

Draft Submittal

(Pink Paper)

1. Written Exam Sample outlines

CRYSTAL RIVER EXAM 50-302/2002-301

JAN. 28 - FEB. 6, 2002

PWR RO Examination Outline Worksheet

Based on NUREG-1021 Form ES-401-4 Pg 33 of 45 Rev.8													
		K/A Category Points											
Tier	Group	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Point Total
Tier 1 Plant Evolutions	1	2	1	2				4	4			3	16
	2	3	4	4				2	2			2	17
	3	0	1	2				0	0			0	3
	Tier Totals	5	6	8				6	6			5	36
Tier 2 Plant Systems	1	4	2	4	1	1	1	1	2	1	3	3	23
	2	2	1	3	2	2	1	2	2	2	2	1	20
	3	1	0	0	1	1	0	1	2	0	1	1	8
	Tier Totals	7	3	7	4	4	2	4	6	3	6	5	51
Tier 3 Generic		Cat1	Cat2	Cat3	Cat4								13
		3	4	3	3								

K/A/G/ Totals	12	9	15	4	4	2	10	12	3	6	10	
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PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000005 Inoperable/Stuck Control Rod / I									
000015/17 RCP Malfunctions / IV				1			AA1.03 Ability to operate and / or monitor the following as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow): Reactor trip alarms, switches, and indicators	3.7	1
E09 Natural Circ. / IV									
000024 Emergency Boration / I									
000026 Loss of Component Cooling Water / VIII					1		AA2.01 Ability to determine and interpret the following as they apply to the Loss of Nuclear Services / Decay Heat Closed Cycle Cooling: Location of a leak in the SWS / DCS NOTE 1	2.9	1
000027 Pressurizer Pressure Control System Malfunction / III				1			AA1.01 Ability to operate and / or monitor the following as they apply to the Pressurizer Pressure Control Malfunctions: PZR heaters, sprays, and PORVs	4.0	1
000040 (E05) Steam Line Rupture (Excessive Heat Transfer) / IV									
000051 Loss of Condenser Vacuum / IV					1	1	AA2.02 Ability to determine and interpret the following as they apply to the Loss of Condenser Vacuum: Conditions requiring reactor and/or turbine trip 2.4.48 Ability to interpret control room indications to verify the status and operation of system, and understand how operator actions and directives affect plant and system conditions.	3.9 3.5	1 1

Emergency and Abnormal Plant Evolutions - Tier1/Group1

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PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000074 Inad. Core Cooling / IV						1	<u>2.4.21^ Knowledge of the parameters and logic used to assess the status of safety functions including:</u> <u>1. Reactivity control</u> <u>2. Core cooling and heat removal</u> <u>3. Reactor coolant system integrity</u> <u>4. Reactor Building conditions</u> <u>5. Radioactivity release control.</u>	3.7	1
E03 Inadequate Subcooling Margin / IV	1		1				EK1.2 Knowledge of the operational implications of the following concepts as they apply to the (Inadequate Subcooling Monitor): Normal, abnormal and emergency operating procedures associated with (HPI Termination). EK3.1 Knowledge of the reasons for the following responses as they apply to the (Inadequate Subcooling Monitor): Facility operating characteristics during transient conditions, including coolant chemistry and the effects of temperature, pressure, and reactivity changes and operating limitations and reasons for these operating characteristics.	3.8 3.2	1 1
000076 High Reactor Coolant Activity / IX					1		AA2.02 Ability to determine and interpret the following as they apply to the High Reactor Coolant Activity: Corrective actions required for high fission product activity in RCS NOTE 1	2.8	1
A02&A03 Loss of NNI-X/Y / VII									
K/A Category Totals:	2	1	2	4	4	3		Group Point Total =	16

PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group2

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000001 Continuous Rod Withdrawal / I									
000003 Dropped Control Rod / I	1						AK1.13 Knowledge of the operational implications of the following concepts as they apply to Dropped Control Rod: Interaction of ICS control stations as well as purpose, function, and modes of operation of ICS	3.2	1
000007 (E02&E10) Reactor Trip - Stabilization - Recovery / I		1					EK2.02 Knowledge of the interrelations between a reactor trip and the following: Breakers, relays and disconnects	2.6	1
A01 Plant Runback / I									
A04 Turbine Trip / IV			1				AK3.2 Knowledge of the reasons for the following responses as they apply to the (Turbine Trip): Normal, abnormal and emergency operating procedures associated with (Turbine Trip).	3.4	1
000008 Pressurizer Vapor Space Accident / III			1				AK3.02 Knowledge of the reasons for the following responses as they apply to the Pressurizer Vapor Space Accident: Why PORV or code safety exit temperature is below RCS or PZR temperature	3.6	1
000009 Small Break LOCA / III						1	<u>2.4.24^ Knowledge of loss of cooling water procedures.</u>	3.3	1
000011 Large Break LOCA / III		1					EK2.02 Knowledge of the interrelations between the Large Break LOCA and ECCS pumps.	2.6	1
E08 LOCA Cooldown/Depress. / IV						1	2.1.28 Knowledge of the purpose and function of major system components and controls.	3.2	1
000022 Loss of Reactor Coolant Makeup / II									
000025 Loss of RHR System / IV									
000029 Anticipated Transient w/o Scram / I	1						EK1.03 Knowledge of the operational implications of the following concepts as they apply to the ATWS: Effects of boron on reactivity	3.6	1

PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group2

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000032 Loss of Source Range NI / VII					1		AA2.02 Ability to determine and interpret the following as they apply to the Loss of Source Range Nuclear Instrumentation: Expected change in source range count rate when rods are moved	3.6	1
000033 Loss of Intermediate Range NI / VII			1				AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Intermediate Range Nuclear Instrumentation: Termination of startup following loss of intermediate-range instrumentation	3.2	1
000037 Steam Generator Tube Leak / III	1						AK1.01 Knowledge of the operational implications of the following concepts as they apply to Steam Generator Tube Leak: Use of steam tables	2.9	1
000038 Steam Generator Tube Rupture / III					1		<u>EA2.15^ Ability to determine or interpret the following as they apply to a SGTR: Pressure at which to maintain RCS during S/G cooldown</u>	4.2	1
000054 Loss of Main Feedwater / IV			1				AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): Reactor and/or turbine trip, manual and automatic	4.1	1
E04 Inadequate Heat Transfer - Loss of Secondary Heat Sink / IV		1					EK2.1 Knowledge of the interrelations between the (Inadequate Heat Transfer) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.8	1
000058 Loss of DC Power / VI									
000059 Accidental Liquid RadWaste Rel. / IX		1					AK2.01 Knowledge of the interrelations between the Accidental Liquid Radwaste Release and the following: Radioactive-liquid monitors	2.7	1

PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group2

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000060 Accidental Gaseous Radwaste Rel. / IX				1			AA1.02 Ability to operate and / or monitor the following as they apply to the Accidental Gaseous Radwaste: Ventilation system	2.9	1
000061 ARM System Alarms / VII				1			AA1.01 Ability to operate and / or monitor the following as they apply to the Area Radiation Monitoring (ARM) System Alarms: Automatic actuation	3.6	1
K/A Category Totals:	3	4	4	2	2	2	Group Point Total =	17	

PWR RO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group3

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000028 Pressurizer Level Malfunction / II									
000036 (A08) Fuel Handling Accident / VIII									
000056 Loss of Off-site Power / VI			1				AK3.02 Knowledge of the reasons for the following responses as they apply to the Loss of Offsite Power: Actions contained in EOP for loss of offsite power	4.4	1
000065 Loss of Instrument Air / VIII			1				AK3.08 Knowledge of the reasons for the following responses as they apply to the Loss of Instrument Air: Actions contained in AOP for loss of instrument air	3.7	1
E13&E14 EOP Rules and Enclosures									
A05 Emergency Diesel Actuation / VI		1					AK2.1 Knowledge of the interrelations between the (Emergency Diesel Actuation) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	4.0	1
A07 Flooding / VIII									
K/A Category Totals:	0	1	2	0	0	0	Group Point Total =	3	

PWR RO Examination Outline

Plant Systems - Tier2/Group1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
001 Control Rod Drive	1									1	1	K1.09 Knowledge of the physical connections and/or cause-effect relationships between the CRDS and the SW system (must be cut in before energizing CRDS).	2.8	1
												A4.04^ <u>Ability to manually operate and/or monitor APSR rod position.</u>	3.9	1
												2.1.32 Ability to explain and apply all system limits and precautions. NOTE 1	3.4	1
003 Reactor Coolant Pump			1					1				K3.05 Knowledge of the effect that a loss or malfunction of the RCPs will have on the following: ICS	3.6	1
												A2.01^ <u>Ability to (a) predict the impacts of the following malfunctions or operations on the RCPs; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Problems with RCP seals, especially rates of seal leak-off</u>	3.5	1
004 Chemical and Volume Control			1								1	K3.04 Knowledge of the effect that a loss or malfunction of the MUPS will have on the RCP's	3.7	1
												2.1.30 Ability to locate and operate components, including local controls.	3.9	1

PWR RO Examination Outline

Plant Systems - Tier2/Group1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
013 Engineered Safety Features Actuation												K2.01 Knowledge of bus power supplies to the ESFAS / safeguards equipment control.	3.6	1
												NOTE 3		
		1	1					1				K3.02 Knowledge of the effect that a loss or malfunction of the ESFAS will have on the RCS.	4.3	1
015 Nuclear Instrumentation												<u>A2.06^ Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based Ability on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations; Inadvertent ESFAS actuation</u>	3.7	1
										1		A4.01 Ability to manually operate and/or monitor in the control room: Selection of controlling NIS channel	3.6	1
017 In-core Temperature Monitor							1					<u>A1.01^ Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ITM system controls including: Core exit temperature</u>	3.7	1
											1	<u>2.2.34^ Knowledge of the process for determining the internal and external effects on core reactivity.</u>	3.2	1
022 Containment Cooling												K2.01 Knowledge of power supplies to the following: Reactor Building cooling fans	3.0	1
		1	1									<u>K3.01^ Knowledge of the effect that a loss or malfunction of the CCS will have on the following: Reactor Building equipment subject to damage by high or low temperature, humidity, and pressure</u>	2.9	1

