

Facility: Wolf Creek		Date of Exam: November 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	3	3	3	N/A			3	3	N/A			3	18			6	
	2	1	2	0	N/A			2	2	N/A			2	9			4	
	Tier Totals	4	5	3	N/A			5	5	N/A			5	27			10	
2. Plant Systems	1	3	3	3	2	2	2	3	2	3	3	2	28			5		
	2	1	0	1	1	1	1	1	1	1	1	1	10			3		
	Tier Totals	4	3	4	3	3	3	4	3	4	4	3	38			8		
3. Generic Knowledge and Abilities Categories				1		2		3		4		10		1	2	3	4	7
				3		2		2		3								

Note:

- Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 Radiation Control K/A is allowed if the K/A is replaced by a K/A from another Tier 3 Category).
- 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.
- Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted with justification; operationally important, site-specific systems/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 for guidance regarding the elimination of inappropriate K/A statements.
- 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.
- 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.
- Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
- 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.
- On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams.
- For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

G* Generic K/As

ES-401	PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO)						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			X				EK3.01 - Actions contained in EOP for reactor trip	4.0	1
000008 Pressurizer Vapor Space Accident / 3		X					AK2.01 - Valves	2.7	2
000009 Small Break LOCA / 3				X			EA1.15 - PORV and PORV block valve	3.9	3
000011 Large Break LOCA / 3									
000015/17 RCP Malfunctions / 4						X	2.1.19 –Conduct of Ops – Ability to use plant computers to evaluate system or component status.	3.9	4
000022 Loss of Rx Coolant Makeup / 2									
000025 Loss of RHR System / 4			X				AK3.02 - Isolation of RHR low-pressure piping prior to pressure increase above specified level	3.3	5
000026 Loss of Component Cooling Water / 8				X			AA1.05 - The CCWS surge tank, including level control and level alarms, and radiation alarm	3.1	6
000027 Pressurizer Pressure Control System Malfunction / 3	X						AK1.01 - Definition of saturation temperature	3.1	7
000029 ATWS / 1					X		EA2.07 - Reactor trip breaker indicating lights	4.2	8
000038 Steam Gen. Tube Rupture / 3									
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4		X					EK2.1 - Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.4	9
000054 (CE/E06) Loss of Main Feedwater / 4					X		AA2.04 - Proper operation of AFW pumps and regulating valves	4.2	10
000055 Station Blackout / 6	X						EK1.01 - Effect of battery discharge rates on capacity	3.3	11
000056 Loss of Off-site Power / 6						X	2.4.45 - Ability to prioritize and interpret the significance of each annunciator or alarm.	4.1	12
000057 Loss of Vital AC Inst. Bus / 6				X			AA1.05 - Backup instrument indications	3.2	13
000058 Loss of DC Power / 6			X				AK3.01 - Use of dc control power by D/Gs	3.4	14
000062 Loss of Nuclear Svc Water / 4						X	2.2.44 - Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions.	4.2	15
000065 Loss of Instrument Air / 8									
W/E04 LOCA Outside Containment / 3	X						EK1.3 - Annunciators and conditions indicating signals, and remedial actions associated with the (LOCA Outside Containment).	3.5	16
W/E11 Loss of Emergency Coolant Recirc. / 4		X					EK2.1 - Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.6	17
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									
000077 Generator Voltage and Electric Grid Disturbances / 6					X		AA2.09 - Operational status of emergency diesel generators	3.9	18
K/A Category Totals:	3	3	3	3	3	3	Group Point Total:		18

ES-401		PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO)						Form ES-401-2	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G *	K/A Topic(s)	IR	#
000001 Continuous Rod Withdrawal / 1									
000003 Dropped Control Rod / 1	X						AK1.01 - Reason for turbine following reactor on dropped rod event	3.2	19
000005 Inoperable/Stuck Control Rod / 1									
000024 Emergency Boration / 1				X			AA1.02 - Boric acid pump	3.7	20
000028 Pressurizer Level Malfunction / 2									
000032 Loss of Source Range NI / 7					X		AA2.04 - Satisfactory source-range / intermediate-range overlap	3.1	21
000033 Loss of Intermediate Range NI / 7				X			AA1.02 - Level trip bypass	3.0	22
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					X		AA2.16 - Vital equipment and control systems to be maintained and operated during a fire	3.3	24
000068 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5						X	2.3.11 - Ability to control radiation releases	3.8	25
000074 (W/E06&E07) Inad. Core Cooling / 4									
000076 High Reactor Coolant Activity / 9		X					AK2.01 – Process radiation monitors	2.6	23
W/E01 & E02 Rediagnosis & SI Termination / 3									
W/E13 Steam Generator Over-pressure / 4									
W/E15 Containment Flooding / 5									
W/E16 High Containment Radiation / 9									
BW/A01 Plant Runback / 1									
BW/A02&A03 Loss of NNI-X/Y / 7									
BW/A04 Turbine Trip / 4									
BW/A05 Emergency Diesel Actuation / 6									
BW/A07 Flooding / 8									
BW/E03 Inadequate Subcooling Margin / 4									
BW/E08; W/E03 LOCA Cooldown - Depress. / 4						X	2.1.25 - Ability to interpret reference materials, such as graphs, curves, tables, etc.	3.9	26
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4									
BW/E13&E14 EOP Rules and Enclosures									
CE/A11; W/E08 RCS Overcooling - PTS / 4		X					EK2.2 - Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility.	3.6	27
CE/A16 Excess RCS Leakage / 2									
CE/E09 Functional Recovery									
K/A Category Point Totals:	1	2	0	2	2	2	Group Point Total:		9

ES-401		PWR Examination Outline Plant Systems - Tier 2/Group 1 (RO)											Form ES-401-2	
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	K/A Topic(s)	IR	#
003 Reactor Coolant Pump					X							K5.02 - Effects of RCP coastdown on RCS parameters	2.8	28
004 Chemical and Volume Control					X							K5.20 - Reactivity effects of xenon, boration, and dilution A3.11 - Charging/letdown	3.6 3.6	29 30
005 Residual Heat Removal		X										K2.01 - RHR pumps	3.0	31
006 Emergency Core Cooling						X						K6.02 - Core flood tanks (accumulators)	3.4	32
007 Pressurizer Relief/Quench Tk	X											K1.01 - Containment system	2.9	33
008 Component Cooling Water								X				A2.04 - PRMS alarm	3.3	34
010 Pressurizer Pressure Control											X	2.1.23 - Ability to perform specific system and integrated plant procedures during all modes of plant operation.	4.3	35
012 Reactor Protection		X										K2.01 - RPS channels, components, and interconnections	3.3	36
013 Engineered Safety Features Actuation	X							X				K1.18 - Premature reset of ESF actuation A1.06 - RWST level	3.7 3.6	37 38
022 Containment Cooling											X	A4.02 - CCS pumps	3.2	39
025 Ice Condenser														
026 Containment Spray				X								K4.05 - Prevention of material from clogging nozzles during recirculation 2.2.12 - Knowledge of surveillance procedures.	2.8 3.7	42 40
039 Main and Reheat Steam							X					A1.06 - Main steam pressure	3.0	41
059 Main Feedwater			X									K3.03 - S/GS	3.5	43
061 Auxiliary/Emergency Feedwater		X				X						K2.01 - AFW system MOVs K6.02 - Pumps	3.2 2.6	44 45
062 AC Electrical Distribution	X						X					K1.03 - DC distribution A1.01 - Significance of D/G load limits	3.5 3.4	46 47
063 DC Electrical Distribution									X			A3.01 - Meters, annunciators, dials, recorders, and indicating lights	2.7	48
064 Emergency Diesel Generator				X								K4.11 - Automatic load sequencer: safeguards A4.07 - Transfer ED/G (with load) to grid	3.5 3.4	49 50
073 Process Radiation Monitoring											X	A4.03 - Check source for operability demonstration	3.1	51
076 Service Water								X				A2.01 - Loss of SWS	3.5	52
078 Instrument Air			X									K3.02 - Systems having pneumatic valves and controls A3.01 - Air pressure	3.4 3.1	53 54
103 Containment			X									K3.03 - Loss of containment integrity under refueling operations	3.7	55
K/A Category Point Totals:	3	3	3	2	2	2	3	2	3	3	2	Group Point Total:	28	

ES-401	PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO)											Form ES-401-2		
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 Control Rod Drive														
002 Reactor Coolant	X											K1.08 - ECCS	4.5	56
011 Pressurizer Level Control			X									K3.03 - PZR PCS	3.2	57
014 Rod Position Indication														
015 Nuclear Instrumentation														
016 Non-Nuclear Instrumentation									X			A3.01 - Automatic selection of NNIS inputs to control systems	2.9	58
017 In-Core Temperature Monitor							X					A1.01 - Core exit temperature	3.7	59
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling								X				A2.03 - Abnormal spent fuel pool water level or loss of water level	3.1	60
034 Fuel Handling Equipment						X						K6.02 - Radiation monitoring systems	2.6	61
035 Steam Generator											X	2.1.27 - Knowledge of system purpose and/or function.	3.9	62
041 Steam Dump/Turbine Bypass Control										X		A4.04 - Pressure mode	2.7	63
045 Main Turbine Generator					X							K5.23 - Relationship between rod control and RCS boron concentration during T/G load increases	2.7	64
055 Condenser Air Removal														
056 Condensate														
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring														
075 Circulating Water														
079 Station Air														
086 Fire Protection				X								K4.03 - Detection and location of fires	3.1	65
K/A Category Point Totals:	1	0	1	1	1	1	1	1	1	1	1	Group Point Total:		10

