Facility: Date of Exam:

Tier	Group	RO K/A Category Points: K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	Total	SRO-Only Points: A2	G*	Total
1. Emergency & Abnormal Plant Evolutions	1	3	3	3	N/A			3	3	N/A		3	18			6
	2	1	2	2				1	2			1	9			4
	Tier Totals	4	5	5				4	5			4	27			10
2. Plant Systems	1	2	3	2	2	3	2	3	3	2	3	3	28			5
	2	1	1	1	1	0	1	1	1	1	1	1	10			3
	Tier Totals	3	4	3	3	3	3	4	4	3	4	4	38			8

3. Generic Knowledge and Abilities Categories	1	2	3	4	Total	SRO: 1	2	3	4	Total
	3	2	2	3	10					7

Note:

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

G* Generic K/As

ES-401 PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO) Form ES-401-2									
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G*	K/A Topic(s)	IR	#
000007 Reactor Trip - Stabilization - Recovery / 1	X						EK1.05 Knowledge of the operational implications of decay power as a function of time as they apply to the reactor trip. (CFR 41.8 / 41.10 / 45.3)	3.3	39
000008 Pressurizer Vapor Space Accident / 3				X			AA1.02 Ability to operate and / or HPI pump to control PZR level/pressure as they apply to the Pressurizer Vapor Space Accident. (CFR 41.7 / 45.5 / 45.6)	4.1	40
000009 Small Break LOCA / 3					X		EA2.38 Ability to determine or interpret the Existence of head bubble as they apply to a small break LOCA: (CFR 43.5 / 45.13)	3.9	41
000011 Large Break LOCA / 3					X		EA2.13 Ability to determine or interpret the difference between overcooling and LOCA indications as they apply to a Large Break LOCA. (CFR 43.5 / 45.13)	3.7*	42
000015/17 RCP Malfunctions / 4			X				AK3.01 Knowledge of the reason for the potential damage from high winding and/or bearing temperatures as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow). (CFR 41.5, 41.10/45.6/45.13)	2.5*	43
000022 Loss of Rx Coolant Makeup / 2	X						AK1.03 Knowledge of the operational implications of the relationship between charging flow and PZR level as they apply to Loss of Reactor Coolant Makeup. (CFR 41.8 / 41.10 / 45.3)	3.0	44
000025 Loss of RHR System / 4				X			AA1.23 Ability to operate and / or monitor RHR heat exchangers as they apply to the Loss of Residual Heat Removal System: (CFR 41.7 / 45.5 / 45.6)	2.8	45
000026 Loss of Component Cooling Water / 8						X	~~G2.2.39 Knowledge of less than or equal to one hour Technical Specification action statements for systems. (CFR: 41.7 / 41.10 / 43.2 / 45.13)~~ G2.4.11 - Knowledge of abnormal condition procedures. (IR 4.0)	4.0	46
000027 Pressurizer Pressure Control System Malfunction / 3									
000029 ATWS / 1		X					EK2.06 Knowledge of the interrelations between breakers, relays, and disconnects following an ATWS. (CFR 41.7 / 45.7)	2.9*	47
000038 Steam Gen. Tube Rupture / 3	X						EK1.02 Knowledge of the operational implications of leak rate vs. pressure drop as they apply to the SGTR. (CFR 41.8 / 41.10 / 45.3)	3.2	48
000040 (W/E12) Steam Line Rupture - Excessive Heat Transfer / 4						X	~~G2.4.49 Ability to perform without reference to procedures those actions that require immediate operation of system components and controls. (CFR: 41.10 / 43.2 / 45.6)~~ G2.4.2 - Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions.	~~4.6~~ 4.5	49

000054 Loss of Main Feedwater / 4			X				AK3.03 Knowledge of the reasons for manual control of AFW flow control valves as they apply to the Loss of Main Feedwater (MFW). (CFR 41.5,41.10 / 45.6 / 45.13)	3.8	50
000055 Station Blackout / 6									
000056 Loss of Off-site Power / 6					X		~~AA2.09 Ability to determine and interpret the operational status of reactor building cooling unit as they apply to the Loss of Offsite Power:~~ Replaced with AA2.21 - Ability to determine and interpret the following as they apply to the Loss of Offsite Power: EDG voltage and frequency indicators	~~2.7~~ 3.6	51
000057 Loss of Vital AC Inst. Bus / 6						X	G2.4.3 Ability to identify post-accident instrumentation. (CFR: 41.6 / 45.4)	3.7	52
000058 Loss of DC Power / 6									
000062 Loss of Nuclear Svc Water / 4			X				~~AK3.04 Knowledge of the reasons for the effect on Nuclear Service water discharge flow header of a loss of CCW as they apply to the Loss of Nuclear Service Water. (CFR 41.4, 41.8 / 45.7)~~ AK3.03 - Guidance actions contained in EOP for Loss of nuclear service water (ASW)	~~3.5~~ 4.0	53
000065 Loss of Instrument Air / 8				X			AA1.05 Ability to operate and / or monitor the following as they apply to the Loss of Instrument Air. (CFR 41.7 / 45.5 / 45.6) RPS	3.3*	54
W/E04 LOCA Outside Containment / 3									
W/E11 Loss of Emergency Coolant Recirc. / 4									
W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4		X					EK2.1 Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.7)	3.7	55
000077 Generator Voltage and Electric Grid Disturbances / 6		X					AK2.05 Knowledge of the interrelations between Generator Voltage and Electric Grid Disturbances and Pumps. (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8)	3.1	56
K/A Category Totals:	3	3	3	3	3	3	Group Point Total:		18/6

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

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G*	K/A Topic(s)	IR	#
000001 Continuous Rod Withdrawal / 1									
000003 Dropped Control Rod / 1									
000005 Inoperable/Stuck Control Rod / 1									
000024 Emergency Boration / 1									
000028 Pressurizer Level Malfunction / 2			X				AK3.02 Knowledge of the reasons for the relationship between PZR pressure increase and reactor makeup/letdown imbalance as they apply to the Pressurizer level Control Malfunctions. (CFR 41.5, 41.10/45.6/45.13)	2.9	57
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7									
000036 Fuel Handling Accident / 8					X		AA2.01 ~~AK2.01Knowledge of the interrelations between the Fuel Handling Incidents and fuel handling equipment.~~ (CFR 41.7 / 45.7) Ability to determine and interpret the following as they apply to the Fuel Handling Incidents: ARM system indications	~~2.9~~ 3.2	58
000037 Steam Generator Tube Leak / 3									
000051 Loss of Condenser Vacuum / 4									
000059 Accidental Liquid Radwaste Rel. / 9				X			AA1.02 Ability to operate and / or monitor the ARM system as they apply to the Accidental Liquid Radwaste Release. NOTE: ARM should be PRM as rad monitor for liquid radwaste is a process, not area monitor at DCPP (CFR 41.7 / 45.5 / 45.6)	3.3	59
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
000067 Plant Fire On-site / 8									
000068 Control Room Evac. / 8									
000069 Loss of CTMT Integrity / 5						X	G2.1.7 Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. (CFR: 41.5 / 43.5 / 45.12 / 45.13)	4.4	60
000074 Inad. Core Cooling / 4			X				EK3.08 Knowledge of the reasons for the Securing RCPs as they apply to the Inadequate Core Cooling. (CFR 41.5 / 41.10 / 45.6 / 45.13)	4.1	61
000076 High Reactor Coolant Activity / 9									
W/EO1 & E02 Rediagnosis & SI Termination / 3	X						EK1.2 Knowledge of the operational implications of the Normal, abnormal and emergency operating procedures associated with (SI Termination).as they apply to the (SI Termination) (CFR: 41.8 / 41.10, 45.3)	3.4	62