PWR RO Examination Outline

Plant Systems - Tier2/Group1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
056 Condensate	1											K1.03 Knowledge of the physical connections and/or cause-effect relationships between the Condensate System and the following systems: MFW NOTE 1	2.6	1
059 Main Feedwater	1			1								K1.07 Knowledge of the physical connections and/or cause-effect relationships between the MFW and the following systems: ICS <u>K4.18^ Knowledge of MFW design feature(s) and/or interlock(s) which provide for the following: Automatic feedwater reduction on plant trip.</u> NOTE 4	3.2 2.8	1 1
061 Auxiliary/Emergency Feedwater	1											K1.01 Knowledge of the physical connections and/or cause-effect relationships between the EFW and the following systems: S/G system NOTE 5 (RO only)	4.1	1
068 Liquid Radwaste						1						K6.10 Knowledge of the effect of a loss or malfunction on the following will have on the Liquid Radwaste System: Radiation monitors	2.5	1
071 Waste Gas Disposal					1							<u>K5.04^ Knowledge of the operational implication of the following concepts as they apply to the Waste Gas Disposal System: Relationship of hydrogen/oxygen concentrations to flammability</u>	2.5	1

PWR RO Examination Outline

Plant Systems - Tier2/Group1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
072 Area Radiation Monitoring									1	1		A4.03 Ability to manually operate and/or monitor in the control room: Check source for operability demonstration	3.1	1
												A3.01^ Ability to monitor automatic operation of the ARM system, including: <u>Changes in ventilation alignment</u> NOTE 4	2.9	1
K/A Category Totals:													Group Point Total = 23	

PWR RO Examination Outline

Plant Systems - Tier2/Group2

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
002 Reactor Coolant					1							K5.10 Knowledge of the operational implications of the relationship between reactor power and RCS differential temperature as it applies to the RCS. NOTE 1	3.6	1
006 Emergency Core Cooling									1			A3.03 Ability to monitor automatic operation of the ECCS, including: ESFAS-operated valves	4.1	1
010 Pressurizer Pressure Control		1										K2.03 Knowledge of bus power supplies to the following: Indicator for PORV position NOTE 4/5	2.8	1
011 Pressurizer Level Control														
012 Reactor Protection						1						K6.04 Knowledge of the effect of a loss or malfunction of the following will have on the RPS: Bypass-block circuits NOTE 3	3.3	1
014 Rod Position Indication												K4.04 Knowledge of RPIS design feature(s) which provide zone reference lights. NOTE 1	2.6	1
												<u>A2.04 ^ Ability to (a) predict the impacts of a misaligned rod on the RPIS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of this malfunction.</u>	3.4	1
				1				2				A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the RPIS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of offsite power NOTE 1	2.8	1

PWR RO Examination Outline

Plant Systems - Tier2/Group2

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
016 Non-nuclear Instrumentation											1	2.1.31 Ability to locate control room switches, controls and indications and to determine that they are correctly reflecting the desired plant lineup.	4.2	1
026 Containment Spray							1					A1.06 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the BSS controls including: Reactor Building spray pump cooling	2.7	1
029 Containment Purge	1											K1.01 Knowledge of the physical connections and/or cause-effect relationships between the Containment Purge System and the following: Gaseous radiation release monitors	3.4	1
033 Spent Fuel Pool Cooling			1									<u>K3.03^ Knowledge of the effect that a loss or malfunction of the Spent Fuel Pool Cooling System will have on the following: Spent fuel temperature</u>	3.0	1
035 Steam Generator				1	1							<u>K4.01^ Knowledge of S/GS design feature(s) and/or interlock(s) which provide for S/G level control.</u> K5.01 Knowledge of the effect of secondary parameters, pressure, and temperature on reactivity as they apply to the S/GS.	3.4	1
039 Main and Reheat Steam											2	A4.03 Ability to manually operate and/or monitor in the control room: MFW pump turbines <u>A4.01^ Ability to manually operate and/or monitor in the control room: Main steam supply valves</u>	2.8 2.9	1 1

PWR RO Examination Outline

Plant Systems - Tier2/Group2

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
055 Condenser Air Removal			1									K3.01 Knowledge of the effect that a loss or malfunction of the CARS will have on the following: Main condenser NOTE 1	2.5	1
062 AC Electrical Distribution									1			A3.04 Ability to monitor automatic operation of the AC distribution system, including: Operation of inverter (e.g., precharging synchronizing light, static transfer)	2.7	1
063 DC Electrical Distribution														
064 Emergency Diesel Generator			1									K3.02 Knowledge of the effect that a loss or malfunction of the ED/G system will have on the following: ESFAS controlled or actuated systems	4.2	1
073 Process Radiation Monitoring														
075 Circulating Water	1											K1.01 Knowledge of the physical connections and/or cause-effect relationships between the CW system and the following systems: RW System	2.5	1
079 Station Air														
086 Fire Protection							1					A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Fire Protection System operating the controls including: Fire header pressure	2.9	1
K/A Category Totals:	2	1	3	2	2	1	2	2	2	2	1		Group Point Total =	20