Facility: Wolf Creek			Date of Exam: November 2015			
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.1	Knowledge of conduct of operations requirements.	3.8	66		
	2.1.32	Ability to explain and apply system limits and precautions.	3.8	67		
	2.1.37	Knowledge of procedures, guidelines, or limitations associated with reactivity management.	4.3	68		
	Subtotal			3		
2. Equipment Control	2.2.38	Knowledge of conditions and limitations in the facility license.	3.6	69		
	2.2.43	Knowledge of the process used to track inoperable alarms.	3.0	70		
	Subtotal			2		
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions.	3.2	71		
	2.3.14	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.	3.4	72		
	Subtotal			2		
4. Emergency Procedures / Plan	2.4.5	Knowledge of the organization of the operating procedures network for normal, abnormal, and emergency evolutions.	3.7	73		
	2.4.9	Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies.	3.8	74		
	2.4.39	Knowledge of RO responsibilities in emergency plan implementation.	3.9	75		
	Subtotal			3		
Tier 3 Point Total				10		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/2	076 AK 2.01	Difficulty is writing plausible distractors without giving to much information in the stem so the question becomes too simple to answer. 036 AK 1.03 rejected. See write up.
2/1	008 A2.04	Loss of air to these valves causes little affect to the plant. 008 A 2.05 rejected. See write up.
2/1	005 K 2.03	Instrument Air is not represented on our plant computer with enough detail to determine any system status without giving up to much information which makes the question to simple. 078 2.1.19 rejected. See write up.
1/1	015 2.1.19	KA combination not allowed by NUREG 1021

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

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- G* Generic K/As

ES-401		PWR Examination Outline						Form ES-401-2	
		Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO)							
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									
000011 Large Break LOCA / 3					X		EA2.13 - Difference between overcooling and LOCA indications	3.7	76
000015/17 RCP Malfunctions / 4									
000022 Loss of Rx Coolant Makeup / 2									
000025 Loss of RHR System / 4						X	2.1.23 - Ability to perform specific system and integrated plant procedures during all modes of plant operation.	4.4	77
000026 Loss of Component Cooling Water / 8									
000027 Pressurizer Pressure Control System Malfunction / 3									
000029 ATWS / 1									
000038 Steam Gen. Tube Rupture / 3						X	2.2.22 - Knowledge of limiting conditions for operations and safety limits.	4.7	78
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						X	2.4.4 - Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures.	4.7	79
000058 Loss of DC Power / 6									
000062 Loss of Nuclear Svc Water / 4									
000065 Loss of Instrument Air / 8					X		AA2.08 - Failure modes of air-operated equipment	3.3	80
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					X		AA2.07 - Operational status of engineered safety features	4.0	81
K/A Category Totals:					3	3	Group Point Total:		6

ES-401		PWR Examination Outline						Form ES-401-2	
Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO)									
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G*	K/A Topic(s)	IR	#
000001 Continuous Rod Withdrawal / 1									
000003 Dropped Control Rod / 1									
000005 Inoperable/Stuck Control Rod / 1									
000024 Emergency Boration / 1									
000028 Pressurizer Level Malfunction / 2									
000032 Loss of Source Range NI / 7						X	AA2.02 - Expected change in source range count rate when rods are moved	3.9	82
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									
000068 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5						X	AA2.02 - Verification of automatic and manual means of restoring integrity	4.4	83
000074 (W/E06&E07) Inad. Core Cooling / 4									
000076 High Reactor Coolant Activity / 9									
W/E01 & E02 Rediagnosis & SI Termination / 3						X	2.1.20 – Ability to interpret and execute procedure steps.	4.6	84
W/E13 Steam Generator Over-pressure / 4									
W/E15 Containment Flooding / 5						X	2.1.31 – Ability to locate control room switches controls and indications and to determine that they correctly reflect the desired plant lineup.	4.3	85
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	Group Point Total:		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											X	2.2.25 - Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.	4.2	86
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water														
010 Pressurizer Pressure Control														
012 Reactor Protection														
013 Engineered Safety Features Actuation											X	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.	4.1	87
022 Containment Cooling														
025 Ice Condenser														
026 Containment Spray								X				A2.07 - Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit	3.9	88
039 Main and Reheat Steam														
059 Main Feedwater								X				A2.05 - Rupture in MFW suction or discharge line	3.4	89
061 Auxiliary/Emergency Feedwater														
062 AC Electrical Distribution														
063 DC Electrical Distribution														
064 Emergency Diesel Generator								X				A2.09 - Synchronization of the ED/G with other electric power supplies	3.3	90
073 Process Radiation Monitoring														
076 Service Water														
078 Instrument Air														
103 Containment														
K/A Category Point Totals:								3			2	Group Point Total:		5

ES-401		PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)											Form ES-401-2	
System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G*	K/A Topic(s)	IR	#
001 Control Rod Drive														
002 Reactor Coolant														
011 Pressurizer Level Control														
014 Rod Position Indication								X				A2.02 – Loss of power to RPIS	3.6	91
015 Nuclear Instrumentation														
016 Non-Nuclear Instrumentation														
017 In-Core Temperature Monitor														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling														
034 Fuel Handling Equipment							X					A1.02 Ability to predict and or monitor changes in parameters to prevent exceeding design limits associated with operating the fuel handling system controls including – water level in the refueling canal.	3.7	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														
079 Station Air														
086 Fire Protection								X				A2.04 – Failure to actuate the FPS when required, resulting in fire damage.	3.9	92
K/A Category Point Totals:							1	2				Group Point Total:		3

Facility: Wolf Creek		Date of Exam: November 2015				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.	2.1.2 – Knowledge of Operator responsibilities during all modes of plant operation.			4.4	94
	2.1.	2.1.41 - Knowledge of the refueling process.			3.7	95
	2.1.					
	2.1.					
	2.1.					
	Subtotal					2
2. Equipment Control	2.2.	2.2.7 - Knowledge of the process for conducting special or infrequent tests.			3.6	96
	2.2.	2.2.17 - Knowledge of the process for managing maintenance activities during power operations, such as risk assessments, work prioritization, and coordination with the transmission system operator.			3.8	97
	2.2.					
	2.2.					
	2.2.					
	Subtotal					2
3. Radiation Control	2.3.	2.3.14 - Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.			3.8	98
	2.3.					
	2.3.					
	Subtotal					1
4. Emergency Procedures / Plan	2.4.	2.4.8 - Knowledge of how abnormal operating procedures are used in conjunction with EOPs.			4.5	99
	2.4.	2.4.37- Knowledge of the lines of authority during implementation of the emergency plan.			4.1	100
	2.4.					
	2.4.					
	2.4.					
	Subtotal					2
Tier 3 Point Total				10		7

Facility: **Wolf Creek**Date of Exam: **November 2015**

Tier / Group	Randomly Selected K/A	Reason for Rejection
Tier 3	2.1.23	Not SRO only topic at Wolf Creek. 2.1.15 rejected. See write-up.
2/2	014 A 2.02	Wolf Creek has no post-accident instrumentation for Spent Fuel Pool Cooling. See write-up
1/2	033 AA 2.10	Overlap with the RO exam. 032 AA 2.04 rejected. See write up.
3	2.1.2	Overlap with different question.
3	2.4.37	Can't write a question for this in the SRO area. 2.4.23 rejected. See write up.

KA Rejection List Justification:

1. **RO Tier 1 Group 2**

Original KA: 036 Fuel handling accident / 8, AK 1.03 – Knowledge of the operational implications of the following concepts as they apply to fuel handling incidents - Indications of approaching criticality (IR 4.0/4.3)

Justification for Rejection: After spending many hours on this K/A, it has been determined that identifying plausible distractors is very difficult. Wolf Creek has criticality monitors for the Spent Fuel Pool and SR NIs for the vessel. If it is stated that indications are rising so what could be the cause, then identifying plausible distractors becomes very difficult. Recommend rejecting this KA and resampling per the resampling criteria. SEB 3/24/15

Replacement Methodology: Since there are 12 *evolutions* (or *systems* for Tier 2) for this Tier/Group that have not been sampled, and the random number selected was 5, 076 High Reactor Coolant Activity / 9, was chosen. With only 5 K's and A's, and the random number selected was 2, AK2 was chosen. Since there is only one K/A with an Importance Rating over 2.5, AK 2.01 was chosen.

2. **RO Tier 2 Group 1**

Original KA: 008 Component Cooling Water / 8, A 2.05 - Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations - Effect of loss of instrument and control air on the position of the CCW valves that are air operated. (IR 3.3/3.5)

Justification for Rejection: This K/A has little impact to the plant. There are only three total air operated valves in the CCW system. One on the CCW heat exchanger that regulate temperature that fail closed to provide full cooling. The CCW system has no low temperature alarms. The other is on the Letdown Heat exchanger to control letdown temperature. There are no low letdown temperature alarms either. This valve fails open to allow for full cooling of the letdown water. Since the Off Normal procedure for CCW malfunctions only deals with pumps running, overall system flow, leak, and head tank level, there are no items to write a question over which have procedural guidance. Recommend rejecting this KA and resampling per the resampling criteria. SEB 3/16/15.

