Emergency Boration per ABN-107, Att. 1, Emergency Boration through the Emergency Borate Valve 1-8104. The RO will verify a Charging Pump running, start a BA Transfer Pump, and open 1/1-8104.	Emergency Boration flow will be verified via 1-FI-183A, EMER BORATE FLO on CB-06.
After a Loss of all Onsite and Offsite Power, restore power from an Offsite source per ABN-601, Response to a 138/345 KV System Malfunction and ECA-0.0A, Loss of All AC Power prior to completion of SG Depressurization in ECA-0.0A.	Degraded emergency core cooling system (ECCS) or emergency power Capacity.	Safeguards Bus 1EA1 has an 86-1 Lockout and cannot be powered from the DG or Offsite Power. DG 1-02 will power Safeguards Bus 1EA2 prior to tripping on Overspeed and is unable to be re-started. Both Safeguards Busses will remain de-energized until an Offsite source of power is available to re-power Safeguards Bus 1EA2.	The BOP Operator will perform the necessary actions to prepare Safeguards 1EA2 to receive Offsite Power per ABN-601. Offsite Power will be restored via 138 KV to the XST1 Transformer. The BOP turn on the Synch Scope and Manually close the Alternate Feeder Breaker to 1EA2.	Safeguards Bus 1EA2 Voltage and Frequency as indicated on V-1EA2-1, BUS 1EA2 VOLT and F-1EA2, BUS 1EA2 FREQ on CB-11.

NOTE: (Per NUREG-1021, Appendix D) If an operator or the Crew significantly deviates from or fails to follow procedures that affect the maintenance of basic safety functions, those actions may form the basis of a CT identified in the post-scenario review.

Facility:	CPNPP 1 & 2	Scenario No.:	4	Op Test No.:	CPNPP 2018 NRC
Examiners:		Operators:			

Initial Conditions: Unit 1 is stable at 100% Reactor Power. BOL (IC15), Boron is 1138 ppm (by sample).

Turnover: Maintain Unit Load and Availability. A severe thunderstorm watch is in effect for all North Texas until 23:00 tonight. The previous shift has completed applicable sections of ABN-907, Acts of Nature, Section 5.0, Severe Weather.

Critical Tasks:
- CT-1 Identify and Isolate Faulted Steam Generator Prior to Exiting EOP-2.0A, Faulted Steam Generator Isolation.
- CT-2 Initiate Cooldown of the Reactor Coolant System in accordance with ECA-3.1A, Prior to Commencing ECCS Flow Reduction.

Event No.	Malf. No.	Event Type*	Event Description
1	MS13D	C (BOP,SRO)	PT-2328, MSL 4 Pressure Transmitter Fails High
2	NI05E	C (RO, SRO) TS (SRO)	PR Channel NI-43 Fails High (LCO 3.3.1)
3	CR01	C (RO, SRO) TS (SRO)	Fuel Failure (LCO 3.4.16)
4	LQY-553	C (BOP, SRO) TS (SRO)	SG 1-03 FCV (FCV-530) Oscillations (LCO 3.3.1, 3.3.2)
5	MS01C SG01C	M (RO,BOP, SRO)	SG 1-03 Faulted/Ruptured IRC
6	CS02E CS02G CS09A DICSHS4764 DICSHS4765	C (RO, BOP, SRO)	Train A CSPs Fail to Sequence on SI Train A CSPs Fail to Actuate on Hi-3 Unable to manually start pumps
7	CS07B	C (RO, SRO)	1-HS-4777, CS HX 2 Out Vlv Fails to Auto Open
8	DISGHS2399A	C (BOP)	SG 1-03 Blowdown Iso Vlv Fails to Close on MSLI

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

Actual	Target Quantitative Attributes
8	Total malfunctions (5-8)
3	Malfunctions after EOP entry (1-2)
4	Abnormal events (2-4)
2	Major transients (1-2)
3	EOPs entered/requiring substantive actions (1-2)
1	EOP contingencies requiring substantive actions (0-2)
2	Critical tasks (2-3)

SCENARIO 1 SUMMARY

Event 1
The first event is a failure high of Steam Line Pressure Transmitter PT-2328 causing SG 1-04 Atmospheric Relief Valve to open. The BOP will verify steam line pressure is below the lift pressure of 1125 psig and take manual control of 1-PK-2328 and close the ARV. The crew will take the actions of ABN-709, STEAM LINE PRESSURE, STEAM HEADER PRESSURE, TURBINE 1st-STAGE PRESSURE AND FEED HEADER PRESSURE INSTRUMENT MALFUNCTION

Event 2
The second event is a failure high of Power Range Nuclear Instrument NI-43. The Reactor Operator will verify no transient in progress and place Rod Control in manual to stop unnecessary rod motion. The crew will take the actions of ABN-703, POWER RANGE INSTRUMENTATION MALFUNCTION. The SRO will refer to Technical Specifications.

