Facility: STP Date of Exam:

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

Note:

1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only 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).
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 and justified; 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 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.

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 (~~BW/E02&E10; CE/E02~~) Reactor Trip - Stabilization - Recovery / 1									
000008 Pressurizer Vapor Space Accident / 3									
000009 Small Break LOCA / 3	X						**Knowledge of the operational implications of the following concepts as they apply to the small break LOCA:** (CFR 41.8 / 41.10 / 45.3) EK1.02 Use of steam tables RO 3.5/SRO 4.2	3.5	1
000011 Large Break LOCA / 3									
000015/17 RCP Malfunctions / 4				X			**Ability to operate and / or monitor the following as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow)** (CFR 41.7 / 45.5 / 45.6) AA1.22 RCP seal failure/malfunction RO 4.0/SRO4.2	4.0	2
000022 Loss of Rx Coolant Makeup / 2									
000025 Loss of RHR System / 4					X		**Ability to determine and interpret the following as they apply to the Loss of Residual Heat Removal System:** **(CFR: 43.5 / 45.13)** AA2.07 Pump cavitation RO 3.4/SRO 3.7	3.4	3
000026 Loss of Component Cooling Water / 8						X	**G 2.4.4 Ability to recognize abnormal indications for systems operating parameters that are entry level conditions for emergency and abnormal operating procedures.** (CFR: 45.2 / 45.6) RO 3.9/SRO 4.0	3.9	4
000027 Pressurizer Pressure Control System Malfunction / 3	X						**Knowledge of the operational implications of the following concepts as they apply to Pressurizer Pressure Control Malfunctions:** **(CFR 41.8 / 41.10 / 45.3)** AK1.02 Expansion of liquids as temperature increases RO2.8/SRO 3.1	2.8	5

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	#
000029 ATWS / 1		X					**Knowledge of the interrelations between the and the following an ATWS:** (CFR 41.7 / 45.7) EK2.06 Breakers, relays, and disconnects RO 2.9*/SRO 3.1*	2.9	6
000038 Steam Gen. Tube Rupture / 3			X				**Knowledge of the reasons for the following responses as the apply to the SGTR**: (CFR 41.5 / 41.10 / 45.6 / 45.13) EK3.02 Prevention of secondary PORV cycling RO 4.4/SRO 4.5	4.4	7
000040 (~~BW/E05; CE/E05~~; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4				X			**Ability to operate and / or monitor the following as they apply to the Steam Line Rupture:** **(CFR 41.7 / 45.5 / 45.6)** AA1.15 T-ave. protection indicators RO 3.9*/SRO 3.8*	3.9	8
000054 (~~CE/E06~~) Loss of Main Feedwater / 4					X		**Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW):** **(CFR: 43.5 / 45.13)** AA2.03 Conditions and reasons for AFW pump startup RO 4.1/SRO 4.2	4.1	9
000055 Station Blackout / 6						X	**2.4.1 Knowledge of EOP entry conditions and immediate action steps** (CFR: 41.10 / 43.5 / 45.13) RO 4.6 / SRO 4.8	4.6	10
000056 Loss of Off-site Power / 6				X			**Ability to operate and / or monitor the following as they apply to the Loss of Offsite Power:** **(CFR 41.7 / 45.5 / 45.6)** AA1.06 Safety injection pump RO 3.6*/SRO 3.6*	3.6	11
000057 Loss of Vital AC Inst. Bus / 6			X				**Knowledge of the reasons for the following responses as they apply to the Loss of Vital AC Instrument Bus:** **(CFR 41.5,41.10 / 45.6 / 45.13)** AK3.01 Actions contained in EOP for loss of vital ac electrical instrument bus RO 4.1/SRO 4.4	4.1	12

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	#
000058 Loss of DC Power / 6			X				**Knowledge of the reasons for the following responses as they apply to the Loss of DC Power:** **(CFR 41.5,41.10 / 45.6 / 45.1)** AK3.02 Actions contained in EOP for loss of dc power RO 4.0/SRO 4.2	4.0	13
000062 Loss of Nuclear Svc Water / 4					X		**Ability to determine and interpet the following as they apply to the Loss of Nuclear Service Water (SWS):** **CFR 43.5 / 45.13)** AA2.01 Location of leak in the SWS RO 2.9/SRO3.6	2.9	14
000065 Loss of Instrument Air / 8									
W/E04 LOCA Outside Containment / 3						X	2.1.28 **Knowledge of the purpose and function of major system components and controls.** (CFR: 41.7) RO 3.2/SRO 3.3	3.2	15
W/E11 Loss of Emergency Coolant Recirc. / 4	X						**Knowledge of the operational implications of the following concepts as they apply to the (Loss of Emergency Coolant Recirculation)** (CFR: 41.8 / 41.10 / 45.3) EK1.1 Components, capacity, and function of emergency systems. RO 3.7/SRO 4.0	3.7	16
~~BW/E04~~; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4		X					**Knowledge of the interrelations between the (Loss of Secondary Heat Sink) and the following:** (CFR: 41.7 / 45.7) EK2.2 Facility*s heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. RO 3.9/SRO 4.2	3.9	17
000077 Generator Voltage and Electric Grid Disturbances / 6		X					**Knowledge of the interrelations between Generator Voltage and Electric Grid Disturbances and the following:** (CFR: 41.4, 41.5, 41.7, 41.10/ 45.8) AK 2.0 1 Motors **RO 3.1/SRO** 3.2	3.1	18
K/A Category Totals:	3	3	3	3	3	3	Group Point Total:		18/6

ES-401 PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (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	#
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				**Knowledge of the reasons for the following responses as they apply to the Loss of Intermediate Range Nuclear Instrumentation:** **(CFR 41.5,41.10 / 45.6 / 45.13)** AK3.02 Guidance contained in EOP for loss of intermediate range instrumentation. RO 3.6/SRO 3.9	3.6	19
000036 (BW/A08) Fuel Handling Accident / 8			X				**Ability to operate and / or monitor the following as they apply to the Fuel Handling Incidents:** **(CFR 41.7 / 45.5 / 45.6)** AA1.03 Reactor building containment evacuation alarm enable switch. RO 3.5/SRO 3.9	3.5	20
000037 Steam Generator Tube Leak / 3				X			**Ability to operate and / or monitor the following as they apply to the Steam Generator Tube Leak:** **(CFR 41.7 / 45.5 / 45.6)** AA1.06 Main steam line rad monitor meters RO 3.8*/SRO 3.9*	3.8	21
000051 Loss of Condenser Vacuum / 4					X		**Ability to determine and interpret the following as they apply to the Loss of Condenser Vacuum:** **(CFR: 43.5 / 45.13)** AA2.02 Conditions requiring reactor and/or turbine trip. RO 3.9/SRO 4.1	3.9	22
000059 Accidental Liquid RadWaste Rel. / 9						X	2.1.32 **Ability to explain and apply all system limits and precautions.** (CFR: 41.10 / 43.2 / 45.12) RO 3.4/ SRO 3.8	3.4	23

ES-401 PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (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	#
000060 Accidental Gaseous Radwaste Rel. / 9	X						**Knowledge of the operational implications of the following concepts as they apply to Accidental Gaseous Radwaste Release:** **(CFR 41.8 / 41.10 / 45.3)** AK1.02 Biological effects on humans of the various types of radiation, exposure levels that are acceptable for personnel in a nuclear reactor power plant; the units used for radiation intensity measurements and for radiation exposure levels. RO 2.5/SRO 3.1*	2.5	24
000061 ARM System Alarms / 7		X					**Knowledge of the interrelations between the Area Radiation Monitoring (ARM) System Alarms and the following:** **(CFR 41.7 / 45.7)** AK2.01 Detectors at each ARM system location. RO 2.5*/SRO 2.6*	2.5	25
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	X						**Knowledge of the operational implications of the following concepts as they apply to the (SI Termination)** (CFR: 41.8 / 41.10, 45.3) EK1.2 Normal, abnormal and emergency operating procedures associated with (SI Termination). RO 3.4/SRO 3.9	3.4	26
W/E13 Steam Generator Over-pressure / 4		X					**Knowledge of the interrelations between the (Steam Generator Overpressure) and the following:** (CFR: 41.7 / 45.7) EK2.2 Facility*s heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. RO 3.0/SRO 3.2	3.0	27
W/E15 Containment Flooding / 5									

ES-401	PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (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	#
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~~									
~~CE/A16 Excess RCS Leakage / 2~~									
~~CE/E09 Functional Recovery~~									
K/A Category Point Totals:	2	2	2	1	1	1	Group Point Total:		9/4

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
003 Reactor Coolant Pump							X					**Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RCPS controls including:** (CFR: 41.5 / 45.7) A1.03 RCP motor stator winding temperatures RO 2.6 /SRO 2.6	2.6	28
004 Chemical and Volume Control						X						**Knowledge of the effect of a loss or malfunction on the following CVCS components:** (CFR: 41.7 / 45.7) K6.17 Flow paths for emergency boration RO 4.4/SRO 4.6	4.4	29
005 Residual Heat Removal								X				**Ability to (a) predict the impacts of the following malfunctions or operations on the RHRS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:** (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.01 Failure modes for pressure, flow, pump motor amps, motor temperature, and tank level instrumentation RO 2.7/SRO 2.9*	2.7	30
006 Emergency Core Cooling					X							**Knowledge of the operational implications of the following concepts as they apply to ECCS:** (CFR: 41.5 / 45.7) K5.11 Basic heat transfer equation RO 2.5/SRO 2.4*	2.5	31
007 Pressurizer Relief/Quench Tank									X			**Ability to monitor automatic operation of the PRTS, including:** (CFR: 41.7 / 45.5) A3.01 Components which discharge to the PRT. RO 2.7*/SRO 2.9	2.7	32

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
008 Component Cooling Water										X		**Ability to manually operate and/or monitor in the control room:** (CFR: 41.7 / 45.5) A4.05 Normal CCW-header total flow rate and the flow rates to the components cooled by the CCWS. RO 2.7*/ 2.5	2.7	33
010 Pressurizer Pressure Control		X										**Knowledge of bus power supplies to the following:** (CFR: 41.7) K2.01 Pressurizer Heaters RO 3.0/SRO 3.4	3.0	34
012 Reactor Protection				X								**Knowledge of RPS design feature(s) and/or interlock(s) which provide for the following:** (CFR: 41.7) K4.06 Automatic or manual enable/disable of RPS trips RO 3.2/ SRO 3.5	3.2	35
013 Engineered Safety Features Actuation									X			**Ability to monitor automatic operation of the ESFAS including:** (CFR: 41.7/45.5) A3.01 Input channels and logic RO 3.7*/SRO 3.9	3.7	36
022 Containment Cooling			X									**Knowledge of the effect that a loss or malfunction of the CCS will have on the following:** (CFR: 41.7 / 45.6) K3.02 Containment instrumentation readings. RO 3.0/SRO 3.3	3.0	37
~~025 Ice Condenser~~														

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
026 Containment Spray				X								**Knowledge of CSS design feature(s) and/or interlock(s) which provide for the following:** (CFR: 41.7) K4.08 Automatic swapover to containment sump suction for recirculation phase after LOCA (RWST low-low level alarm) RO 4.1*/SRO 4.3*	4.1	38
039 Main and Reheat Steam					X							**Knowledge of the operational implications of the following concepts as the apply to the MRSS:** (CFR: 41.5 / 45.7) K5.05 Bases for RCS cooldown limits RO 2.7/SRO 3.1*	2.7	39
059 Main Feedwater							X					**Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the MFW controls including:** (CFR: 41.5 / 45.5) A1.03 Power level restrictions for operation of MFW pumps and valves RO 2.7*/SRO 2.9*	2.7	40
061 Auxiliary/Emergency Feedwater								X				**Ability to (a) predict the impacts of the following malfunctions or operations on the AFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:** (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.07 Air or MOV failure. RO 3.4/SRO 3.5	3.4	41
062 AC Electrical Distribution											X	**2.4.3 Ability to identify post-accident instrumentation.** (CFR: 41.6 / 45.4) RO 3.7/SRO 3.9	3.7	42
063 DC Electrical Distribution											X	**2.2.39 Knowledge of less than or equal to one hour Technical Specification action statements for systems.** RO 3.9/SRO 4.5	3.9	43