Replacement KA: 008 Component Cooling Water / 8, A2.04
Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: PRMS alarm (IR 3.3/3.5)

3. RO Tier 2 Group 1

Original KA: 078 Instrument Air, 2.1.19 – Conduct of ops – Ability to use plant computers to evaluate system or component status.

Justification for Rejection: This K/A asks to monitor IA with the plant computer. Our plant computer has very limited inputs from IA and if that is the only source of information looked at diagnosing status of IA would be very difficult. Alarms are about all we have and if I give the alarm for an air compressor trip it makes the question very low cognitive level. Recommend resampling for this tier and group. SEB 3/27/15

Replacement KA: 078 Instrument Air , A3.01 – Ability to monitor automatic operation of the IAS including: Air pressure.

4. SRO Tier 3

Original KA: G 2.1.15 – Knowledge of administrative requirements for temporary management directives, such as standing orders, night orders, operations memos, etc.

Justification for Rejection: This KA applies to both SRO and ROs at Wolf Creek and the procedure for this is very generic in nature to allow for variations in what is needed. An SRO only question here is not practical. Recommend resampling.

Replacement KA: 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. The replacement KA was chosen using the resampling criteria for same Tier and Topic.

5. SRO Tier 2 Group 2

Original KA: 033 2.4.3 Spent Fuel Pool Cooling – Identify post-accident instrumentation.

Justification for rejection: This does not apply to Wolf Creek. There is no post-accident instrumentation for fuel pool cooling.

Replacement KA: 014 A 2.02 – Rod position indication – Ability to predict the impacts of the following malfunctions or operations on the RPIS and based on those on those predications use procedures to correct control or mitigate the consequences of those malfunctions or operations – loss of power to the RPIS

6. RO Tier 1 Group 1

Original KA: 015 2.1.45 – RCP malfunctions – Ability to identify and interpret diverse indication to validate the response of another indication.

Justification for rejection: This KA combination is not allowed by NUREG 1021

Replacement KA: 015 2.1.19 – RCP malfunctions – Ability to use plant computers to evaluate system or component status.

7. SRO Tier 1 Group 2

Original KA: 032 AA 2.04 – Satisfactory SR/IR overlap.

Justification for rejection: Overlap with the RO test

Replacement KA: 033 AA 2.10 – TS limits if both IR channels have failed

8. SRO Tier 3

Original KA: 2.4.23 – Knowledge of the bases for prioritizing emergency procedure implementation during emergency operations.

Justification for rejection: Can't write a SRO Level question from this topic.

Replacement KA: 2.4.37 – Knowledge of the lines of authority during implementation of the emergency plan.

9. SRO Tier 3

Original KA: 2.1.32 – Ability to explain and apply system limits and precautions.

Justification for rejection: Overlap with the RO test.

Replacement KA: 2.1.2 – Knowledge of Operator responsibilities during all modes of plant operation.

Facility: WCNOC		Date of Examination: <u>Nov 16, 2015</u>
Exam Level: RO <input checked="" type="checkbox"/> SRO <input type="checkbox"/>		Operating Test No.: <u>2015</u>
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
<p>Conduct of Operations</p> <p>A1 - Determine the actions required for a specific level of S/G Tube Leakage</p>	R,N	<p>Given the indications of a steam generator tube leak, the data for GE RE-92, and the Setpoint Adjustment And Conversion Graphs From Theoretical Monitor Response form, the Applicant will determine that a prompt and controlled plant shutdown to less than or equal to 50% power within 1 hour is required. Additional actions are to be in Mode 3 within the next 2 hours (total of 3 hours), and that a Plant cooldown to Mode 5 is required per OFN BB-07A, Steam Generator Tube Leakage.</p> <p>2.1.7 Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.</p> <p>Imp Rating: 4.4/4.7</p>
<p>Conduct of Operations</p> <p>A2 - EMG ES-04, Attachment A, Determination Of RCS Boron Concentration Based On Total Mass</p>	R,N	<p>The Applicant will use the supplied chemistry sample results to perform the calculations for EMG ES-04, Attachment A, Determination Of RCS Boron Concentration Based On Total Mass.</p> <p>2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc</p> <p>Imp Rating: 3.9</p>
<p>Equipment Control</p> <p>A3 – Perform surveillance test for AFD</p>	R, M	<p>The Applicant will perform STS SF-002, Core Axial Flux Difference, and determined that the AFD is out of limits.</p> <p>2.2.42 - Ability to recognize system parameters that are entry level conditions for T.S.</p> <p>Imp Rating 3.9</p>
<p>Radiation Control</p> <p>A4 - Determine maximum authorized emergency stay times for an individual</p>	R,N	<p>The Applicant will determine and the maximum authorized emergency stay times for two individuals associated with isolating the ARV.</p> <p>2.3.4 Knowledge of radiation exposure limits under normal or emergency conditions.</p> <p>Imp Rating: 3.2/3.7</p>

Facility: WCNOC		Date of Examination: <u>Nov 16, 2015</u>	
Exam Level: RO <input checked="" type="checkbox"/> SRO <input type="checkbox"/>		Operating Test No.: <u>2015</u>	
Administrative Topic (see Note)	Type Code*	Describe activity to be performed	
Emergency Plan		Not Used.	
NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).			
* Type Codes & Criteria: <ul style="list-style-type: none"> (C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes) (N)ew or (M)odified from bank (≥ 1) (P)revious 2 exams (≤ 1; randomly selected) 			

Facility: WCNOC		Date of Examination: <u>Nov 16, 2015</u>
Exam Level: RO <input type="checkbox"/> SRO <input checked="" type="checkbox"/>		Operating Test No.: <u>2015</u>
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations A5 - Determine the actions required for a specific level of S/G Tube Leakage.	(R), (N)	Given the indications of a steam generator tube leak, the data for GE RE-92, and the Setpoint Adjustment And Conversion Graphs From Theoretical Monitor Response form, the Applicant determines that a prompt and controlled plant shutdown to less than or equal to 50% power within 1 hour is required. Additional actions are to be in Mode 3 within the next 2 hours (total of 3 hours), and that a Plant cooldown to Mode 5 is required per OFN BB-07A, Steam Generator Tube Leakage. Applicant determines T.S. 3.4.13, Condition B, Primary to Secondary leakage is not within limit. This is a Mode 3 in 6 hours and Mode 5 in 36 hours spec. 2.1.7 Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation. Imp Rating: 4.4/4.7
Conduct of Operations A6 - EMG ES-04, Attachment A, Determination Of RCS Boron Concentration Based On Total Mass.	(R), (N)	The Applicant will review the Reactor Operator's calculations for EMG ES-04, Attachment A, Determination Of RCS Boron Concentration Based On Total Mass, and determine that there are errors. The Applicant will correct the errors and determine that the RCS boron concentration is less than the required Xenon free cold shutdown concentration. 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. Imp Rating: 4.2

Facility: WCNOC		Date of Examination: <u>Nov 16, 2015</u>
Exam Level: RO <input type="checkbox"/> SRO <input checked="" type="checkbox"/>		Operating Test No.: <u>2015</u>
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Equipment Control A7 - Determine the Operability of BG HV-8110 and CCP A.	(R), (M)	The Applicant will review STN BG-202 and determine the operability of the BG HV-8110 and CCP A. The Applicant will determine that BG HV-8110 is INOPERABLE. Per T.S. 3.5.2 Bases, CCP A will INOPERABLE and one boration subsystem is NONFUNCTIONAL per TRM 3.1.9 condition A 2.2.37 Ability to determine operability and/or availability of safety related equipment. Imp Rating: 4.6
Radiation Control A8 – Review a release permit for approval	(R), (D)	The Applicant will review a release permit and determine that it contains three errors 2.3.6 Ability to approve release permits Imp Rating: 3.8
Emergency Plan A9 - Make a Protective Action Recommendation.	(R), (N)	The Applicant will make a “PAR Only” Emergency Notification that is accurate and within the 15 minute requirement. 2.4.44 Knowledge of emergency plan protective action recommendations. Imp Rating: 4.4
NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).		
* Type Codes & Criteria: <ul style="list-style-type: none"> (C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes) (N)ew or (M)odified from bank (≥ 1) (P)revious 2 exams (≤ 1; randomly selected) 		

Facility: WCNOG	Date of Examination: Nov 16, 2015	
Exam Level: RO <input checked="" type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/>	Operating Test No.: 2015	
Control Room Systems:* 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U		
System / JPM Title	Type Code*	Safety Function
S1. CVCS/Transfer from the NCP to a CCP. 004 A2.22, IR: 3.2/3.1	(A), (D), (S)	1
S2. CCW/Respond to the loss of CCW flow to the Service Loop. APE 026 AK3.03 IR: 4.0/4.2	(A), (M), (S)	8
S3. ECCS/Isolation of BIT IAW EMG ES-03. E02 EA1.1 IR: 4.0/3.9	(L), (N), (S)	3
S4. Steam Dump System/Respond to failed open steam dumps. 041 A4.08 IR 3.0/3.1	(A), (L), (D), (S)	4S
S5. Class IE 4160V buses/EMG C-0 loss of all AC restore power to safeguards bus using OFN NB-30 EPE 055 EA1.07 IR: 4.3/4.5	(A), (N), (S)	6
S6. Place hydrogen analyzers in service using EMG ES-11, post LOCA cooldown and depressurization 028 A4.03 IR: 3.1/3.3	(N), (S)	5
S7. Mitigate the failure of CSAS and CISB to auto initiate using EMG FR-Z1 013 A4.01 IR: 4.5/4.8	(A), (N), (EN), (S)	2
S8. Process Radiation Monitoring System/Change GE RE-92 setpoints on RM-11R for S/G tube leak. APE 037 AA1.04 IR: 3.6/3.9	(M), (S)	7
In-Plant Systems* (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
P1. Establishing Alternate Boration Flow path starting at Step A7 of OFN BG-009, EMERGENCY BORATION. APE 024 AA1.20 IR: 3.2/3.3	(A), (E), (L), (M), (R)	2
P2. RCPs/Perform the Turbine Bldg Operators actions of OFN RP-017 to trip the RCPs and remove control power to the breakers. APE 068 AK3.18 IR: 4.2/4.5	(E), (L), (M)	4P

