Form ES-401-2

Facility: DCPP Date of Exam: 2018-01

Tier	Group	RO K/A Category Points											SRO-Only Points		
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	Total	A2	G*	Total
1. Emergency & Abnormal Plant Evolutions	1	3	3	3	N/A			3	3	N/A		3	18			6
	2	2	2	2				1	1			1	9			4
	Tier Totals	5	5	5				4	4			4	27			10
2. Plant Systems	1	3	2	2	4	2	2	2	3	3	3	2	28			5
	2	2	0	1	2	1	0	1	1	0	1	1	10			3
	Tier Totals	5	2	3	6	3	2	3	4	3	4	3	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 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

[Outline developed using Rev. 2 Supp. 1 of NUREG-1122, "K/A Catalog for Nuclear Power Plant Operators: PWR", the latest revision of the K/A catalog available at the time of outline generation (2/16/2017), per NUREG 1021 ES-401 D.1.b.]

ES-401	PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO)							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 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1									
000008 Pressurizer Vapor Space Accident / 3						X	2.4.3 Ability to identify post-accident instrumentation. (CFR: 41.6 / 45.4)	3.7	1/39
000009 Small Break LOCA / 3						X	2.4.21 Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. (CFR: 41.7 / 43.5 / 45.12)	4.0	2/40
000011 Large Break LOCA / 3									
000015/17 RCP Malfunctions / 4			X				AK3.07 Knowledge of the reasons for the following responses as they apply to the Reactor Coolant Pump Malfunctions (**Loss of RC Flow**): Ensuring that S/G levels are controlled properly for natural circulation enhancement. (CFR 41.5, 41.10 / 45.6 / 45.13)	4.1	3/41
000022 Loss of Rx Coolant Makeup / 2				X			AA1.08 Ability to operate and / or monitor the following as they apply to the Loss of Reactor Coolant Makeup: VCT level (CFR 41.7 / 45.5 / 45.6)	3.4	4/42
000025 Loss of RHR System / 4	X						AK1.01 Knowledge of the operational implications of the following concepts as they apply to Loss of Residual Heat Removal System: Loss of RHRS during all modes of operation (CFR 41.8 / 41.10 / 45.3)	3.9	5/43
000026 Loss of Component Cooling Water / 8					X		AA2.04 Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: The normal values and upper limits for the temperatures of the components cooled by CCW (CFR: 43.5 / 45.13)	2.5	6/44
000027 Pressurizer Pressure Control System Malfunction / 3		X					AK2.03 Knowledge of the interrelations between the Pressurizer Pressure Control Malfunctions and the following: Controllers and positioners (CFR 41.7 / 45.7)	2.6	7/45
000029 ATWS / 1				X			EA1.12 Ability to operate and monitor the following as they apply to a ATWS: M/G set power supply and reactor trip breakers (CFR 41.7 / 45.5 / 45.6)	4.1	8/46
000038 Steam Gen. Tube Rupture / 3	X						EK1.01 Knowledge of the operational implications of the following concepts as they apply to the SGTR: Use of steam tables (CFR 41.8 / 41.10 / 45.3)	3.1	9/47

000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4		X					AK2.02 Knowledge of the interrelations between the Steam Line Rupture and the following: Sensors and detectors (CFR 41.7 / 45.7)	2.6	10/48
000054 (CE/E06) Loss of Main Feedwater / 4			X				AK3.04 Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): Actions contained in EOPs for loss of MFW (CFR 41.5,41.10 / 45.6 / 45.13)	4.4	11/49
000055 Station Blackout / 6									
000056 Loss of Off-site Power / 6					X		AA2.45 Ability to determine and interpret the following as they apply to the Loss of Offsite Power: Indicators to assess status of ESF breakers (tripped/not-tripped) and validity of alarms (false/not-false) (CFR: 43.5 / 45.13)	3.6	12/50
000057 Loss of Vital AC Inst. Bus / 6				X			AA1.06 Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: Manual control of components for which automatic control is lost (CFR 41.7 / 45.5 / 45.6)	3.5	13/51
000058 Loss of DC Power / 6						X	~~2.2.22 Knowledge of limiting conditions for operations and safety limits.~~ ~~(CFR: 41.5 / 43.2 / 45.2)~~ Replaced with KA - G2.2.37 Ability to determine operability and/or availability of safety related equipment.	~~4.0~~ 3.6	14/52
000062 Loss of Nuclear Svc Water / 4			X				~~AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: The conditions that will initiate the automatic opening and closing of the SWS isolation valves to the nuclear service water coolers~~ ~~(CFR 41.4, 41.8 / 45.7)~~ Replaced with AK3.03 Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: Guidance actions contained in EOP for Loss of nuclear service water	~~3.2~~ 4.0	15/53
000065 Loss of Instrument Air / 8					X		AA2.08 Ability to determine and interpret the following as they apply to the Loss of Instrument Air: Failure modes of air-operated equipment. (CFR: 43.5 / 45.13)	2.9	16/54
W/E04 L OCA Outside Containment / 3									
W/E11 Loss of Emergency Coolant Recirc. / 4	X						EK1.3 Knowledge of the operational implications of the following concepts as they apply to the (Loss of Emergency Coolant Recirculation) Annunciators and conditions indicating signals, and remedial actions associated with the (Loss of Emergency Coolant Recirculation). (CFR: 41.8 / 41.10 / 45.3)	3.6	17/55
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									

000077 Generator Voltage and Electric Grid Disturbances / 6		X					AK2.07 Knowledge of the interrelations between Generator Voltage and Electric Grid Disturbances and the following: Turbine / generator control. (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8)	3.6	18/56
K/A Category Totals:	3	3	3	3	3	3	Group Point Total:		18

od									
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 DCPP Bank - P-40331	X						AK1.18 Knowledge of the operational implications of the following concepts as they apply to Continuous Rod Withdrawal: Fuel temperature coefficient. (CFR 41.8 / 41.10 / 45.3)	3.4	19/57
000003 Dropped Control Rod / 1									
000005 Inoperable/Stuck Control Rod / 1		X					AK2.02 Knowledge of the interrelations between the Inoperable / Stuck Control Rod and the following: Breakers, relays, disconnects, and control room switches (CFR 41.7 / 45.7)	2.5	20/58
000024 Emergency Boration / 1									
000028 Pressurizer Level Malfunction / 2									
000032 Loss of Source Range NI / 7			X				AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Source Range Nuclear Instrumentation: Startup termination on source-range loss (CFR 41.5,41.10 / 45.6 / 45.13)	3.2	21/59
000033 Loss of Intermediate Range NI / 7									
000036 (BW/A08) Fuel Handling Accident / 8									
000037 Steam Generator Tube Leak / 3									
000051 Loss of Condenser Vacuum / 4						X	2.1.32 Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	4.0	22/60
000059 Accidental Liquid Radwaste Rel. / 9									
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
000067 Plant Fire On-site / 8									
000068 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5		X					AK2.03 Knowledge of the interrelations between the Loss of Containment Integrity and the following: Personnel access hatch and emergency access hatch (CFR 41.7 / 45.7)	2.8	23/61
000074 (W/E06&E07) Inad. Core Cooling / 4					X		EA2.03 Ability to determine or interpret the following as they apply to Inadequate Core Cooling: Availability of turbine bypass valves for cooldown (CFR 43.5 / 45.13)	3.8	24/62
000076 High Reactor Coolant Activity / 9									
W/EO1 & E02 Rediagnosis & SI Termination / 3									

W/E13 Steam Generator Over-pressure / 4				X			EA1.1 Ability to operate and / or monitor the following as they apply to the (Steam Generator Overpressure) Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR: 41.7 / 45.5 / 45.6)	3.1	25/63
W/E15 Containment Flooding / 5			X				EK3.2 Knowledge of the reasons for the following responses as they apply to Containment Flooding: Normal, abnormal and emergency operating procedures associated with Containment Flooding. (CFR: 41.5 / 41.10, 45.6, 45.13)	2.8	26/64
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 - Depress. / 4									
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4									
~~BW/E13&E14 EOP Rules and Enclosures~~									
CE/A11; W/E08 RCS Overcooling - PTS / 4	X						EK1.3 Knowledge of the operational implications of the following concepts as they apply to Pressurized Thermal Shock: Annunciators and conditions indicating signals, and remedial actions associated with Pressurized Thermal Shock. (CFR: 41.8 / 41.10, 45.3)	3.5	27/65
~~CE/A16 Excess RCS Leakage / 2~~									
~~CE/E09 Functional Recovery~~									
K/A Category Point Totals:	2	2	2	1	1	1	Group Point Total:		9