PWR RO Examination Outline

Plant Systems - Tier2/Group3

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
005 Residual Heat Removal					1							K5.02 Knowledge of the operational implications of the following concepts as they apply the Decay Heat System: Need for adequate subcooling	3.4	1
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water				1								K4.09 Knowledge of SWS / DCS design feature(s) and/or interlock(s) which provide for the standby feature of the SWS / DCS pumps.	2.7	1
027 Containment Iodine Removal											1	2.1.28 Knowledge of the purpose and function of major system components and controls. NOTE 1	3.2	1
028 Hydrogen Recombiner and Purge Control														
034 Fuel Handling Equipment								1			1	A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the Fuel Handling System ; and (b) based those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Dropped cask NOTE 1 <u>A4.02^ Ability to manually operate and/or monitor in the control room: Neutron levels</u>	3.4 3.5	1 1
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator	1											K1.18 Knowledge of the physical connections and/or cause-effect relationships between the MT/G system and the RPS. NOTE 1	3.6	1

PWR RO Examination Outline

Plant Systems - Tier2/Group3

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
076 Service Water								1				A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the RWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of RWS	3.5	1
078 Instrument Air														
103 Containment							1					A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the reactor building system controls including: Reactor Building pressure and temperature	3.7	1
K/A Category Totals:	1	0	0	1	1	0	1	2	0	1	1	Group Point Total =	8	

PWR RO Examination Outline
Generic Knowledges and Abilities

Category	KA #	K/A Topic	Imp.	Points
Conduct of Operations	2.1.17^	2.1.17^ Ability to make accurate, clear and concise verbal reports	3.5	1
	2.1.19^	2.1.19^ Ability to use plant computer to obtain and evaluate parametric information on system or component status.	3.0	1
	2.1.23^	2.1.23^ Ability to perform specific system and integrated plant procedures during all modes of plant operation.	3.9	1
	Total Points			3
Equipment Control	2.2.2^	2.2.2^ Ability to manipulate the console controls as required to operate the facility between shutdown and designated power levels.	4.0	1
	2.2.22^	2.2.22^ Knowledge of limiting conditions for operations and safety limits.	3.4	1
	2.2.25^	2.2.25^ Knowledge of bases in technical specifications for limiting conditions for operations and safety limits.	2.5	1
	2.2.28^	2.2.28^ Knowledge of new and spent fuel movement procedures.	2.6	1
	Total Points			4
Radiation Control	2.3.2	2.3.2 Knowledge of facility ALARA program.	2.5	1
	2.3.9	2.3.9 Knowledge of the process for performing a containment purge.	2.5	1
	2.3.11^	2.3.11^ Ability to control radiation releases.	2.7	1
	Total Points			3
Emergency Procedures / Plan	2.4.2	2.4.2 Knowledge of system set points, interlocks and automatic actions	3.9	1
	2.4.12	2.4.12 Knowledge of general operating crew responsibilities during emergency operations.	3.4	1
	2.4.25	2.4.25 Knowledge of fire protection procedures.	2.9	1
	Total Points			3
TIER 3 Category Totals:				13

PWR RO Examination Outline

Generic Knowledges and Abilities

Category	KA #	K/A Topic	Imp.	Points
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NOTE 1 : Random generator chose a category with no RO K/As with an importance factor of 2.5 or greater. Chose a different category to obtain a K/A with an importance factor greater than 2.5.

NOTE 2: New K/A chosen for the same topic to obtain a K/A supporting plant specific SRO objectives and /or 10 CFR 55.43 IAW NUREG 1021 Revision 8, Supplement 1.

NOTE 3: Random generator did not meet the requirement for 2 items in a category. Chose a system and K/A that would complete the category requirements.

NOTE 4: K/A moved within topic per NRC request 7/27/2001 to provide more uniform coverage of K/As

NOTE 5: Movement of K/As per NRC request created a separate question for RO. Considered a common question.

RO ONLY QUESTIONS are identified by ^ italicized print and underlined.

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PWR SRO Examination Outline Worksheet

Based on NUREG-1021 Form ES-401-3 Pg 26 of 45 Rev.8													
		K/A Category Points											
Tier	Group	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Point Total
Tier 1 Plant Evolutions	1	4	3	2				3	6			6	24
	2	1	2	5				3	3			2	16
	3	0	1	2				0	0			0	3
	Tier Totals	5	6	9				6	9			8	43
Tier 2 Plant Systems	1	3	2	3	1	1	1	1	2	0	2	3	19
	2	2	0	2	1	2	1	2	2	2	1	2	17
	3	1	0	0	1	1	0	0	1	0	0	0	4
	Tier Totals	6	2	5	3	4	2	3	5	2	3	5	40
Tier 3 Generic		Cat1	Cat2	Cat3	Cat4								
		5	3	4	5								17