Facility: WCNOC		Date of Examination: <u>Nov 16, 2015</u>
Exam Level: RO <input checked="" type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/>		Operating Test No.: <u>2015</u>
Control Room Systems: * 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U		
System / JPM Title	Type Code*	Safety Function
P3. 120VAC Class IE Instrument Buses/Energize Bus NN01(02) from NN15(16). APE 057 AA1.01 IR: 3.7/3.7	(E), (N)	6
* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all five SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.		
* Type Codes	Criteria for RO / SRO-I / SRO-U	
(A)lternate path (C)ontrol room (D)irect from bank (E)mergency or abnormal in-plant (EN)gineered safety feature (L)ow-Power / Shutdown (N)ew or (M)odified from bank including 1(A) (P)revious 2 exams (R)CA (S)imulator	4-6 / 4-6 / 2-3 ≤ 9 / ≤ 8 / ≤ 4 ≥ 1 / ≥ 1 / ≥ 1 ≥ 1 / ≥ 1 / ≥ 1 (control room system) ≥ 1 / ≥ 1 / ≥ 1 ≥ 2 / ≥ 2 / ≥ 1 ≤ 3 / ≤ 3 / ≤ 2 (randomly selected) ≥ 1 / ≥ 1 / ≥ 1	

Facility: WCNOC	Date of Examination: Nov 16, 2015	
Exam Level: RO <input type="checkbox"/> SRO-I <input checked="" type="checkbox"/> SRO-U <input type="checkbox"/>	Operating Test No.: 2015	
Control Room Systems:* 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U		
System / JPM Title	Type Code*	Safety Function
S1. CVCS/Transfer from the NCP to a CCP. 004 A2.22, IR: 3.2/3.1	(A), (D), (S)	1
S2. CCW/Respond to the loss of CCW flow to the Service Loop. APE026AK3.03 IR: 4.0/4.2	(A), (M), (S)	8
S3. RO Only.		
S4. Steam Dump System/Respond to failed open steam dumps. 041 A4.08 IR 3.0/3.1	(A), (L), (D), (S)	4S
S5. Class IE 4160V buses/EMG C-0 loss of all AC restore power to safeguards bus using OFN NB-30 EPE055 EA2.03 IR: 3.9/4.7	(A), (N), (S)	6
S6. Place hydrogen analyzers in service using EMG ES-11, post LOCA cooldown and depressurization 027A4.01 IR: 3.3/3.3	(N), (S)	5
S7. Mitigate the failure of CSAS and CISB to auto initiate using EMG FR-Z1 013 A3.02 IR: 4.1/4.2	(A), (N), (EN), (S)	2
S8. Process Radiation Monitoring System/Change GE RE-92 setpoints on RM-11R for S/G tube leak. APE 037 AA1.04 IR: 3.6/3.9	(M), (S)	7
In-Plant Systems* (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
P1. Establishing Alternate Boration Flow path using OFN BG-009, EMERGENCY BORATION. 024 AA1.20 IR: 3.2/3.3	(A), (E), (L), (M), (R)	2
P2. RCPs/Perform the Turbine Bldg Operators actions of OFN RP-017 to trip the RCPs and remove control power to the breakers. 003 G 2.1.23 IR: 4.3/4.4	(E), (L), (M)	4P

Facility: WCNOC		Date of Examination: <u>Nov 16, 2015</u>
Exam Level: RO <input type="checkbox"/>	SRO-I <input checked="" type="checkbox"/>	SRO-U <input type="checkbox"/> Operating Test No.: <u>2015</u>
Control Room Systems: * 8 for RO; 7 for SRO-I; 2 or 3 for SRO-U		
System / JPM Title	Type Code*	Safety Function
P3. 120VAC Class IE Instrument Buses/Energize Bus NN01(02) from NN15(16). APE057 AA1.01 IR: 3.7/3.7	(E), (N)	6
* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all five SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.		
* Type Codes	Criteria for RO / SRO-I / SRO-U	
(A)lternate path (C)ontrol room (D)irect from bank (E)mergency or abnormal in-plant (EN)gineered safety feature (L)ow-Power / Shutdown (N)ew or (M)odified from bank including 1(A) (P)revious 2 exams (R)CA (S)imulator	4-6 / 4-6 / 2-3 ≤ 9 / ≤ 8 / ≤ 4 ≥ 1 / ≥ 1 / ≥ 1 ≥ 1 / ≥ 1 / ≥ 1 (control room system) ≥ 1 / ≥ 1 / ≥ 1 ≥ 2 / ≥ 2 / ≥ 1 ≤ 3 / ≤ 3 / ≤ 2 (randomly selected) ≥ 1 / ≥ 1 / ≥ 1	

Facility: Wolf Creek Scenario No.: 1 (New) Op-Test No.: Nov 2015

Examiners: _____ Operators: _____

Initial Conditions: 100% power, MOL.

IC 301 (IC 30 w/ scenario file and setup included)

Turnover:

No equipment is out of service.

Event No.	Malf. No.	Event Type*	Event Description
1.		C (ATC SRO)	NCP flow control valve failure low (BG FK-462)
2.		I (BOP SRO)	Main feedwater header pressure detector (AE PI-508) failure high.
3.		I (ATC SRO) TS (SRO)	PZR level channel (BB LI-459) fails high over 30 seconds.
4.		C (ATC) TS (SRO) N (BOP SRO)	Dropped rod.
5.		M (ALL)	Rod ejection resulting in a LOCA.
6.		C (BOP)	Turbine fails to trip in auto, and one MSIV fails to close in auto (Note: With the turbine failing to auto trip AND one MSIV failing to auto close the component failure for the BOP will be mitigated by either manually tripping the turbine or manually closing the one open MSIV to prevent uncontrolled RCS cooldown)
7.		C (ALL)	NB01 bus faults and locks out. (drives CT 1 for both the loss of feed and for only one train of safety related equipment available)

Event No.	Malf. No.	Event Type*	Event Description
8.		C (ALL)	<p>B train CCP fails to auto start (manual start available) on the SI following the small break LOCA.</p> <p>CT 1: Establish flow from at least one Charging pump by the completion of EMG E-0, Attachment F. (B CCW pump trips on reactor trip with an auto start of the D CCW pump, this is to check if the crew ensures a CCW pump is running in the same train as the CCP that will be started.)</p>
9.		C (ALL)	<p>Turbine-driven Auxiliary Feedwater Pump (TDAFWP) fails to start due to broken trip throttle valve. MDAFW Pump B shaft shears.</p> <p>CT 2: Establish AUX feed flow (from the NSAFP) to at least ONE intact S/G at a flow rate great enough that core exit temperatures are stable or decreasing AND level in at least ONE S/G is increasing, prior to bleed and feed criteria being met (3 of 4 Wide Range level less than 12% [28% w/ adverse containment conditions]).</p>
* (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)	4 (events 6,7,8,9)
2. Abnormal events (2-4)	4 (events 1,2,3,4)
3. Major transients (1-2)	1 (event 5)
4. EOPs entered/requiring substantive actions (1-2)	1 (EMG E-1)
5. EOP contingencies requiring substantive actions (0-2)	1 (EMG FR-H1)
6. EOP based Critical tasks (2-3)	2 (events 8,9)

Critical Task	Justification	References
<p>CT 1: Establish flow from at least one Charging pump by the completion of EMG E-0, Attachment F.</p> <p>(note: with a CCP in an ECCS line up, meaning after an SI actuation signal, there is no control of flow since all the flow is directed to the BIT header and flow rate is determined by RCS pressure)</p>	<p>The acceptable results obtained in the FSAR analysis of a small-break LOCA are predicated on the assumption of minimum ECCS pumped injection. 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.</p>	<p>BD EMG E-0, REACTOR TRIP OR SAFETY INJECTION, Rev 26a, step F5</p>
<p>CT 2: Establish AUX feed flow (from the NSAFP) to at least ONE intact S/G at a flow rate great enough that core exit temperatures are stable or decreasing AND level in at least ONE S/G is increasing, prior to bleed and feed criteria being met (3 of 4 Wide Range level less than 12% [28% w/ adverse containment conditions]).</p>	<p>SAFETY SIGNIFICANCE -- Failure to establish feedwater flow to any SG results in the crew having to rely upon the lower-priority action of establishing RCS bleed and feed to minimize core uncover. This constitutes incorrect performance that fails to prevent "degradation of any barrier to fission product release."</p>	<p>BD EMG FR-H1, RESPONSE TO LOSS OF SECONDARY HEAT SINK, Rev 15, step 8 and 17</p>

SCENARIO # 1 NARRATIVE

Turnover: Scenario starts out at 100% power MOL. No equipment is out of service.