W/E03 LOCA Cooldown - Depress. / 4		X					~~EK2.1~~ EK2.2 - Knowledge of the interrelations between the (LOCA Cooldown and Depressurization) and the facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility.. (CFR: 41.7 / 45.7) (KA statement/importance for EK2.2 not EK2.1)	3.7	63
W/E13 Steam Generator Over-pressure / 4					X		EA2.1 Ability to determine and interpret the facility conditions and selection of appropriate procedures during abnormal and emergency operations as they apply to the (Steam Generator Overpressure) (CFR: 43.5 / 45.13)	2.9	64
W/E15 Containment Flooding / 5									
W/E16 High Containment Radiation / 9		X					EK2.1 Knowledge of the interrelations between the (High Containment Radiation) and the Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.7)	3.0	65
K/A Category Point Totals:	1	2	2	1	2	1	Group Point Total:		9/4

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

System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	K/A Topic(s)	IR	#
003 Reactor Coolant Pump							X					A1.08 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RCPS controls including Seal water temperature. (CFR: 41.5 / 45.5)	2.5	1
003 Reactor Coolant Pump											X	~~G2.2.4 Ability to explain the variations in control board/control room | layouts, systems, instrumentation, and procedural actions between units at a facility. (CFR: 41.6 / 41.7 / 41.10 / 45.1 / 45.13)~~ G2.2.36 Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations. (CFR: 41.10 / 43.2 / 45.13)	~~3.6~~ 3.1	2
004 Chemical and Volume Control							X					A1.09 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CVCS controls including RCS pressure and temperature. (CFR: 41.5 / 45.5)	3.6	3
005 Residual Heat Removal					X							K5.05 Knowledge of the operational implications of the plant response during "solid plant": pressure change due to the relative incompressibility of water as they apply the RHRS. (CFR: 41.5 / 45.7)	2.7*	4
006 Emergency Core Cooling				X								K4.14 Knowledge of ECCS design feature(s) and/or interlock(s) which provide for Cross-Connection of HPI/LPI/SIP. (CFR: 41.7)	3.9	5
007 Pressurizer Relief/Quench Tank					X							K5.02 Knowledge of the operational implications of the method of forming a steam bubble in the PZR as they apply to PRTS. (CFR: 41.5 / 45.7)	3.1	6
008 Component Cooling Water											X	~~G2.2.25 Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)~~ G2.1.28 Knowledge of the purpose and function of major system components and controls. (CFR: 41.7)	~~3.2~~ 4.1	7
008 Component Cooling Water			X									K3.03 Knowledge of the effect that a loss or malfunction of the CCWS will have on the RCP. (CFR 41.7)	4.1	8
010 Pressurizer Pressure Control										X		A4.03 Ability to manually operate and/or monitor PORV and block valves in the control room. (CFR: 41.7 / 45.5 to 45.8)	4.0	9

012 Reactor Protection		X										K2.01 Knowledge of bus power supplies to the RPS channels, components, and interconnections. (CFR: 41.7)	3.3	10
012 Reactor Protection						X						K6.03 Knowledge of the effect of a loss or malfunction of the trip logic circuits will have on the RPS. (CFR: 41.7 / 45/7)	3.1	11
013 Engineered Safety Features Actuation		X										K2.01 Knowledge of bus power supplies to ESFAS/safeguards equipment control. (CFR 41.7)	3.6*	12
013 Engineered Safety Features Actuation					X							K5.02 Knowledge of the operational implications of safety system logic and reliability as they apply to the ESFAS. (CFR: 41.5 / 45.7)	2.9	13
022 Containment Cooling									X			A3.01 Ability to monitor automatic operation of the CCS, including initiation of safeguards mode of operation. (CFR: 41.7 / 45.5)	4.1	14
026 Containment Spray	X											K1.01 Knowledge of the physical connections and/or cause effect relationships between the CSS and ECCS. (CFR: 41.2 to 41.9 / 45.7 to 45.8)	4.2	15
039 Main and Reheat Steam									X			A3.02 Ability to monitor automatic operation of the MRSS, including isolation of the MRSS. (CFR: 41.5 / 45.5)	3.1	16
039 Main and Reheat Steam				X								K4.06 Knowledge of MRSS design feature(s) and/or interlock(s) which prevent reverse steam flow on steam line break. (CFR: 41.7)	3.3	17
059 Main Feedwater			X									K3.02 Knowledge of the effect that a loss or malfunction of the MFW will have on the AFW system. (CFR: 41.7 / 45.6)	3.6	18
061 Auxiliary/Emergency Feedwater						X						K6.02 Knowledge of the effect of a loss or malfunction of Pumps will have on the AFW components. (CFR: 41.7 / 45.7)	2.6	19
062 AC Electrical Distribution							X					A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ac distribution system controls including the significance of D/G load limits. (CFR: 41.5 / 45.5)	3.4	20
062 AC Electrical Distribution										X		A4.03 Ability to manually operate and/or monitor synchro scope, including an understanding of running and incoming voltages in the control room. (CFR: 41.7 / 45.5 / to 45.8)	2.8	21

063 DC Electrical Distribution											X	~~G2.4.1 Knowledge of EOP entry conditions and immediate action steps. (CFR: 41.10 / 43.5 / 45.13)~~ G2.4.6Knowledge of EOP mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	~~4.6~~ 3.7	22
064 Emergency Diesel Generator	X											K1.02 Knowledge of the physical connections and/or cause effect relationships between the ED/G system and the D/G cooling water system. (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.1	23
073 Process Radiation Monitoring								X				A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the PRM system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Erratic or failed power supply. (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.5	24
076 Service Water		X										~~K2.08 Knowledge of bus power supplies to ESF actuated MOVs. (CFR: 41.7)~~ K2.01 Knowledge of bus power supplies to Service Water.	~~3.1~~* 2.7	25
078 Instrument Air										X		A4.01 Ability to manually operate and/or monitor pressure guages in the control room. (CFR: 41.7 / 45.5 to 45.8)	3.1	26
103 Containment								X				A2.03 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: Phase A and B isolation. (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.5*	27
103 Containment								X				A2.05 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: Emergency Containment entry. (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9	28
K/A Category Point Totals:	2	3	2	2	3	2	3	3	2	3	3	Group Point Total:		28/5

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

Plant Systems - Tier 2/Group 2 (RO / 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	#
001 Control Rod Drive														
002 Reactor Coolant						X						K6.06 Knowledge of the effect or a loss or malfunction on Sensors and Detectors. (CFR: 41.7 / 45.7)	2.5	29
011 Pressurizer Level Control														
014 Rod Position Indication														
015 Nuclear Instrumentation		X										K2.01 Knowledge of bus power supplies to NIS channels, components, and interconnections. (CFR: 41.7)	3.3	30
016 Non-Nuclear Instrumentation					X							~~K5.01 Knowledge of the operational implication of separation of control and protection circuits as they apply to the NNIS. (CFR: 41.5 / 45.7)~~ K3.01 –Knowledge of the effect that a loss or malfunction of the NNIS will have on the following: RCS	~~2.7~~ 3.4*	31
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling .							X					~~A1.02 Knowledge of the physical connections and/or cause effect relationships between the Spent Fuel Pool Cooling System and RHRS. (CFR: 41.2 to 41.9 / 45.7 to 45.8)~~ A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Spent Fuel Pool Cooling System operating the controls including: Spent fuel pool water level	~~2.5~~ 2.7	32
034 Fuel Handling Equipment										X		A4.02 Ability to manually operate and/or monitor neutron levels in the control room. (CFR: 41.7 / 45.5 to 45.8)	3.5	33
035 Steam Generator									X			A3.01 Ability to monitor automatic operation of the S/G including S/G water level control. (CFR: 41.7 / 45.5)	4.0	34
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator														
055 Condenser Air Removal														
056 Condensate														
068 Liquid Radwaste														