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (RO)												Form ES-401-2	
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	K/A Topic(s)	IR	#
003 Reactor Coolant Pump				X								K4.04 Knowledge of RCPS design feature(s) and/or interlock(s) which provide for the following: Adequate cooling of RCP motor and seals (CFR: 41.7)	2.8	28/1
004 Chemical and Volume Control					X							K5.14 Knowledge of the operational implications of the following concepts as they apply to the CVCS: Reduction process of gas concentration in RCS: vent accumulated non-condensable gases from PZR bubble space, depressurized during cooldown or by alternately heating and cooling (spray) within allowed pressure band (drive more gas out of solution) (CFR: 41.5/45.7)	2.5	29/2
005 Residual Heat Removal											X	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	30/3
005 Residual Heat Removal	X											K1.10 Knowledge of the physical connections and/or cause effect relationships between the RHRS and the following systems: Containment Spray System (CSS) (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.2	31/4
006 Emergency Core Cooling										X		A4.11 Ability to manually operate and/or monitor in the control room: Overpressure protection system. (CFR: 41.7 / 45.5 to 45.8)	4.2	32/5
007 Pressurizer Relief/Quench Tank									X			A3.01 Ability to monitor automatic operation of the PRTS, including: Components which discharge to the PRT (CFR: 41.7 / 45.5)	2.7	33/6
008 Component Cooling Water			X									K3.01 Knowledge of the effect that a loss or malfunction of the CCWS will have on the following: Loads cooled by CCWS	3.4	34/7
008 Component Cooling Water		X										K2.02 Knowledge of bus power **supplies to the following: CCW pump, including emergency backup.** (CFR: 41.7)	3.0	35/8
010 Pressurizer Pressure Control						X						K6.01 Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: Pressure detection systems (CFR: 41.7 / 45.7)	2.7	36/9

012 Reactor Protection					X						K5.02 Knowledge of the operational implications of the following concepts as the apply to the RPS: Power density (CFR: 41.5 / 45.7)`	3.1	37/10
012 Reactor Protection							X				A1.01 Ability to predict and/or monitor Changes in parameters (to prevent exceeding design limits) associated with operating the RPS controls including: Trip setpoint adjustment (CFR: 41.5 / 45.5)	2.9	38/11
013 Engineered Safety Features Actuation										X	2.4.9 Knowledge of low power / shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies. (CFR: 41.10 / 43.5 / 45.13)	3.8	39/12
013 Engineered Safety Features Actuation								X			A2.05 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 dc control power (CFR: 41.5 / 43.5 / 45.3 / 45.13)	3.7	40/13
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	41/14
~~025 Ice Condenser~~													
026 Containment Spray									X		A4.05 Ability to manually operate and/or monitor in the control room: Containment spray reset switches (CFR: 41.7 / 45.5 to 45.8)	3.5	42/15
039 Main and Reheat Steam			X								K3.05 Knowledge of the effect that a loss or malfunction of the MRSS will have on the following: RCS (CFR: 41.7 / 45.6)	3.6	43/16
059 Main Feedwater New -lower				X							K4.02 Knowledge of MFW design feature(s) and/or interlock(s) which provide for the following: Automatic turbine/reactor trip runback. (CFR: 41.7)	3.3	44/17
061 Auxiliary/Emergency Feedwater							X				A1.04 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the AFW controls including: AFW source tank level. (CFR: 41.5 / 45.5)	3.9	45/18
061 Auxiliary/Emergency Feedwater	X										K1.01 Knowledge of the physical connections and/or cause-effect relationships between the AFW and the following systems: S/G system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	4.1	46/19

062 AC Electrical Distribution								X				A2.03 Ability to (a) predict the impacts of the following malfunctions or operations on the ac distribution system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Consequences of improper sequencing when transferring to or from an inverter. (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9	47/20
062 AC Electrical Distribution				X								K4.03 Knowledge of ac distribution system design feature(s) and/or interlock(s) which provide for the following: Interlocks between automatic bus transfer and breakers (CFR: 41.7)	2.8	48/21
063 DC Electrical Distribution								X				A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the DC electrical systems; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Grounds (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.5	49/22
064 Emergency Diesel Generator				X								K4.01 Knowledge of ED/G system design feature(s) and/or interlock(s) which provide for the following: Trips while loading the ED/G (frequency, voltage, speed) (CFR: 41.7)	3.8	50/23
064 Emergency Diesel Generator						X						K6.07 Knowledge of the effect of a loss or malfunction of the following will have on the ED/G system: Air receivers (CFR: 41.7 / 45.7)	2.7	51/24
073 Process Radiation Monitoring	X											K1.01 Knowledge of the physical connections and/or cause-effect relationships between the PRM system and the following systems: Those systems served by PRMs (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.6	52/25
076 Service Water		X										~~K2.08 Knowledge of bus power supplies to the following: ESF actuated MOVs~~ Replaced with KA K2.01 (CFR: 41.7)	~~3.1~~ 2.7	53/26
078 Instrument Air									X			A3.01 Ability to monitor automatic operation of the IAS, including: Air pressure (CFR: 41.7 / 45.5)	3.1	54/27
103 Containment										X		A4.04 Ability to manually operate and/or monitor in the control room: Phase A and phase B resets. (CFR: 41.7 / 45.5 to 45.8)	3.5	55/28
K/A Category Point Totals:	3	2	2	4	2	2	2	3	3	3	2	Group Point Total:		28

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO)											Form ES-401-2		
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	K/A Topic(s)	IR	#
001 Control Rod Drive														
002 Reactor Coolant	X											K1.07 Knowledge of the physical connections and/or cause-effect relationships between the RCS and the following systems: Reactor vessel level indication system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	3.5	56/29
011 Pressurizer Level Control														
014 Rod Position Indication				X								K4.05 Knowledge of RPIS design feature(s) and/or interlock(s) which provide for the following: Rod hold interlocks (CFR: 41.5 / 45.7)	3.1	57/30
015 Nuclear Instrumentation							X					A1.05 Ability to predict and/or monitor changes in parameters to prevent exceeding design limits) associated with operating the NIS controls including: Imbalance (axial shape) (CFR: 41.5 . 45.5)	3.7	58/31
016 Non-Nuclear Instrumentation														
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling								X				A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the Spent Fuel Pool Cooling System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of SFPCS (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.7	59/32
034 Fuel Handling Equipment														
035 Steam Generator					X							K5.01 Knowledge of operational implications of the following concepts as they apply to the S/GS: Effect of secondary parameters, pressure, and temperature on reactivity. (CFR: 41.5 / 45.7)	3.4	60/33
041 Steam Dump/Turbine Bypass Control										X		A4.04 Ability to manually operate and/or monitor in the control room: Pressure mode (CFR: 41.7 / 45.5 to 45.8)	2.7	61/34

045 Main Turbine Generator			X								K3.01 Knowledge of the effect that a loss or malfunction of the MT/G system will have on the following: Remainder of the plant. (CFR: 41.7 / 45.6)	2.9	62/35
055 Condenser Air Removal													
056 Condensate	X										K1.03 Knowledge of the physical connections and/or cause-effect relationships between the Condensate System and the following systems: MFW (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.6	63/36
068 Liquid Radwaste													
071 Waste Gas Disposal													
072 Area Radiation Monitoring										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	64/37
075 Circulating Water													
079 Station Air													
086 Fire Protection				X							K4.06 Knowledge of design feature(s) and/or interlock(s) which provide for the following: CO2 (CFR: 41.7)	3.0	65/38
K/A Category Point Totals:	2	0	1	2	1	0	1	1	0	1	1	Group Point Total:		10

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.3	Knowledge of shift or short-term relief turnover practices. (CFR: 41.10 / 45.13)	3.7	66		
	2.1.44	Knowledge of RO duties in the control room during fuel handling, such as responding to alarms from the fuel handling area, communication with the fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentation. (CFR: 41.10 / 43.7 / 45.12)	3.9	67		
	2.1.34	2.1.34 Knowledge of primary and secondary plant chemistry limits. (CFR: 41.10 / 43.5 / 45.12)	2.7	68		
	Subtotal			3		
2. Equipment Control	2.2.43	Knowledge of the process used to track inoperable alarms. (CFR: 41.10 / 43.5 / 45.13)	3.0	69		
	2.2.13	Knowledge of tagging and clearance procedures. (CFR: 41.10 / 45.13)	4.1	70		
	2.2.3	Knowledge of the design, procedural, and operational differences between units. (CFR: 41.5 / 41.6 / 41.7 / 41.10 / 45.12)	3.8	71		
	Subtotal			3		
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)	2.9	72		
	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions. (CFR: 41.12 / 43.4 / 45.10)	3.2	73		
	Subtotal			2		
4. Emergency Procedures / Plan	2.4.25	Knowledge of fire protection procedures. (CFR: 41.10 / 43.5 / 45.13)	3.3	74		
	2.4.19	Knowledge of EOP layout, symbols, and icons. (CFR: 41.10 / 45.13)	3.4	75		
	Subtotal			2		
Tier 3 Point Total				10		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
RO -T2G1	076 K2.08	In the Service Water (Aux Saltwater) system there are no "ESF actuated MOVs". Replaced with the other available K2 KA for 076. K2.01 – Service Water (2.7)
RO-T1G1	APE 058 G2.2.22	Unable to write RO question to "apply LCO" for loss of DC. Replaced with another G2 .2, 2.2.37 (3.6)
RO-T1G1	APE 062 AK3.01	There are not automatic valves in Diablo Canyon's Aux Saltwater System (equivalent to Nuclear Service Water). Replaced with AK3.03 (4.0)