K/A/G/ Totals	11	8	14	3	4	2	9	14	2	3	13
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PWR SRO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000001 Continuous Rod Withdrawal / I									
000003 Dropped Control Rod / I	1						AK1.13 Knowledge of the operational implications of the following concepts as they apply to Dropped Control Rod: Interaction of ICS control stations as well as purpose, function, and modes of operation of ICS	3.6	1
000005 Inoperable/Stuck Control Rod / I						1	<u>2.1.12* Ability to apply technical specifications for a system.</u>	4.0	1
000011 Large Break LOCA / III		1				1	EK2.02 Knowledge of the interrelations between the Large Break LOCA and ECCS pumps. <u>2.4.5* Knowledge of the organization of the operating procedures network for normal, abnormal, and emergency evolutions.</u>	2.7 3.6	1 1
000015/17 RCP Malfunctions / IV				1			AA1.03 Ability to operate and / or monitor the following as they apply to the Reactor Coolant Pump Malfunctions (Loss of RC Flow): Reactor trip alarms, switches, and indicators	3.8	1
E09 Natural Circ. / IV									
000024 Emergency Boration / I					1		<u>AA2.05* Ability to determine and interpret the following as they apply to the Emergency Boration: Amount of boron to add to achieve required SDM</u>	3.9	1

PWR SRO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000026 Loss of Component Cooling Water / VIII					1		AA2.01 Ability to determine and interpret the following as they apply to the Loss of Nuclear Services / Decay Heat Closed Cycle Cooling: Location of a leak in the SWS / DCS NOTE 1	3.5	1
000029 Anticipated Transient w/o Scram / I	1				1		EK1.03 Knowledge of the operational implications of the following concepts as they apply to the ATWS: Effects of boron on reactivity	3.8	1
							<u>EA2.07* Ability to determine or interpret the following as they apply to a ATWS: Reactor trip breaker indicating lights</u> NOTE 2	4.3	1
000040 (E05) Steam Line Rupture - Excessive Heat Transfer / IV									
000051 Loss of Condenser Vacuum / IV					1	1	AA2.02 Ability to determine and interpret the following as they apply to the Loss of Condenser Vacuum: Conditions requiring reactor and/or turbine trip	4.1	1
							2.4.48 Ability to interpret control room indications to verify the status and operation of system, and understand how operator actions and directives affect plant and system conditions.	3.8	1

PWR SRO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000055 Station Blackout / VI				1	1		EA1.06 Ability to operate and monitor the following as they apply to a Station Blackout: Restoration of power with one ED/G	4.5	1
							<u>EA2.03* Ability to determine or interpret the following as they apply to a Station Blackout: Actions necessary to restore power</u>	4.7	1
000057 Loss of Vital AC Elec. Inst. Bus / VI			1	1			AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Vital AC Instrument Bus: Actions contained in EOP for loss of vital ac electrical instrument bus	4.4	1
							AA1.05 Ability to operate and / or monitor the following as they apply to the Loss of Vital AC Instrument Bus: Backup instrument indications	3.4	1
000059 Accidental Liquid RadWaste Rel. / IX		1					AK2.01 Knowledge of the interrelations between the Accidental Liquid Radwaste Release and the following: Radioactive-liquid monitors	2.8	1
000062 Loss of Nuclear Service Water / IV									
000067 Plant Fire On-site / IX	1					1	AK1.01 Knowledge of the operational implications of the following concepts as they apply to Plant Fire on Site: Fire classifications, by type	3.9	1
							<u>2.4.27* Knowledge of fire in the plant procedure.</u>	3.5	1

PWR SRO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group1

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000068 (A06) Control Room Evac. / VIII		1				1	AK2.07 Knowledge of the interrelations between the Control Room Evacuation and the following: ED/G <u>2.4.35* Knowledge of local auxiliary operator tasks during emergency operations including system geography and system implications.</u>	3.4 3.5	1 1
000069 Loss of CTMT Integrity / V									
000074 Inad. Core Cooling / IV						1	<u>2.4.21* Knowledge of the parameters and logic used to assess the status of safety functions including:</u> <u>1. Reactivity control</u> <u>2. Core cooling and heat removal</u> <u>3. Reactor coolant system integrity</u> <u>4. Reactor Building conditions</u> <u>5. Radioactivity release control</u>	4.3	1
E03 Inadequate Subcooling Margin / IV	1		1				EK1.2 Knowledge of the operational implications of the following concepts as they apply to the (Inadequate Subcooling Monitor): Normal, abnormal and emergency operating procedures associated with (HPI Termination). EK3.1 Knowledge of the reasons for the following responses as they apply to the (Inadequate Subcooling Monitor): Facility operating characteristics during transient conditions, including coolant chemistry and the effects of temperature, pressure, and reactivity changes and operating limitations and reasons for these operating characteristics.	4.0 3.8	1 1

PWR SRO Examination Outline									
Emergency and Abnormal Plant Evolutions - Tier1/Group1									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000076 High Reactor Coolant Activity / IX					1		AA2.02 Ability to determine and interpret the following as they apply to the High Reactor Coolant Activity: Corrective actions required for high fission product activity in RCS NOTE 1	3.4	1
A02&A03 Loss of NNI-XY / VII									
K/A Category Totals:	4	3	2	3	6	6	Group Point Total =	24	