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
064 Emergency Diesel Generator						X						**Knowledge of the effect of a loss or malfunction of the following will have on the ED/G system:** (CFR: 41.7 / 45.7) K6.08 Fuel oil storage tanks RO 3.2/ SRO 3.3	3.2	44
073 Process Radiation Monitoring	X											**Knowledge of the physical connections and/or cause effect relationships between the PRM system and the following systems:** (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.01 Those systems served by PRMs RO 3.6/SRO 3.9	3.6	45
076 Service Water							X					**Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SWS controls including:** (CFR: 41.5 / 45.5) A1.02 Reactor and turbine building closed cooling water temperatures RO 2.6*/SRO 2.6*	2.6	46
078 Instrument Air			X									**K3 Knowledge of the effect that a loss or malfunction of the IAS will have on the following:** (CFR: 41.7 / 45.6) K3.02 Systems having pneumatic valves and controls. RO 3.4/SRO 3.6	3.4	47
103 Containment				X								**Knowledge of containment system design feature(s) and/or interlock(s) which provide for the following:** (CFR: 41.7) K4.06 Containment isolation system. RO 3.1/SRO 3.7	3.1	48

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
008 Component Cooling Water											X	**2.2.42 Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications.** (CFR: 43.2 / 43.3 / 45.3) RO 3.4/ SRO 4.0	3.4	49
026 Containment Spray			X									**Knowledge of the effect that a loss or malfunction of the CSS will have on the following:** (CFR: 41.7 / 45.6) K3.02 Recirculation spray system RO 4.2/SRO 4.3	4.2	50
063 DC Electrical Distribution	X											**Knowledge of the physical connections and/or cause/effect relationships between the DC electrical system and the following systems:** (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.03 Battery charger and battery RO 2.9/SRO 3.5	2.9	51
064 Emergency Diesel Generator								X				**Ability to (a) predict the impacts of the following malfunctions or operations on the ED/G system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:** (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.08 Consequences of opening/closing breaker between buses (VARS, out-of-phase, voltage). RO 2.7/SRO 3.1	2.7	52
076 Service Water										X		**Ability to manually operate and/or monitor in the control room:** (CFR: 41.7 / 45.5 to 45.8) A4.01 SWS pumps RO 2.9/ SRO 2.9	2.9	53

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
078 Instrument Air									X			**Ability to monitor automatic operation of the IAS, including:** (CFR: 41.7 / 45.5) A3.01 Air Pressure. RO 3.1/SRO 3.2	3.1	54
005 Residual Heat Removal		X										**Knowledge of bus power supplies to the following:** (CFR: 41.7) K2.01 RHR pumps RO 3.0/ SRO 3.2	3.2	55
K/A Category Point Totals:	2	2	3	3	2	2	3	3	3	3	2	Group Point Total:		28/ 5

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)											Form ES-401-2	
System # / Name	K1	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		X										**Knowledge of bus power supplies to the following**: (CFR: 41.7) K2.01 Charging pumps RO 3.1/SRO 3.2	3.1	56
014 Rod Position Indication														
015 Nuclear Instrumentation				X								**Knowledge of NIS design feature(s) and/or interlock(s) provide for the following:** (CFR: 41.7) K4.07 Permissives RO 3.7/SRO 3.8	3.7	57
016 Non-nuclear Instrumentation														
017 In-core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge								X				**Ability to (a) predict the impacts of the following malfunctions or operations on the Containment Purge System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:** (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.01 Maintenance or other activity taking place inside containment. RO 2.9/SRO 3.6	2.9	58
033 Spent Fuel Pool Cooling									X			**Ability to monitor automatic operation of the Spent Fuel Pool Cooling System including:** (CFR: 41.7 / 45.5) A3.02 Spent fuel leak or rupture RO 2.9/SRO 3.1	2.9	59
034 Fuel Handling Equipment														

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)												Form ES-401-2	
System # / Name	K1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
035 Steam Generator						X						Knowledge of the effect of a loss or malfunction on the following will have on the S/GS: (CFR: 41.7 / 45.7) K6.03 S/G level detector RO 2.6/SRO 3.0	2.6	60
041 Steam Dump/Turbine Bypass Control							X					**Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SDS controls including:** (CFR: 41.5 / 45.5) A1.02 Steam pressure RO 3.1/SRO 3.2	3.1	61
045 Main Turbine Generator			X									**Knowledge of the effect that a loss or malfunction of the MT/G system will have on the following:** (CFR: 41.7 / 45.6) K3.01 Remainder of the plant RO 2.9/SRO 3.2	2.9	62
055 Condenser Air Removal														
056 Condensate	X											**Knowledge of the physical connections and/or cause-effect relationships between the Condensate System and the following systems:** (CFR: 41.2 to 41.9 / 45.7 to 45.8) K1.03 MFW RO 2.6*/SRO 2.6	2.6	63
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring														

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)											Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	IR	#
075 Circulating Water								X				**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:** (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.02 Loss of circulating water pumps RO 2.5 / SRO 2.7	2.5	64
079 Station Air														
086 Fire Protection										X		**Ability to monitor automatic operation of the Fire Protection System including:** (CFR: 41.7 / 45.5) A3.01 Starting mechanisms of fire water pumps RO 2.9/SRO 3.3	2.9	65
K/A Category Point Totals:	1	1	1	1	0	1	1	2	1	1	0	Group Point Total:		10/3

Facility: STP		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.	2.1.18 **Ability to make accurate, clear, and concise logs, records, status boards, and reports.** (CFR: 41.10 / 45.12 / 45.13) RO 3.6 SRO 3.8	3.6	66		
	2.1.	2.1.21 **Ability to obtain and verify controlled procedure copy.** (CFR: 45.10 / 45.13) RO 3.1 SRO 3.2	3.1	67		
	2.1.	2.1.3 **Knowledge of shift turnover practices.** (CFR: 41.10 / 45.13) RO 3.0 SRO 3.4	3.0	68		
	Subtotal					
2. Equipment Control	2.2.	2.2.13 **Knowledge of tagging and clearance procedures.** (CFR: 41.10 / 45.13) RO 3.6 SRO 3.8	3.6	69		
	2.2.	2.2.22 **Knowledge of limiting conditions for operations and safety limits.** (CFR: 43.2 / 45.2) RO 3.4 SRO 4.1	3.4	70		
	Subtotal					
3. Radiation Control	2.3.	**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) IMPORTANCE RO 3.2 SRO 3.7	3.2	71		
	2.3.	2.3.4 **Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized.** (CFR: 43.4 / 45.10) RO 2.5 SRO 3.1	2.5	72		
	Subtotal					
4. Emergency Procedures / Plan	2.4.	2.1.18 **Ability to make accurate, clear, and concise logs, records, status boards, and reports.** (CFR: 41.10 / 45.12 / 45.13) RO 3.6 SRO 3.8	3.6	73		
	2.4.	2.4.16 **Knowledge of EOP implementation hierarchy and coordination with other support procedures.** (CFR: 41.10 / 43.5 / 45.13) RO 3.5 SRO 4.4	3.5	74		

Facility: STP		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
	2.4.	**2.4.17 Knowledge of EOP terms and definitions.** (CFR: 41.10 / 45.13) IMPORTANCE RO 3.9 SRO 4.3	3.9	75		
	Subtotal					
Tier 3 Point Total				10		7

Facility: STP Date of Exam: 9/24/2015

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				N/A					N/A				3	3	6
	2													2	2	4
	Tier Totals													5	5	10
2. Plant Systems	1													2	3	5
	2													1 1	1	3
	Tier Totals													5	3	8
3. Generic Knowledge and Abilities Categories		1			2			3			4			1 2	3 4	7
														2 2	1 2	

Note: 1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only 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).

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 and justified; 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 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.

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 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1									
000009 Small Break LOCA / 3					X		EA2 Ability to determine or interpret the following as they apply to a small break LOCA: (CFR 43.5 / 45.13) EA2.34 Conditions for throttling or stopping HPI	4.2	76
000011 Large Break LOCA / 3					X		EA2 Ability to determine or interpret the following as they apply to a Large Break LOCA: (CFR 43.5 / 45.13) EA2.01 Actions to be taken, based on RCS temperature and pressure - saturated and superheated	4.7	77
000015/17 RCP Malfunctions / 4									
000022 Loss of Rx Coolant Makeup / 2									
000025 Loss of RHR System / 4									
000026 Loss of Component Cooling Water / 8									
000027 Pressurizer Pressure Control System Malfunction / 3									
000029 ATWS / 1							EPE: 029 Anticipated Transient Without Scram (ATWS) (CFR: 41.10 / 43.5 / 45.12) 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc.	4.2	78
000038 Steam Gen. Tube Rupture / 3						X	APE: 038 Steam Generator Tube Rupture (CFR 55.43.2, 55.41.5, 55.41.7) G2.2.25 Knowledge of the basis in the Technical Specifications for limiting conditions and safety limits	4.2	79
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4									
000054 (CE/E06) 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							APE: 062 Loss of Nuclear Service Water (CFR: 41.10 / 43.1 / 45.13) 2.4.18 Knowledge of the specific bases for EOPs.	4.0	80

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	#
000065 Loss of Instrument Air / 8					X		AA2. Ability to determine and interpret the following as they apply to the Loss of Instrument Air: (CFR: 43.5 / 45.13) AA2.05 When to commence plant shutdown if instrument air pressure is decreasing	4.1	81
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									
K/A Category Totals:					3	3	Group Point Total:		18/6

ES-401 PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (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	#
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						X	APE: 032 Loss of Source Range Nuclear Instrumentation (CFR: 41.10 / 43.5 / 45.12) 2.1.20 Ability to interpret and execute procedure steps.	4.6	83
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									
000059 Accidental Liquid RadWaste Rel. / 9									
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
000067 Plant Fire On-site / 8									
000069 (W/E14) Loss of CTMT Integrity / 5									
000074 (W/E06&E07) Inad. Core Cooling / 4						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) RO 4.0/SRO 4.6	4.6	82
000076 High Reactor Coolant Activity / 9					X		AA2. Ability to determine and interpret the following as they apply to the High Reactor Coolant Activity: (CFR: 43.5 / 45.13) AA2.02 Corrective actions required for high fission product activity in RCS.	3.4	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					X		EA2. Ability to determine and interpret the following as they apply to the (High Containment Radiation) (CFR: 43.5 / 45.13) EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations. RO 2.9/SRO 3.3	3.3	84
~~BW/A01 Plant Runback / 1~~									

ES-401	PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (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	#
~~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:		9/4

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
003 Reactor Coolant Pump														
004 Chemical and Volume Control														
005 Residual Heat Removal														
006 Emergency Core Cooling														
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water														
010 Pressurizer Pressure Control											X	010 Pressurizer Pressure Control 2.2.12 Knowledge of surveillance procedures. (CFR: 41.10 / 45.13) RO 3.7/SRO 4.1	4.1	86
012 Reactor Protection														
013 Engineered Safety Features Actuation											X	APE: 013 Engineered Safety Features Actuation System (ESFAS) 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) RO 4.4 SRO 4.7	4.7	87
022 Containment Cooling														
025 Ice Condenser														
026 Containment Spray														
039 Main and Reheat Steam											X	039 Main and Reheat Steam 2.2.38 Knowledge of conditions and limitations in the facility license. (CFR: 41.7 / 41.10 / 43.1 / 45.13) RO 3.6 / SRO 4.5	4.5	88
059 Main Feedwater														
061 Auxiliary/Emergency Feedwater								X				061 Auxiliary/Emergency Feedwater A2 Ability to (a) predict the impacts of the following malfunctions or operations on the AFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.13) A2.04 pump failure or improper operation.	3.8	89
062 AC Electrical Distribution														

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 1 (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	#
063 DC Electrical Distribution														
064 Emergency Diesel Generator														
073 Process Radiation Monitoring														
076 Service Water								X				A2 Ability to (a) predict the impacts of the following malfunctions or operations on the SWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45/3 / 45/13) A2.01 Loss of SWS	3.7	90
078 Instrument Air														
103 Containment														
K/A Category Point Totals:								3			2	Group Point Total:		28/5

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								X				014 Rod position Indication A2 Ability to (a) predict the impacts of the following malfunctions or operations on the RPIS; and (b) based on those on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: A2.04 Misaligned rod	3.9	91
015 Nuclear Instrumentation														
016 Non-nuclear Instrumentation											X	016 Non-nuclear Instrumentation (CFR: 41.7 / 43.5 / 45.12) 2.2.37 Ability to determine operability and/or availability of safety related equipment.	4.6	92
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							X					034 Fuel Handling Equipment A1 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the Fuel Handling System controls including: (CFR: 41.5 / 45.5) A1.01 Load limits	3.2	93
035 Steam Generator														
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator														
055 Condenser Air Removal														
056 Condensate														
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring														
075 Circulating Water														