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		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	Total	A2		G*		Total	
1. Emergency & Abnormal Plant Evolutions	1				N/A					N/A			18	3		3		6	
	2												9	2		2		4	
	Tier Totals												27	5		5		10	
2. Plant Systems	1												28	2		3		5	
	2												10		3	0		3	
	Tier Totals												38	5		3		8	
3. Generic Knowledge and Abilities Categories		1		2		3		4		10			1 2	2 2		3 1	4 2	7	

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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 (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 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1									
000008 Pressurizer Vapor Space Accident / 3									
000009 Small Break LOCA / 3						X	2.1.7 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)	4.7	76
000011 Large Break LOCA / 3									
000015/17 RCP Malfunctions / 4									
000022 Loss of Rx Coolant Makeup / 2						X	~~2.4.41 Knowledge of the emergency action level thresholds and classifications.~~ ~~(CFR: 41.10 / 43.5 / 45.11)~~ **~~(#76 – L091)~~** **Replace with KA 2.4.4 Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures.**	4.6 4.7	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		EA2.08 Ability to determine or interpret the following as they apply to a ATWS: Rod bank step counters and RPI. (CFR 43.5 / 45.13)	3.5	78
000038 Steam Gen. Tube Rupture / 3									
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4									
000054 (CE/E06) Loss of Main Feedwater / 4						X	2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR: 41.10 / 43.5 / 45.2 / 45.6)	4.4	79
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					X		AA2.03 Ability to determine and interpret the following as they apply to the Loss of DC Power: DC loads lost; impact on ability to operate and monitor plant systems. (CFR: 43.5 / 45.13)	3.9	80

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									
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									
000077 Generator Voltage and Electric Grid Disturbances / 6 New - higher					X		AA2.05 Ability to determine and interpret the following as they apply to Generator Voltage and Electric Grid Disturbances: Operational status of offsite circuit. (CFR: 41.5 and 43.5 / 45.5, 45.7, and 45.8)	3.8	81
K/A Category Totals:					3	3	Group Point Total:		6

ES-401	PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (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	#
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									
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7					X		AA2.04 Ability to determine and interpret the following as they apply to the Loss of Intermediate Range Nuclear Instrumentation: Satisfactory overlap between source-range, intermediate-range and power-range instrumentation. (CFR: 43.5 / 45.13)	3.2	82
000036 (BW/A08) Fuel Handling Accident / 8					X		AA2.03 Ability to determine and interpret the following as they apply to the Fuel Handling Incidents: Magnitude of potential radioactive release (CFR: 43.5 / 45.13).	4.2	83
000037 Steam Generator Tube Leak / 3						X	2.2.22 Knowledge of limiting conditions for operations and safety limits. (CFR: 41.5 / 43.2 / 45.2)	4.7	84
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 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5									
000074 (W/E06&E07) Inad. Core Cooling / 4									
000076 High Reactor Coolant Activity / 9									
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						X	2.4.2 Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. (CFR: 41.7 / 45.7 / 45.8)	4.6	85
~~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 - Depress. / 4										
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4										
~~BW/E13&E14 EOP Rules and Enclosures~~										
CE/A11; W/E08 RCS Overcooling - PTS / 4										
~~CE/A16 Excess RCS Leakage / 2~~										
~~CE/E09 Functional Recovery~~										
K/A Category Point Totals:					2	2	Group Point Total:		4	

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (SRO)												Form ES-401-2	
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	K/A Topic(s)	IR	#
003 Reactor Coolant Pump														
004 Chemical and Volume Control								X				A2.26 Ability to (a) predict the impacts of the following malfunctions or operations on the CVCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Low VCT pressure. (CFR: 41.5/ 43/5 / 45/3 / 45/5)	3.0	86
005 Residual Heat Removal														
006 Emergency Core Cooling														
007 Pressurizer Relief/Quench Tank								X				A2.04 Ability to (a) predict the impacts of the following malfunctions or operations on the P S; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Overpressurization of the waste gas vent header. (CFR: 41.5 / 43.5 / 45.3 / 45.13)	2.9	87
008 Component Cooling Water														
010 Pressurizer Pressure Control														
012 Reactor Protection														
013 Engineered Safety Features Actuation														
022 Containment Cooling											X	2.4.41 Knowledge of the emergency action level thresholds and classifications. (CFR: 41.10 / 43.5 / 45.11)	4.6	88
~~025 Ice Condenser~~														
026 Containment Spray														
039 Main and Reheat Steam														
059 Main Feedwater														
061 Auxiliary/Emergency Feedwater														
062 AC Electrical Distribution														
063 DC Electrical Distribution														
064 Emergency Diesel Generator														

073 Process Radiation Monitoring										X	2.1.32 Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	4.0	89
076 Service Water										X	2.2.25 Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits. (CFR: 41.5 / 41.7 / 43.2)	4.2	90
078 Instrument Air													
103 Containment													
K/A Category Point Totals:							2			3	Group Point Total:		5

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)											Form ES-401-2		
System # / Name	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								X				A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the NNIS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Detector failure. (CFR: 41.5 / 43.5 / 45.3 / 45.5)	3.1	91
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling														
034 Fuel Handling Equipment														
035 Steam Generator								X				A2.05 Ability to (a) predict the impacts of the following malfunctions or operations on the S/G; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Unbalanced flows to the S/Gs. (CFR: 41.5 / 43.5 / 45.3 / 45.5)	3.4	92
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator														
055 Condenser Air Removal														
056 Condensate														

068 Liquid Radwaste							X				~~A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the Liquid Radwaste System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Lack of tank recirculation prior to release.~~ A2.04 Ability to (a) predict the impacts of the following malfunctions or operations on the Liquid Radwaste System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Failure or automatic isolation (CFR: 41.5 / 43.5 / 45.3 / 45.13)	~~2.8~~ 3.3	93
071 Waste Gas Disposal													
072 Area Radiation Monitoring													
075 Circulating Water													
079 Station Air													
086 Fire Protection													
K/A Category Point Totals:							3			0	Group Point Total:		3

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.26	Knowledge of industrial safety procedures (such as rotating equipment, electrical, high temperature, high pressure, caustic, chlorine, oxygen and hydrogen). (CFR: 41.10 / 45.12)			3.6	94
	2.1.35	Knowledge of the fuel-handling responsibilities of SROs. (CFR: 41.10 / 43.7)			3.9	95
	Subtotal					2
2. Equipment Control	2.2.6	Knowledge of the process for making changes to procedures. (CFR: 41.10 / 43.3 / 45.13)			3.6	96
	2.2.17	Knowledge of the process for managing maintenance activities during power operations, such as risk assessments, work prioritization, and coordination with the transmission system operator.(CFR: 41.10 / 43.5 / 45.13)			3.8	97
	Subtotal					2
3. Radiation Control	2.3.6	Ability to approve release permits. (CFR: 41.13 / 43.4 / 45.10)			3.8	98
	Subtotal					1
4. Emergency Procedures / Plan	2.4.5	Knowledge of the organization of the operating procedures network for normal, abnormal, and emergency evolutions. (CFR: 41.10 / 43.5 / 45.13)			4.3	99
	2.4.37	Knowledge of the lines of authority during implementation of the emergency plan. (CFR: 41.10 / 45.13)			4.1	100
	Subtotal					2
Tier 3 Point Total				10		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
T1/G1	APE 022 G2.4.41	KA is covered by SRO Admin JPM. Randomly selected G2.4.4 (IR 4.7)
T2/G2	068 A2.02	Not able to write relevant SRO level question. Selected A2.04 as replacement, IR 3.3

Facility: Diablo Canyon Date of Examination: 01/19/2018

Examination Level: RO ☒ SRO ☐ Operating Test Number: L162

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations (NRCL162-A1)	N, R	**Determine Affected Indicators Due To Malfunction of Eagle 21 Protection or Control Channel** 2.1.7 Ability to evaluate plant performance and make operational judgements based on operating characteristics, reactor behavior, and instrument interpretation. (4.4)
Conduct of Operations (NRCL162-A2)	N, R	**Calculate Rod Position Alignment and Rod Insertion Limits** 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (4.3)
Equipment Control (NRCL162-A3)	M, R	**Calculate Axial Flux Difference** 2.2.42 Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (3.9) (modified from L061C)
Radiation Control (NRCL162-A4)	M, R	**Calculate Maximum Stay Time** 2.3.4 Knowledge of radiation exposure limits under normal or emergency conditions. (3.2) (modified from L111 NRC)