PWR SRO Examination Outline
Emergency and Abnormal Plant Evolutions - Tier1/Group2

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000007 (E02&E10) Reactor Trip - Stabilization - Recovery / I		1					EK2.02 Knowledge of the interrelations between a reactor trip and the following: Breakers, relays and disconnects	2.8	1
A01 Plant Runback / I									
A04 Turbine Trip / IV			1				AK3.2 Knowledge of the reasons for the following responses as they apply to the (Turbine Trip): Normal, abnormal and emergency operating procedures associated with (Turbine Trip).	3.6	1
000008 Pressurizer Vapor Space Accident / III			1				AK3.02 Knowledge of the reasons for the following responses as they apply to the Pressurizer Vapor Space Accident: Why PORV or code safety exit temperature is below RCS or PZR temperature	4.1	1
000009 Small Break LOCA / III						1	2.4.22* Knowledge of the bases for prioritizing safety functions during abnormal/emergency operations.	4.0	1
E08 LOCA Cooldown - Depress. / IV						1	2.1.28 Knowledge of the purpose and function of major system components and controls.	3.3	1
000022 Loss of Reactor Coolant Makeup / II									
000025 Loss of RHR System / IV									
000027 Pressurizer Pressure Control System Malfunction / III				1			AA1.01 Ability to operate and / or monitor the following as they apply to the Pressurizer Pressure Control Malfunctions: PZR heaters, sprays, and PORVs	3.9	1

PWR SRO Examination Outline Emergency and Abnormal Plant Evolutions - Tier1/Group2									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000032 Loss of Source Range NI / VII					1		AA2.02 Ability to determine and interpret the following as they apply to the Loss of Source Range Nuclear Instrumentation: Expected change in source range count rate when rods are moved	3.9	1
000033 Loss of Intermediate Range NI / VII			1				AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Intermediate Range Nuclear Instrumentation: Termination of startup following loss of intermediate-range instrumentation	3.6	1
000037 Steam Generator Tube Leak / III	1						AK1.01 Knowledge of the operational implications of the following concepts as they apply to Steam Generator Tube Leak: Use of steam tables	3.3	1
000038 Steam Generator Tube Rupture / III					1		<u>EA2.01* Ability to determine or interpret the following as they apply to a SGTR: When to isolate one or more S/Gs</u>	4.7	1
000054 Loss of Main Feedwater / IV			1				AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Main Feedwater (MFW): Reactor and/or turbine trip, manual and automatic	4.4	1
E04 Inadequate Heat Transfer - Loss of Secondary Heat Sink / IV		1					EK2.1 Knowledge of the interrelations between the (Inadequate Heat Transfer) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	4.0	1

PWR SRO Examination Outline									
Emergency and Abnormal Plant Evolutions - Tier1/Group2									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000058 Loss of DC Power / VI					1		AA2.03* <u>Ability to determine and interpret the following as they apply to the Loss of DC Power: DC loads lost; impact on ability to operate and monitor plant systems</u> NOTE 2	3.9	1
000060 Accidental Gaseous Radwaste Rel. / IX				1			AA1.02 Ability to operate and / or monitor the following as they apply to the Accidental Gaseous Radwaste: Ventilation system	3.1	1
000061 ARM System Alarms / VII				1			AA1.01 Ability to operate and / or monitor the following as they apply to the Area Radiation Monitoring (ARM) System Alarms: Automatic actuation	3.6	1
000065 Loss of Instrument Air / VIII			1				AK3.08 Knowledge of the reasons for the following responses as they apply to the Loss of Instrument Air: Actions contained in AOP for loss of instrument air	3.9	1
K/A Category Totals:							Group Point Total =	16	

PWR SRO Examination Outline

Emergency and Abnormal Plant Evolutions - Tier1/Group3

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000028 Pressurizer Level Malfunction / II									
000036 (A08) Fuel Handling Accident / VIII									
000056 Loss of Off-site Power / VI			1				AK3.02 Knowledge of the reasons for the following responses as they apply to the Loss of Offsite Power: Actions contained in EOP for loss of offsite power	4.7	1
E13&E14 EOP Rules and Enclosures			1				E14EA2.2* Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments. NOTE 2	4.0	1
A05 Emergency Diesel Actuation / VI		1					AK2.1 Knowledge of the interrelations between the (Emergency Diesel Actuation) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.8	1
A07 Flooding / VIII									
K/A Category Totals:	0	1	2	0	0	0	Group Point Total =	3	