Event 1: NCP flow control valve fails low (BG FK-462). The failure will cause the running charging pump (NCP) to lower flow. If the ATC does not take action when lowering flow is first noted then annunciator 41A, SEAL INJ TO RCP FLOW LO, and 42A, CHG LINE FLOW HILO alarm. The ATC will place BG FK-462 in manual and restore charging flow to normal. The SRO enters and directs 42A.

Event 2: Main feedwater header pressure detector AE PI-508 failure high. The failure causes the MFP speed to slow. The BOP will take manual control of MFP Turbine Master Speed Controller, FC SK-509A, and restore feed pump speed to normal value and recognize that AE PI-508 has failed high. SRO enters and directs OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment B, STEAM OR FEEDWATER HEADER PRESSURE CHANNEL MALFUNCTION. Annunciators 108B through 111B may alarm if the BOP does not recognize AE PI-508 failing in a timely manner.

Event 3: PZR level channel BB LI-459 fails hi over 30 seconds. This will cause multiple alarms and PZR indicated level to rise. The crew diagnoses and identifies the level channel failure and the SRO enters and directs OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment J, PZR LEVEL CHANNEL MALFUNCTION. The SRO enters TS 3.3.1, REACTOR TRIP SYSTEM INSTRUMENTATION, Table 3.3.1-1, Function 9 Cond A – Immediately, and Cond M – 72 hrs.

Event 4: Dropped rod. Control rod H8 will suffer a stationary gripper failure and fall into the core. The SRO enters and directs OFN SF-011, REALIGNMENT OF DROPPED RODS AND ROD CONTROL MALFUNCTIONS. Pressure transient from the dropped rod results in the SRO entering T.S. 3.4.1 RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits, Condition A. The ATC and BOP coordinate actions to stop rod motion, reduce turbine load per GEN 00-004, Attachment F, and prepare to recover the dropped rod. The SRO enters T.S. 3.1.4¹, Rod Group Alignment Limits Cond B – 1 hr. QPTR and AFD will be monitored to determine if the T.S. limit is exceeded.

Event 5: Rod ejection resulting in a LOCA. The crew should diagnose the rod ejection through DRPI indications and the RCS leak indications. The SRO should direct reactor trip and manual initiation of safety injection, which will automatically occur if no actions are taken. The SRO enters and directs EMG E-0, REACTOR TRIP OR SAFETY INJECTION.

Event 6: Turbine fails to trip in auto, and one MSIV fails to close in auto. The BOP is expected to recognize that the turbine failed to trip in automatic and manually trip the turbine as his immediate action. This action will be directed by EMG E-0, REACTOR TRIP OR SAFETY INJECTION, step 2 RNO.

(Note: With the turbine failing to auto trip AND one MSIV failing to auto close the component failure for the BOP will be mitigated by either manually tripping the turbine or manually closing the one open MSIV to prevent uncontrolled RCS cooldown.)

Event 7: NB01 bus faults and locks out. The NB01 bus will lockout when the safety injection signal is actuated. NE01 output breaker, NE HIS-25, will not close when the EDG is up to speed and voltage as normal. The ATC should recognize that EDG NE01 is running and report the condition to the SRO. If the crew does not recognize that the EDG is running, it will trip on high jacket water temperature. The bus fault causes a loss of all 'A' train safety related equipment.

(NOTE: Per OFN NB-030, LOSS OF AC EMERGENCY BUS NB01 (NB02), Foldout Page Item 2, IDLE EMERGENCY DIESEL CRITERIA, IF an Emergency Diesel is running unloaded and cooling water can not be established within 30 minutes, THEN stop affected Emergency Diesel. If the crew does not stop the EDG before it trips on high jacket water temperature, then a comment on their performance should be documented.)

¹ Incorrectly included Condition A in the As-Given exam.

Event 8: The B train CCP fails to auto start from the SIS (manual start available).

CT 1: Establish flow from at least one Charging pump by the completion of EMG E-0, Attachment F.

(NOTE: B CCW pump trips on reactor trip with an auto start of the D CCW pump, this is to check if the crew ensures a CCW pump is running in the same train as the CCP that will be started)

Event 9: Following the reactor trip the TDAFWP fails to start due to broke trip throttle valve and B MDAFW pump shaft shears. During the performance of EMG E-0, REACTOR TRIP OR SAFETY INJECTION, the crew will diagnosis a loss of all AFW due to the 'B' MDAFWP shaft shear, loss of NB01 (loss of 'A' MDAFWP), and the failure of the TDAFWP to start due to the broken trip throttle valve. The crew will complete the required actions of E-0 and then transition to EMG FR-H1, RESPONSE TO LOSS OF SECONDARY HEAT SINK. Subsequent actions start the Non-Safety Aux Feed Pump (NSAFP).

CT 2: Establish AUX feed flow (from the NSAFP) to at least ONE intact S/G at a flow rate great enough that core exit temperatures are stable or decreasing AND level in at least ONE S/G is increasing, prior to bleed and feed criteria being met (3 of 4 Wide Range level less than 12% [28% w/ adverse containment conditions].

Crew transitions from EMG FR-H1 to E-0 then to EMG E-1, LOSS OF REACTOR OR SECONDARY COOLANT. The crew will continue in E-1 until SI is reset after which the scenario can be terminated.

Procedures entered:

- ALR 00-042A, CHG LINE FLOW HILO
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment B, STEAM OR FEEDWATER HEADER PRESSURE CHANNEL MALFUNCTION
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment J, PZR LEVEL CHANNEL MALFUNCTION
- OFN SF-011, REALIGNMENT OF DROPPED RODS AND ROD CONTROL MALFUNCTIONS
- EMG E-0, REACTOR TRIP OR SAFETY INJECTION
- EMG E-1, LOSS OF REACTOR OR SECONDARY COOLANT
- EMG FR-H1, RESPONSE TO LOSS OF SECONDARY HEAT SINK
 - SYS AP-122, NON SAFETY AUX FEED PUMP OPERATION

Scenario file:

```
;ILO Scenario 1, Rev 4
;Turbine fails to trip in auto
IMF mAC02B i:-1 f:-1
;MDAFW Pump B shaft shear
ICM mtrDPAL01B t:1 d:0
;TDAFW Pump fails - broken trip throttle valve
ICM movFCHV0312 t:2 d:0
;NB01 faults on SIS.
{jpplsi} IMF mNB03
;MSIVs fail to close in auto
IMF mSA27AB07 i:-1 f:-1
;NCP trip on reactor trip
{jpplp4} ICM bkrPB00301 t:1 d:0
;B CCP fails to start in auto
IMF mBG27B i:-1 f:-1
;Trip a B CCW on reactor trip
{jpplp4} ICM bkrDPEG01B t:1 d:0
;Key 1, Event 1: NCP flow control valve fails
closed in auto – ATC
IMF mBG25A f:-50 k:1
;Key 2, Event 2: Main feedwater header pressure
detector AE PI-508 fails high – BOP
ICM trAEPT0508 t:2 d:0 k:2
;Key 3, Event 3: PZR level channel 459 fails hi
over 30 seconds – ATC
IMF mBB22A f:100 r:30 k:3
;Key 4, Event 4: Control rod H8 stationary gripper
failure – ATC
IMF mSF04H8 f:1 k:4
;Key 5, Event 5, Major: Ejected rod during
recovery.
IMF mSF05H8 f:800 k:5
;Key 6: Shutdown NE01
{Key[6]} scn SimGroup\SHTDNDGA
;Key 7: Establish flow from Non-Safety Related
AFW Pump
{Key[7]} scn SimGroup\Start PAP01
;end file
```

Facility: Wolf Creek Scenario No.: 2 (New) Op-Test No.: Nov 2015

Examiners: _____ Operators: _____

Initial Conditions: Rx is at 5-7% Power, EOL, with no equipment OOS. 'A' MFP is running

IC-302 (IC-861 w/ scenario file and setup included), 103D and E on white board

Turnover:

Continue raising power to 8-10% Power.

Event No.	Malf. No.	Event Type*	Event Description
1.		R (ATC) N (BOP SRO)	Mode 1 with reactor power between 5 and 7% Power. Continue raising power to 8-10% Power.
2.		I (ATC SRO) TS (SRO)	Loop A Primary RTD (411C – T _{COLD}) fails high.
3.		I (BOP, SRO) TS (SRO)	'A' S/G level channel (AE LI-551) fails low.
4.		I (ATC, SRO) TS (SRO)	Power Range Channel (SE NI-43) failure upscale to 80% over 15 seconds.
5.		C (BOP SRO)	'B' S/G ARV fails open (manual control available).
6.		M (ALL)	'A' S/G fault inside CTMT. CT 1: Isolate feed flow into and steam flow from the faulted SG before ANY RCS Cold Leg temperatures reach 240°F or before transition to EMG C-21.
7.		I (ATC)	SIS fails to auto initiate. CT 2: Manually actuate SI (SB HS-27 & 28) after auto SI actuation criteria are met prior to transition out of EMG E-0.