071 Waste Gas Disposal											X	G2.1.30 Ability to locate and operate components, including local controls. (CFR: 41.7 / 45.7)	4.4	35
072 Area Radiation Monitoring				X								K4.01 Knowledge of ARM system design feature(s) and/or interlock(s) which provide for containment ventilation isolation. (CFR: 41.7)	3.3*	36
075 Circulating Water														
079 Station Air	X											K1.01 Knowledge of the physical connections and/or cause effect relationships between the SAS and IAS. (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.0	37
086 Fire Protection								X				A2.04 Ability to (a) predict the impacts of failure to actuate the FPS when required, resulting in fire damage on the Fire Protection System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of failure to actuate the FPS when required, resulting in fire damage: (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.3	38
K/A Category Point Totals:	1	1	0	1	1	1	1	1	1	1	1	Group Point Total:		10/3

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.15	Knowledge of administrative requirements for temporary management directives, such as standing orders, night orders, Operations memos, etc. (CFR: 41.10 / 45.12)	2.7	66		
	2.1.32	Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	3.8	67		
	2.1.45	Ability to identify and interpret diverse indications to validate the response of another indication. (CFR: 41.7 / 43.5 / 45.4)	4.3	68		
	Subtotal					
2. Equipment Control	~~2.2.42~~ 2.2.43	~~Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (CFR: 41.7 / 41.10 / 43.2 / 43.3 / 45.3)~~ Knowledge of the process used to track inoperable alarms.	~~3.9~~ 3.0	69		
	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	70		
	Subtotal					
3. Radiation Control	2.3.11	Ability to control radiation releases. (CFR: 41.11 / 43.4 / 45.10)	3.8	71		
	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	72		
	Subtotal					
4. Emergency Procedures / Plan	2.4.4	Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.5	73		
	2.4.32	Knowledge of operator response to loss of all annunciators. (CFR: 41.10 / 43.5 / 45.13)	3.6	74		
	2.4.37	Knowledge of the lines of authority during implementation of the emergency plan. (CFR: 41.10 / 45.13)	3.0	75		
	Subtotal					

Tier 3 Point Total		10		7

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Emergency &
Abnormal
Plant
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Plant
Systems</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>28</td><td colspan="2">3</td><td colspan="2">2</td><td>5</td></tr>
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</table>

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

G* Generic K/As

ES-401							PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO)	Form ES-401-2	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G*	K/A Topic(s)	IR	#
000007 Reactor Trip - Stabilization - Recovery / 1									
000008 Pressurizer Vapor Space Accident / 3									
000009 Small Break LOCA / 3									
000011 Large Break LOCA / 3									
000015/17 RCP Malfunctions / 4					X		~~AA2.10 Ability to determine and interpret when to secure RCPs on loss of cooling or seal injection as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow). (CFR 43.5 / 45.13)~~ AA2.11 -when to jog RCPs during ICC	~~3.7~~ 3.8	76
000022 Loss of Rx Coolant Makeup / 2					X		AA2.01 Ability to determine and interpret whether charging line leak exists as they apply to the Loss of Reactor Coolant Makeup. (CFR 43.5/ 45.13)	3.8	77
000025 Loss of RHR System / 4									
000026 Loss of Component Cooling Water / 8									
000027 Pressurizer Pressure Control System Malfunction / 3									
000029 ATWS / 1						X	G2.4.41 Knowledge of the emergency action level thresholds and classifications. (CFR: 41.10 / 43.5 / 45.11)	4.6	78
000038 Steam Gen. Tube Rupture / 3					X		EA2.03 Ability to determine or interpret which S/G is ruptured as they apply to a SGTR. (CFR 43.5 / 45.13)	4.6	79
000040 Steam Line Rupture - Excessive Heat Transfer / 4									
000054 Loss of Main Feedwater / 4									
000055 Station Blackout / 6									
000056 Loss of Off-site Power / 6									
000057 Loss of Vital AC Inst. Bus / 6									
000058 Loss of DC Power / 6									
000062 Loss of Nuclear Svc Water / 4									
000065 Loss of Instrument Air / 8									
W/E04 LOCA Outside Containment / 3									
W/E11 Loss of Emergency Coolant Recirc. / 4						X	G2.4.2 Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)	4.6	80
W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									

000077 Generator Voltage and Electric Grid Disturbances / 6						X	G2.4.30 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. (CFR: 41.10 / 43.5 / 45.11)	4.1	81
K/A Category Totals:					3	3	Group Point Total:		18/6

ES-401 PWR Examination Outline Form ES-401-2 Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO)									
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G*	K/A Topic(s)	IR	#
000001 Continuous Rod Withdrawal / 1									
000003 Dropped Control Rod / 1									
000005 Inoperable/Stuck Control Rod / 1						X	G2.4.47 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	82
000024 Emergency Boration / 1					X		AA2.04 Ability to determine and interpret the availability of BWST as they apply to the Emergency Boration. (CFR: 43.5 / 45.13)	4.2	83
000028 Pressurizer Level Malfunction / 2									
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7					X		AA2.12 Ability to determine and interpret the maximum allowable channel disagreement as they apply to the Loss of Intermediate Range Nuclear instrumentation. (CFR: 43.5 / 45.13)	3.1*	84
000036 Fuel Handling Accident / 8									
000037 Steam Generator Tube Leak / 3									
000051 Loss of Condenser Vacuum / 4									
000059 Accidental Liquid Radwaste Rel. / 9									
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
000067 Plant Fire On-site / 8									
000068 Control Room Evac. / 8									
000069 Loss of CTMT Integrity / 5									
000074 (W/E06&E07) Inad. Core Cooling / 4									
000076 High Reactor Coolant Activity / 9						X	G2.4.31 Knowledge of annunciator alarms, indications, or response procedures. (CFR: 41.10 / 45.3)	4.1	85
W/EO1 & E02 Rediagnosis & SI Termination / 3									
W/E13 Steam Generator Over-pressure / 4									
W/E15 Containment Flooding / 5									
W/E16 High Containment Radiation / 9									
K/A Category Point Totals:					2	2	Group Point Total:		9/4

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

System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	K/A Topic(s)	IR	#
003 Reactor Coolant Pump														
004 Chemical and Volume Control											X	G2.1.20 Ability to interpret and execute procedure steps. (CFR: 41.10 / 43.5 / 45.12)	4.6	86
005 Residual Heat Removal														
006 Emergency Core Cooling								X				(Replacement for 078 A2.01) A2.13,Ability to (a) predict the impacts of the following malfunctions or operations on the ECCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Inadvertent SIS actuation	4.2	90
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water														
010 Pressurizer Pressure Control														
012 Reactor Protection														
013 Engineered Safety Features Actuation								X				A2.04 Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based Ability on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations; Loss of instrument bus (CFR: 41.5 / 43.5 / 45.3 / 45.13)	4.2	87
022 Containment Cooling														
026 Containment Spray														
039 Main and Reheat Steam														
059 Main Feedwater								X				A2.03 Ability to (a) predict the impacts of the following malfunctions or operations on the MFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Overfeeding event (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.1*	88
061 Auxiliary/Emergency Feedwater											X	G2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 43.5 / 45.12)	4.2	89
062 AC Electrical Distribution														
063 DC Electrical Distribution														
064 Emergency Diesel Generator														
073 Process Radiation Monitoring														

076 Service Water														
078 Instrument Air														
103 Containment														
K/A Category Point Totals:								3			2	Group Point Total:		28/5

ES-401 PWR Examination Outline Form ES-401-2
Plant Systems - Tier 2/Group 2 (RO / 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	#
001 Control Rod Drive														
002 Reactor Coolant														
011 Pressurizer Level Control														
014 Rod Position Indication														
015 Nuclear Instrumentation														
016 Non-Nuclear Instrumentation														
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge											X	~~G2.4.8 Knowledge of how abnormal operating procedures are used in conjunction with EOPs. (CFR: 41.10 / 43.5 / 45.13)~~ G2.2.25 – Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.	~~4.5~~ 4.2	91
033 Spent Fuel Pool Cooling														
034 Fuel Handling Equipment														
035 Steam Generator														
041 Steam Dump/Turbine Bypass Control												A2.02 - Ability to (a) predict the impacts of the following malfunctions or operations on the SDS; and (b) based on those predictions or mitigate the consequences of those malfunctions or operations: Steam valve stuck open	3.9	
~~045 Main Turbine Generator~~								~~X~~				~~A2.13 Ability to (a) predict the impacts of the following malfunctions or operation on the MT/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Opening of the steam dumps at low pressure (CFR: 41.5 / 43.5 / 45.3 / 45.5)~~	2.5*	92
055 Condenser Air Removal														
056 Condensate														
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring														