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

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

Facility: Diablo Canyon Date of Examination: 01/19/2018

Examination Level: RO ☐ SRO ☒ Operating Test Number: L162

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations (NRCL162-A5)	N, R	**Review AP-5 Bistable Trip Authorization Form** 2.1.7 Ability to evaluate plant performance and make operational judgements based on operating characteristics, reactor behavior, and instrument interpretation. (4.7)
Conduct of Operations (NRCL162-A6)	N, R	**Review Rod Position Alignment and Rod Insertion Limits** 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (4.3)
Equipment Control (NRCL162-A7)	M, R	**Verify AFD is within Tech Spec Limits** 2.2.42 Ability to recognize system parameters that are entry-level conditions for Technical Specifications. (4.6) (Modified from L061C)
Radiation Control (NRCL162-A8)	M, R	**Approve Liquid Waste Release Permit** 2.3.6 Ability to approve release permits. (3.8) (Modified from L061C)
Emergency Plan (NRCL162-A9)	N, R	**Perform an Emergency Classification** 2.4.41 Emergency Procedures/Plan. (4.6)

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

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

Facility: Diablo Canyon Date of Examination: 01/19/2018

Exam Level: RO ☒ SRO-I ☐ SRO-U ☐ Operating Test Number: L162

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) (004.A2.14) Establish Emergency Boration (Bank LJC-063)	A,D,S	1
b. (S2) (013.A4.01) Respond to CVI Actuation (Modified from NRCL081LJC-S5)	**A,EN,M**,S	2
c. (S3) (006.A1.13) Respond to High Accumulator Pressure (Bank LJC-009)	D,S	3 (RO Only)
d. (S4) (E03.EA1.1) Start Reactor Coolant Pumps (Bank LJC-044)	D,E,L,S	4P
e. (S5) (022.A4.01) Respond to CFCU High Vibration	**A**,**N**,S	5
f. (S6) (064.A4.01) Transfer Vital 4kV Bus from D/G to Startup (Modified from Bank LJC-087)	E,L,**M**,S	6
g. (S7) (045.A4.01) Perform Load Trim to Match Tave to Tref	**N**,S	4S
h. (S8) (060.AA1.02) Respond to Gaseous Rad Release	**A**,**N**,S	9
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. (P1) (004.A2.06) Isolate Dilution Flow Paths (LJP-062)	D,E,L	1
j. (P2) (064.A3.06) Perform a Local Start of a Diesel Generator (LJP-038)	A,D,E,L	6
k. (P3) (067.AA1.08) Manually Operate the Cardox System (LJP-138A)	A,D	8

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

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

Facility: Diablo Canyon Date of Examination: 01/19/2018

Exam Level: RO ☐ SRO-I ☒ SRO-U ☐ Operating Test Number: L162

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) (004.A2.14) Establish Emergency Boration (Bank LJC-063)	A,D,S	1
b. (S2) (013.A4.01) Respond to CVI Actuation (Modified from NRCL081LJC-S5)	**A,EN,M**,S	2
c.		
d. (S4) (E03.EA1.1) Start Reactor Coolant Pumps (Bank LJC-044)	D,E,L,S	4P
e. (S5) (022.A4.01) Respond to CFCU High Vibration	**A**,**N**,S	5
f. (S6) (064.A4.01) Transfer Vital 4kV Bus from D/G to Startup (Modified from Bank LJC-087)	E,L,**M**,S	6
g. (S7) (045.A4.01) Perform Load Trim to Match Tave to Tref	**N**,S	4S
h. (S8) (060.AA1.02) Respond to Gaseous Rad Release	**A**,**N**,S	9
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. (P1) (004.A2.06) Isolate Dilution Flow Paths (LJP-062)	D,E,L	1
j. (P2) (064.A3.06) Perform a Local Start of a Diesel Generator (LJP-038)	A,D,E,L	6
k. (P3) (067.AA1.08) Manually Operate the Cardox System (LJP-138A)	A,D	8

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

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

Group I (I1, I2, R1, R2)

Facility: **DCPP** Date of Exam: **Jan 19, 2018** Operating Test Number: **L162**

APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		Day-1 (S4)			Day-2 (S1)			Day-3 (S2)			Day-4 (S5)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP		R	I	U
RO1 ☒ SRO-I ☐ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C		1,3,7				2,3,5,7,8			1,2,4,6,7				13	4	4	2
	MAJ		5,6				6,9			5				5	2	2	1
	TS													0	0	2	2
RO2 ☒ SRO-I ☐ SRO-U ☐	RX					1								1	1	1	0
	NOR														1	1	1
	I/C			1,3,4,7,8		3,4,5							1,2,6	11	4	4	2
	MAJ			5,6		6,9							5	5	2	2	1
	TS													0	0	2	2
RO ☐ SRO-I1 ☒ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C	1,3,4,7						1,2,4				3,4,6		10	4	4	2
	MAJ	5,6						5				5		4	2	2	1
	TS	1,2						2,3						4	0	2	2
RO ☐ SRO-I2 ☒ SRO-U ☐	RX				1									1	1	1	0
	NOR														1	1	1
	I/C				2,3,4,5				2,4,8		1,2,3,4,6			12	4	4	2
	MAJ				6,9				5		5			4	2	2	1
	TS				2,3,5						1,2			5	0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES D 1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the at the controls (ATC) and balance of plant (BOP) positions. Instant SROs (SRO I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO I additionally serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or controlled abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional I/C malfunctions on a one for one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right hand columns.

4. For new reactor facility licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO I applicants in either the ATC or BOP position to best evaluate the SRO I in manipulating plant controls.

Group II (I3, I4, R3, R4)

Facility: **DCPP** Date of Exam: **Jan 19, 2018** Operating Test Number: **L162**

APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		Day-1 (S4)			Day-2 (S1)			Day-3 (S2)			Day-4 (S5)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP		R	I	U
RO3 ☒ SRO-I ☐ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C		1,3,7				2,3,5,7,8			1,2,4,6,7				13	4	4	2
	MAJ		5,6				6,9			5				5	2	2	1
	TS													0	0	2	2
RO4 ☒ SRO-I ☐ SRO-U ☐	RX					1								1	1	1	0
	NOR														1	1	1
	I/C			1,3,4,7,8		3,4,5							1,2,6	11	4	4	2
	MAJ			5,6		6,9							5	5	2	2	1
	TS													0	0	2	2
RO ☐ SRO-I2 ☒ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C	1,3,4,7						1,2,4				3,4,6		10	4	4	2
	MAJ	5,6						5				5		4	2	2	1
	TS	1,2						2,3						4	0	2	2
RO ☐ SRO-I3 ☒ SRO-U ☐	RX				1									1	1	1	0
	NOR														1	1	1
	I/C				2,3,4,5				2,4,8		1,2,3,4,6			12	4	4	2
	MAJ				6,9				5		5			4	2	2	1
	TS				2,3,5						1,2			5	0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES D 1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the at the controls (ATC) and balance of plant (BOP) positions. Instant SROs (SRO I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO I additionally serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or controlled abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional I/C malfunctions on a one for one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right hand columns.

4. For new reactor facility licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO I applicants in either the ATC or BOP position to best evaluate the SRO I in manipulating plant controls.

Group III (I5, R5, R6)

Facility: **DCPP** Date of Exam: **Jan 19, 2018** Operating Test Number: **L162**

APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		Day-1 (S4)			Day-2 (S1)			Day-3 (S2)			Day-4 (S5)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	**SUR**	ATC	BOP	SRO	ATC	BOP		R	I	U
RO5 ☒ SRO-I ☐ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C		1,3,7				2,3,5,7,8			1,2,4,6,7				13	4	4	2
	MAJ		5,6				6,9			5				5	2	2	1
	TS														0	2	2
RO6 ☒ SRO-I ☐ SRO-U ☐	RX					1								1	1	1	0
	NOR														1	1	1
	I/C			1,3,4,7,8		3,4,5								8	4	4	2
	MAJ			5,6		6,9								4	2	2	1
	TS														0	2	2
RO ☐ SRO-I5 ☒ SRO-U ☐	RX				1									1	1	1	0
	NOR														1	1	1
	I/C	1,3,4,7			2,3,4,5				2,4,8					11	4	4	2
	MAJ	5,6			6,9				5					5	2	2	1
	TS	1,2			2,3,5									5	0	2	2
RO ☐ SRO-I ☒ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES D 1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the at the controls (ATC) and balance of plant (BOP) positions. Instant SROs (SRO I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO I additionally serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or controlled abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional I/C malfunctions on a one for one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right hand columns.

4. For new reactor facility licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO I applicants in either the ATC or BOP position to best evaluate the SRO I in manipulating plant controls.