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	#
079 Station Air														
086 Fire Protection														
K/A Category Point Totals:							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.	2.1.36 Knowledge of procedures and limitations involved in core alterations. (CFR: 41.10 / 43.6 / 45.7)			4.1	94
	2.1.	2.1.1 Knowledge of conduct of operations requirements. (CFR: 41.10 / 45.13)			4.2	95
	2.1.					
	2.1.					
	Subtotal					
2. Equipment Control	2.2.	2.2.18 Knowledge of the process for managing maintenance activities during shutdown operations, such as risk assessments, work prioritization, etc. (CFR: 41.10 / 43.5 / 45.13))			3.9	96
	2.2.	2.2.6 Knowledge of the process for making changes to procedures. (CFR: 41.10 / 43.3 / 45.13)			3.6	97
	2.2.					
	2.2.					
	Subtotal					
3. Radiation Control	2.3.	2.3.13 Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc. (CFR: 41.12 / 43.4 / 45.9 / 45.10)			3.8	98
	2.3.					
	2.3.					
	Subtotal					
4. Emergency Procedures / Plan	2.4.	2.4.30 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	99
	2.4.	2.4.40 Knowledge of SRO responsibilities in emergency plan implementation. (CFR: 41.10 / 43.5 / 45.11)			4.5	100
	2.4.					
	2.4.					
	Subtotal					
Tier 3 Point Total				10		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
1 / 1	EK1.02	This was supposed to be a generic K/A, EK 1.02 mistakenly selected. Replace with Generic K/A 2.4.1
2 / 1	2.1.33	This K/A is not one of the topics for Tiers 1 and 2 Generic K/As. Replace with K/A 2.1.25
3 / 1	2.1.11	This K/A was moved with the release of Revision 2, Supplement 1 of NUREG 1021. Replace with K/A 2.1.18
3 / 3	2.3.1	This K/A was moved with the release of Revision 2, Supplement 1 of NUREG 1021. Replace with K/A 2.3.12
3 / 4	2.4.15	This K/A was moved with the release of Revision 2, Supplement 1 of NUREG 1021. Replace with K/A 2.4.17
1/1	000022 Loss of Rx Coolant Makeup / 2 Ability to operate and / or monitor the following as they apply to the Loss of Reactor Coolant Pump Makeup: AA1.07 Excess letdown containment isolation valve switches and indicators	Rejected K/A as could not come up with a quality question. Replaced with 000015/17 RCP Malfunctions / 4, AA1.22 RCP Seal failure/malfunction

1 / 1	000057 Loss of Vital AC Inst. Bus / 6 AK2 Knowledge of the interrelations between the Loss of Vital AC Instrument Bus and the following: (CFR 41.7 / 45.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with AK3 of same system.
1 / 1	000077 Generator Voltage and Electric Grid Disturbances / 6 AK3 Knowledge of the operational implications of the following concepts as they apply to Generator Voltage and Electric Grid Disturbances: (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8)	Replaced with AK2 of same Emergency/Abnormal system to even out the distribution of knowledge attributes
1 / 1	000033 Loss of Intermediate Range NI / 7 K2Knowledge of the interrelations between the Loss of Intermediate Range Nuclear Instrumentation and the following: (CFR 41.7 / 45.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with AK3 of same system.

1/1	000065 Loss of Instrument Air / 8 Ability to determine and interpret the following as they apply to the Loss of Instrument Air: (CFR: 43.5 / 45.13) AA2.08 Failure modes of air-operated equipment RO2.9*/SRO 3.3	Resampled to due to excessive number of Instrument air questions on the exam. Replaced with 062 Loss of Nuclear Service Water A2.02
2 / 1	026 Containment Spray K5 Knowledge of operational implications of the following concepts as they apply to the CSS: (CFR: 41.5 / 45.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with a K4 of the same system
2 / 1	039 Main and Reheat Steam Knowledge of the effect of a loss or malfunction on the following will have on the MRSS: (CFR: 41.7 / 45.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with a K5 of the same system

2 / 1	008 Component Cooling Water Knowledge of the operational implications of the following concepts as they apply to the CCWS: (CFR: 41.5 / 45.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with a K1 of the same system
2 / 1	026 Containment Spray Knowledge of the effect of a loss or malfunction of the following will have on the CSS: (CFR: 41.7 / 45.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with a K3 of the same system
2 / 2	045 Main Turbine Generator Knowledge of bus power supplies to the following: (CFR: 41.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with a K3 of the same system
2 / 2	056 Condensate Knowledge of Condensate System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with a K1 of the same system
2 / 2	079 Station Air Knowledge of bus power supplies to the following: (CFR: 41.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with system 015 Nuclear Instrumentation K2

2/2	029 Containment Purge Knowledge of the operational implication of the following concepts as they apply to the Containment Purge System: (CFR: 41.5 / 45.7)	There are no Knowledge factors listed in NUREG 1122 Rev 2 with an importance factor of greater than 2.5. Replaced with a A2 of the same system
3	2.4.22 Knowledge of the basis for prioritizing safety functions during abnormal/emergency operations. (CFR 41.7/43.5/41.10/45.12)	Difficulty writing a valid RO level question

Tier / Group	Randomly Selected K/A	Reason for Rejection
3 / 4	2.4.41	A question using this K/A could not be written without duplicating an Admin JPM. Replaced with 2.4.44

Facility: South Texas Project
Examination Level: RO X SRO

Date of Examination: _____
Operating Test Number: _____

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations RA(6) K/A Importance: 3.9	N,R	2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. Perform an RWST blended makeup calculation
Conduct of Operations RA(7) K/A Importance: 4.6	D,R	2.1.20 Ability to interpret and execute procedure steps. Verify an excore QPTR calculation.
Equipment Control RA(8) K/A Importance: 3.5	N,R	2.2.41 Ability to obtain and interpret station electrical and mechanical drawings. Using mechanical drawings determine the isolation boundaries for a leak on the RHR system.
Radiation Control RA(9) K/A Importance: 3.2	M,R	2.3.4 Knowledge of radiation exposure limits under normal or emergency conditions. Calculate stay time based on dose rates.
Emergency Procedures/Plan		N/A

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

RO A(6): The applicant will be required to calculate a blended makeup to the RWST. The critical tasks include calculating total makeup volume and boric acid flowrate. The JPM should require the applicant to determine the total volume required to raise RWST level from 96% to 100%, the required boric acid flowrate, the required reactor makeup water flowrate, and the total volume of boric acid required.

RO A(7): The applicant will verify an excore QPTR calculation. This JPM is a bank JPM, and the values should be modified from those in the bank.

RO A(8): The initial condition for this JPM is that RHR is in its normal standby lineup. The operator will be told that RHR Pump Discharge Valve is leaking. The operator will be directed to determine the valves that must be closed to stop the leak using station P&IDs. The operator will also be told to stop the leak while maintaining the "A" loop of RHR Containment Cooling and Sprays operational.

RO A(9): The applicant will calculate the allowed stay time to complete a described tagout without exceeding his yearly station administrative radiation dose limits. (This will likely be a modified bank question).

Facility: South Texas Project Date of Examination: _____

Examination Level: RO ☐ SRO X Operating Test Number: _____

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations SA(1) K/A Importance: 4.6	R, M	2.1.37 Knowledge of procedures, guidelines, or limitations associated with reactivity management. JPM: Calculate SDM with a misaligned control rod and determine applicable Technical Specification
Conduct of Operations SA(2) K/A Importance: 4.4	R, N	2.1.23, Ability to perform specific system and integrated plant procedures during all modes of plant operation. JPM: Perform a Calorimetric Heat Balance and Evaluate Technical Specifications
Equipment Control SA(3) K/A Importance: 3.5	R,N	2.2.41, Ability to obtain and interpret station electrical and mechanical drawings. JPM: Using mechanical drawings determine the isolation boundaries for a leak on the RHR system.
Radiation Control SA(4) K/A Importance: 3.8	R, N	2.3.6 Ability to approve release permits. JPM: approve a completed liquid waste release permit (alternate path actual release did not match the approved release limits)
Emergency Procedures/Plan SA(5) K/A Importance: 4.6	R,N	2.4.41, Knowledge of the emergency action level thresholds and classifications. JPM: Determine appropriate Emergency Plan EAL.

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

SRO A(1): Calculate SDM with a misaligned control rod and determine applicable Technical Specification. The calculated SDM will not meet the TS required SDM.

SRO A(2): Perform a manual heat balance calculation

SRO A(3): The initial condition for this JPM is that RHR is in its normal standby lineup. The operator will be told that RHR Pump Discharge Valve is leaking. The operator will be directed to determine the valves that must be closed to stop the leak using station P&IDs. The operator will also be told to stop the leak while maintaining the "A" loop of RHR Containment Cooling and Sprays operational.

SRO A(4): Approve a liquid waste release,the completed release paperwork shows that the actual release was in violation of the approved release rate/quantity

SRO A(5): Determine the EAL call for a security event involving an explosion on site within the protected area resulting in a loss of offsite power.

Facility: STP Date of Examination: _____
Exam Level: RO X SRO-I SRO-U Operating Test No.: _____

Control Room Systems:* 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U

System / JPM Title	Type Code*	Safety Function
S1. Swap Running Isophase Bus Cooling Fans	N,A,S	VI
S2. Cross Connect AFW and Feed 2 SG's from same AFW pump	N,E,S	IV
S3. Commence Emergency Boration	N,E,S	II
S4. Re-establishing Letdown	D,A,E,S	I
S5. Perform CCW valve operability testing	N,S	VIII
S6. Transfer to Hot Leg Recirculation	D,E,L,S	III
S7. Manual Containment Isolation Phase A Actuation	N,A,E,S, EN	V
S8. Respond to a Radiation Monitor alarm	D,A,E,S	VII
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
P1. Locally close MSIV's/MSIB's	D,L,E	IV
P2. Commence a liquid waste release, then a CCW pump trips require the release to be secured per the contingency step 5.53 of 0POP02-WL-0100	N,A,R	IX
P3. Place RWST on Recirculation	D, E, EN	II

@ 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
(A)lternate path	4-6 (5)
(C)ontrol room	
(D)irect from bank	≤ 9 (5)
(E)mergency or abnormal in-plant	≥ 1 (2)
(EN)gineered safety feature	- (2)
(L)ow-Power / Shutdown	≥ 1 (2)
(N)ew or (M)odified from bank including 1(A)	≥ 2 (6)
(P)revious 2 exams	≤ 3 (0)
(R)CA	≥ 1 (1)
(S)imulator	

S1 (NEW)

Swap Running Isophase Bus Cooling Fans

The applicant is directed to place Isophase bus cooling fan 11 in service and Isophase bus fan 12 in standby.

Applicant obtains a copy of 0POP02-NN-0001, Isolated-Phase Bus and Duct Cooling and identifies that Section 8 is the required selection to be performed.

8.2 Switching from Fan 12(22) to Fan 11(21)
8.2.1 START "ISOPHASE BUS COOLING FAN 11(21)".
8.2.2 WHEN "ISOPHASE BUS COOLING FAN 11(21)" has reached rated speed, THEN STOP "ISOPHASE BUS COOLING FAN 12(22)".
8.2.3 IF "ISOPHASE BUS COOLING FAN 12(22)" is to be placed in standby, THEN PLACE "ISOPHASE BUS COOLING FAN 12(22)" control switch in AUTO.