075 Circulating Water								X				A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the circulating water system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of circulating water pumps (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.7	93
079 Station Air														
086 Fire Protection														
K/A Category Point Totals:								2			1	Group Point Total:		10/3

Facility:	Date of Exam:					
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	~~2.1.25~~	~~Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR: 41.10 / 43.5 / 45.12)~~			~~4.2~~	
	2.1.41	Knowledge of the refueling process. (CFR: 41.2 / 41.10 / 43.6 / 45.13)			3.7	95
	2.1.40	Knowledge of refueling administrative requirements.			3.9	94
2. Equipment Control	2.2.23	Ability to track Technical Specification limiting conditions for operations. (CFR: 41.10 / 43.2 / 45.13)			4.6	96
	2.2.37	Ability to determine operability and/or availability of safety related equipment. (CFR: 41.7 / 43.5 / 45.12)			4.6	97
3. Radiation Control	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)			3.7	98
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities. (CFR: 41.12 / 43.4 / 45.10)			3.8	99
4. Emergency Procedures / Plan	2.4.43	Knowledge of emergency communications systems and techniques. (CFR: 41.10 / 45.13)			3.8	100
	Subtotal					
Tier 3 Point Total				10		7

Diablo Canyon Exam 10/2016

SRO KA's REJECTED		
Tier / Group	Randomly Selected K/A	Reason for Rejection
SRO T1G1	015/017 AA2.10	This KA is very similar to questions in the RO section. Of the available KA's in this APE, selected AA2.11, When to jog RCPs during ICC (IR 3.8)
SRO T2G1	078A2.01	Unable to write to SRO level. Randomly replaced with: 006 A2.13, Ability to (a) predict the impacts of the following malfunctions or operations on the ECCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Inadvertent SIS actuation (IR 4.2)
SRO T3G1	G2.1.25	Not able to write SRO "generic" question for KA Randomly replaced with G2.1.40, Knowledge of refueling administrative requirements. (IR 3.9)
SRO T2G2	029 G2.4.8	No abnormal procedures for containment purge. Randomly replaced with G2.2.25, Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (IR 4.2)

SRO T2G2	045 A2.13	Unable to write to proper level, low operational validity for SRO. Shifted KA to 041, Steam Dumps, not tested on either examination and randomly selected A2.02 - Ability to (a) predict the impacts of the following malfunctions or operations on the SDS; and (b) based on those predictions or mitigate the consequences of those malfunctions or operations: Steam valve stuck open (IR 3.9)

RO KA's REJECTED		
RO T1G1	APE 026 G2.2.39	No less than 1 hour LCO for selected system. G2.4.11 - Knowledge of abnormal condition procedures (4.0)
RO T1G1	APE040 G2.4.49	There are no immediate actions for a steam line rupture. Randomly replaced with G.2.4.2- Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (IR 4.5)
RO T1G1	APE 056 AA2.09	Rejected due to already sampled with KA 022 A3.01. Both require knowledge of CFCU operation. Randomly replaced with AA2.21 Ability to determine and interpret the following as they apply to the Loss of Offsite Power: EDG voltage and frequency indicators (IR 3.6)
RO T1G1	APE 062 AK3.04	Unable to write question to address KA. Replaced with AK3.03 Guidance actions contained in EOP for Loss of nuclear service water (ASW) (IR 4.0)
RO T1G2	E03 EK2.1	Apparent typo – write up and importance align with EK2.2. Question written to EK2.2
RO T1G2	APE036 AA2.01	Apparent typo – write up and importance align with AK2.01. To maintain outline balance, wrote question to AA2.01. Updated ES-401-2 to reflect wording and importance for AA2.01.

RO T2G1	003 G2.2.4	There are no unit differences for RCP control board instrumentation, etc. Randomly replaced with 003 G2.2.36 Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations. (IR 3.1)
RO T2G1	008 G2.2.25	Tech Spec Bases is not RO Knowledge. Randomly replaced with 008 G2.1.28 Knowledge of the purpose and function of major system components and controls. (IR 4.1)
RO T2G1	063 G2.4.1	No immediate action steps for DC electrical distribution. Randomly replaced with 063 G2.4.6 Knowledge of EOP mitigation strategies. (IR 3.7)
RO T2G1	076 K2.08	No ESF actuated MOVs. Randomly replaced with 076 K2.01 Knowledge of bus power supplies to Service Water. (IR 2.7)
RO T2G2	033 A1.02	No tie between SFP and RHR Randomly replaced with 033 A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Spent Fuel Pool Cooling System operating the controls including: Spent fuel pool water level (IR 2.7)

RO T2G2	016 K5.01	KA is too similar to T2G1 KA013 K5.02. As this is the only K5 for 016, therefore, randomly selected K3.01 as replacement. This results in a more balanced distribution of the RO Systems Tiers. The original distribution was 3/4/**2**/3/3/**4** (2 K3's and 4 K5's). Now there is 3 K3's and 3 K5's and an overall distribution of 3/4/**3**/3/3/**3**. 016 K3.01 - Knowledge of the effect that a loss or malfunction of the NNIS will have on the following: RCS (IR 3.4)
RO T3G2	2.2.42	KA, Ability to recognize system parameters that are entry-level conditions for Technical Specifications is not a "generic" KA for tier 3. Randomly replaced with 2.2.43,Knowledge of the process used to track inoperable alarms. (IR 3.0)

Facility: Diablo Canyon	Date of Examination: 10/14/2016
Examination Level: RO ☐ SRO ☒	Operating Test Number: L161

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations (NRCL161-A5)	M, R	**Evaluate Shift Staffing Assignments** 2.1.5 Ability to use procedures related to shift staffing, such as minimum crew complement, overtime limitations, etc. (3.9) (modified from NRCL081LJA_SROA1)
Conduct of Operations (NRCL161-A6)	N, R	**Evaluate Fire Zone Operability** 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. (4.2)
Equipment Control (NRCL161-A7)	N, R	**Evaluate Valve Stroke Surveillance Test** 2.2.12 Knowledge of surveillance procedures. (4.1)
Radiation Control (NRCL161-A8)	N, R	**Authorize Emergency Exposure** 2.3.4 Knowledge of radiation exposure limits under normal or emergency conditions. (3.7)
Emergency Procedures/Plan (NRCL161-A9)	N, R	**Classify Hostile Action** 2.4.41 Knowledge of the emergency action level thresholds and classifications. (4.6)

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

* 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)

Rev 0: rev follows initial submittal

Facility: Diablo Canyon Date of Examination: 10/14/2016

Exam Level: RO ☐ SRO-I ☒ SRO-U ☐ Operating Test Number: L161

Control Room Systems@ (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U)

System / JPM Title	Type Code*	Safety Function
a. (LJC-S1) (001.A2.11) Respond to Unexpected Rod Motion during Routine Dilution	A,E,M,S	1
b. (LJC-S2) (013.A4.01) SSPS Main Steam Line Actuation Failure	A,E,EN,L,N,S	2
c. (LJC-S3) (010.A2.03) Prepare for RCS Depressurization during a SGTR	A,E,L,N,S	3
d. (LJC-S4) (E05.EA1.1) Initiate Feed and Bleed for a Loss of Heat Sink (LJC-116)	D,E,L,S	4S
e. (LJC-S5) (E14.EA1.1) Initiate Containment Spray Manually (LJC-010)	D,E,L,S	5
f. (LJC-S6) (064.A4.06) Crosstie of Vital Bus G to H (LJC-032)	A,D,E,L,S	6
g.		
h. (LJC-S7) (068.AA1.23) Perform Control Room Actions Prior to Evacuation (LJC-21)	D,E,S	8

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

System / JPM Title	Type Code*	Safety Function
i. (P1) (040.AA1.03) Close MSIV and Bypass Locally – LJP-212	D,E,EN,L	4S
j. (P2) (E14.EA1.1) Isolate the Spray Additive Tank – LJP-224	A,E,L,R	5
k. (P3) (062.A2.11) Transfer the TSC to Vital Power – modified LJP-058A	A,M,E,L	6

@ 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; 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: Diablo Canyon   Date of Examination: 10/14/2016

Exam Level: RO ☐ SRO-I ☐ SRO-U ☒   Operating Test Number: L161

Control Room Systems@ (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U)

System / JPM Title	Type Code*	Safety Function
a. (LJC-S1) (001.A2.11) Respond to Unexpected Rod Motion during Routine Dilution	A,E,M,S	1
b. (LJC-S2) (013.A4.01) SSPS Main Steam Line Actuation Failure	A,E,EN,L,N,S	2
c.		
d.		
e.		
f.		
g.		
h.		