Group IV (I6, R7, R8)

Facility: **DCPP** Date of Exam: **Jan 19, 2018** Operating Test Number: **L162**

APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		Day-1 (S4)			Day-2 (S1)			Day-3 (S2)			Day-4 (S5)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	**SUR**	ATC	BOP	SRO	ATC	BOP		R	I	U
RO5 ☒ SRO-I ☐ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C		1,3,7				2,3,5,7,8			1,2,4,6,7				13	4	4	2
	MAJ		5,6				6,9			5				5	2	2	1
	TS														0	2	2
RO6 ☒ SRO-I ☐ SRO-U ☐	RX					1								1	1	1	0
	NOR														1	1	1
	I/C			1,3,4,7,8		3,4,5								8	4	4	2
	MAJ			5,6		6,9								4	2	2	1
	TS														0	2	2
RO ☐ SRO-I5 ☒ SRO-U ☐	RX				1									1	1	1	0
	NOR														1	1	1
	I/C	1,3,4,7			2,3,4,5				2,4,8					11	4	4	2
	MAJ	5,6			6,9				5					5	2	2	1
	TS	1,2			2,3,5									5	0	2	2
RO ☐ SRO-I ☒ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES D 1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the at the controls (ATC) and balance of plant (BOP) positions. Instant SROs (SRO I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO I additionally serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or controlled abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional I/C malfunctions on a one for one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right hand columns.

4. For new reactor facility licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO I applicants in either the ATC or BOP position to best evaluate the SRO I in manipulating plant controls.

Spare

Facility: **DCPP**				Date of Exam: **Jan 19, 2018**							Operating Test Number: **L162**						
APPLICANT	EVENT TYPE	Scenarios												TOTAL	MINIMUM(*)		
		Spare			Day-2 (S1)			Day-3 (S2)			Day-4 (S5)						
		CREW POSITION			CREW POSITION			CREW POSITION			CREW POSITION						
		SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP	SRO	ATC	BOP		R	I	U
RO ☐ SRO-I ☐ SRO-U ☐	RX	3	3	3											1	1	0
	NOR														1	1	1
	I/C	1,2,4	4,6	1,2,6											4	4	2
	MAJ	5	5	5											2	2	1
	TS	1,4													0	2	2
RO ☐ SRO-I ☐ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO ☐ SRO-I ☐ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO ☐ SRO-I ☐ SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2

Instructions:

1. Check the applicant level and enter the operating test number and Form ES D 1 event numbers for each event type; TS are not applicable for RO applicants. ROs must serve in both the at the controls (ATC) and balance of plant (BOP) positions. Instant SROs (SRO I) must serve in both the SRO and the ATC positions, including at least two instrument or component (I/C) malfunctions and one major transient, in the ATC position. If an SRO I additionally serves in the BOP position, one I/C malfunction can be credited toward the two I/C malfunctions required for the ATC position.

2. Reactivity manipulations may be conducted under normal or controlled abnormal conditions (refer to Section D.5.d) but must be significant per Section C.2.a of Appendix D. (*) Reactivity and normal evolutions may be replaced with additional I/C malfunctions on a one for one basis.

3. Whenever practical, both instrument and component malfunctions should be included; only those that require verifiable actions that provide insight to the applicant's competence count toward the minimum requirements specified for the applicant's license level in the right hand columns.

4. For new reactor facility licensees that use the ATC operator primarily for monitoring plant parameters, the chief examiner may place SRO I applicants in either the ATC or BOP position to best evaluate the SRO I in manipulating plant controls.

Facility: Diablo Canyon (PWR) **Scenario No:** 1 **Op-Test No:** L162 NRC

Examiners: _____ **Operators:** _____

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Initial Conditions: **3% power with CCP 1-2 In Service (75 gpm letdown); MFP 1-1 supplying S/Gs; on Startup Power; MOL, 1234 ppm boron**

Turnover: **In OP L-3, performing step 6.28, raising power to 8%.**

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	N/A	**R (ATC, SRO)**	Raise reactor power from 3% to ≈ 8% **OP L-3,** sec 6.28
2	XMT_RMS23_3 1E+006	**TS, I (BOP, SRO)**	S/G Blowdown RM-23 fails high. FCV-498/ FCV-499 and half of sample valves fail to isolate, but can be manually closed (**ECG 39.3.B**)(**PK11-17**)
3	PMP_CVC2_2 OVERLOAD_DEV_FAIL	**TS, C (ALL)**	Centrifugal Charging Pump 1-2 OC Trip requiring restoration of letdown (**TS 3.5.2.A**) (**AP-17**)
4	XMT_MSS1_3 15 ramp=300	**I (ATC, SRO)**	PT-507, Steam Generator Header Pressure Transmitter, slow failure low causing Group I dumps to close. (**AP-5**)
5	PMP_AFW1_2 OVERLOAD_DEV_FAIL PMP_AFW2_2 OVERLOAD_DEV_FAIL BST_MFW1_1 1	**TS, C (ALL)**	MFP 1-1 trips. MDAFW pumps start but trip; requires start of TDAFW pump. (**TS 3.7.5.D**)(**PK09-12, AP-15**)
6	MAL_MSS6A 90 ramp=240 MAL_MSS6A 0 delay=10 cd='jpplsia'	**M (ALL)**	S/G 1-1 Safety Lifts; reseats 10 seconds after SI
7	CVC9CVC_CCP11_MTRSHEAR delay=30 cd='jpplsia'	**C (BOP)**	CCP 1-1 shaft shear 30 seconds after SI
8	VLV_PZR4_2 0.3 cd='jpplsia' del ay=60	**C (BOP)**	Pressurizer PORV PCV-455C fails slightly open on trip requiring manual isolation by associated block valve
9	MAL_RCS3B 3.5 cd='V1_240S_1 or V1_241S_1' delay=0 ramp=15	**M (ALL)**	SBLOCA after SI is terminated in **E-1.1**

***(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 2,3,4,5,6,7,8,9)	8
2. Malfunctions after EOP entry (1-2) (Event 7,8)	2
3. Abnormal events (1–4) (Events 2,3,4,5)	4
4. Major transients (1-2) (Events 6,9)	2
5. EOPs entered/requiring substantive actions (1–2) (E-1.1)	1
6. EOP contingencies requiring substantive actions (0–2)	0
7. Critical tasks (2–3)(See description below)	2

Critical Task	Justification	Reference
(S1CT-1) Close the block MOV upstream of the stuck open PORV prior to performance of step 8 of EOP E-0, Reactor Trip or Safety Injection.	The open PORV and block valve constitute the degradation of a fission product barrier. Closing the block valve is essential to safety since failure to do so results in the unnecessary continuation of the degraded condition.	• Westinghouse Owner's Group WCAP-17711-NP
(S1CT-2) Reinitate SI before a severe challenge to the Core Cooling Critical Safety Function develops (magenta path on F-0.2 Core Cooling).	Degraded core cooling is caused by a substantial loss of primary coolant. Reinitiation of high pressure safety injection is the most effective method to restore RCS inventory and core cooling. The effectiveness of safety injection in restoring core cooling is determined by the trend in core exit TC temperatures or RVLIS full range when the RCPs are tripped.	• Background Information for WOG Emergency Response Guideline HFRC2BG Rev 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.		

SCENARIO SUMMARY – NRC #1

1. Control rods are used to raise power from 2% to ≈ 8% **OP L-3, Secondary Plant Startup,** step 6.28**.** ATC operator complies with 1 step pull and wait procedural requirement while monitoring relevant controls and diverse indicators. Shift Foreman provides reactivity oversight.

2. S/G Blowdown RM-23 fails high resulting in only a partial blowdown isolation. The crew responds, manually isolating the unactuated sample isolation valves and realigning blowdown discharge to the Equipment Drain Receiver, following the guidance of **AR PK11-17, SG BLOW DOWN HI RAD.** Shift Foreman enters **ECG 39.3.B, Radioactive Liquid Effluent Monitoring Instrumentation**, for Steam Generator Blowdown Tank (RM-23) inoperable.

3. Charging Pump CCP 1-2 trips on over current. The crew responds by entering **OP AP-17, Loss of Charging** to restore normal charging and letdown. Shift Foreman enters Tech Spec **3.5.2.A, ECCS – Operating**, for one ECCS train inoperable.

4. PT-507, Steam Generator Header Pressure Transmitter, slowly fails low causing Group I dumps to close. Crew diagnoses the failure 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 to normal bands.

5. MFP 1-1 trips on high vibration. Both MDAFW pumps start initially, but trip on overcurrent. The crew enters **AR PK09-12, Main Feedwater Pump Trip**, and follow the guidance of **OP AP-15, Loss of Feedwater Flow, Section B: Single Operating MFP Trips**, starting the TDAFW pump, tripping the turbine, and inserting rods in manual to reduce power to 2%. Shift Foreman enters Tech Spec **3.7.5.D, AFW System**, for two AFW trains inoperable.

6. S/G 1-1 Safety lifts causing uncontrollable depressurization of S/G 1-1. Shift Foreman directs board operators to trip the reactor and initiate Safety Injection once reactor trip has been verified. The crew enters **EOP E-0, Reactor Trip or Safety Injection.** The safety valve reseats 45 seconds after Safety Injection initiates. The crew throttles AFW to control the cooldown as they work their way towards SI termination.

7. CCP 1-1 fails due to a sheared shaft 30 seconds after SI actuation. The board operator identifies the condition based on low motor amps and flow.