Event 3
The third event is a 0.5% Fuel failure. N16 Instrumentation will begin increasing due to the failure. The crew will respond per ABN-102, HIGH REACTOR COOLANT ACTIVITY. The SRO will refer to Technical Specification 3.4.16.

Event 4
The fourth event is an oscillation of feedwater controller FCV-530 in automatic. The BOP will diagnose improper control response, place 1-FK-530 in manual and control feedwater flow to restore SG 3 level to program. The crew will take the actions of ABN-710, STEAM GENERATOR LEVEL INSTRUMENTATION MALFUNCTION. The SRO will refer to Technical Specifications.

Events 5, 6, 7 & 8
The major will be a Fault and Tube Rupture on SG 1-03. The crew will respond to the reactor trip and Safety Injection, perform the Immediate Actions of EOP-0.0A, REACTOR TRIP OR SAFETY INJECTION. The crew will transition through EOP-2.0A, FAULTED STEAM GENERATOR ISOLATION

The Reactor Trip is complicated by a failure of SG 3 BLDN HELB ISOL VLV to automatically close. The valve must be manually closed by placing the Control Board handswitch, 1-HS-2399A, in the close position.

The Safety Injection Actuation is complicated by a Train A Containment Spray System failure. Train A Containment Spray will remain unavailable throughout the scenario regardless of actions taken by the crew.

Containment Spray Actuation is complicated by the Train B CS Hx Outlet Valve failing to auto open on HI-3 containment pressure. Train B containment spray flow can be established by manually opening 1-HS-4777 from the main control board.

The crew will transition from EOP-0.0A, REACTOR TRIP OR SAFETY INJECTION to EOP-2.0A, FAULTED STEAM GENERATOR ISOLATION. Isolating the Faulted/Ruptured SG is identified as Critical Task 1.

The crew will transition from EOP-2.0A, FAULTED STEAM GENERATOR ISOLATION to , EOP-3.0A, STEAM GENERATOR TUBE RUPTURE and into ECA-3.1A, SGTR WITH LOSS OF REACTOR COOLANT - SUBCOOLED RECOVERY DESIRED. Initiating an RCS Cooldown per ECA-3.1A, SGTR WITH LOSS OF REACTOR COOLANT - SUBCOOLED RECOVERY DESIRED is identified as Critical Task 2.

Terminating Criteria

Scenario will be terminated when the crew has commenced a cooldown per EOS-1.2A, Post LOCA Cooldown and Depressurization, or at the discretion of the lead Examiner.

Risk Significance:

- Failure of risk significant systems prior to trip: 0.5% Fuel failure
- Risk significant core damage sequence: Faulted/Ruptured SG
- Risk significant operator actions: Establish Containment Spray flow from Train B.
  Isolate Faulted/Ruptured SG

Critical Task Determination

Critical Task	Safety Significance	Cueing	Measurable Performance Indicators	Performance Feedback
CT-1 Identify and Isolate Faulted Steam Generator Prior to Exiting EOP-2.0A, Faulted Steam Generator Isolation.	Take one or more actions that would prevent a challenge to plant safety.	Procedurally driven from EOP-2.0A to isolate the faulted SG to prevent further RCS cooldown and mass and energy release.	The operator will close the SG 3 BLDN HELB ISOL VLV from the handswitch on CB08.	Valve position will change.
CT-2 Initiate Cooldown of the Reactor Coolant System in accordance with ECA-3.1A, Prior to Commencing ECCS Flow Reduction.	Take one or more actions that would prevent a challenge to plant safety.	Procedurally driven from ECA-3.1A to commence cooldown to reduce the overall temperature of the RCS.	The operator will increase dumping steam from the SGs via the Steam Dumps to reduce RCS temperature.	Lowering SG pressures and lowering RCS temperatures beginning with the cold leg temperatures.
NOTE: (Per NUREG-1021, Appendix D) If an operator or the Crew significantly deviates from or fails to follow procedures that affect the maintenance of basic safety functions, those actions may form the basis of a CT identified in the post-scenario review.				