* (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)	1 (event 7)
2. Abnormal events (2-4)	4 (event 2,3,4,5)
3. Major transients (1-2)	1 (event 6)
4. EOPs entered/requiring substantive actions (1-2)	2 (E-2, ES-03)
5. EOP contingencies requiring substantive actions (0-2)	0
6. EOP based Critical tasks (2-3)	2 (events 6,7)

Critical Task	Justification	References
CT 1: Isolate feed flow into and steam flow from the faulted SG before ANY RCS Cold Leg temperatures reach 240°F or before transition to EMG C-21.	Limit CTMT peak pressure which would challenge the containment barrier and excessive cooldown which would result in a PTS concern.	USAR 15.1.5 and 6.2.1.4. CSF F-04 INTEGRITY.
CT 2: Manually actuate SI (SB HS-27 & 28) after auto SI actuation criteria are met prior to transition out of EMG E-0, step 4.	Failure to do so will violate the facility license and make FSAR assumptions invalid for accident analysis.	USAR 15.1.5

SCENARIO # 2 NARRATIVE

Initial conditions: Rx is at 5.1% Power, EOL, with no equipment OOS.

Turnover: Continue with GEN 00-003, step 6.11.2.1, (p) WITHDRAW control rods in MANUAL, to establish Reactor Power stable between 5% and 10% while continuing with this procedure.

Event 1: The crew will continue to raise power towards 10% power using GEN 00-003, HOT STANDBY TO MINIMUM LOAD, step 6.11.2.

Event2: Loop A Primary RTD (411C – T_{COLD}) fails high. The crew will mitigate using OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment L, NARROW RANGE RTD MALFUNCTION. No immediate actions are required due to the low power level. SRO will direct the procedure. The ATC will select out the failed channel. The SRO enters T.S. 3.3.1, REACTOR TRIP SYSTEM INSTRUMENTATION, Table 3.3.1-1, Functions 6 and 7, Condition A – Immediately, Condition E – 72 hrs.

Event 3: 'A' S/G level channel (AE LI-551) fails low. The crew will mitigate using OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment F, S/G LEVEL CHANNEL MALFUNCTION. The BOP will initially take manual control of the MFW regulating bypass valve and control S/G level. Automatic control will be restored once an alternate control channel is selected. The SRO enters T.S. 3.3.1, REACTOR TRIP SYSTEM INSTRUMENTATION, Table 3.3.1-1, Function 14, Condition A – Immediately, Condition E – 72 hrs., and T.S. 3.3.2, ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION, Table 3.3.2-1, Functions 5.c And 6.d, Condition A – Immediately, Condition D – 72 hrs., and Condition I – 72 hrs.

Event 4: Power Range Channel (SE NI-43) failure upscale to 80% over 15 seconds. The ATC will check no runback in progress and then ensure rods are in manual (rods should be in manual due to power level). The crew will diagnose the failure and enter OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment R, POWER RANGE NEUTRON FLUX CHANNEL MALFUNCTION, and bypass the failed channel. The SRO enters T.S. 3.3.1, REACTOR TRIP SYSTEM INSTRUMENTATION, Table 3.3.1-1, Functions 2, 3, 6, 18.b, 18.c, 18.d, And 18.e, Condition A – Immediately, Condition D – 12 hrs., Condition E – 72 hrs., Condition S – 1 hr., and Condition T – 1 hr.

Event 5: 'B' S/G ARV fails open (manual control available). The BOP will either notice that the ARV is open and inform the SRO and close the valve in manual, or, if he does not see the open ARV will lower main turbine load to lower reactor power to less than 100%. The crew may enter OFN AB-041, STEAMLINE OR FEEDLINE LEAK, to mitigate the event. There will be no alarms for this event. The SRO determines that the ARV is operable per T.S. 3.7.4 bases, i.e., capable of fully opening and closing with no seat leakage.

Event 6: 'A' S/G Fault inside Containment and MSIVs fail to Auto close. The crew recognizes CTMT conditions changing, and power rising. Due to the rapid transient, the crew may not have opportunity to manually trip the reactor before automatic actuation occurs. The crew enters and performs EMG E-0, REACTOR TRIP OR SAFETY INJECTION. Following the completion of Immediate Action step 2, the BOP should recognize that Foldout Page Item # 3, Faulted S/G Isolation Criteria, applies and closes MSIVs, isolates feed flow to 'A' S/G, ensuring AFW flow is maintained to the unaffected S/Gs.

CT 1: Isolate feed flow into and steam flow from the faulted SG before ANY RCS Cold Leg temperatures reach 240°F or before transition to EMG C-21.

Event 7: SIS fails to auto initiate. The crew must recognize the requirement for SIS and manually initiate both trains. This should be performed by the ATC. The crew transitions to EMG E-2, FAULTED STEAM GENERATOR ISOLATION, for the mitigation of the faulted S/G.

CT 2: Manually actuate SI (SB HS-27 & 28) after auto SI actuation criteria are met prior to transition out of EMG E-0, step 4.

The crew completes EMG E-2 and transitions to EMG ES-03, SI TERMINATION. The scenario may be terminated by the chief examiner after the crew stops all but one CCP at step 5.

Procedures entered:

- ALR 00-066B, LOOP 1 Δ T LO DEV
- ALR 00-078A, PR CHANNEL DEV
- ALR 00-108A, SG A LEV HI/LO
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment F, S/G LEVEL CHANNEL MALFUNCTION
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment L, NARROW RANGE RTD MALFUNCTION
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment R, POWER RANGE NEUTRON FLUX CHANNEL MALFUNCTION
- OFN AB-041, STEAMLINE OR FEEDLINE LEAK
- EMG E-0, REACTOR TRIP OR SAFETY INJECTION
- EMG E-2, FAULTED STEAM GENERATOR ISOLATION
- EMG ES-03, SI TERMINATION

Scenario file:

;ILO Scenario 2 rev 1

;SIS fails to auto initiate

IMF mSA14A f:1

IMF mSA14B f:1

;MSIVs fail to auto close

IMF mSA24A f:1

IMF mSA24B f:1

;Key 2, Event 2: RTD fails low 411C - ATC

IMF mBB01E f:636 r:15 k:2

;Key 3, Event 3: AE LI-551 fails low - BOP

IMF mAE15A4 f:0 r:60 k:3

;Key 4, Event 4: power range N-43 fails hi to 80%

IMF mSE03C f:80 k:4

;Key 5, Event 5: B ARV fails open manual control available

IMF mAB07B f:100 r:30 k:5

;Key 6, Event 6: A SG fault inside ctmr

IMF mAB03A f:1.6e+007 r:60 k:6

;end file

Facility: Wolf Creek Scenario No.: 3 (New) Op-Test No.: Nov 2015

Examiners: _____ Operators: _____

Initial Conditions: 100% power, MOL. Service Water pump 'B' is tagged out for maintenance.

IC 303 (IC 30 w/ scenario file and setup included) **NOTE: Ensure the AMSAC TEST/BYPASS Panel**

Simulator Soft Panel is displayed behind the CR panels.

Turnover:

Maintain 100% power. Thunderstorm warning is in effect. T.R 3.7.8, Service Water System, Condition A, is in effect for the B service water pump maintenance.

Event No.	Malf. No.	Event Type*	Event Description
1.		C (ATC SRO) TR (SRO)	Service Water pump 'C' trips.
2.		C (BOP SRO)	Main feedwater regulating valve (AE FK-530) will fail in automatic to 15% open over a 2 minute period.
3.		I (ATC SRO) TS (SRO)	PZR pressure channel (BB PI-457) fails low.
4.		I (BOP SRO) TS (SRO)	HP Turbine 1 st stage pressure (AC PT-505) fails low causing rods to step in.
5.		R (ATC) N (BOP SRO)	Abnormal condenser vacuum requiring load decrease.
6.		M (ALL)	500 gpm SGTR in 'B' S/G. (Loss of off-site power when reactor is tripped; drives CT1 to start at least one EDG, MSIVs fail open and cannot be closed; drives EMG C-31, SGTR WITH LOSS OF REACTOR COOLANT – SUBCOOLED RECOVERY DESIRED procedure entry).
7.		C (ATC)	Both EDGs fail to auto start. CT 1: Manually start at least one EDG prior to transitioning to EMG C-0, LOSS OF ALL AC POWER, at EMG E-0, step 3 RNO.

Event No.	Malf. No.	Event Type*	Event Description
8.		C (BOP)	'B' MDAFW throttle valve (AL HK-9A) fails open. CT 2: Terminate AFW to the Ruptured B S/G within 18 min of safety injection initiation.
* (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 (events 7,8)
2. Abnormal events (2-4)	5 (events 1,2,3,4,5)
3. Major transients (1-2)	1 (event 6)
4. EOPs entered/requiring substantive actions (1-2)	1 (E-3)
5. EOP contingencies requiring substantive actions (0-2)	1 (C-31)
6. EOP based Critical tasks (2-3)	2 (events 7,8)

Critical Task	Justification	References
CT1: Manually start at least one EDG prior to transitioning to EMG C-0, LOSS OF ALL AC POWER, at EMG E-0, step 3 RNO.	Failure to energize an ac emergency bus constitutes mis-operation or incorrect crew performance in which the crew does not prevent "degraded ... emergency power capacity." Failure to perform the critical task also results in needless "degradation of any barrier to fission product release," specifically of the RCS barrier at the point of the RCP seals.	BD-EMG E-0, REACTOR TRIP OR SAFETY INJECTION, Rev 26A.
CT2: Terminate AFW to the Ruptured B S/G within 18 min of safety injection.	TCA USAR 15.6.3, NE 05-0037 (prevent overfill of the ruptured S/G).	AI 21-016, OPERATOR TIME CRITICAL ACTIONS VALIDATION, Rev 10.