When applicant completes step 8.2.2 both isophase bus cooling fans trip and will not restart

Applicant will attempt to start either or both of the tripped fans (will not start)

Applicant will then inform the SRO

SRO acknowledges and asks if there is any procedural guidance on what to do

Applicant may reference alarm response guide or commence a turbine load reduction at 5% per min until < 18500 amps are read on gauge on CP007 as directed in Section 6 of the same procedure
Critical task is to lower turbine load within limits specified in the procedure within 6 min of fans tripping off

S2 (NEW)

Reactor has tripped and AFW pump for the A SG did not start and attempts to start the pump have been unsuccessful. You are directed to cross tie the AFW system and feed the A Steam Generator

S3 (NEW)

Applicant responds to Window E-4 "BANK INSRT LO-LO"
Applicant obtains a copy of 0POP04-CV-0003, Emergency Boration
Applicant performs steps 1-3
Step 4 (no charging pumps are running performs the RNO actions (alternate path)

Step 5 when no BA pumps will start (alternate path)
Applicant directs field operator to make field alignments
Applicant closes one of the VCT valves listed
Applicant verifies 50 gpm charging flow
Applicant verifies that PZr level is at or trending to required level
After 2 min the Window E-4 "BANK INSRT LO-LO" goes out
Applicant reports that boration is no longer required
End of JPM

Critical Steps
Starting a Charging pump

S4 (BANK)

Pressurizer Level Channel 465 failed low. An inadvertent Reactor Trip/Safety Injection occurred before the actions of the 0POP04-RP-0002 were completed. We have transitioned from 0POP05-EO-EO00 to 0POP05-EO-ES11, and are currently at step 12.b. Charging is in service and Pressurizer Level is slowly rising. The bistables for LT-0465 have been tripped by I&C. The Unit Supervisor directs you to Re-Establish Letdown according to 0POP05-EO-ES11, SI TERMINATION, Addendum 2.

Applicant will place letdown in service in accordance with 0POP05-EO-ES11, SI TERMINATION, Addendum 2. Alternate path should be step 2, which requires aligning CCW to the letdown heat exchanger.

Critical tasks are aligning CCW to the letdown heat exchanger, step2, and the opening of the individual letdown isolation valves, steps 7 through 10.

S5 (NEW)

The Control Room Supervisor (CRS) directs you to perform the “Exercise and Isolation Time Test of MOV-0291, CCW Containment Isolation Valve,” and “Exercise and Isolation Time Test of MOV-0318, CCW Containment Isolation Valve,” 0PSP03-CC-0010, Sections 5.1, 5.2, and 5.3.

The applicant will perform exercise and isolation time test of MOV-0291 and MOV-0318. The stroke time of MOV-0291 will be 12.25 seconds, which is an unsatisfactory stroke time.

While performing the test for MOV-0318, the applicant receives a CCW Surge Tank Low Level Alarm. The applicant should IMMEDIATELY stop the test and open MOV-0318.

Critical tasks include closing the two valves while timing the stroke, acknowledging the CCW Surge Tank Low Level Alarm, and opening MOV-0318.

S6 (BANK)

The Control Room Supervisor (CRS) directs you to transfer to hot leg recirculation on SI Train A then Train B in accordance with 0POP05-EO-ES14, “Transfer to Hot Leg Recirculation.

The applicant will align hot leg recirc for the A HHSI pump, followed by the A LHSI pump, the B HHSI pump, and the B LHSI pump. The critical tasks will be the opening of the loop hot leg injection valves (steps 2.a.1 through 2.a.3; 2.b.2 through 2.b.4; 3.a.1 through 3.a.3; and 3.b.2 through 3.b.4).

S7 (NEW)

The Plant has experienced a reactor trip and safety injection from full power. The crew is performing 0POP05-EO-EO00. The CRS has assigned you to perform Addendum 5 of 0POP05-EO-EO00.

The main focus of this task is for the applicant to recognize that Phase A Containment Isolation has not actuated, and after manual actuation, recognize that two valves did not close and manually close them. The two valves should be outboard containment isolation valve MOV-0025, and discharge outboard containment isolation valve FV-7800. These tasks make up the critical tasks for this JPM.

S8 (BANK)

The Plant is at approximately 70% power. RCB Supplementary Purge is in progress in preparation for making a containment entry. You have just received a radiation alarm on the RM-11. The CRS directs you to investigate the alarm and take any action necessary.

The applicant should recognize that RT-8013 is above the high setpoint, and RT-8012 is above the alert setpoint. The applicant should use 0POP04-RA-001, Addendum 3. While performing Addendum 3, the applicant should determine that containment ventilation actuation did not occur and manually closes the supplementary containment purge and RCB Atmosphere Radiation Monitor valves (steps 2.d and 2.e of Addendum 3), which make up the JPM critical tasks.

P1 (BANK)

STP T82044, Respond to a Loss of All AC Power. Respond to a Loss of All AC Power in accordance with 0POP05-EO-EC00, Loss of All AC Power, The unit has just experienced a loss of all AC power, and procedure 0POP05-EO-EC00, LOSS OF ALL AC, is being performed. The crew is currently at step 10 a. RNO, and determines the Main Steam Isolation Valve (MSIV) for 1(2) ‘A’ Steam Generator did not shut and cannot

be shut manually from the Control Room. The applicant is directed to locally close Steam Generator 1(2) 'A' MSIV by performing Addendum 3, "Failing Air to MSIVs and MSIBs".

P2

Commence a liquid waste release at step 5.40 of 0POP02-WL-0100, OC flow is aligned through the MAB Chiller, all equipment is working properly after discharge is established have the control room notify the operator that 1 CCW pump has tripped, Alternate path the operator must take that actions of step 5.53 to secure the release

P3 (BANK)

Unit is at 100% power, steady state conditions. Maintenance has been recently completed on the Refueling Water Purification Pump (RWPP) and it is time to return it to service. The Unit Supervisor directs you to place the RWST on purification recirculation using the RWPP through SFP demineralizer 1A (2A) in accordance with 0POP02-FC-0001, Spent Fuel Pool Cooling and Cleanup System. Prerequisites of this procedure have been verified. SFP Purification is aligned through SFP Demin 1B(2B). The Radwaste Operator is standing by in the FHB to assist.

Critical tasks will be the opening of "SFP purification loop return to RWST isolation valve", FC-0046B (Step 7.4.4), and throttling refueling water purification pump discharge throttle valve, FC-0042 (Step 7.4.6).

Facility: __STP_____ Date of Examination: _____
Exam Level: RO SRO-I X SRO-U Operating Test No.: _____

Control Room Systems:* 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U

System / JPM Title	Type Code*	Safety Function
S1. Swap Running Isophase Bus Cooling Fans	N,A,S	VI
S2. Cross Connect AFW and Feed 2 SG's from same AFW pump	N,E,S	IV
S3. Commence Emergency Boration	N,E,S	II
S4. Re-establishing Letdown	D,A,E,S	I
S6. Transfer to Hot Leg Recirculation	D,E,L,S	III
S7. Manual Containment Isolation Phase A Actuation	N,A,E,S	V
S8. Respond to a Radiation Monitor alarm	D,A,E,S	VII

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

P1. Locally close MSIV's/MSIB's	D,L,E	IV
P2. Commence a liquid waste release, then a CCW pump trips require the release to be secured per the contingency step 5.53 of 0POP02-WL-0100	N,A,R	IX
P3. Place RWST on Recirculation	D, E, EN	II

@ 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 SRO-I
(A)lternate path	4-6 (5)
(C)ontrol room	
(D)irect from bank	≤ 8 (5)
(E)mergency or abnormal in-plant	≥ 1 (2)
(EN)gineered safety feature	-
(L)ow-Power / Shutdown	≥ 1 (2)
(N)ew or (M)odified from bank including 1(A)	≥ 2 (5)
(P)revious 2 exams	≤ 3 (0)
(R)CA	≥ 1 (1)
(S)imulator	

S1 (NEW)

Swap Running Isophase Bus Cooling Fans

The applicant is directed to place Isophase bus cooling fan 11 in service and Isophase bus fan 12 in standby.

Applicant obtains a copy of 0POP02-NN-0001, Isolated-Phase Bus and Duct Cooling and identifies that Section 8 is the required selection to be performed.

8.2 Switching from Fan 12(22) to Fan 11(21)
8.2.1 START "ISOPHASE BUS COOLING FAN 11(21)".
8.2.2 WHEN "ISOPHASE BUS COOLING FAN 11(21)" has reached rated speed, THEN STOP "ISOPHASE BUS COOLING FAN 12(22)".
8.2.3 IF "ISOPHASE BUS COOLING FAN 12(22)" is to be placed in standby, THEN PLACE "ISOPHASE BUS COOLING FAN 12(22)" control switch in AUTO.

When applicant completes step 8.2.2 both isophase bus cooling fans trip and will not restart

Applicant will attempt to start either or both of the tripped fans (will not start)

Applicant will then inform the SRO

SRO acknowledges and asks if there is any procedural guidance on what to do

Applicant may reference alarm response guide or commence a turbine load reduction at 5% per min until < 18500 amps are read on gauge on CP007 as directed in Section 6 of the same procedure
Critical task is to lower turbine load within limits specified in the procedure within 6 min of fans tripping off

S2 (NEW)

Reactor has tripped and AFW pump for the A SG did not start and attempts to start the pump have been unsuccessful. You are directed to cross tie the AFW system and feed the A Steam Generator

S3 (NEW)

Applicant responds to Window E-4 "BANK INSRT LO-LO"
Applicant obtains a copy of 0POP04-CV-0003, Emergency Boration
Applicant performs steps 1-3
Step 4 (no charging pumps are running performs the RNO actions (alternate path)

Step 5 when no BA pumps will start (alternate path)
Applicant directs field operator to make field alignments
Applicant closes one of the VCT valves listed
Applicant verifies 50 gpm charging flow
Applicant verifies that PZr level is at or trending to required level
After 2 min the Window E-4 "BANK INSRT LO-LO" goes out
Applicant reports that boration is no longer required
End of JPM

Critical Steps
Starting a Charging pump

S4 (BANK)

Pressurizer Level Channel 465 failed low. An inadvertent Reactor Trip/Safety Injection occurred before the actions of the 0POP04-RP-0002 were completed. We have transitioned from 0POP05-EO-EO00 to 0POP05-EO-ES11, and are currently at step 12.b. Charging is in service and Pressurizer Level is slowly rising. The bistables for LT-0465 have been tripped by I&C. The Unit Supervisor directs you to Re-Establish Letdown according to 0POP05-EO-ES11, SI TERMINATION, Addendum 2.

Applicant will place letdown in service in accordance with 0POP05-EO-ES11, SI TERMINATION, Addendum 2. Alternate path should be step 2, which requires aligning CCW to the letdown heat exchanger.

Critical tasks are aligning CCW to the letdown heat exchanger, step2, and the opening of the individual letdown isolation valves, steps 7 through 10.

S6 (BANK)

The Control Room Supervisor (CRS) directs you to transfer to hot leg recirculation on SI Train A then Train B in accordance with 0POP05-EO-ES14, “Transfer to Hot Leg Recirculation.

The applicant will align hot leg recirc for the A HHSI pump, followed by the A LHSI pump, the B HHSI pump, and the B LHSI pump. The critical tasks will be the opening of the loop hot leg injection valves (steps 2.a.1 through 2.a.3; 2.b.2 through 2.b.4; 3.a.1 through 3.a.3; and 3.b.2 through 3.b.4).

S7 (NEW)

The Plant has experienced a reactor trip and safety injection from full power. The crew is performing 0POP05-EO-EO00. The CRS has assigned you to perform Addendum 5 of 0POP05-EO-EO00.

The main focus of this task is for the applicant to recognize that Phase A Containment Isolation has not actuated, and after manual actuation, recognize that two valves did not close and manually close them. The two valves should be outboard containment isolation valve MOV-0025, and discharge outboard containment isolation valve FV-7800. These tasks make up the critical tasks for this JPM.

S8 (BANK)

The Plant is at approximately 70% power. RCB Supplementary Purge is in progress in preparation for making a containment entry. You have just received a radiation alarm on the RM-11. The CRS directs you to investigate the alarm and take any action necessary.

The applicant should recognize that RT-8013 is above the high setpoint, and RT-8012 is above the alert setpoint. The applicant should use 0POP04-RA-001, Addendum 3. While performing Addendum 3, the applicant should determine that containment ventilation actuation did not occur and manually closes the supplementary containment purge and RCB Atmosphere Radiation Monitor valves (steps 2.d and 2.e of Addendum 3), which make up the JPM critical tasks.

P1 (BANK)

STP T82044, Respond to a Loss of All AC Power. Respond to a Loss of All AC Power in accordance with 0POP05-EO-EC00, Loss of All AC Power, The unit has just experienced a loss of all AC power, and procedure 0POP05-EO-EC00, LOSS OF ALL AC, is being performed. The crew is currently at step 10 a. RNO, and determines the Main Steam Isolation Valve (MSIV) for 1(2) 'A' Steam Generator did not shut and cannot be shut manually from the Control Room. The applicant is directed to locally close Steam Generator 1(2) 'A' MSIV by performing Addendum 3, "Failing Air to MSIVs and MSIBs".