8. Board operators also identify PCV-455C in mid-position. The valve will not close and must be isolated using the associated block valve 8000B **(S1CT-1) Close the block MOV upstream of the stuck open PORV before performing step 8 of EOP E-0).**

9. Once termination criteria has been met, the crew transitions to EOP **E-1.1, SI Termination**. A SBLOCA occurs immediately following the shutdown of Safety Injection Pump 1-2. The crew performs the final critical task of reinitiating Safety Injection **(S1CT-2) Reinitate SI before a severe challenge to the Core Cooling Critical Safety Function develops (magenta path on F-0.2 Core Cooling).**

The scenario is terminated once ECCS pumps have been restarted.

Facility: Diablo Canyon (PWR) **Scenario No:** 2 **Op-Test No:** L162 NRC

Examiners: _____ **Operators:** _____

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Initial Conditions: **50% with CCP 1-3 and MFP 1-1 OOS; CCP 1-2 IS; MOL, 1000 ppm boron**

Turnover: **MFP 1-2 has elevated vibrations. ODM held earlier established action plan with ramping guidelines should conditions degrade.**

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	GGACRL_94BTVSP 1	**C, BOP**	Gen Voltage Regulator fails requiring manual voltage control on the base adjuster (**PK14-22**).
2	VLV_CVC16_2 .11 delay=15 ramp=3	**TS, C (ALL)**	CVCS-8152 fails to 90% closed requiring Excess Letdown to be placed in service (**PK04-21, AP-18**) (**TS 3.6.3.A**).
3	MAL_SEI1 0.12 delay=0 ramp=15 ASISRWST 1.6e6 delay=10 ramp=1800	**C, TS only (SRO)**	Large seismic event causes rupture of RWST. (**PK06-20, TS 3.5.4.B**).
4	MAL_MFW2B 2.45 delay=0 ramp=60	**C (ALL)**	Vibrations on MFP 1-2 rise to ODM limit, requiring predesignated Unit 1 shutdown at 6 MW/min. (**AP-25**).
5	MAL_SEI1 0.2 cd='bsisrwst lt 54.6' delay=0 ramp=10 MAL_RCS1C 100%_DBA cd='bsisrwst lt 54.5'	**M (ALL)**	DBA LOCA on aftershock.
6	MAL_PPL5A BOTH MAL_PPL5B BOTH	**C (BOP)**	ATWS (13D/E Work)
7	MAL_PPL1A FAILURE_TO_INIT	**C (BOP)**	Phase A Train A fails to actuate.
8	MAL_CNM3 100 cd='rsih8980 lt 0.02' delay=60 ramp=15	**C (ATC)**	Sump blockage.

***(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 6,7,8)	3
3. Abnormal events (1–4) (Events 1,2,4)	3
4. Major transients (1-2) (Event 5)	1
5. EOPs entered/requiring substantive actions (1–2) (E-1, E-1.3, ECA-1.3)	3
6. EOP contingencies requiring substantive actions (0–2) (ECA-1.3)	1
7. Critical tasks (2–3)(See description below)	2

Critical Task	Justification	Reference
(S2CT-1) Initiate reactor trip prior to performance of E-0, step 2.	The safeguards systems that protect the plant during accidents are designed assuming that only decay heat and pump heat are being added to the RCS. Failure to manually trip the reactor causes a extreme challenge to the subcriticality critical safety function (red path on F-0.1 subcriticality) beyond that irreparably introduced by the postulated conditions.	• Westinghouse Owner's Group WCAP-17711-NP • Calc G.2 Rev 5 (08151-2169) • OP1.ID2, Time Critical Operator Actions Rev 8A, #34.
(S2CT-2) Stop all running ECCS pumps with suction aligned to the containment recirc sump by the completion of ECA-1.3, step 5: • CCP 1-1 • CCP 1-2 • SIP 1-1 • SIP 1-2 • RHRP 1-1 • RHRP 1-2	Failure to stop the cavitating pumps leads to damage sufficient to render the pumps unavailable for use once an alternate make-up supply is aligned to the RCS.	• Background Information for Westinghouse Owners Group Sump Blockage Guideline, Rev 0.
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 #2

1. Generator Voltage Regulator trips due to a loss of sensing voltage. The crew responds by entering **AR PK14-22, GENERATOR VLTG REG TRIP** and determine the voltage regulator is now operating in manual mode. Annunciator guidance is followed to maintain a lagging power factor.

2. Letdown Hx Inlet Valve, CVCS-8152 fails 90% closed causing letdown to divert to the Pressurizer Relief Tank. **AR PK04-21, LETDOWN PRESS / FLOW TEMP** comes into alarm, directing the crew to isolate Normal Letdown and place Excess Letdown in service per **OP B-1A:IV, CVCS – Excess Letdown – Place In Service and Remove From Service**. Alternately, the crew may elect to enter **OP AP-18, Letdown Line Failure**, which provides equivalent guidance. Shift Foreman enters **TS 3.6.3.A – Containment Isolation Valves,** for one containment isolation valve inoperable.

3. A 0.12 g seismic event results in a rupture of RWST, causing level to lower rapidly. The crew identifies RWST level lowering by monitoring level indications on VB-2 or by evaluating **AR PK06-20, PPC Select** which identifies RWST level is below the alarm setpoint. Field operators report a crack in the RWST extending down to approximately the 50% level. The Shift Foreman enters **TS 3.5.4.B – Refueling Water Storage Tank (RWST)** for borated water volume less than the required minimum of 455,300 gallons (~94%).

4. Vibrations on MFP 1-2 rise to 2.5 mil which corresponds to a ODM limit, requiring predesignated Unit 1 shutdown at 6 MW/min. A ramp is commenced following the guidance of **OP AP-25, Rapid Load Reduction or Shutdown**.

5. A 0.20 g seismic aftershock results in 100% DBA LOCA.

6. The crew enters **E-0, Reactor Trip or Safety Injection**, performing their immediate actions. A reactor trip fails to automatically actuate (ATWS); manual Rx Trip control switches are ineffective as well. Control board operators perform their respective response actions: ATC drives control rods inward and BOP manually opens control rod breakers 13D/E on VB5 **(S2CT-1) Initiate reactor trip prior to performance of E-0, step 2)**.

7. With the reactor tripped, the crew continues on, checking for actuation of emergency safeguards equipment and diagnosing conditions consistent with a large break LOCA (high containment pressure, loss of pressurizer pressure and level, loss of subcooling, high containment sump levels). The crew identifies RCP trip criteria are met, and with Shift Foreman concurrence, trip all four RCPs. Shift Foreman directs the BOP Operator to complete **Appendix E, ESF AUTO ACTIONS, SECONDARY AND AUXILIARIES STATUS**, and continues on in E-0. Train A of Phase A, Containment Isolation, fails to actuate, requiring board operators to manually align the associated inside containment isolation valves.

(continued on next page)

SCENARIO SUMMARY – NRC #2

8. The Shift Foreman continues through E-0 diagnostic steps, and transitions to **E-1, Loss of Reactor or Secondary Coolant**. Functional restoration status trees are checked and crew identifies transition criteria for **FR-P.1, Response to Imminent Pressurized Thermal Shock**. Conditions will be met for exiting the procedure at the first step.

   When RWST level reaches 33%, the crew transitions immediately to **E-1.3, Transfer to Cold Leg Recirculation**, and performs the required alignment steps. When RWST suction valve SI-8980 is isolated, ECCS recirculation flow is lost due to sump blockage. The crew transitions to **ECA-1.3, Sump Blockage** either directly, or by way of **ECA-1.1, Loss of Emergency Coolant Recirculation**, where they secure all running ECCS pumps (**S2CT-2, Stop all running ECCS pumps with suction aligned to the containment recirc sump by the completion of ECA-1.3, step 5)**.

The scenario is terminated once Critical Task S2CT-2 is complete.