SCENARIO # 3 NARRATIVE

Turnover: Scenario starts with the unit at 100% power. Service Water pump 'B' is tagged out for maintenance, not expected to return this shift. The crew is to maintain 100% power. A Thunderstorm warning is in effect. T.R 3.7.8, Service Water System, Condition A, has been entered due to the 'B' service water pump.

Event 1: Service Water pump 'C' trips. The Low Flow pump cannot increase service water pressure enough – PRA #3. The crew places both ESW trains in service IAW ALR 00-008B, SERV WTR PRESS HILO. SRO enters T.R 3.7.8, Service Water System, Conditions A, B for the loss of two Service Water pumps and C for NOT being capable of supplying both ESW trains from Service Water. Condition A was already in effect for Service Water pump 'B'.

Event 2: Main feedwater regulating valve (AE FK-530) will fail closed in automatic over a 2 minute period. The crew mitigates the event using ALR 00-110C, SG C FLOW MISMATCH. The BOP places AE FV-530 in manual and restores level to program as directed by the SRO. The BOP maintains manual control of 'C' steam generator level. There is no off-normal procedure associated with this failure.

Event 3: PZR pressure channel (BB PI-457) fails low. The crew performs OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment K, PZR PRESSURE MALFUNCTIONS. The ATC places the PZR master controller in manual, controls pressure, and then selects an alternate control channel. The SRO directs placing the PZR master controller back in auto once pressure is stabilized. SRO enters T.S. 3.3.1, Reactor Trip System Instrumentation, Conditions A, E, and M, and 3.3.2, Engineered Safety Feature Actuation System Instrumentation, Conditions A, D, and L.

Event 4: HP Turbine 1st stage pressure (AC PT-505) fails low causing rods to step in. The ATC places rods in manual after verifying no turbine runback. The ATC or BOP identifies the failure and the crew enters OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment D, TURBINE IMPULSE PRESSURE CHANNEL MALFUNCTION, to select an alternate channel for control. SRO enters TS 3.3.1, Reactor Trip System Instrumentation, Condition A and T.

Event 5: Abnormal condenser vacuum requiring load decrease using OFN AF-025, UNIT LIMITATIONS, ATTACHMENT F, LOSS OF CONDENSER VACUUM. Crew reduces turbine loading using OFN MA-038, RAPID PLANT SHUTDOWN.

Event 6: 500 gpm SGTR in 'B' S/G – PRA#5. At the time of the reactor trip a Loss of off-site power– PRA#1 (Drives CT 1 to start at least one EDG). Additionally, the MSIVs fail open and cannot be closed (Drives EMG C-31, SGTR WITH LOSS OF REACTOR COOLANT – SUBCOOLED RECOVERY DESIRED procedure entry). The crew recognizes RCS pressure and pressurizer level trending down and 'B' S/G MFRV controller trending closed as level trends up. RM-11 indicates S/G process radiation trending up on GE RE-92. The crew may enter OFN BB-07A, STEAM GENERATOR TUBE LEAKAGE, which will eventually direct manually tripping the reactor and initiating Safety Injection. The Crew performs EMG E-0, REACTOR TRIP OR SAFETY INJECTION. A loss of offsite power will occur when the reactor is tripped (PRA#1). Additionally, the MSIVs fail open and cannot be closed.

Event 7: Both EDGs fail to auto start. The ATC starts both EDGs per immediate action step 3 of EMG E-0, REACTOR TRIP OR SAFETY INJECTION.

CT 1: Manually start at least one EDG prior to transitioning to EMG C-0, LOSS OF ALL AC POWER, at EMG E-0, step 3 RNO.

Event 8: 'B' MDAFW throttle valve (AL HK-9A) fails open. Once the crew determines the 'B' S/G is ruptured the BOP isolates the S/G per foldout page of EMG E-0, REACTOR TRIP OR SAFETY INJECTION. The BOP stops the 'A' MDAFWP and dispatches an operator to locally isolate AL HV-9. If the BOP fails to stop the MDAFW pump, the local operator will report that the isolation valve cannot be closed. Otherwise the local operator isolates AL HV-9 and the BOP restarts the 'A' MDAFWP.

CT 2: Terminate AFW to the Ruptured B S/G within 18 min of safety injection initiation.

The crew continues in EMG E-0, transitions to EMG E-3, STEAM GENERATOR TUBE RUPTURE, and then to EMG C-31, SGTR WITH LOSS OF REACTOR COOLANT – SUBCOOLED RECOVERY DESIRED. After the crew resets SIS the scenario may be terminated by the Lead Examiner.

Procedures entered:

- ALR 00-008B, SERV WTR PRESS HILO
- ALR 00-009B, SERV WTR PMP TRIP
- ALR 00-033C, PZR PRESS LO HTRS ON
- ALR 00-065E, T REF/T AUCT LO
- ALR 00-110C, SG C FLOW MISMATCH
- ALR 00-115D, MANUAL ACTION REQUESTED
- OFN BB-07A, STEAM GENERATOR TUBE LEAKAGE
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment D, TURBINE IMPULSE PRESSURE CHANNEL MALFUNCTION
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment K, PZR PRESSURE MALFUNCTIONS
- OFN AF-025, UNIT LIMITATIONS, ATTACHMENT F, LOSS OF CONDENSER VACUUM
- OFN MA-038, RAPID PLANT SHUTDOWN
- EMG E-0, REACTOR TRIP OR SAFETY INJECTION
- EMG E-3, STEAM GENERATOR TUBE RUPTURE
- EMG C-31, SGTR WITH LOSS OF REACTOR COOLANT – SUBCOOLED RECOVERY DESIRED

Scenario file:

;ILO Scenario 3 rev 3

;Timer for CT2

{jpplsi} CT2 - Begin - SIS

{x05i154p} CT2 - End - AL HIS-23A in PTL

;Tagout 'B' Service Water Pump

ICR bkrWS01PB t:2 d:0

;Loss of off-site power when reactor is tripped.

{jpplp4} IMF mSY01 i:-1 f:-1

;MSIVs fail open and cannot be closed.

ICM vmodABHV0011 t:1 d:0

ICM vmodABHV0014 t:1 d:0

ICM vmodABHV0017 t:1 d:0

ICM vmodABHV0020 t:1 d:0

;EDGs fail to auto start.

IMF mNE02A i:-1 f:-1

IMF mNE02B i:-1 f:-1

; 'B' MDAFW valve fails open.

ICM vmodALHV0009 t:1 d:0

;Key 1, Event 1: Service Water pump 'C' trips
requiring start of ESW pumps - PRA #3 - ATC

ICM bkrWS01PC t:1 d:0 k:1

;Key 2, Event 2: S/G C FW CTRL VLV AEFV530
AUTO CTL SIG CARD FAILURE - BOP

IMF mAE08C f:15 r:120 k:2

;Key 3, Event 3: PZR pressure channel 457 fails
low - ATC

IMF mBB21C f:1692 r:60 k:3

;Key 4, Event 4: AC PT-505 failure

ICM trACPT0505 t:1 d:0 k:4

;Key 5, Event 5: Abnormal condenser vacuum
requiring load decrease. SROI/ATC - R, BOP - N

IMF mAD01 f:50 k:5

{P24115A.CurrValue>4.5} MMF mAD01 f:30

{P24115A.CurrValue>5.5} MMF mAD01 f:4

;Key 6, Event 6: 500 gpm SGTR in 'B' S/G. Major
IMF mBB02B f:500 r:120 k:6

;Key 7: ALV0047 - MDAFW PMP A TO S/G B
ALHV9 MAN ISO VLV

{x05i154p}{Key[7]}IRF rAL13 f:0 d:300 r:120

;Key 8: Close ABV0085 - S/G B TO TDAFP ISO
VALVE

IRF rAB04A f:0 d:60 r:10 k:8

;Key 9: Close ABV0072 - MAIN STM LOOP 2
DRAIN TO COND LV-8 INLET ISO

IRF rAB03B f:0 d:60 r:9 k:9

;end file

Facility: Wolf Creek Scenario No.: 4 (New) Op-Test No.: Nov 2015

Examiners: _____ Operators: _____

Initial Conditions: 100% power. EDG 'A' is OOS. Maintain power stable.

IC 304 (IC 30 w/ scenario file and setup included)

Turnover:

T.S. 3.8.1, AC Sources Operating, Condition B, for EDG 'A' OOS.

Event No.	Malf. No.	Event Type*	Event Description
1.		I (ATC SRO) TS (SRO)	Power range NI (SE NI-42B) fails high.
2.		I (BOP SRO) TS (SRO)	Steam generator 'D' pressure channel (AB PI-545A) fails high.
3.		C (ATC BOP SRO) TS (SRO)	Loss of NN02 Instrument bus.
4.		R (ATC) TS (SRO) N (BOP SRO)	Loss of Wolf Creek-Benton 345 kV offsite line.
5.		M (ALL)	Inadvertent SI 'B' Train. CT 1: Isolate BIT inlet and outlet valves within 8 minutes from initiation.