P2

Commence a liquid waste release at step 5.40 of 0POP02-WL-0100, OC flow is aligned through the MAB Chiller, all equipment is working properly after discharge is established have the control room notify the operator that 1 CCW pump has tripped, Alternate path the operator must take that actions of step 5.53 to secure the release

P3 (BANK)

Unit is at 100% power, steady state conditions. Maintenance has been recently completed on the Refueling Water Purification Pump (RWPP) and it is time to return it to service. The Unit Supervisor directs you to place the RWST on purification recirculation

using the RWPP through SFP demineralizer 1A (2A) in accordance with 0POP02-FC-0001, Spent Fuel Pool Cooling and Cleanup System. Prerequisites of this procedure have been verified. SFP Purification is aligned through SFP Demin 1B(2B). The Radwaste Operator is standing by in the FHB to assist.

Critical tasks will be the opening of "SFP purification loop return to RWST isolation valve", FC-0046B (Step 7.4.4), and throttling refueling water purification pump discharge throttle valve, FC-0042 (Step 7.4.6).

Facility: __STP_____ Date of Examination: _____
Exam Level: RO SRO-I SRO-U X Operating Test No.: _____

Control Room Systems:* 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U

System / JPM Title	Type Code*	Safety Function
S1. Swap Running Isophase Bus Cooling Fans	N,A,S	VI
S6. Transfer to Hot Leg Recirculation	D,E,L,S	III
S7. Manual Containment Isolation Phase A Actuation	N,A,E,S, EN	V

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

P2. Commence a liquid waste release, then a CCW pump trips require the release to be secured per the contingency step 5.53 of 0POP02-WL-0100	N,A,R	IX
P3. Place RWST on Recirculation	D, E, EN	II

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

S1 (NEW)

Swap Running Isophase Bus Cooling Fans

The applicant is directed to place Isophase bus cooling fan 11 in service and Isophase bus fan 12 in standby.

Applicant obtains a copy of 0POP02-NN-0001, Isolated-Phase Bus and Duct Cooling and identifies that Section 8 is the required selection to be performed.

8.2 Switching from Fan 12(22) to Fan 11(21)
8.2.1 START "ISOPHASE BUS COOLING FAN 11(21)".
8.2.2 WHEN "ISOPHASE BUS COOLING FAN 11(21)" has reached rated speed, THEN STOP "ISOPHASE BUS COOLING FAN 12(22)".
8.2.3 IF "ISOPHASE BUS COOLING FAN 12(22)" is to be placed in standby, THEN PLACE "ISOPHASE BUS COOLING FAN 12(22)" control switch in AUTO.

When applicant completes step 8.2.2 both isophase bus cooling fans trip and will not restart

Applicant will attempt to start either or both of the tripped fans (will not start)

Applicant will then inform the SRO

SRO acknowledges and asks if there is any procedural guidance on what to do

Applicant may reference alarm response guide or commence a turbine load reduction at 5% per min until < 18500 amps are read on gauge on CP007 as directed in Section 6 of the same procedure

Critical task is to lower turbine load within limits specified in the procedure within 6 min of fans tripping off

S6 (BANK)

The Control Room Supervisor (CRS) directs you to transfer to hot leg recirculation on SI Train A then Train B in accordance with 0POP05-EO-ES14, “Transfer to Hot Leg Recirculation.

The applicant will align hot leg recirc for the A HHSI pump, followed by the A LHSI pump, the B HHSI pump, and the B LHSI pump. The critical tasks will be the opening of the loop hot leg injection valves (steps 2.a.1 through 2.a.3; 2.b.2 through 2.b.4; 3.a.1 through 3.a.3; and 3.b.2 through 3.b.4).

S7 (NEW)

The Plant has experienced a reactor trip and safety injection from full power. The crew is performing 0POP05-EO-EO00. The CRS has assigned you to perform Addendum 5 of 0POP05-EO-EO00.

The main focus of this task is for the applicant to recognize that Phase A Containment Isolation has not actuated, and after manual actuation, recognize that two valves did not close and manually close them. The two valves should be outboard containment isolation valve MOV-0025, and discharge outboard containment isolation valve FV-7800. These tasks make up the critical tasks for this JPM.

P2

Commence a liquid waste release at step 5.40 of 0POP02-WL-0100, OC flow is aligned through the MAB Chiller, all equipment is working properly after discharge is established have the control room notify the operator that 1 CCW pump has tripped, Alternate path the operator must take that actions of step 5.53 to secure the release

P3 (BANK)

Unit is at 100% power, steady state conditions. Maintenance has been recently completed on the Refueling Water Purification Pump (RWPP) and it is time to return it to service. The Unit Supervisor directs you to place the RWST on purification recirculation using the RWPP through SFP demineralizer 1A (2A) in accordance with 0POP02-FC-0001, Spent Fuel Pool Cooling and Cleanup System. Prerequisites of this procedure have been verified. SFP Purification is aligned through SFP Demin 1B(2B). The Radwaste Operator is standing by in the FHB to assist.

Critical tasks will be the opening of "SFP purification loop return to RWST isolation valve", FC-0046B (Step 7.4.4), and throttling refueling water purification pump discharge throttle valve, FC-0042 (Step 7.4.6).

Facility: South Texas Project | Date of Exam: | Operating Test No.:

APPLICANT	EVENT TYPE	Crew A Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4						
		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-1 X	RX									X					1	1	0
	NOR									X					1	1	1
	I/C									X					4	4	2
	MAJ									X					2	2	1
	TS									X					0	2	2
RO ☐ SRO-I-1 X SRO-U ☐	RX		X					X							1	1	0
	NOR		X					X							1	1	1
	I/C		X					X							4	4	2
	MAJ		X					X							2	2	1
	TS		X					X							0	2	2
RO-1 X SRO-I ☐ SRO-U ☐	RX			X					X						1	1	0
	NOR			X					X						1	1	1
	I/C			X					X						4	4	2
	MAJ			X					X						2	2	1
	TS			X					X						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 instrument or component 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 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: South Texas Project | Date of Exam: | Operating Test No.:

APPLICANT	EVENT TYPE	Crew B Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4						
		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-2 X	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO ☐ SRO-I-2 X SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO-2 X 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 instrument or component 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 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: South Texas Project | Date of Exam: | Operating Test No.:

APPLICANT	EVENT TYPE	Crew C Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4						
		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-3 X	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO ☐ SRO-I-3 X SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO-3 X 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 instrument or component 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 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: South Texas Project | Date of Exam: | Operating Test No.:

APPLICANT	EVENT TYPE	Crew D Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4						
		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-4 X	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO-4 X 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-5 X 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 instrument or component 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 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: South Texas Project Date of Exam: Operating Test No.:

APPLICANT	EVENT TYPE	Crew E Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4						
		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-5 X	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO ☐ SRO-I-4 X SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO-6 X 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 instrument or component 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 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: South Texas Project | Date of Exam: | Operating Test No.:

APPLICANT	EVENT TYPE	Crew F Scenarios												TOTAL	MINIMUM(*)		
		1			2			3			4						
		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-6 X	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO ☐ SRO-I-5 X SRO-U ☐	RX														1	1	0
	NOR														1	1	1
	I/C														4	4	2
	MAJ														2	2	1
	TS														0	2	2
RO-7 X 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-8 X 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 instrument or component 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 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: __STP_____ Scenario No.: ____1____ Op-Test No.: _____

Examiners: _____ Operators: _____
_____ _____
_____ _____

Initial Conditions: IC-XXXX, Unit is at 95% MOL,

Turnover: Raise RX power to 100% using control rods.
EDG A is removed from service for maintenance and will not be available for 12 hours.

Critical Tasks:
1. Start HPCI pump prior to exit E-0
2. Depressurize S/G to less than 1000 psig within 45 min of SBLOCA

Event No.	Malf. No.	Event Type*	Event Description
1		RO (R)	Raise RX power to 100% using control rods per XXXXXX
2		BOP (N)	Shift control room ventilation from A train to B train
3		SRO(TS)	Report from field that while removing scaffold the bubbler for CSP B has been broken and oil has spilled all over the floor
4		RO (I) SRO(TS)	PZR Pressure Channel PT-457 fails high Entry into OP0P04-RP-0001 Loss of Automatic Pressure Control
5		BOP (C)	IA system leak, Standby IA compressor 12 fails to auto start IA pressure will stabilize at 114 psig Entry into OP0P04-IA-0001 Loss of Instrument Air
6		ALL (C) SRO(TS)	A ES 4160V bus lockout Entry into 0POP04-AE-0001 First Response to Loss of Any or All 13.8 KV or 4.16 KV Bus
7		ALL (M)	Small Break Loss of Coolant Accident, pressure will lower to below HPCI discharge pressure **CT: Depressurize S/G to less than 1000 psig in 45 min of SBLOCA**
8		ALL (C)	4 control rods fail to insert on the Reactor trip (Emergency Boration is Required)
9		ALL (C)	B HPCI pump fails to start **CT: Identify and start pump using hand switch**

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
1. Malfunctions after EOP entry (1-2)	2
2. Abnormal events (2-4)	3
3. Major transients (1-2)	1
4. EOPs entered/requiring substantive actions (1-2)	1
5. EOP contingencies requiring substantive actions (0-2)	0
6. EOP based Critical tasks (2–3)	2

Narrative of Scenario 1

1. Crew receives turnover and is directed to raise power to100% using control rods.

   Actions: SRO directs the OAC to commence a power increase to 100% power using control rods.

2. From turnover sheet the SRO will direct the BOP operator to swap the running control room ventilation

   Actions: SRO will direct the BOP to swap the running control room ventilation fans in accordance with station procedures

3. Booth notification: "My crew was moving scaffold poles and one of my guys accidently broke a glass bubbler on CSP B, all of the oil has spilled on to the floor. I called facilities and they are going to clean up the oil."

   Actions: SRO enters ITS associated with the CSP and takes actions to ensure that the pump will not start

4. As soon as the control room ventilation fans have been swapped and TS addressed, the controlling range RCS pressure instrument fails high. 0POP04-RP-0001 Loss of Automatic Pressure Control

   Write-in CT (Operators need to take action to ensure the RCS low pressure trip set point is not reached resulting in a reactor trip)

   Actions: OAC will recognize the failure take actions necessary per the abnormal procedure

5. IA leak, a substantial leak in the instrument air system will occur and the standby IA compressor will fail to auto start. Once the standby IAP has been started IA header will stabilize at ~ 95 psig. The leak should be big enough to see a steady lowering of IA header pressure but allow the operators an opportunity to find and start the standby IA pump. 0POP04-IA-0001 Loss of Instrument Air

   Actions: Identify the failure of the standby IA pump. If not started, IA header pressure will continue to lower until second backup compressor starts and then slowly continue to lower. It should take a significant amount of time to reach any trip criteria this will allow entry into the Off-Normal procedure for loss of IA and take required actions in that procedures. Once the Standby IA compressor is started IA header pressure will rise to 95psig and remain stable. [5-10] min after starting the standby IAP the control room will receive a phone call saying that the leak has been identified and isolated by closing a valve, IA header recovers fully after that action.

6. A loss of the A ES 4160 volt bus occurs (cannot be re-energized)

   Actions: Crew takes actions necessary in the abnormal procedure to ensure that required equipment for operation is restarted and the SRO should enter TS associated with the distribution system.

7. Small Break loss of coolant accident inside containment

   Actions: Reactor is tripped and required actions taken.

   Critical: Operators must take action to lower S/G pressure to < 1000psig within 45 min of leak

8. 4 control rods fail to insert.

   Actions: Emergency Boration is required

9. When ES actuates the control board operator identifies that the B high pressure injection pump fails to start and starts the pump from the control room switch. When the B High pressure injection pump has started the RCS pressure stabilizes at a pressure above the actuation of the Low Pressure injection actuation point.