Facility: Diablo Canyon (PWR) **Scenario No:** 3 **Op-Test No:** L162 NRC

Examiners: _____ **Operators:** _____

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Initial Conditions: **75% with CFCU 1-5 OOS; MOL, 919 ppm boron**

Turnover: **At 75% power due to grid instability.**

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	EECKSELECT2382371XPWR 0	**C, TS (BOP, SRO)**	Load Tap Changer Auto Control Failure (**PK20-04) TS 3.8.1.A**
2	XMT_CVC16_3 150 delay=0 ramp=15	**I (BOP, SRO)**	TE-130 fails high (**PK04-21, AP-5**)
3	N/A	**R (ALL)**	Backdown Order; Shed 150 mw over next 15 minutes (**AP-25**).
4	DSC_ROD1 cd='smss lt 800'	**C, TS (ATC, SRO)**	DRPI loss of normal power requires ramp to be placed on hold, rods taken to manual. (**AR PK03-21) (TS 3.1.7.B**)
5	MAL_MSS4 720000 delay=0 ramp=60	**M (ALL)**	MSLB outside containment
6	VLV_MSS7_2, VLV_MSS8_2, VLV_MSS9_2, VLV_MSS10_2 1	**C (ALL)**	All MSIVs fail open

***(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)	6
2. Malfunctions after EOP entry (1-2) (Event 6)	1
3. Abnormal events (1–4) (Events 1,2,3,4)	4
4. Major transients (1-2) (Event 5)	1
5. EOPs entered/requiring substantive actions (1–2) (E-2, ECA-2.1)	2
6. EOP contingencies requiring substantive actions (0–2) (ECA-2.1)	1
7. Critical tasks (2–3)(See description below)	2

Critical Task	Justification	Reference
(S3CT-1) Stop uncontrolled cooldown by controlling AFW flow before a severe challenge to Integrity Safety Function develops (magenta path on F-0.4 RCS Integrity)	An event or series of events which leads to a relatively rapid and severe reactor vessel downcomer cooldown can result in a thermal shock to the vessel wall that may lead to a small flaw, which may already exist in the vessel wall, growing into a larger crack. The growth or extension of such a flaw may lead, in some cases (where propagation is not stopped within the wall), to a loss of vessel integrity	• Background Information for WOG Emergency Response Guideline
(S3CT-2) Terminate SI prior to rupture of PRT by closing 8801A/B and/or 8803A/B. *(Note: CT is met by closing either 8801A/B OR 8803A/B.)*	Failure to terminate ECCS flow when SI termination criteria are met results in overfill of the Pressurizer and the eventual rupture of the PRT. This constitutes the avoidable degradation of the RCS as a fission product barrier.	• Westinghouse Owner's Group WCAP-17711-NP
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. Startup Transformer 1-1 Load Tap Changer control power supply fails. Crew responds per **AR PK20-04, SU TRANSF 11, 12, OR 21 LOCAL ANNUN,** and manually controls transformer voltage. Shift Foreman enters **TS 3.8.1.A, AC Sources – Operating** for one required offsite circuit inoperable.

2. Letdown heat exchanger temperature element TE-130 fails high, causing actual letdown temperature to lower. **AR PK04-21, LETDOWN PRESS / FLO TEMP** comes into alarm, directing the crew to take manual control of letdown temperature (TCV-130), to restore temperature to normal range. Alternately, the crew may elect to follow the guidance of **OP AP-5, Malfunction of Eagle 21 Protection or Control Channel .**

3. Shift Manager reports a confirmed Grid Control Center backdown order due to grid instability. Unit 1 is directed to shed 150 MW within 15 minutes. The Shift Foreman determines an appropriate ramp rate to meet the backdown order requirement (may assign this task to reactor operator) and implements **OP AP-25, Rapid Load Reduction or Shutdown.** The ATC determines an initial boration based on the Reactivity Handbook and advises the Shift Foreman of his recommendation. The BOP enters the programmed ramp into the turbine control system. The reactivity evolutions are implemented sequentially, with the Shift Foreman providing oversight.

4. DRPI power failure due to normal supply breaker tripping open near the end of the ramp. Ramp is placed on hold, rods are taken to manual, and Tave is matched within 1.5 ^{o}F (if required) per **AR PK03-21, DRPI FAILURE / ROD BOTTOM**. The Shift Foreman enters **TS 3.1.7.B - Rod Position Indication** for more than one DRPI per group inoperable.

5. A main steamline break develops downstream of the Main Steam Isolation Valves, outside containment. The crew identifies the need to isolate the Main Steam Isolation Valves and perform a safety injection (SI) based on pressurizer pressure and level lowering rapidly. Shift Foreman directs a reactor trip and SI and enters **EOP E-0, Reactor Trip or Safety Injection.**

6. All four main steam isolation valves fail open. The crew transitions to **EOP E-2, Faulted Steam Generator Isolation**, and then to **EOP ECA-2.1, Uncontrolled Depressurization of All Steam Generators**. The crew performs the critical tasks of stopping the uncontrolled cooldown **(S3CT-1) Stop uncontrolled cooldown before a severe challenge (magenta path) develops on F-0.4 RCS Integrity** by minimizing feedflow and then terminating safety injection **(S3CT-2) Terminate SI prior to rupture of PRT**.

The scenario is terminated once SI is terminated .

Facility: Diablo Canyon (PWR) **Scenario No:** 4 **Op-Test No:** L162 NRC

Examiners: _____ **Operators:** _____

_____ _____

_____ _____

Initial Conditions: **100% with MAFW Pump 1-3 OOS; MOL, 878 ppm boron**

Turnover:

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	MAL_NIS6A 200 delay=0 ramp=420	**I, TS (ALL)**	NI-41 slow failure HIGH (**AP-5; Multiple TS** (see summary section))
2	XMT_RCS6_3 -376.0 ramp=60	**I, TS only (SRO)**	PT-403 fails low (**PK05-07, 09**)(**TS 3.3.3.A**)
3	MAL_CWS2C 2.3 delay=0 ramp=2	**C (ALL)**	Condenser In-leakage (**PK12-05, AP-20 & 25**)
4	XMT_CND29_3 282 ramp=240 XMT_CND30_3 278 ramp=240 CD04CND_CDP13_MTFSEIZUR 1 cd='(h_v3_225r_1 and (txmtcbmo(3) gt 280))' delay=15	**C (BOP, SRO)**	CBP Set 1-3 high bearing temp when ramp reaches 1000 MW (**PK10-06**)
5	MAL_SEI1 0.15 delay=0 ramp=10 CNV_MFW3_2 0 delay=0 ramp=60	**M (ALL)**	FCV-510 fails closed following seismic event.
6	MAL_RCS4F 600 cd='fnispr_2 lt 5' delay=0 ramp=10	**M (ALL)**	600 gpm SGTR (S/G 1-2)
7	MAL_PPL3A BOTH, MAL_PPL3B BOTH	**C (ALL)**	SI Actuation Fails (both auto and manual)
8	CNV_RCS1_2 CNV_RCS2_2	**C (BOP)**	Prz Sprays failed closed / PORV used for depressurization fails opened; block valve can not be closed

***(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 7,8)	2
3. Abnormal events (1–4) (Events 1,3,4)	3
4. Major transients (1-2) (Event 5,6)	2
5. EOPs entered/requiring substantive actions (1–2) (E-3, ECA-3.1)	2
6. EOP contingencies requiring substantive actions (0–2) (ECA-3.1)	1
7. Critical tasks (2–3)(See description below)	3

Critical Task	Justification	Reference
(S4CT-1) Manually trip the reactor before S/G 1-1 reaches dry out conditions as indicated by WR level less than 10%.	Steam Generator Level below 15% narrow range in 1 of 4 loops after a power level dependent time delay, normally generates a reactor trip signal to protect against a loss of heat sink. For this scenario, power remains above 50%, so the time delay = 0. Once the S/G has reached dry out conditions, it is no longer capable of RCS heat removal. Furthermore, the S/G is susceptible to structural damage as the result of thermal shock once feedwater is re-established from the Auxiliary Feedwater System.	• WOG Backgd HFHR1BG_R3
(S4CT-2) 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 start and manually align the minimum required safeguards equipment results in the persistence of degraded emergency core cooling system capacity.	• WCAP-17711-NP, CT-2 • WOG Backgrnd HE0BG_R2
(S4CT-3) Isolate the ruptured steam generator from the intact steam generators prior to commencing cooldown of the RCS in step 9.c (40% steam dumps) or 10.b (10% steam dump) by completing the following: Isolate feedwater by ensuring closed: • LCV-107 (MDAFW Level Control Valve) • LCV-111 (TDAFW Level Control Valve) Isolate steamflow by ensuring closed: • FCV-42 (S/G 1-2 MSIV) • FCV-37 (S/G 1-2 supply to TD AFW Pp)	SG inventory increase leads to water release through the S/G PORV or safety valve(s) or to SG overfill, which would seriously compromise the SG as a fission-product barrier and complicate mitigation.	• W Margin to Overfill (CN-CRA-05-53 Rev1) • W Offsite Doses (CN-CRA-05-54) • SGTR UFSAR 15.4.3 • WCAP-17711-NP

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. Power Range Nuclear Instrument NI-41 slowly fails high causing inward rod motion. Crew diagnoses failure, and once motion is deemed unwarranted, takes rods to manual. Failure is addressed per **OP AP-5, Malfunction of Eagle 21 Protection or Control Channel**, which removes the failed channel from service and directs the Shift Foreman to address **Tech Specs 3.3.1.D,E,S,T Reactor Trip System Instrumentation; ECG 37.2 Axial Flux Difference (AFD) monitoring, and ECG 37.3 (Quadrant Power Tilt Ratio Alarms).**

2. PT-403, RCS Wide Range Pressure Transmitter, fails low. The crew responds to **PK05-07, Subcooling Margin Lo/Lo-Lo** and **PK05-09, RVLIS Lo Lvl RVLIS/SCMM Trouble,** identifying the affected instrumentation. Shift Foreman addresses **TS 3.3.3.A, Post Accident Monitoring Instrumentation**

3. A saltwater leak develops in the SW quadrant of the condenser, bringing in **AR PK12-05, COND PPS DISCH HDR CATION CONDT'Y HI.** The crew determines cation conductivity is elevated and the Shift Foreman enters **OP AP-20, Condenser Tube Leak**, which calls for a 25 MW/min ramp to 50%. The crew immediately implements **OP AP-25, Rapid Load Reduction or Shutdown** to commence the ramp**.**

4. Annunciator **AR PK10-06, CNDS & CNDS BSTR PPS** comes into alarm due to rising bearing temperatures on Condensate Booster Pump Set (CBP) 1-3. Reactor operators identify rapidly rising bearing temperatures using plant process computer trends. The crew manually starts CBP 1-2 and secures CBP 1-3 to prevent motor damage.