Event No.	Mal. No.	Event Type*	Event Description
6.		C (ATC SRO)	<p>Loss of all AC. LOOP w/ 'B' EDG failing to start in auto and manual.</p> <p>CT 2: Energize either NB01 or NB02 using SYS KU-121 or SYS KU-122 before the following are met:</p> <ul style="list-style-type: none"> • RCS subcooling – Less Than or Equal to 30°F [45°F] <p style="text-align: center;"><u>OR</u></p> <ul style="list-style-type: none"> • Pressurizer level – Less Than or Equal to 6% [32%]
* (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)	1 (event 6)
2. Abnormal events (2-4)	4 (events 1,2,3,4)
3. Major transients (1–2)	1 (event 5)
4. EOPs entered/requiring substantive actions (1–2)	1 (EMG CS-01)
5. EOP contingencies requiring substantive actions (0-2)	1 (EMG C-0)
6. EOP based Critical tasks (2–3)	2 (events 5,6)

Critical Task	Justification	References
CT 1: Isolate BIT inlet and outlet valves within 8 minutes from ECCS initiation.	TCA USAR 15.5.1; Terminate ECCS injection following an inadvertent ECCS operation event (Close BIT inlet and outlet isolation valves) within 8 minutes from initiation.	AI 21-016, OPERATOR TIME CRITICAL ACTIONS VALIDATION, Rev 10.
CT 2: Energize either NB01 or NB02 using SYS KU-121 or SYS KU-122 before the following are met: <ul style="list-style-type: none"> • RCS subcooling – Less Than or Equal to 30°F [45°F] <li style="text-align: center;"><u>OR</u> • Pressurizer level – Less Than or Equal to 6% [32%] 	Energizing at least one NB bus in a timely manner ensures RCS integrity does not become an issue.	BD-EMG C-0, LOSS OF ALL AC POWER, Rev 21.

SCENARIO # 4 NARRATIVE

Turnover: 100% power. EDG 'A' is OOS. Maintain power stable. T.S. 3.8.1, AC Sources Operating, Condition B for EDG 'A' OOS. 24 hours remain to restore EDG 'A' to operable condition.

Event 1: Power range NI (SE NI-42B) fails high. The ATC determines there is no turbine runback in progress and places rods in manual to stop inward rod motion. The crew diagnoses the failure and enters OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment R, POWER RANGE NEUTRON FLUX CHANNEL MALFUNCTION. ALR 00-078A, 82A, and 83C will actuate and the Crew could use any of these to get to the OFN. The crew bypasses the channel and restores rods to auto. The SRO enters TS 3.3.1, Reactor Trip System Instrumentation, Conditions A, D, E, S, and T and T.R. 3.3.17, REACTIVITY CONTROL AND POWER DISTRIBUTION ALARMS, Condition D.

Event 2: Steam generator 'D' pressure channel (AB PI-545A) fails high. The crew should diagnose steam flow from the 'D' S/G indicating higher than the other S/G or level rising. ALR 00-111B, SG D LEV DEV, actuates. The BOP places the MFRV in manual and controls level. The SRO enters the ALR and/or OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment C, SG PRESSURE CHANNEL MALFUNCTION. Attachment A, STEAM FLOW CHANNEL MALFUNCTION, may be entered first on the high flow indication, which will reference back to Attachment C. An alternate channel will be selected and automatic control restored. The SRO enters TS 3.3.2, Engineered Safety Features Actuation System Instrumentation, Conditions A and D.

Event 3: Loss NN02 Instrument bus. The SRO directs OFN NN-021, LOSS OF VITAL 120 VAC INSTRUMENT BUS, Attachment B, LOSS OF VITAL INSTRUMENT BUS NN02 (WHITE TRAIN). The ATC selects the alternate PZR pressure channel for control, adjusting pressure control as needed. The BOP selects the red train instruments for S/G level and steam flow. Once the alternate channels are selected, the NN02 bus may be reenergized. SRO enters T.S. 3.8.7, Inverters Operating, Condition A, and T.S. 3.8.9 Distribution Systems – Operating, Condition C. These apply as long as the breaker NN0201 is open and the NN bus is unavailable. Protection and Control interlocks are verified, however, T.S. 3.3.1 and 3.3.2 are not entered.

Event 4: Loss of Wolf Creek-Benton 345 kV offsite line. The crew enters OFN AF-025, UNIT LIMITATIONS, Attachment A, UNIT LOAD LIMITS, reducing unit load to less than 800 MWE NET (845 MWE GROSS). SRO enters TR 3.8.1, Offsite Power System Transmission Network, Condition A.

Event 5: Inadvertent SI 'B' Train. The crew enters EMG E-0, REACTOR TRIP OR SAFETY INJECTION. The crew actuates the second train of SI, resets SI, isolates the BIT inlet and outlet valves and then continues with the procedure.

CT 1: Isolate BIT inlet and outlet valves within 8 minutes from initiation.

Event 6: Loss of all AC. LOOP w/ 'B' EDG failing to start in auto and manual. (PRA). The crew enters EMG C-0, LOSS OF ALL AC POWER. The crew is able to restore power from the SBO diesels to either NB bus using OFN NB-030, LOSS OF AC EMERGENCY BUS NB01 (NB02). The OFN will direct the crew to SYS KU-121 (122), ENERGIZING NB01 (NB02) FROM STATION BLACKOUT DIESEL GENERATORS. Only one safeguards bus can be energized by the SBO diesels.

CT 2: Energize either NB01 or NB02 using SYS KU-121 or SYS KU-122 before the following are met:

- **RCS subcooling – Less Than or Equal to 30°F [45°F]**
- OR**
- **Pressurizer level – Less Than or Equal to 6% [32%]**

The crew energizes an NB bus then continues with EMG C-0, LOSS OF ALL AC POWER, and then transitions to EMG CS-01, LOSS OF ALL AC POWER RECOVERY WITHOUT SI REQUIRED. After the crew resets CISA the scenario may be terminated by the Lead Examiner.

Procedures entered:

- ALR 00-026A, NN02 INST BUS UV
- ALR 00-078A, PR CHANNEL DEV
- ALR 00-111B, SG D LEV DEV
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment A, STEAM FLOW CHANNEL MALFUNCTION (Might enter before Attachment C)
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment C, SG PRESSURE CHANNEL MALFUNCTION
- OFN SB-008, INSTRUMENT MALFUNCTIONS, Attachment R, POWER RANGE NEUTRON FLUX CHANNEL MALFUNCTION
- OFN NN-021, LOSS OF VITAL 120 VAC INSTRUMENT BUS, Attachment B, LOSS OF VITAL INSTRUMENT BUS NN02 (WHITE TRAIN)
- OFN AF-025, UNIT LIMITATIONS, Attachment A, UNIT LOAD LIMITS
- OFN MA-038, RAPID PLANT SHUTDOWN
- EMG E-0, REACTOR TRIP OR SAFETY INJECTION
- EMG C-0, LOSS OF ALL AC POWER
 - OFN NB-030, LOSS OF AC EMERGENCY BUS NB01 (NB02)
 - SYS KU-121 (122), ENERGIZING NB01 (NB02) FROM STATION BLACKOUT DIESEL GENERATORS
- EMG CS-01, LOSS OF ALL AC POWER RECOVERY WITHOUT SI REQUIRED

Scenario file:

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;ILO Scenario 4 rev 1
;CT1 timer
{Key[5]} CT1 - Begin - SI train B
{rem8801a=1}{rem8801a=0 & rem8801b=0 &
rem8803a=0 & rem8803b=0}CT1 - BIT isolated

;Tag out 'A' EDG
scn SimGroup\TAGDGA

;Event 6: DIESEL GENERATOR B SPEED
FAILURE
IMF mNE01B f:0

;Key 1, Event 1: Power range NI (SE NI-42B) fails
high. I - ATC
IMF mSE03B f:120 r:10 k:1

;Key 2, Event 2: Steam generator pressure
channel (AB PI-545) failure high. I - BOP
IMF mAB01D2 f:1313 r:10 k:2

;Key 3, Event 3: Loss of NN02 Instrument bus. I -
ATC/BOP
IRF rNN02A f:1 k:3

;Key 4, Event 4: Loss of Wolf Creek-Benton 345
kV offsite line. R - ATC
IMF mSY03F i:-1 f:-1 k:4

;Key 5, Event 5: Inadvertent SI, train 'B'
IMF mSA01B i:-1 f:-1 k:5

;Key 6, Event 6: Loss of all AC
IMF mSY01 i:-1 f:-1 k:6

;Key 7: Restore NN02
{Key[7]}IRF rNN02A f:1

;Key 8: close RCP seals
{Key[8]} scn SimGroup\ISOSEALS

;Key 9: ROTATE power switch NF39A 8N28-1
{Key[9]}scn SimGroup\NF39A 8N28-1 - OFF

;Key 10: Energize NB01 from SBO diesels (3 min,
30 sec)
{Key[10]}scn SimGroup\SBO Start and Energize
NB01

;Key 11: ROTATE power switch NF39B 8N28-1
{Key[11]}scn SimGroup\NF39B 8N28-1 - OFF

;Key 12: Energize NB02 from SBO diesels (3 min,
30 sec)
{Key[12]}scn SimGroup\SBO Start and Energize
NB02

;end file

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