Critical: Start HPCI pump prior to exit E-0 [or agreed-upon criteria]

Critical Tasks	Depressurize S/G to less than 1000psig within 45 min of SBLOCA	Establish Charging from at least 1 HPCI pump prior to transition from E-0
EVENT	7	9
Safety significance	SAFETY SIGNIFICANCE -- This operator action is necessary to ensure the acceptance criteria of 10CFR50.46 (specifically the ECCS acceptance criteria for peak cladding temperature < 2200°F) is met. Refer to correspondence NOC-AE-000151 (13), NOC-AE-000159 (14), and NOC-AE-000545 (15).	SAFETY SIGNIFICANCE -- Failure to manually start at least one Charging/SI pump (high-head SI pump for LP plants) under the postulated conditions constitutes misoperation or incorrect crew performance in which the crew does not prevent "degraded emergency core cooling system (ECCS) … capacity." In this case, at least one Charging/SI pump (high-head SI pump for LP plants) can be manually started from the control room. Therefore, failure to manually start a Charging/SI pump (high-head SI pump for LP plants) also represents a failure by the crew to "demonstrate the following abilities: • Effectively direct or manipulate engineered safety feature (ESF) controls that would prevent a significant reduction of safety margin beyond that irreparably introduced by the scenario • Recognize a failure or an incorrect automatic actuation of an ESF system or component" Additionally, under the postulated plant conditions, failure to manually start a Charging/SI pump (high-head SI pump for LP plants) (when it is possible to do so) is a "violation of the facility license condition." The acceptable results obtained in the FSAR analysis of a small-break LOCA are predicated on the assumption of minimum ECCS pumped injection. The analysis assumes that a minimum pumped ECCS flow rate, which varies with RCS pressure, is injected into the core. The flow rate values assumed for minimum pumped injection are based on operation of one each of the following ECCS pumps: Charging/SI pump (HP plants only), high-head SI pump, and low-head SI pump. Operation of this minimum required complement of ECCS injection pumps is consistent with the FSAR assumption that only minimum safeguards are actuated. For both the minimum and maximum cases specified in Comment 1 of this critical task worksheet and for all cases in between, failure to perform the critical task means that the plant is needlessly left in an unanalyzed condition. Performance of the critical task would return the plant to a condition for which analysis shows acceptable results. Because compliance with the assumptions of the FSAR is part of the facility license condition, failure to perform the critical task (under the postulated plant conditions) constitutes a violation of the license condition.
Cueing	○ PZR level and indications of a small break loss of coolant accident	• Indication and/or annunciation that Charging/SI pump (high-head SI pump for LP plants)injection is required ○ SI actuation

		○ RCS pressure below the shutoff head of the Charging/SI pump (high-head SI pump for LP plants) AND • Indication and/or annunciation that no Charging/SI pump (high-head SI pump for LP plants) is injecting into the core ○ Control switch indication that the circuit breakers or contactors for both Charging/SI pumps (high-head SI pumps for LP plants) are open ○ All Charging/SI pump (high-head SI pump for LP plants) discharge pressure indicators read zero ○ All flow rate indicators for Charging/SI pump (high-head SI pump for LP plants) injection read zero
Performance indicator	Manipulation of controls as required to adjust secondary pressure	Manipulation of controls as required to establish flow from at least one Charging/SI pump (high-head SI pump for LP plants) • Control switch indication that the circuit breaker or contactor for at least one Charging/SI pump (high-head SI pump for LP plants) is closed
Performance feedback	S/G pressure and valve position indication	• Indication and/or annunciation that at least one Charging/SI pump (high-head SI pumpfor LP plants) is injecting • Flow rate indication of injection from at least one Charging/SI pump (high-head SI pump for LP plants)
Justification for the chosen performance limit	This operator action is necessary to ensure the acceptance criteria of 10CFR50.46 (specifically the ECCS acceptance criteria for peak cladding temperature < 2200°F) is met	Failure to manually start at least one Charging/SI pump (high-head SI pump for LP plants) under the postulated conditions constitutes misoperation or incorrect crew performance in which the crew does not prevent "degraded emergency core cooling system (ECCS) … capacity."
PWR Owners Group Appendix	STPEGS EOPT-o3.07 Rev 22	CT-6, ESTABLISH FLOW FROM AT LEAST ONE CHARGING/SI PUMP (HIGH-HEAD SI PUMP FOR LP PLANTS)

References
0POP04-RP-0001 Loss of Automatic Pressure Control
0POP04-TM-0005 Fast Load Rejection
0POP04-IA-0001 Loss of Instrument Air

Facility: STP Scenario No.: 2 Op-Test No.: _____

Examiners: _____ Operators: _____
_____ _____
_____ _____

Initial Conditions:
100% Rx power, MOL

Turnover:
100% Rx Power EOL, Crew has been directed to swap running EHC pumps, one charging pump is tagged out of service for oil change

Critical Tasks:
1. Isolate ruptured SG within [establish agreed-upon criteria]
2. Manually initiate AFW prior to reaching dryout conditions on any steam generator.

[NRC Note: Scenario is event-heavy before major. Evaluate removing one of the I/C malfunctions]

Event No.	Malf. No.	Event Type*	Event Description
1		BOP (N)	Swap Running CALCW pumps
2		BOP (C) SRO (TS)	Charging Pump Overcurrent Trip.
3		ALL (C)	Stator Water cooling low flow alarm. Start Standby pump.
4		OAC (R) SRO (C)	Rod Control Malfunction: continuous rod insertion.
5		BOP (C) SRO (C)	Condensate pump Trip, entry into 0POP04-CD-0001
6		OAC (I) SRO (TS)	Power Range C NI fails low
7		ALL (M)	"C" Steam Generator Tube rupture ramps in over a 5 min until trip setpoint reached.
8		All (C)	"C" SG safety fails to close.
9		All (C)	AFW fails to auto start

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
1. Malfunctions after EOP entry (1-2)	2
2. Abnormal events (2-4)	5
3. Major transients (1-2)	1
4. EOPs entered/requiring substantive actions (1-2)	1
5. EOP contingencies requiring substantive actions (0-2)	1
6. EOP based Critical tasks (2–3)	2

Narrative of Scenario 2:

1. Swap running CALCW pumps,

   Action: Normal evolution SRO directs the BOP operator to swap the running CALCW pumps in accordance with station procedures

2. Charging Pump Trips on overcurrent

   Actions: Operators respond to the loss of the running charging pump and perform the actions required to start the available standby pump ITS call for SRO

3. Stator water cooling demineralizer D/P is high resulting in a low flow condition, Temperatures begin to rise and action to start the standby pump or bypass/swap demineralizers are successful

   Actions: Operators will receive alarm of stator cooling d/p reference the alarm response procedure and take appropriate actions

4. Controlling control rod group begins to continuously insert

   Actions: Operators identify the issue with the control rod system and take manual control to maintain Tave (possible ITS call)

5. Condensate Pump Trips

   Actions: Alarms in control room are received indicating that one condensate has tripped off line. Immediate actions are taken in accordance with 0POP04-CD-0001. Once standby pump is started the plant is stabilized

6. Power Range C NI fails low

   Actions: SRO enters 0POP04-NI-000 and takes appropriate actions, ITS call for SRO

7. Major: SGTR in the C steam generator

   Actions: tube rupture will start small and gradually increase from a tube leak of 15 gpm to 250 gpm. It will take [5 to 10] min to reach the point that a reactor trip is required. The operator will trip the reactor when required by procedure.

8. When the Unit trips one control rod does not fully insert but the plant is shut down. An SG safety valve on the C steam generator fails to reseat, action is required to lower steam pressure to attempt to reseat the valve.

   Actions: Operators take appropriate actions per their procedures and identify that the steam generator safety has failed to seat. Operators take action to lower pressure to attempt to reseat the valve (this is unsuccessful valve will remain open throughout the rest of scenario)

9. AFW pumps fail to start automatically. When manually aligned the AFW pump aligned to the B steam generator has a sheared shaft.

   Actions: Operators identify that AFW failed to auto start and manually start AFW. Operator identifies sheared shaft on AFW Pump to the B steam generator and uses procedural guidance to either cross tie the feed to that generator or isolate it.

Critical Tasks	CT-18, Isolate ruptured steam generator [within agreed-upon criteria]	Establish the [minimum required AFW flow rate] to the SGs [before transition out of E-0 or other agreed-to criteria] unless the transition is to FR-H.1, in which case the task must be [initiated before RCPs are manually tripped] in accordance with Step 4 of generic guideline FR-H.1
EVENT	7	9
Safety significance	SAFETY SIGNIFICANCE -- Failure to isolate the ruptured SG causes a loss of differential pressure between the ruptured SG and the intact SGs. The fact that the crew allows the differential pressure to dissipate and, as a result, are then forced to transition to a contingency ERG constitutes an incorrect performance that "necessitates the crew taking compensating action that would complicate the event mitigation strategy...."	SAFETY SIGNIFICANCE -- Failure to establish the minimum required AFW flow rate, under the postulated plant conditions, results in "adverse consequence or a significant degradation in the mitigative capability of the plant." In this case, the minimum required AFW flow rate can be established by performing the appropriate manual action. Therefore, failure to manually establish the minimum required AFW flow rate also represents a failure by the crew to"demonstrate the following abilities: • Effectively direct or manipulate engineered safety feature (ESF) controls that would prevent (degraded emergency core cooling system (ECCS) … capacity) • Recognize a failure or an incorrect automatic actuation of an ESF system or component" • Take one or more actions that would prevent a challenge to plant safety"
Cueing	• Indication and/or annunciation of SGTR in one SG o Increasing SG water level o Radiation AND • Indication and/or annunciation of reactor trip AND • Indication and/or annunciation of SI	• Indication and/or annunciation that SI is actuated AND • Indication and/or annunciation that the AFW flow rate is less than the minimum required o Total AFW flow rate indicates less than the minimum required o Control switch indication that the circuit breakers or contactors for the motor-driven AFW pumps are open o Control switch indication that the steam supply valves to the turbine-driven AFW pump are closed o AFW valve position indication that a flow path is not established to at least one SG
Performance indicator	Manipulation of controls as required to isolate the ruptured SG • Main steam isolation valve position lamps indicate closed • Main steam isolation bypass valve position lamps indicate closed • PORV setpoint adjusted to ERG Footnote O.03	Manipulation of controls in the control room as required to establish the minimum required AFW flow rate to the SGs

	• Blowdown isolation valve position lamps indicate closed Steam isolation valve to TDAFW pump position lamps indicate closed • AFW valve position lamps and/or indicators indicate closed • Feedwater isolation valve position lamps indicate closed]2	
Performance feedback	• Indication of stable or increasing pressure in the ruptured SG • Indication of decreasing or zero feedwater flow rate in the ruptured SG	• Indication that at least the minimum required AFW flow rate is being delivered to the SGs • SG levels increasing
Justification for the chosen performance limit	• An incorrect action that "necessitates the crew to take compensating actions that would complicate the event mitigation" AND • A "significant reduction of safety margin beyond that irreparably introduced by the scenario"	Given the postulated plant conditions, the adverse consequences that can arise from failure to establish the minimum required AFW flow rate are challenges to the following: • Heat sink CSF • Core cooling CSF • Fuel matrix/clad fission product barrier
PWR Owners Group Appendix	CT-18, Isolate ruptured SG	CT-4, Establish AFW flow to SGs

Facility: STP Scenario No.: 3 Op-Test No.: _____

Examiners: _____ Operators: _____
_____ _____
_____ _____

Initial Conditions: Unit 1 is just below POAH, MOL. Unit 2 is at 100%. The B Safety Injection Pump and the D Condenser Circulating Water Pump are tagged out for preventative maintenance.

Turnover: Unit 1 is just below POAH, MOL. Unit 2 is at 100%. B Safety Injection Pump and the D Condenser Circulating Water Pump are tagged out for preventative maintenance. The crew is to increase power to1% by withdrawing control rods. LCO 3.0.4.(b) has been assessed for the B Safety Injection Pump inoperability and Mode change has been authorized. The Startup SG Feed Pump is running with one Main Feed Pump being warmed up but not yet at idle.

Critial Tasks:
1. Stop the RCP within 5 min of reaching loss of SCM setpoint.
2. Manually start SW pumps for safeguards equipment cooling prior to Plant specific critreria

Event No.	Malf. No.	Event Type*	Event Description
1		RO (R)	Withdraw control rods to increase reactor power to 1%
2		RO (I) SRO (I)	1D S/G W/R signal fails low. Feed reg. bypass valve opens. Loss of S/G level Control 0POP4-FW-0001
3		BOP (C) SRO (C,TS)	One loop's essential cooling water pump shaft seizes and will require the operator to start an additional Essential cooling water pump. This will require a Technical specification call for one loop Essential Cooling water loop being OOS (3.7.4)
4		BOP (C) SRO (C,TS)	Running Feed Pump trips will require entry into 0POP04-FW-0002, Steam Generator Feed Pump Trip. 1 AFW Pump will not start requiring a Technical Specification call (3.7.1.2)
5		ALL (M)	PZR PORV fails open. Manual closure attempt is unsuccessful. Manual block valve will not close. (Requires a Rx trip) SBLOCA due to PORV (RCP must be secured) (CRITICAL)
6		ALL (C)	Phase A Train B fails to auto actuate with CV-MOV-0023 failed open
7		ALL (C)	Required number of service water pumps fail to start requiring manual pump start (CRITICAL)
8		ALL (M)	After RCP have been secure or 5 min after trip a Large break LOCA resulting in a loss of Sub-Cooling Margin

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
1. Malfunctions after EOP entry (1-2)	2
2. Abnormal events (2-4)	3
3. Major transients (1-2)	2
4. EOPs entered/requiring substantive actions (1-2)	1
5. EOP contingencies requiring substantive actions (0-2)	0
6. EOP based Critical tasks (2-3)	2

Narrative for Scenario 1

1. Raise reactor power to 1%. Crew will use rods since unit is below POAH. Once POAH is reached trigger next event at lead examiners discretion.