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

System / JPM Title	Type Code*	Safety Function
i. (P1) (040.AA1.03) Close MSIV and Bypass Locally – LJP-212	D,E,EN,L	4S
j. (P2) (E14.EA1.1) Isolate the Spray Additive Tank – LJP-224	A,E,L,R	5
k. (P3) (062.A2.11) Transfer the TSC to Vital Power – modified LJP-058A	A,M,E,L	6

@ 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; 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 feature	≥ 1 / ≥ 1 / ≥ 1 (control room system)
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Facility: Diablo Canyon (PWR) **Scenario No:** 1 **Op-Test No:** L161 NRC

Examiners: ______________________ **Operators:** ______________________

______________________ ______________________

______________________ ______________________

Initial Conditions: **2% with AFW in service, backfeeding from 500 kV, BOL, 1609 ppm boron**

Turnover: **At start of OP L-3, preparing MFPs to place in service.**

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	XMT_CVC19_3 0.0 delay=0 ramp=120	I (ATC, SRO)	LT-112 Fails Low (auto make-up) (**AP-19, AP-5**)
2	DSC_VEN12 BREAKER_OPEN	TS only (SRO)	Loss of Power to S-31 (**PK15-17; T.S. 3.7.12.B**)
3	AS01ASW_ASP11_MTFSEIZUR 1 AS02E03V00_52HG6TF_SF6 2	TS, C (BOP, SRO)	ASW Pp 1-1 Seizes; Pp 1-2 SF6 Breaker Pressure Fault (**AP-10, T.S. 3.0.3**)
4	XMT_MSS1_3 1215 delay=0 ramp=300	I (ATC, SRO)	PT-507 Fails High (**AP-5**)
5	MAL_RCS3G .75 delay=0 ramp=300	M (ALL)	750 gpm LOCA on Loop 4 Hot Leg due to earthquake
6	MAL_PPL3B BOTH	C (BOP)	Safety Injection, Train B fails to actuate
7	VLV_SIS1_1 1	C (ATC)	8803 A Fails closed on SI (**S1CT-1**)
8	MAL_SEI1 0.1500000 ramp=10 ASISRWST 1.53e6 delay=10 ramp=300	C (ALL)	RWST drains to less than 4% due to seismic damage (**S1CT-2**)

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d) (from form ES301-4)	Actual Attributes
1. Total malfunctions (5–8) (Events 1,3,4,5,6,7,8)	7
2. Malfunctions after EOP entry (1-2) (Events 6,7,8)	3
3. Abnormal events (1–4) (Events 1,3,4)	3
4. Major transients (1-2) (Event 5)	1
5. EOPs entered/requiring substantive actions (1–2) (E-1.3)	1
6. EOP contingencies requiring substantive actions (0–2) (ECA-1.1)	1
7. Critical tasks (2–3)(See description below)	2

Critical Task	Justification	Reference
(S1CT-1) Manually align at least one train of SIS actuated safeguards before transition out of EOP E-0, Reactor Trip or Safety Injection.	FSAR analysis predicates acceptable results on the assumption that, at the very least, one train of safeguards has actuated and is providing flow to the core. Failure to manually align the minimum required safeguards equipment results in the persistence of degraded emergency core cooling system capacity.	• WCAP-17711-NP, CT-2 • WOG Background HE0BG_R2
(S1CT-2) Stop all running ECCS pumps with suction aligned to the RWST before insufficient RWST level results in ECCS pump cavitation as indicated by rapid swings in pump amperage.	Damage to the RWST in this scenario results in a continuous loss of level and eventual inability to meet the minimum NPSH requirements for the running ECCS pumps. Failure to stop the pumps before cavitation occurs can lead to pump damage sufficient to render the pumps unavailable for use once an alternate make-up supply is aligned to the RCS.	• WCAP-17711-NP, CT-28 • WOG Background HECA11BG_R2
Per NUREG-1021, Appendix D, if an operator or 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.		

SCENARIO SUMMARY – NRC #1

1. Volume Control Tank (VCT) level channel LT-112 fails low, causing a continuous (and erroneous) makeup signal. The crew diagnoses the level channel failure by comparing other VCT parameters, and by using **OP AP-19, Malfunction of the Reactor Makeup Control System**. The makeup system is secured, and makeup is accomplished (if needed) using manual mode (or enabling the auto mode for short periods). May elect to use **OP AP-5, Malfunction of Eagle 21 Protection or Control Channel** to take manual control of **Makeup Control System.**

2. Auxiliary Building Supply Fan S-31 loses power and crew responds per **AR PK15-17, AUX & FHB VENT PWR FAILURE.** Auxiliary Building Ventilation System, ABVS, which was operating in Buildings and Safeguards, swaps to Safeguards only. Crew verifies automatic shutdown of Supply E-1 as well as auto-swap to Safeguards only alignment for the ABVS. Shift Foreman enters **TS 3.7.12.B, Auxiliary Building Ventilation System (ABVS)** for one ABVS train inoperable.

3. ASW Pump 1-1 trips due to a seized shaft. Standby ASW Pump 1-2 fails to start as the result of a fault at the breaker (SF6 pressure fault). The Shift Foreman implements **OP AP-10, Loss of Auxiliary Salt Water** and cross-ties to the Unit 2 ASW system via the ASW cross-tie valve FCV-601. Shift Foreman enters **T.S. 3.0.3** for two trains of ASW inoperable on Unit 1.

4. Steam Generator Header Pressure Transmitter, PT-507, fails high over 5 minutes causing actual temperature to lower. Crew identifies malfunction noting increase in steam flow and lowering Tcold, and takes manual control of HC-507. **OP AP-5, Malfunction of Eagle 21 Protection or Control Channel** is used to address the failure and return primary and secondary plant parameters to normal bands.

5. An earthquake occurs, causing a 750 gpm leak to ramp in on loop 4 hot leg. The crew determines the leak is substantial in size based on a rapid drop in pressurizer level. The Shift Foreman directs a reactor trip and safety injection.

6. The crew enters **EOP E-0, Reactor Trip or Safety Injection.** Train B of Safety Injection fails to actuate, requiring the crew to perform numerous manual alignments and pump starts as part of **Appendix E.**

7. Charging Injection Supply Valve, CVCS-1-8803A fails to open on SI as well. The crew must open 8803A or its parallel equivalent, CVCS-1-8803B in order to meet the requirements of **S1CT-1, Manually actuate at least one train of SIS actuated safeguards before transition out of EOP E-0**.***

8. The seismic event damages the RWST, resulting in a large fissure that terminates close to the bottom of the tank. The crew briefly enters **E-1, Loss of Reactor or Secondary Coolant** prior to transitioning to **E-1.3, Transfer to Cold Leg Recirculation** when RWST level reaches 33%, which happens quickly due to the leaking RWST. With the Containment Recirc Sump Level less than 92%, the crew is forced into **EOP ECA-1.1, Loss of Emergency Coolant Recirculation.** The fissure location causes the RWST to continue to drain, requiring the crew to perform the second critical task **S1CT2 – Stop ECCS pumps aligned to the RWST before insufficient level results in ECCS pump cavitation**.***

The scenario is terminated once the crew has implemented Appendix W, RCS Makeup from VCT.