PWR SRO Examination Outline

Plant Systems - Tier2/Group1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
001 Control Rod Drive	1										1	K1.09 Knowledge of the physical connections and/or cause-effect relationships between the CRDS and the SW system (must be cut in before energizing CRDS).	3.1	1
												2.1.32 Ability to explain and apply all system limits and precautions. NOTE 1	3.8	1
003 Reactor Coolant Pump			1									K3.05 Knowledge of the effect that a loss or malfunction of the RCPs will have on the following: ICS	3.7	1
004 Chemical and Volume Control			1								1	K3.04 Knowledge of the effect that a loss or malfunction of the MUPS will have on the RCP's	3.9	1
												2.1.30 Ability to locate and operate components, including local controls.	3.4	1
013 Engineered Safety Features Actuation		1	1					1				K2.01 Knowledge of bus power supplies to the ESFAS / safeguards equipment control. NOTE 3	3.8	1
												K3.02 Knowledge of the effect that a loss or malfunction of the ESFAS will have on the RCS.	4.5	1
												<u>A2.05* Ability to (a) predict the impacts of the following malfunctions or operations on the ESFAS; and (b) based Ability on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations; Loss of dc control power</u>	4.2	1

PWR SRO Examination Outline

Plant Systems - Tier2/Group1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
014 Rod Position Indication				1				1				K4.04 Knowledge of RPIS design feature(s) which provide zone reference lights. NOTE 1	2.9	1
												A2.01 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: Loss of offsite power NOTE 1	3.3	1
015 Nuclear Instrumentation										1		A4.01 Ability to manually operate and/or monitor in the control room: Selection of controlling NIS channel	3.6	1
017 In-core Temperature Monitor											1	<u>2.1.12* Ability to apply technical specifications for a system.</u>	4.0	1
022 Containment Cooling		1										K2.01 Knowledge of power supplies to the following: Reactor Building cooling fans	3.1	1
026 Containment Spray							1					A1.06 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the BSS controls including: Reactor Building spray pump cooling	3.0	1
056 Condensate	1											K1.03 Knowledge of the physical connections and/or cause-effect relationships between the Condensate System and the following systems: MFW NOTE 1	2.6	1
059 Main Feedwater	1											K1.07 Knowledge of the physical connections and/or cause-effect relationships between the MFW and the following systems: ICS	3.2	1

PWR SRO Examination Outline

Plant Systems - Tier2/Group1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
061 Auxiliary/Emergency Feedwater					1							K5.01 Knowledge of the operational implications of the following concepts as they apply to the AFW: Relationship between AFW flow and RCS heat transfer NOTE 4/5 (SRO only)	3.9	1
063 DC Electrical Distribution														
068 Liquid Radwaste						1						K6.10 Knowledge of the effect of a loss or malfunction on the following will have on the Liquid Radwaste System : Radiation monitors	2.9	1
071 Waste Gas Disposal														
072 Area Radiation Monitoring										1		A4.03 Ability to manually operate and/or monitor in the control room: Check source for operability demonstration	3.1	1
K/A Category Totals:	3	2	3	1	1	1	1	2	0	2	3	Group Point Total =	19	

PWR SRO Examination Outline

Plant Systems - Tier2/Group2

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
002 Reactor Coolant					1							K5.10 Knowledge of the operational implications of the relationship between reactor power and RCS differential temperature as it applies to the RCS. NOTE 1	4.1	1
006 Emergency Core Cooling									1			A3.03 Ability to monitor automatic operation of the ECCS, including: ESFAS-operated valves	4.1	1
010 Pressurizer Pressure Control				1								K4.03 Knowledge of PZR PCS design feature(s) and/or interlock(s) which provide for the following: Over pressure control NOTE 4/5 (SRO only)	4.1	1
011 Pressurizer Level Control														
012 Reactor Protection						1						K6.04 Knowledge of the effect of a loss or malfunction of the following will have on the RPS: Bypass-block circuits NOTE 3	3.6	1
016 Non-nuclear Instrumentation											1	2.1.31 Ability to locate control room switches, controls and indications and to determine that they are correctly reflecting the desired plant lineup.	3.9	1
027 Containment Iodine Removal											1	2.1.28 Knowledge of the purpose and function of major system components and controls. NOTE 1	3.3	1
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge	1											K1.01 Knowledge of the physical connections and/or cause-effect relationships between the Containment Purge System and the following: Gaseous radiation release monitors	3.7	1

PWR SRO Examination Outline

Plant Systems - Tier2/Group2

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
033 Spent Fuel Pool Cooling								1				<u>A2.03* Ability to (a) predict the impacts of the following malfunctions or operations on the Spent Fuel Pool Cooling System ; and (b) based those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Abnormal spent fuel pool water level or loss of water level</u> NOTE 2	3.5	1
034 Fuel Handling Equipment								1				A2.02 Ability to (a) predict the impacts of the following malfunctions or operations on the Fuel Handling System ; and (b) based those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Dropped cask NOTE 1	3.9	1
035 Steam Generator					1							K5.01 Knowledge of the effect of secondary parameters, pressure, and temperature on reactivity as they apply to the S/GS.	3.9	1
039 Main and Reheat Steam										1		A4.03 Ability to manually operate and/or monitor in the control room: MFW pump turbines	2.8	1
055 Condenser Air Removal			1									K3.01 Knowledge of the effect that a loss or malfunction of the CARS will have on the following: Main condenser NOTE 1	2.7	1
062 AC Electrical Distribution									1			A3.04 Ability to monitor automatic operation of the AC distribution system, including: Operation of inverter (e.g., precharging synchronizing light, static transfer)	2.9	1