2. 1D S/G W/R level signal fails LOW; associated Feed Reg. Bypass Valve opens. RO takes manual control to stabilize and restore 1D S/G level. (Loss of SG Level control). This failure is internal and does not indicate on the W/R level board indication.

3. One loops essential cooling water pump shaft seizes and will require the operator to start an additional Essential cooling water pump. This will require a Technical specification call for one loop Essential Cooling water loop being OOS (3.7.4).

4. Operating Start Up Feedwater Pump trips, no other feedwater pump is idle at this point and the operators are expected to work their way to starting AFW to stabilize S/G level. When attempting to start one of the AFW pumps it will not start and the SRO will need to cross connect the aux feed water and evaluate TS 3.7.1.2 once SG levels are stable notify the control room that the SU Feedwater pump is ready to start and allow crew to transition back to normal feedwater

5. (PZR PORV) fails open. RO attempts manual closure of the PORV. This will not be successful. (Pressurizer Pressure Anomalies) entry. This is the major event because the PZR PORV cannot be closed, nor will the manual block isolation close. Recognizing a SBLOCA, the crew will determine that the reactor must be tripped. The operators will need to recognize that a loss of sub-cooling margin has occurred and secure the RCP's within 5 min (CRITICAL)

6. Phase A (Train B) fails to auto actuate, and CV-MOV-0023 fails open, causing a loss of containment isolation, until operator action corrects the situation.

7. SW pumps are either tripped or fail to start and require the crew to start as necessary they will start form the control room. (Critical)

8. When Reactor Trips a large depressurization occurs due to a LBLOCA and sub-cooling margin is lost. No ES systems automatically actuate. All ECCS components will start if manually started from the control room. The operators will need to recognize that a loss of sub-cooling margin has occurred and secure the RCP's within 5 min (CRITICAL)

Critical Tasks	Critical Task 2 – Trip NC pumps on loss of subcooling with S/I flow verified per E-0 within 5 minutes of criteria met.	Manually start SW pumps for safeguards equipment cooling
EVENT	5	7
Safety significance	SAFETY SIGNIFICANCE -- Failure to trip the RCPs under the postulated plant conditions leads to core uncovery and to fuel cladding temperatures in excess of 2200°F, which is the limit specified in the [ECCS acceptance criteria].9 Thus, failure to perform the task represents misoperation or incorrect crew performance in which the crew has failed to prevent "degradation of...{the fuel cladding} ...barrier to fission product release" and which leads to "violation of the facility license condition." The analysis presented in the FSAR for a SBLOCA typically assumes that the RCPs trip because of a loss of offsite power that coincides with the reactor trip. However, during a SBLOCA, offsite power might remain available and RCPs might continue to run for some period of time. Following the accident at TMI-2, the NRC expressed concern about RCP operation during a SBLOCA. In response, the WOG sponsored analyses to determine when the RCPs must be if power remains available. It was determined that manually tripping the RCPs before RCS inventory is depleted to less than the "critical inventory" results in a peak cladding temperature about the same as the PCT in the FSAR analysis. Manually tripping the RCPs before depletion below the critical inventory conservatively ensures that PCT remains below 2200°F. The concept of critical inventory is used to determine RCP trip criteria for SBLOCAs in which the RCPs do not trip at the time of reactor trip. However, the critical inventory is defined in terms of the original FSAR analysis in which RCP trip coincides with reactor trip. The critical inventory is the amount of inventory remaining in the RCS when the break completely uncovers and the break flow changes from a mixture of liquid and steam to all steam. Continued RCP operation after the RCS is depleted to the critical inventory results in more mass being lost through the break than would otherwise be the case. More mass is lost because RCP operation causes liquid to continue to flow from the break, whereas, in an RCS depleted to the critical inventory, liquid	SAFETY SIGNIFICANCE -- Failure to manually start at least the minimum required number of SW pumps in an operating safeguards train represents a failure by the crew to "demonstrate the following abilities: ☐ Effectively direct or manipulate engineered safety feature (ESF) controls that would prevent a significant reduction of safety margin beyond that irreparably introduced by the scenario ☐ Recognize a failure or an incorrect automatic actuation of an ESF system or component" Additionally, under the postulated plant conditions, failure to manually start at least the minimum required number of SW pumps (when it is possible to do so) is a "violation of the facility license condition."

	loss from the break stops when RCPs are stopped. The WOG provided guidance for its members to convert this event (RCS depletion to the critical inventory) into useful control room indications, called the RCP trip criteria. Upon receipt of the plant-specific conditions that the RCP trip criteria are met, the crew must trip the RCPs. Failure to do so results in more liquid inventory being lost through the break than would be the case if the RCPs were tripped. The WOG studied the effects of delaying RCP trip beyond the time that the RCP trip criteria are met (that is, beyond the time that the RCS is depleted to the critical inventory). The Analysis of Delayed Reactor Coolant Pump Trip during Small Loss of Coolant Accidents for Westinghouse Nuclear Steam Supply Systems (WCAP-9584, 1979) examined cold-leg breaks of 2, 3, and 4 inches for the bounding plant type, which is a 3-loop plant. The analysis showed that, for the bounding plant type (which is a 3-loop plant), delayed RCP trip can cause adverse consequence for the 2- and 3-inch breaks, meaning that PCT exceeds 2200°F. WCAP-9584 also demonstrated that similar windows for adverse consequence exist for 2- and 4-loop plants, [although for slightly different break-size ranges].10 The adverse consequence arises when RCP trip occurs within a specific window of time. As break size increases, the window for adverse consequence shortens and begins sooner. For the 2-inch break (three loop, cold leg), the window begins at about 33 minutes and lasts for such a long time that the analysis was stopped before the window ended (it is assumed that the window would eventually end). For the 3-inch break (three loop, cold leg), the window begins at about 8 minutes and ends at 12 minutes. The 4-inch break (three loop, cold leg) has no window, meaning PCT remains below 2200°F regardless of RCP trip delay. The window for adverse consequence is caused by the fact that the drop in the core mixture level that occurs when RCPs are tripped has two competing effects. First, delaying RCP trip results in faster depletion of RCS inventory so that, when the RCPs finally trip, core uncover can occur almost instantaneously. If the RCPs are tripped soon after the trip criteria are met, little or no core uncovery occurs and PCT remains below 2200°F. As RCP trip is delayed beyond the trip criteria, core	

	uncovery (when the RCPs finally do trip) is much deeper and PCT exceeds 2200°F. Second, and competing with core uncovery, is accumulator injection. The analysis shows that very deep core uncovery causes a rapid RCS depressurization. Less decay heat is transferred to the core fluid, causing RCS temperature and pressure to drop. The rapid RCS depressurization causes the accumulators to inject sooner and faster, re-covering the core and mitigating the rise in PCT.	
Cueing	• Indications of a SBLOCA AND • Indication and/or annunciation of safety injection AND • Indication and/or annunciation that only one train of [safety injection pumps]4 actuates AND • Indication that the RCP trip criteria are met	• Indication and/or annunciation that SI is actuated • AND • Indication [and/or annunciation]9 that less than the minimum required number of SW pumps is running – Control switch indication that the circuit breakers or contactors for all SW pumps are open – SW pump discharge pressure indicator reads zero – SW flow indicator reads zero – SW pump trouble alarm
Performance indicator	Manipulation of controls as required to trip all RCPs • RCP breaker position lights indicate breaker open	Manipulation of controls as required to start at least the minimum required number of SW pumps in an operating safeguards train • Control switch indication that the appropriate circuit breaker(s) or contactor(s) are closed
Performance feedback	• Indication that all RCPs are stopped o RCP breaker position lights o RCP flow decreasing o RCP motor amps decreasing	Indication and/or annunciation that at least the minimum required number of SW pumps is running in an operating safeguards train • SW low flow condition clear; indication of flow • SW low pressure condition clear; indication of pressure
Justification for the chosen performance limit	The analysis based on Appendix K conditions shows that, for the bounding plant type (which again is a 3-loop plant), delayed RCP trip causes PCT to exceed 2200°F [for a range of cold leg break sizes, up to 4.5 inches].11 The minimum response time for the operating crew is 5 minutes, which is for the 4.5 inch break. If the RCPs are tripped within 5 minutes of the trip criteria being met, PCT remains below 2200°F. If the RCPs are tripped later than 5 minutes after meeting the trip criteria, PCT exceeds 2200°F.	Failure to manually start minimum number of SW pumps will take the required safety pumps cooled by SW out of service that are required for the safety function.
PWR Owners Group	CT-16, Manually trip RCPs	CT-9, Manually start [at least the minimum required number of SW pumps]1 [in an operating safeguards train]2 [before plant- and scenario-specific criteria

Appendix		are exceeded]

References
Loss of Circulating Water Flow, 0POP4-CW-0001
Loss of S/G level Control, 0POP4-FW-0001
Loss of Circulating Water Flow, 0POP4-CW-0001
Steam Generator Feed Pump Trip, 0POP04-FW-0002
EOP's

Facility: _____ Scenario No.: ___4____ Op-Test No.: _____

Examiners: _____ Operators: _____
_____ _____
_____ _____

Initial Conditions: IC-XXXX, Unit is at 65% MOL,

Turnover: Reduce Reactor Power to 60% to remove the B main feed pump from service for maintenance. Circ water pump #13 is OOS for maintenance

Critical Tasks:
1. Close MSIV prior to either the subcriticality or the integrity CSF or before transition to ECA-2.1, whichever happens first.
2. Isolate Feed to the B steam generator prior to [establish criteria]

Event No.	Malf. No.	Event Type*	Event Description
1		R (RO)	SRO directs RO to lower power to 60%
2		N (BOP)	Secure B main feed pump
3		I (RO) TS (SRO)	Turbine impulse pressure (PT-506) transmitter fails low causing rod insertion. Enters OP0P04-TM-0004
4		C (BOP)	Gland seal regulator fails high Operator action required to take manual control
5		C (RO) TS (SRO)	COLD LEG TE-420B FAILS HIGH Requires entry into 0POP04-RP-0004
6		M (All)	B S/G steamline break upstream of "B" MSIV
7		C (BOP)	B MSIV fails to close
8		C (BOP)	AFW pump switch fails to secure the B AFW pump and the valves must be closed to isolate

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
1. Malfunctions after EOP entry (1-2)	2
2. Abnormal events (2-4)	3
3. Major transients (1-2)	1
4. EOPs entered/requiring substantive actions (1-2)	1
5. EOP contingencies requiring substantive actions (0-2)	0
6. EOP based Critical tasks (2-3)	2

Narrative of Scenario 4

1. Crew receives turnover and is directed to reduce power to 60% using control rods. SRO directs the OAC to commence a power reduction to 60% power using control rods to secure the A MFP for maintenance. Power reduction is successful to ~ 60%.

2. Following the power reduction, the crew is directed to secure the A MFP.

3. Once the feed pump is secure, a turbine impulse pressure instrument will fail low causing rod insertion. The OAC will take manual control of the rods, and the BOP operator will select out the failed channel.

4. Gland seal regulator fails high and manual control is needed to control gland seal pressure

5. Cold leg RTD TE-420B fails high. Crew enters 0POP04-RP-0004, FAILURE OF RCS LOOP RTD PROTECTION CHANNEL.

6. The major event will be a main steam line break upstream of the "B" MSIV.

7. The BOP operator should also note that the "B" MSIV failed to close, and take manual action to close the MSIV. (CT - Manually close the B MSIV before an orange path challenge develops to either the subcriticality or the integrity CSF or before transition to ECA-2.1, whichever happens first)

8. AFW will not isolate to the B S/G normally (either in automatic or manual), causing continued feed to the faulted steam line until manual isolation of the AFW to the B SG is done either by securing pump or closing an isolation valve. (CT – Isolate AFW to faulted SG)

The scenario should be terminated when B SG is dry and control of subsequent heat up is established.