*** CT / TCOA note:

Facility: Diablo Canyon (PWR) **Scenario No:** 2 **Op-Test No:** L161 NRC

Examiners: ________________ **Operators:** ________________

Initial Conditions: 100% MOL, 878 ppm boron

Turnover: TDAFW OOS for repair; Emergent issue on CCP 1-1 (OOS)

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	VLV_SIS7_2 0 cd='h_v1_144g_1 AND V1_144 S_2'	C (BOP, SRO)	SI-8923A fails closed during STP V-3L10A
2	XMT_CVC4_3 0.0 delay=0 ramp=30	TS, I (ATC, SRO)	FT-128 Fails low causing high charging flow (**OP AP-5; OP AP-17**, **T.S. 3.3.4.A**)
3	MAL_SIS1C 100 delay=0 r amp=180	TS only (SRO)	Accumulator 1-3 100 gpm leak (**PK02-10; T.S. 3.5.1.B**)
4	MAL_RCS3C .10 delay=0 ramp=180	TS, C (ALL)	100 gpm RCS leak on Loop 3 (**OP AP-1, T.S. 3.4.13.A**)
5	PMP_CVC2_2 OVERLOAD_DEV_FAIL	M (ALL)	CCP 1-2 OC Trip requiring crew to trip/SI plant
6	MAL_RCS3C 11 cd='jpplsia' del ay=0 ramp=120	M (ALL)	4.5 sq in SBLOCA on Loop 3
7	pmp_afw2_1 open delay=0 cd='fnispr lt 5'	C (ATC)	MDAFW Pp 1-3 Autostart Failure (Requires manual start; (**S2CT-1**) *(Occurs w/Loss of MDAFW Pp 1-2 on Bus H Differential)*
8	MAL_EPS4E_2 DIFFERENTIAL cd='h_ v4_218r_1' CV09CVC_932TASTEM 0 PMP_CVC3_2 OVERLOAD_DEV_FAIL cd='jpplsia and H_V2_266R_1' delay=120	C (ALL)	SIP 1-2 Lost on Bus H Differential CCP 1-3 cavitates and trips. Loss of all high and intermediate head injection; CT to depressurize to inject accumulators (**S2CT-2**).

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d) (from form ES301-4)	Actual Attributes
1. Total malfunctions (5–8) (Events 1,2,4,5,6,7,8)	7
2. Malfunctions after EOP entry (1-2) (Events 7,8)	2
3. Abnormal events (2–4) (Events 1,2,4)	3
4. Major transients (1-2) (Event 5,6)	2
5. EOPs entered/requiring substantive actions (1–2) (E-1)	1
6. EOP contingencies requiring substantive actions (FR-C.2)	1
7. Critical tasks (2–3)(See description below)	2

<table>
<tr><th>Critical Task</th><th>Justification</th><th>Reference</th></tr>
<tr><td>(S2CT-1) Establish at least 435 gpm AFW flow to the steam generators prior to exiting EOP E-0.</td><td>Failure to manually establish the minimum required AFW flow rate (when it is possible to do so) results in a challenge to the Heat Sink critical safety function. In this scenario, adequate S/G level is also required to effectively depressurize the RCS to inject accumulators in the absence of both high and intermediate head injection pumps.</td><td>• WCAP-17711-NP, CT-4
• WOG Background HFRH1BG_R2</td></tr>
<tr><td>(S2CT-2) Depressurize Steam Generators to inject SI Accumulators to re-flood the core as indicated by RVLIS level returning above the minimal required level shown below before a RED path develops on Core Cooling Critical Safety Function.

RVLIS Dynamic Range Indication - GREATER THAN:
<table><tr><th>RCPs Running</th><th>RVLIS Level</th><th>RVLIS Range</th></tr><tr><td>1</td><td>14%</td><td>Dyn</td></tr><tr><td>2</td><td>20%</td><td>Dyn</td></tr><tr><td>3</td><td>30%</td><td>Dyn</td></tr><tr><td>4</td><td>44%</td><td>Dyn</td></tr></table></td><td>Failure to depressurize the SGs results in the avoidable continuation of the degraded of core cooling condition. Depressurizing the S/Gs provides immediate benefit by condensing steam on the primary side of the U-tubes. Once pressure RCS falls below approximately 625 psig, Accumulators will inject, flooding the core and clearing the magenta path on Core Cooling. Continuing the 100^{o}F/hr cooldown after Accumulators have injected ultimately results in RCS pressure lowering below RHR shutoff head and the core cooling CSF status returning to normal.</td><td>• WCAP-17711-NP, CT-42
• WOG Background HFRC2BG_R2</td></tr>
<tr><td colspan="3">Per NUREG-1021, Appendix D, if an operator or 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.</td></tr>
</table>

SCENARIO SUMMARY – NRC #2

1. Crew performs timed stroke test of SI Pump 1-1 suction valve 8923A per **STP V-3L10A, Exercising Valve SI-8923A, Safety Injection Pump 1 Suction Valve**. The valve strokes closed, but does not respond when the crew attempts to re-open it per the test procedure. The Shift Foreman notes already in Tech Spec for CCP 1-1 out of service. May contact Maintenance for assistance.

2. FT-128 (charging flow) fails low, causing actual charging flow to rise. The crew responds per **OP AP-5, Malfunction of Eagle 21 Protection or Control Channel**. FCV-128 and HC-459D are taken to manual, and charging flow is monitored using alternate indications (RCP seals, Pzr level, VCT level, etc) for the remainder of the scenario. **OP AP-17, Loss of Charging**, Section B (Charging System Equipment Malfunctions), may also be used to respond to the failure. **TS 3.3.4.A, Remote Shutdown Systems,** is implemented.

3. Accumulator 1-3 develops a 100 gpm leak, bringing in **AR PK02-10, ACUM LEVEL HI-LO** for level below 60.8%**.** Shift Foreman enters **TS 3.5.1.B, Accumulators**, when level falls below 52%.

4. A 100 gpm RCS leak on loop 3 ramps in over the next 3 minutes, requiring entry in **OP AP-1, Excessive Reactor Coolant System Leakage**. Pressure and level are stabilized once CCP 1-2 is started and letdown isolated. VCT level cannot be maintained at the current leak rate, however, and the crew determines a plant shutdown is required. Shift Foreman enters **TS 3.4.13.A, RCS Operational Leakage**.

5. CCP 1-2 trips and charging is no longer able to keep up with the leak. Shift Foreman directs a Reactor Trip and Safety Injection. The crew enters **EOP E-0, Reactor Trip or Safety Injection** and performs their immediate actions.