   (*Note: Malfunction is designed to trip CBP 1-3 if crew has not shut the pump down within 15 seconds of bearing temperature reaching 280^{o}F. The Autostart of CBP 1-2 has been disabled and will require a manual start*).

5. A 0.15 seismic event results in Main Feed Reg valve FCV-510 failing closed. S/G 1-1 level can not be maintained. S/G 1-1 Low Level trip has been disabled and the crew must manually trip the reactor **(S4CT-1) Manually trip the reactor before S/G 1-1 reaches dry out conditions.**

6. A 600 gpm tube rupture develops on S/G 1-2 when the reactor trips. The crew enters **EOP E-0, Reactor Trip or Safety Injection**, and identifies the rupture based on various radiation alarms, rising counts on RM-72, and the inability to maintain RCS pressure and pressurizer level following the trip.

7. Both auto and manual Safety Injection (SI) actuation signals fail and the crew must manually start and align SI actuated equipment **(S4CT-2) Manually align at least one train of SIS actuated safeguards before transition out of EOP E-0.**

(continued on next page)

SCENARIO SUMMARY – NRC #4

8. The crew transitions to **EOP E-3, Steam Generator Tube Rupture**, and where they perform the critical task of isolating S/G 1-2 **(S4CT-3) Isolate the ruptured steam generator from the intact steam generators prior to commencing cooldown of the RCS.***** Depressurization of the RCS is commenced following the cooldown. Pressurizer spray valves fail to operate and a PORV must be used. When the crew attempts to stop the depressurization, both the PORV and associated block valve fail to operate in the closed direction, and the Shift Foreman transitions to **EOP ECA-3.1, SGTR with Loss of Reactor Coolant – Subcooled Recovery Desired.**

The scenario is terminated once the cooldown to Cold Shutdown in ECA-3.1 has been commenced or verified.

*** **CT / TCOA note**: SGTR was evaluated against Time Critical Operator Actions (TCOAs) # 2 (SGTR); initial power level and supporting equipment conditions differ significantly from the conditions used in this scenario. For these reasons, the S/G TCOAs will remain critical (a critical task, per WOG), but TCOA time limits will not be applied to this scenario.

Facility: Diablo Canyon (PWR) **Scenario No:** 5 **Op-Test No:** L162 NRC

Examiners: _____ **Operators:** _____

_____ _____

_____ _____

Initial Conditions: 100% with AFWP 1-2 OOS; MOL, 878 ppm boron

Turnover:

Event No	Malf No.	Event Type*	Event Description (See Summary for Narrative Detail)
1	VLV_PZR6_2 0.1 delay=0 ramp=5	**C, TS (BOP, SRO)**	PCV-474 slowly drifts open (**AP-13**)(**TS 3.4.11.B**).
2	PK1823_0132 1	**C, TS (BOP, SRO)**	Ground on ASW Pump 1-1 (PK18-23)(**TS 3.7.8.A**).
3	GGAHRL_62GSC3TVSP 0 MAL_GEN3 LO_FLOW delay=10 delIA MAL_GEN3 2 cd='smss lt 925'	**C (ATC, SRO)**	Partial Stator Water cooling flow/partial runback (**PK14-19, PK12-12, AP-25**).
4	MAL_CVC8A	**C (ATC, SRO)**	Seal Injection Filter 1-1 plugs causing reduction in charging flow to RCP seals (**PK04-22).**
5	RLY_PPL37 CLOSED(TRUE)	**M (ALL)**	Spurious Phase B causes isolation of CCW Header C requiring Reactor Trip and tripping of all four RCPs (**PK01-08, AP-11**).
6	MAL_AFW1 1 cd='H_V3_109M_1 GT 0.1' MAL_MFW2A,B 25 cd='fnispr lt 5.0' MAL_EPS4C_2 DIFFERENTIAL	**C (ALL)**	Bus F trips on differential on reactor trip causing loss of DRPI and AFW pump 1-3. Both MFPs Trip and TDAFP trips on overspeed; (post trip).

***(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)	6
2. Malfunctions after EOP entry (1-2) (Events 6)	1
3. Abnormal events (1–4) (Events 1,2,3,4)	4
4. Major transients (1-2) (Event 5)	1
5. EOPs entered/requiring substantive actions (1–2) (FR-H.1)	1
6. EOP contingencies requiring substantive actions (0–2) (FR-H.1)	1
7. Critical tasks (2–3)(See description below)	2

Critical Task	Justification	Reference
(S5CT-1) Trip all four Reactor Coolant Pumps (RCPs) as indicated by: • RCP Breaker position = OPEN • RCP Amperage lowering • RCP thrust bearing temperatures lowering prior to a partial loss of reactor coolant flow due to Reactor Coolant Pump failure.	RCPs are susceptible to catastrophic failure and a loss of reactor coolant flow if left running in the absence of adequate bearing cooling flow. If the reactor is at power at the time of the accident, the immediate effect of loss of coolant flow is a rapid increase in the coolant temperature. This increase could result in DNB with subsequent fuel damage if the reactor is not tripped promptly.	• FSAR Accident Analysis, Section 15.2.5 – Partial Loss of Forced Ractor Coolant Flow
(S5CT-2) Establish a secondary heat sink as indicated by: • WR level rising • Core Exit Thermocouple temperatures lowering Prior to reaching bleed and feed criteria which is defined as wide range S/G level in any three S/Gs less than 18% [26%] AND narrow range S/G level in all four S/Gs less than 15% [25%] narrow range.	A loss of all feedwater transient is characterized by a depletion of secondary inventory and eventual degradation of secondary heat transfer capability. As secondary heat transfer capability degrades, core decay heat generation will increase RCS temperature and pressure causing loss of RCS inventory similar in nature to a small break loss of coolant accident. Failure to restore a secondary heat sink when it is possible to do so constitutes "a significant reduction of safety margin beyond that irreparably introduced by the scenario."	• FR-H.1 Background Document (HFRH1BG), Rev. 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.		

SCENARIO SUMMARY – NRC #5

1. Pressurizer Pressure Control Valve PCV-474 drifts open and must be isolated using the associated 8000-A block valve. Shift Forman enters **TS 3.4.11.B Pressurizer Power Operated Relief Valves (PORVs)** – for one PORV inoperable for reasons other than excessive seat leakage.

2. Running ASW Pump 1-1 experiences a ground on 4 kV Bus F. The crew follows the guidance of **AR PK18-23**, **4KV BUS F GROUND OC ALARM**, and shuts down ASW pump 1-1 after starting the 1-2 pump. Shift Forman enters **TS 3.7.8.A, Auxiliary Saltwater (ASW) System** for one train inoperable.

3. Low Stator Coil Cooling Water flow causes a turbine runback. The crew responds per **AR PK14-19, STATOR WTR CLG SYSTEM,** and **OP AP-25, Rapid Load Reduction or Shutdown**. The low flow condition clears quickly (approximately 925 MW), and the crew stabilizes the plant.

4. In-service Seal Injection Filter 1-1 plugs, reducing flow to RCP seals and bringing in **AR PK04-22, RCP Seal Inj Fltr Delta-P Hi**. Reactor Operators verify CCP seal cooling is still being maintained by CCW and ATC operator throttles RCP seal injection hand control valve, HCV-142, as needed to maintain pressurizer level. Shift Foreman establishes bands for pressurizer level and confirms field operators have been dispatched to swap seal injection filters.

5. A spurious actuation of Train A, Phase B results in the isolation of CCW Header C. The crew responds per **AR PK01-08, CCW HEADER C**, or alternately, **OP AP-11, Section E: Loss of CCW Flow to RCPs**, which calls for tripping the reactor and then tripping all four RCPs. **(S5CT-1) Trip all four Reactor Coolant Pumps (RCPs) .**

6. The crew enters **E-0, Reactor Trip or Safety Injection** and performs their immediate actions. On the trip, 4 kV bus F trips on differential. DRPI loses power, but crew is able to determine the reactor has tripped based on diverse indications (lowering reactor power and reactor trip breakers open). MDAFW Pump 1-3 is also lost due to the bus failure. Both main feedpumps trip and the TDAFW pump trips on overspeed leading to Loss of Heat Sink condition. The crew transitions to **EOP FR-H.1, Response to Loss of Secondary Heat Sink**. With the condenser available, Main Feed is used to restore a secondary side heat sink **(S5CT-2) Establish a secondary heat sink.**

The scenario is terminated once Critical Task S5CT-2 is complete.