CT-17 of owner's group document: Critical task to isolate all feed sources to the B S/G prior to [need to establish criteria]

Critical Tasks	Isolate Faulted Steam Generator	Manually close MSIV prior to Orange path CSF
EVENT	9	8
Safety significance	SAFETY SIGNIFICANCE -- Failure to isolate a faulted SG that can be isolated causes challenges to CSFs beyond those irreparably introduced by the postulated conditions. Also, depending upon the plant conditions, it could constitute a failure by the crew to "demonstrate the ability to recognize a failure or an incorrect automatic actuation of an ESF system or component." Failure to isolate a faulted SG can result in challenges to the following CSFs: • Integrity • Subcriticality • Containment Failure to isolate the faulted SG such that multiple SGs are allowed to blow down for an extended time can significantly worsen the power excursion. Similarly, failure to isolate all feedwater flow, including AFW, to the faulted SG such that it continues to blow down for an extended time can significantly worsen the power excursion.	SAFETY SIGNIFICANCE -- Failure to close the MSIVs under the postulated plant conditions causes challenges to CSFs beyond those irreparably introduced by the postulated conditions. Additionally, such an omission constitutes a failure by the crew to "demonstrate (the ability to) recognize a failure or an incorrect automatic actuation of an ESF system or component," and to "take one or more actions that would prevent a challenge to plant safety." In the typical FSAR, the analysis for a large steamline break assumes steamline isolation within a short time frame, on the order of seconds. The analysis typically assumes a steam system piping failure in which a single SG blows down completely. That is, the analysis assumes a fault that can be isolated from all but one SG. However, in the plant conditions postulated for this critical task, the break is located downstream of the MSIVs. Thus, closure of all MSIVs would terminate all uncontrolled blowdown. In this case, there is no reason for even a single SG to completely depressurize. If the crew allows all MSIVs to remain open, then all SGs depressurize uncontrollably and unnecessarily. Uncontrolled depressurization of all SGs causes an excessive rate of RCS cooldown, well beyond the conditions typically analyzed in the FSAR. The excessive cooldown rate creates large thermal stresses in the reactor pressure vessel and causes rapid insertion of a large amount of positive reactivity. Thus, failure to close the MSIVs under the postulated conditions can result in challenges to the following CSFs: • Integrity • Subcriticality The LOFTRAN analyses for uncontrolled depressurization of all SGs presented in the ERG Background Document for ECA-2.1 are based upon best-estimate assumptions rather than upon conservative FSAR assumptions. They do not address subcriticality. However, they do show that RCS cold leg temperature can drop by more than 250°F in less than 3 minutes for a large steamline break involving uncontrolled depressurization of multiple SGs. Additionally, the ERG Background Document for ECA-2.1 specifically states the following: It should be noted that this event (with an extensive cooldown and subsequent repressurization) may result in a challenge to the Integrity Critical Safety Function. In this case the Integrity Critical Safety Function Status Tree may direct the operator to FR-P.1, RESPONSE TO IMMINENT PRESSURIZED

		THERMAL SHOCK CONDITION, for further actions. For some plants, the analysis for a large steamline break shows a return to reactor criticality caused by the large and rapid RCS cooldown, even though only a single SG is assumed to blow down completely. Failure to isolate the SGs from the steamline break such that all SGs are allowed to blow down uncontrollably significantly worsens the power excursion. This worsening of the power excursion is unnecessary; it could be prevented simply by closing the MSIVs.
Cueing	Both of the following: – Steam pressure and flow rate indications that make it possible to identify a single SG as faulted AND – Valve position and flow rate indication that AFW continues to be delivered to the faulted SG	Indication that main steamline isolation is required AND Indication that main steamline isolation has not actuated automatically • MSIVs indicate open • Indication of uncontrolled depressurization of one steam generator
Performance indicator	Manipulation of controls as required to isolate the faulted SG • MSIVs indicate closed • Indication of feedline isolation – Feedwater control valves indicate closed – Feedline isolation valves indicate closed – Main feed pumps indicate tripped • Indication that AFW flow to the faulted SG is stopped • AFW flow control valves for faulted SG indicate closed	Manipulation of controls as required to manually actuate steamline isolation • MSIVs undergo fast-closure • MSIVs indicate closed
Performance feedback	Any depressurization of intact SGs stops • Steam flow indication from faulted SG decreases to zero • RCS cooldown stops • Main feedwater flow rate indication of zero • AFW flow rate indication to faulted SG of zero	• Steam flow indication from all SGs decreases to zero • All SGs stop depressurizing • RCS cooldown stops
Justification for the chosen performance limit	Failure to isolate the AFW to the faulted SG will result in severe overcooling and challenge the CSFs	Failure to close the MSIV causes challenges to CSFs beyond those irreparably introduced by the steamline break. Additionally, such an omission constitutes a failure by the crew to "demonstrate (the ability to) recognize a failure or an incorrect automatic actuation of an ESF system or component," and to "take one or more actions that would prevent a challenge to plant safety."
PWR Owners Group Appendix	CT-17, Isolate Faulted SG	CT-12, Manually actuate main steamline isolation

References
OP0P04-TM-0004, Failure of Turbine Impulse Pressure Transmitter
0POP04-RP-0004, FAILURE OF RCS LOOP RTD PROTECTION CHANNEL.

Facility: _____ Scenario No.: ___5____ Op-Test No.: _____

Examiners: _____ Operators: _____
_____ _____
_____ _____

Initial Conditions: IC-XXXX, Unit is at 75% power, Condensate pump 13 is tagged out for maintenance, Crew is directed to raise power to 100 %, Thunderstorms in the area, SU Feed water pump is tagged out for oil replacement.

Turnover: Increase power to 100%

Critical Tasks:

1. Establish the [minimum required AFW flow rate]1 to the SGs [before transition out of E-0],2 unless the transition is to FR-H.1, in which case the task must be [initiated before RCPs are manually tripped]2 in accordance with Step 4 of generic guideline FR-H.1
2. Manually trip the main turbine [before a severe (ORANGE path) challenge develops to either the subcriticality or the integrity CSF]1 or [before transition to ECA-2.1]2, whichever happens first

(need values or hard plant specific points for items in red)

Event No.	Malf. No.	Event Type*	Event Description
1		RO (R)	Rod withdrawl and power increase to 100% power
2		BOP C	Circulating Water Traveling Screen High Differential Pressure, requires entry into Loss of Circulating Water Flow 0POP4-CW-0001
3		RO (I)	Controlling Pressurizer level transmitter fails low (PT-465) will require entry into OP0P04-RP-0002
4		BOP (I)	Loss of B S/G Steam Flow instrument signal, required entry into OP0P04-FW-0001
5		ALL (C)	Loss of 480v LC E1B1 entry into 0POP04-AE-0001
6		ALL (M)	Main Generator Output Breaker Trips Open, Load rejection requiring a reactor trip. (PT-557 fails at same time to ensure that SG level lower rapidly so FRH1 entry is met)
7		ALL (C)	Main Turbine Fails to trip with reactor trip (Manual Trip required)
8		ALL (C)	AFWP-14 starts but fails to inject due to issue with governor and recirc valve being open, (crossover valves will not open), AFW pumps 12 and 13 trip on overcurrent on start

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

Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
2. Malfunctions after EOP entry (1-2)	2
3. Abnormal events (2-4)	4
4. Major transients (1-2)	1
5. EOPs entered/requiring substantive actions (1-2)	1
6. EOP contingencies requiring substantive actions (0-2)	1
7. EOP Based Critical tasks (2-3)	2

Narrative of Scenario 5

1. Crew receives turnover and is directed to increase power to 100%. SRO directs the OAC and BOP to commence a power ascension to 100% power using control rods and turbine load.

2. After power has been increase by approximately 5% power, a report form the field saying the CW traveling screen D/P is high. The will require the crew to enter 0POP04-CW-0001, eventually leading to securing one of the 4 running CW pumps.

3. Once one of the CW pumps is secured PT -465 fails low resulting in a loss of normal letdown and entry into 0POP04-RP-0002 addendum 3 witch will place excess letdown in service.

4. B Steam Flow instrument will fail requiring the crew to take manual control to prevent a reactor trip. OP0P04-FW-0001

5. Loss of 480 v LC E1B1 entry into 0POP04-AE-0001

6. Major: Main Generator Output breaker trips open coincident with PT-557) failing to ensure s/g lowers. Requiring a reactor trip

7. Main Turbine does not trip when reactor trips must manually trip the main turbine

8. AFWP-14 starts but fails to inject due to issue with governor and recirc valve being open, (crossover valves will not open), AFW pumps 12 and 13 trip on overcurrent on start. The crew can either take manual control of AFW pump 14 and raise discharge pressure in field and close the recirc valve from control room and establish required AFW flow. (Would the crews go to forced safety injection cooling in this situation?)

Scenario will conclude after the operators have received word from the crew that AFW pump 14 can be controlled and the recirc valve is closed and feed to the S/G has been restored.

Critical Tasks:
1. CT-4, Establish Flow to the S/G's
2. CT-13, Manually Trip the Main Turbine

Critical Tasks	Establish the [minimum required AFW flow rate]1 to the SGs [before transition out of E-0],2 unless the transition is to FR-H.1, in which case the task must be [initiated before RCPs are manually tripped]2 in accordance with Step 4 of generic guideline FR-H.1	Manually trip the main turbine [before a severe (ORANGE path) challenge develops to either the subcriticality or the integrity CSF]1 or [before transition to ECA-2.1]2, whichever happens first
EVENT	8	7
Safety significance	SAFETY SIGNIFICANCE -- Failure to establish the minimum required AFW flow rate, under the postulated plant conditions, results in "adverse consequence or a significant degradation in the mitigative capability of the plant." In this case, the minimum required AFW flow rate can be established by performing the appropriate manual action. Therefore, failure to manually establish the minimum required AFW flow rate also represents a failure by the crew to "demonstrate the following abilities: • Effectively direct or manipulate engineered safety feature (ESF) controls that would prevent (degraded emergency core cooling system (ECCS) … capacity) • Recognize a failure or an incorrect automatic actuation of an ESF system or component" • Take one or more actions that would prevent a challenge to plant safety"	SAFETY SIGNIFICANCE -- Failure to trip the main turbine under the postulated plant conditions causes challenges to CSFs beyond those irreparably introduced by the postulated conditions. Additionally, such an omission constitutes a failure by the crew to "demonstrate the ability to…take one or more actions that would prevent a challenge to plant safety." Thus, failure to manually trip the main turbine under the postulated conditions can result in challenges to the following CSFs: • Integrity • Subcriticality

Cueing	• Indication and/or annunciation that SI is actuated
	AND
	• Indication and/or annunciation that the AFW flow rate is less than the minimum required
	  • Total AFW flow rate indicates less than the minimum required
	  • Control switch indication that the circuit breakers or contactors for the motor-driven AFW pumps are open
	  • Control switch indication that the steam supply valves to the turbine-driven AFW pump are closed
	  • AFW valve position indication that a flow path is not established to at least one SG
		• Indication and/or annunciation of reactor trip
		  o Rod bottom lamps illuminated
		  o Reactor trip and bypass breakers status lamps indicate breakers open
		  o Excore nuclear instruments show reactor power decreasing through the intermediate range
		AND
		• Indication that the main turbine has not automatically tripped
		  o Stop valves indicate open
		  o Control valves indicate at their full-load position
		  o Indication of uncontrolled depressurization of all SGs

Performance	Manipulation of controls in the control room as required to	Manipulation of controls as required to manually trip the main turbine

indicator	establish the minimum required AFW flow rate to the SGs	• Stop valves indicate closed
Performance feedback	• Indication that at least the minimum required AFW flow rate is being delivered to the SGs • SG levels increasing	• Steam flow indication from all SGs decreases to zero • All SGs stop depressurizing • RCS cooldown stops
Justification for the chosen performance limit	Given the postulated plant conditions, the adverse consequences that can arise from failure to establish the minimum required AFW flow rate are challenges to the following: • Heat sink CSF • Core cooling CSF • Fuel matrix/clad fission product barrier	Thus, failure to manually trip the main turbine under the postulated conditions can result in challenges to the following CSFs: • Integrity • Subcriticality
PWR Owners Group Appendix	CT-4, Establish AFW flow to SGs	CT-13, Manually trip the turbine

References