6. Loop 3 ruptures on the Safety Injection, with a 4.5 inch SBLOCA ramping in over the next 2 minutes.

7. Bus H is lost on a differential trip during the transfer to Startup and MDAFW Pp 1-3 fails to Autostart, leading to the critical task of starting MDAFW Pp 1-3 **(S2CT-1) Establish at least 435 gpm AFW flow to the steam generators prior to exiting EOP E-0.*****

8. SIP 1-2 is lost with the loss of bus H. Non-ECCS Charging Pump CCP 1-3 begins to cavitate and eventually trips, resulting in a total loss of all high and intermediate head injection. The crew proceeds through E-0, noting that RCPs must remaining running when pressure falls below 1300 psig due to a lack of running ECCS CCPs and SIPs. The crew determines the RCS is not intact and transitions to **E-1, Loss of Reactor or Secondary Coolant**. A loss of subcooling and lowering RVLIS level eventually results in a magenta path on the core cooling critical safety function, and the crew transitions to **FR-C.2, Response to Degraded Core Cooling**. Following the guidance of FR-C.2, the crew will perform the critical task of temporarily recovering the core:
   (S2CT-2) Depressurize Steam Generators to inject SI Accumulators to re-flood the core before a RED path develops on Core Cooling Critical Safety Function.***

The scenario is terminated once Accumulators have injected enough volume to clear the MAGENTA path on CORE COOLING

*** **CT / TCOA note**:

Facility: Diablo Canyon (PWR) **Scenario No:** 3 **Op-Test No:** L161 NRC

Examiners: ______ **Operators:** ______

Initial Conditions: 100% MOL, 878 ppm boron

Turnover: OOS Equipment: PT-403

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	CC01CCW_CCP11_MTFSHEAR 1	TS, C (BOP, SRO)	CCW Pp 11 Shaft Shear (**AR PK01-11, AR PK01-09, AR PK01-08, AP-11; TS 3.7.7.A**)
2	EECIX5213D5_51TF_ACT 1	C (ATC, SRO)	Pressurizer Heater Group #1 Over Current Trip (**AR PK05-19, OP A-4A:I**)
3	MAL_PPL7J 1	TS, I (BOP, SRO)	Eagle 21 DFP-1 Halt in Rack 10 (**AP-5; T.S. 3.3.1.D,E,M; 3.3.2.D, L; 3.4.11**)
4	LOA_TUR28 0	C (ALL)	Main Turbine Stop Valve #2 (Loop 1) Closes (**PK04-06, PK 08-12**)
5	CNV_MFW6_2 1 delay=0 ramp=30	M (ALL)	Loop 4 FW Reg Fails to 100%, P-14 (High S/G Level Trip) Failure (**S3CT-3**)
6	MAL_MFW5D 2e+007 cd='fnispr lt 5' delay =0 ramp=10	M (ALL)	Feedline Header Break Inside Containment on S/G 1-4 (**S3CT-2**)
7	MAL_EPS4D_2 DIFFERENTIAL cd='fnispr lt 5'	C (ATC)	4kV Bus G Bus Transfer Failure; Isolate feedflow from TDAFW as part of Critical Task (**S3CT-1, partial**)
8	VLV_MFW4_2 1 dellA VLV_MFW4_2 2 cd='V3_193S_1'	C (BOP)	FCV-441 fails open; Isolate feedflow as part of Critical Task (**S3CT-1, partial**)

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d) (from form ES301-4)	Actual Attributes
1. Total malfunctions (5–8) (Events 1,2,3,4,5,6,7,8)	8
2. Malfunctions after EOP entry (1-2) (Events 7,8)	2
3. Abnormal events (1–4) (Events 1,2,3,4)	4
4. Major transients (1-2) (Event 5,6)	2
5. EOPs entered/requiring substantive actions (1–2) (E-2, E-1.1)	2
6. EOP contingencies requiring substantive actions (0–2)	0
7. Critical tasks (2–3)(See description below)	3

Critical Task	Justification	Reference
(S3CT-1) Manually isolate feedline break before containment wide range sump level reaches 94 feet (LI-940 & LI-941), resulting in a magenta path on the Containment safety function status tree.	Failure to isolate feed flow into containment leads to an unnecessary and avoidable severe challenge to the containment integrity safety function as a result of flooding.	• WOG Background HFRZ2BG_R2
(S3CT-2) Terminate ECCS flow before overfill of the RCS results in a rupturing of the pressurizer relief tank (PRT) as indicated by a PRT pressure drop and subsequent equalization with wide range Containment Pressure.	The feedline rupture introduced in this scenario results in a Safety Injection due to shrinkage and a slightly overcooled condition in the RCS. Once isolated, RCS pressure rises quickly as the result of ongoing injection flow. Eventually the RCS goes solid, with the excess inventory passing water through the Pressure Operated Relief Valves to the PRT. Failure to terminate ECCS flow when it is possible to do so results in a rupture of the PRT and constitutes an avoidable degradation of a fission product barrier.	• DCPP Design Criteria Memorandum S-7: Reactor Coolant System • FSAR Chapter 15,
(S3CT-3) Manually trips the reactor before S/G 1-4 reaches 92% narrow range.	Steam Generator Level above the High High setpoint (P-14) normally generates a turbine trip signal to protect against high feedwater flow and carryover into the steam lines when one out of four S/G has reached a narrow range level greater than 90%. Carryover into the steam lines can result in damage to downstream piping, valves, placing the secondary heat sink at risk.	• Generic Letter 81-28 • WOG Background HFRH3BG_R2

Per NUREG-1021, Appendix D, if an operator or 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.

SCENARIO SUMMARY – NRC #3

1. **AR PK01-11, CCW Pp 1-1 Recirc** comes into alarm for FCV-606, CCW Pump 1-1 Recirc Valve, open. Crew identifies low pump amps on VB-1 and dispatches Nuclear Operator to investigate. Field reports no audible flow sound in spite of indications motor is running. CCW Pump 1-3 is started manually and CCW Pump 1-1 shutdown. **T.S. 3.7.7.A, Vital Component Cooling Water (CCW) System**, is entered for one loop of CCW inoperable.

2. Pressurizer Heater Group #1 trips on over current, bringing in **AR PK05-19, PZR HTRS OC TRIP/FAN FLO LO.** Crew places additional backup heater group in service per **OP A-4A:I, Pressurizer – Make Available, Section 6.6**.

3. Eagle 21 experiences a Digital Filter Processor (DFP) halt on rack 10. Associated indicators PI-456, LI-460A, FI-415, FI-425, FI-435, FI-445 (VB2), and PR-445, LR-459 (CC2) fail "as-is" as well as control channels for PORV 456 (PT-456) and Pressurizer Level Control (LT-460). Crew responds per **OP AP-5, Malfunction of Eagle 21 Protection or Control Channel**. Shift Foreman reviews Tech Specs, entering:
   - **TS 3.3.2.D, PC 456D Low Press SI (72 hrs)**
   - **TS 3.3.1.E, PC-456A High Press Trip (72 hrs)**
   - **TS 3.3.1.M, PC 456C Low Press Trip (72 hrs)**
   - **TS 3.3.1.M, LC 460A High Level Trip (72 hrs)**
   - **TS 3.3.1.M, FC-415(425,435,445) RCS Loop 1 (2,3,4) Flow (72 hrs)**
   - **TS 3.3.2.L, PC-456 B, P-11 (1 hr)**
   - **TS 3.4.11.B1, B2, & B3 PC-456 E, to close & remove power from associated block valve (1 hr) and restore to operable (72 hrs)**

4. Main Turbine Stop Valve #2 (Loop 1) closes, causing a secondary transient, bringing **PK 08-12, TURB LOAD REJECTION C-7A** into alarm. Power lowers approximately 10%. Crew may perform a diagnostic brief to identify the cause of the excursion. The crew identifies various indications that the stop valve is fully closed such as deviations in steam flow, temperature, Triconex display, as well as activation of **PK04-06, PROTECTION CHANNEL ACTIVATED** for 1 out of 4 Turb Stm Stop Vlvs Clsd. Power is stabilized per Shift Foreman's direction.