PWR SRO Examination Outline

Plant Systems - Tier2/Group2

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
064 Emergency Diesel Generator			1									K3.02 Knowledge of the effect that a loss or malfunction of the ED/G system will have on the following: ESFAS controlled or actuated systems	4.4	1
073 Process Radiation Monitoring														
075 Circulating Water	1											K1.01 Knowledge of the physical connections and/or cause-effect relationships between the CW system and the following systems: RW System	2.5	1
079 Station Air														
086 Fire Protection							1					A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Fire Protection System operating the controls including: Fire header pressure	3.3	1
103 Containment							1					A1.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the reactor building system controls including: Reactor Building pressure and temperature	4.1	1
K/A Category Totals:	2	0	2	1	2	1	2	2	2	1	2		Group Point Total = 17	

PWR SRO Examination Outline

Plant Systems - Tier2/Group3

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic	Imp.	Points
005 Residual Heat Removal					1							K5.02 Knowledge of the operational implications of the following concepts as they apply the Decay Heat System: Need for adequate subcooling	3.5	1
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water				1								K4.09 Knowledge of SWS / DCS design feature(s) and/or interlock(s) which provide for the standby feature of the SWS / DCS pumps.	2.9	1
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator	1											K1.18 Knowledge of the physical connections and/or cause-effect relationships between the MT/G system and the RPS. NOTE 1	3.7	1
076 Service Water								1				A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the RWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of RWS	3.7	1
078 Instrument Air														
K/A Category Totals:	1	0	0	1	1	0	0	1	0	0	0	Group Point Total = 4		

PWR SRO Examination Outline

Generic Knowledges and Abilities

Category	KA #	K/A Topic	Imp.	Points
Conduct of Operations	2.1.4*	<u>2.1.4* Knowledge of shift staffing requirements</u> NOTE 2	3.4	1
	2.1.12*	<u>2.1.12* Ability to apply technical specifications for a system.</u>	4.0	1
	2.1.20*	<u>2.1.20* Ability to execute procedure steps.</u> NOTE 2	4.2	1
	2.1.32*	<u>2.1.32* Ability to explain and apply all system limits and precautions.</u> NOTE 2	3.8	1
	2.1.33*	<u>2.1.33* Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications.</u> NOTE 2	4.0	1
	Total Points			5
Equipment Control	2.2.22*	<u>2.2.22* Knowledge of limiting conditions for operations and safety limits.</u>	4.1	1
	2.2.25*	<u>2.2.25* Knowledge of bases in technical specifications for limiting conditions for operations and safety limits.</u>	3.7	1
	2.2.28*	<u>2.2.28* Knowledge of new and spent fuel movement procedures.</u>	3.5	1
	Total Points			3

PWR SRO Examination Outline

Generic Knowledges and Abilities

Category	KA #	K/A Topic	Imp.	Points
Radiation Control	2.3.2	2.3.2 Knowledge of facility ALARA program.	2.9	1
	2.3.6*	<u>2.3.6* Knowledge of the requirements for reviewing and approving release permits.</u> NOTE 2	3.1	1
	2.3.8*	<u>2.3.8* Knowledge of the process for performing a planned gaseous radioactive release.</u> NOTE 2	3.2	1
	2.3.9	2.3.9 Knowledge of the process for performing a containment purge.	3.4	1
	Total Points			4
Emergency Procedures / Plan	2.4.2	2.4.2 Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions.	4.1	1
	2.4.12	2.4.12 Knowledge of general operating crew responsibilities during emergency operations.	3.9	1
	2.4.25	2.4.25 Knowledge of fire protection procedures.	3.4	1
	2.4.27*	<u>2.4.27* Knowledge of fire in the plant procedure.</u> NOTE 2	3.5	1
	2.4.30*	<u>2.4.30* Knowledge of which events related to system operations/status should be reported to outside agencies.</u> NOTE 2	3.6	1
	Total Points			5
TIER 3 Category Totals:				17

PWR SRO Examination Outline

Generic Knowledges and Abilities

Category	KA #	K/A Topic	Imp.	Points
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NOTE 1 : Random generator chose a category with no SRO K/As with an importance factor of 2.5 or greater. Chose a different category to obtain a K/A with an importance factor greater than 2.5.

NOTE 2: New K/A chosen for the same topic to obtain a K/A supporting plant specific SRO objectives and /or 10 CFR 55.43 IAW NUREG 1021 Revision 8, Supplement 1.

NOTE 3: Random generator did not meet the requirement for 2 items in a category. Chose a system and K/A that would complete the category requirements.

NOTE 4: K/A moved within topic per NRC request 7/27/2001 to provide more uniform coverage of K/As

NOTE 5: Movement of K/As per NRC request created a separate question for SRO. Considered a common question does not meet 10 CFR55.43 criteria.

SRO ONLY QUESTIONS are identified by * **BOLD** print and underlined.

[illegible]