5. Loop 4 Feedwater Reg Valve, FCV-540, fails full open. The crew identifies the malfunction and attempts to take manual control, but is unsuccessful. Shift Foreman directs manual reactor trip before S/G 1-4 level reaches the auto trip point of 90%. **(S3CT-3) Manually trips the reactor before S/G 1-4 reaches 92% narrow range.**

6. On the trip, the feedline header to S/G 1-4 fails catastrophically, causing S/G 1-4 to depressurize into containment.

7. Bus G fails to transfer to startup resulting in a loss of power to the TDAFW LCVs and an inability to throttle flow. Feed flow from the pump is isolated during recovery actions as part of critical task **S3CT-1** **(see page 4, below).**

8. Feedwater Isolation Valve FCV-441 fails open, requiring manual isolation at VB-3. **(Part of critical task S3CT-1, see page 4, below).**

<u>SCENARIO SUMMARY – NRC #3</u>

Crew enters **EOP E-0, Reactor Trip or Safety Injection** and performs their immediate actions. E-0 diagnostic steps direct the crew to **E-2, Faulted Steam Generator Isolation** to perform the critical task of isolating the feedline break. **(S3CT-1) Manually isolate feedline break before Containment wide range level reaches 94 feet, resulting in a magenta path on the Containment safety function status tree.** ***

Once isolated, the Shift Foreman verifies SI termination criteria has been met and transitions to **E-1.1, SI Termination,** performing the critical task of sequentially reducing ECCS flow and realigning the plant to a pre-SI configuration. **(S3CT-2) Terminate ECCS flow before overfill of the RCS results in a rupture of the pressurizer relief tank (PRT).** ***

The scenario is terminated once normal charging/letdown is aligned in E-1.1, ready to perform step 15.

Facility: Diablo Canyon (PWR) **Scenario No:** 4 **Op-Test No:** L161 NRC

Examiners: ____________ **Operators:** ____________

____________ ____________

____________ ____________

Initial Conditions: **71% MOL, 919 ppm boron**

Turnover: **OOS Equipment: CCP 1-2**

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	MAL_DEG2B FAULT cd='h_v4_101m_1 gt 680'	TS, C (BOP, SRO)	Fail on D/G 1-2 Manual Start (**AR PK17-01; TS 3.8.1.B**)
2	VLV_CVC22_2 0.2 delay=0 ramp=15	I (ALL)	Regen Hx Isolation Valve, LCV-459, Fails to mid-position (**AP-18**)
3	RLY_PPL63 CLOSED (TRUE)	TS, I (ALL)	SSPS relay actuation causes inadvertent start of TDAFW pump and blowdown sample isolation valves to close (**AR PK04-03, OP1.DC10**; **TS 3.7.5.B**)
4	PK1421_0829 1	C (ALL)	Loss of Main Transformer Cooling (**PK14-21**)
5	MAL_GEN1_3 TRUE	M (ALL)	Main Transformer Unit Trips causing a Turbine trip; Buses transfer to Start-Up Power (**PK14-01, PK12-11, AP-25)**
6	MAL_PPL5A 3, MAL_PPL5B 3 V5_245S_1 0, V5_239S_1 0	M (ALL)	ATWS; rod control malfunction; CT to add negative reactivity (**S4CT-1**).
7	BKR_EPS20 OPEN cd='h_v5_230r_1' MAL_DEG1C_2 NO_RESET cd='H_V4_224R_1'	C (ALL)	12kV Start-Up Feeder Breaker to Start-Up Trip, SDR Failure on D/G 1-1 and 1-3; Critical Task to start D/G 1-3 to restore 4kV vital bus (**S4CT-2**).

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d) (from form ES301-4)	Actual Attributes
1. Total malfunctions (5–8) (Events 1,2,3,4,5,6,7)	7
2. Malfunctions after EOP entry (1-2) (Event 7)	1
3. Abnormal events (1–4) (Events 1,2,3,4)	4
4. Major transients (1-2) (Events 5,6)	2
5. EOPs entered/requiring substantive actions (1–2) (E-0.1)	1
6. EOP contingencies requiring substantive actions (0–2) (FR-S.1, ECA-0.0)	2
7. Critical tasks (2–3)(See description below)	2

Critical Task	Justification	Reference
(S4CT-1) Insert negative reactivity into the core following per EOP FR-S.1 guidance so that power is reduced to less than 5% by the completion of step 19.	Failure to insert negative reactivity as procedurally directed constitutes a failure to provide appropriate reactivity control and represents an unnecessary and avoidable challenge to the criticality safety function.	• WCAP-17711-NP, CT-52 • FR-S.1 Background Document, Rev. 3.
(S4CT-2) Energize at least one vital AC bus and restore RCP seal cooling prior RCP shut down seal activation which is identifiable by seal no. 1 return flow dropping from a normal value of greater than 2 gpm to less than 1 gpm. (occurs when seal outlet temperatures exceed 260^{o}F)	Failure to restore vital AC power when it is available represents an unnecessary continuation of a degraded emergency power condition and presents a potential challenge to the RCS fission product barrier due to a loss of cooling to the RCP seals.	• WCAP-17711-NP, CT-24 • ECA-0.0 Background Document, Rev. 3. • DCM No. S-7, Rev 29
Per NUREG-1021, Appendix D, if an operator or 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.		

SCENARIO SUMMARY – NRC #4

1. Maintenance requests manual start and loading of D/G 1-2 per **OP J-6B:V**, **Diesel Generators - Manual Operation of DG 1-2,** to take thermography readings inside the SED panel due to loose terminations discovered during most recent routine MOW. The diesel fails to start (over crank condition) bringing in **AR PK17-01, DEISEL 12 FAIL TO START.** Shift Foreman enters **TS 3.8.1.B, AC Sources – Operating**, for one D/G inoperable.

2. Regen Hx Isolation Valve, LCV-459, drifts to mid-position causing letdown orifice valve 8149C to close. Shift Foreman enters **OP AP-18, Letdown Line Failure**. Excess Letdown is established per **OP B-1A:IV CVCS - Excess Letdown - Place In Service and Remove From Service.**

3. SSPS relay actuation results in Turbine Driven AFW (TDAFW) Pump Steam Supply Isolation Valve, FCV-95, failing open and isolation of blowdown sample valves inside and outside containment. S/G levels rise and RCS temperature lowers, causing control rods to step out in response. FCV-95 cannot be closed and the crew must isolate the TDAFW Pump by either closing the LCVs to the individual S/Gs or by closing steam supply valves FCV-37 and FCV-38 to leads 1 and 2 respectively. Shift Foreman implements **TS 3.7.5.B, AFW System** for one AFW train inoperable.

4. Crew responds to **AR PK14-21, MAIN TRANSF**. A nuclear operator is dispatched to investigate local alarms and reports back that NO cooling fans or oil pumps are running on Main Bank C Transformer. Shift Foreman enters **OP AP-25, Rapid Load Reduction or Shutdown** and directs a 50 MW/min power reduction while Maintenance and field Operators attempt to restore transformer cooling.

5. At approximately 60% power, the plant experiences a Main Transformer Unit Trip due to a fault in the main transformer and all buses successfully transfer to Start-up power. The Turbine trips as expected, but the reactor trip breakers remain closed. (**AR PK14-01, UNIT TRIP; AR PK12-11 TURBINE TRIP, AR PK04-11 REACTOR TRIP INITIATE**)

6. Reactor power is still greater than 50% and the crew identifies the ATWS condition. **EOP FR-S.1, Response to Nuclear Power Generation / ATWS,** is entered, either directly or from the step 1, response not obtained column of **EOP E-0, Reactor Trip or Safety Injection.** Attempts to trip the reactor from the Control Room are unsuccessful and Auto-rod motion has failed. The crew performs the critical task of adding negative reactivity by manually driving rods **(S4CT-1) Insert negative reactivity into the core so that power is less than 5%.***** The crew continues working through FR-S.1 until field operators are able to locally open the reactor trip breakers.

7. The reactor is verified subcritical and the crew transitions to **EOP E-0, Reactor Trip or Safety Injection. EOP E-0.1 Reactor Trip Response** is entered once the need for a Safety Injection has been ruled out. Shortly after verifying primary and secondary parameters are stable, Startup Feeder Breaker 52VU12 trips open and cannot be closed. D/G 1-1 (no reset) and 1-3 (resettable from Control Room) fail as a result of their associated shutdown relays activating. The crew transitions to **EOP ECA-0.0, Loss of All Vital AC Power** and performs the critical task of starting D/G 1-3 **(S4CT-2) Energize at least one vital AC bus and restore RCP seal cooling before RCP shut down seals activate.*****

The scenario is terminated once RCP seal cooling has been re-established.

*** <u>CT / TCOA note</u>: