3.0 SYSTEMS

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3.0 SYSTEMS

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Safety Function 1: Reactivity Control

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Chemical and Volume Control System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air System	3.0
K 1.02	Component Cooling Water System	2.9
K 1.03	Diverse Actuation System	3.6
K 1.04	Demineralized Water Transfer and Storage System	2.6
K 1.05	Engineered Safeguards Actuation System	4.0
K 1.06	Special Process Heat Tracing System	1.9
K 1.07	Nuclear Instrumentation System	3.0
K 1.08	Post Accident Monitoring System	3.0
K 1.09	Plant Gas System	2.3
K 1.10	Pressurizer Level Control System	3.6
K 1.11	Plant Sampling System	1.9
K 1.12	Passive Core Cooling System	3.6
K 1.13	Reactor Coolant System	3.7
K 1.14	Normal Residual Heat Removal System	3.3
K 1.15	Spent Fuel Pool Cooling System	3.0
K 1.16	Radiologically Controlled Area Ventilation System	2.2
K 1.17	Liquid Radwaste System	2.1
K 1.18	Radioactive Waste Drain System	2.0
K 1.19	Waste Water System	1.8
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Chemical and Volume Control System makeup pumps	3.2
K 2.02	Boric acid tank heaters	2.0
K 2.03	Purification stop valves	3.1
K 2.04	Containment isolation valves	3.7

K 3 Knowledge of the effect that a loss or malfunction of the Chemical and Volume Control System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)

K 3.01	Component Cooling Water System	2.6
K 3.02	Reactor Coolant System	3.8
K 3.03	Pressurizer Level Control System	3.8
K 3.04	Passive Core Cooling System	3.6
K 3.05	Reactor Coolant System	3.7
K 3.06	Hot leg level during mid-loop	3.7
K 3.07	Normal Residual Heat Removal System	3.2
K 3.08	Radiologically Controlled Area Ventilation System	2.1
K 3.09	Liquid Radwaste System	2.1

K 4 Knowledge of Chemical and Volume Control System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Containment penetration isolation	4.0
K 4.02	Boron Dilution Block Actuation	3.8
K 4.03	Chemical and Volume Control System Makeup Isolation Actuation	3.7
K 4.04	Chemical and Volume Control System Letdown Isolation Actuation	3.8
K 4.05	Auxiliary Spray and Purification Line Isolation Actuation	3.5
K 4.06	Preservation of Reactor Coolant System pressure boundary	4.1
K 4.07	Isolation of excessive makeup	3.5
K 4.08	Chemical and Volume Control System Letdown Isolation Actuation (Hot Leg Level Low 1)	3.7
K 4.09	Reactor Coolant System inventory control	3.8
K 4.10	Reactor Coolant System boration and/or dilution	3.7
K 4.11	Pressurizer auxiliary spray supply	3.1
K 4.12	Reactor coolant purification	2.7
K 4.13	Chemical control	2.8
K 4.14	Oxygen control	2.5
K 4.15	Filling and pressure testing the Reactor Coolant System	2.1
K 4.16	Borated makeup to auxiliary equipment	2.4
K 4.17	Reactor Coolant System degassing	2.6

K	4.18	Chemical and Volume Control System makeup pumps suction header control valve interlocks	3.0
K	4.19	Demineralized water supply isolation valves interlocks	3.0
K	4.20	Purification loop temperature control	2.6
K	4.21	Purification stop valves interlocks	3.0
K	4.22	Pressurizer auxiliary spray valve interlocks	3.1
K	4.23	Letdown line isolation valve - orifice side interlocks	3.4
K	4.24	Makeup line containment isolation valves interlocks	3.7
K	4.25	Letdown line outside containment isolation valve interlocks	3.5
K	4.26	Letdown line inside containment isolation valve interlocks	3.8
K	4.27	Chemical and Volume Control System makeup flow control valve interlocks	3.2
K	4.28	Chemical and Volume Control System makeup pumps interlocks	3.1
K	4.29	Reactor Makeup Control System borate mode	3.5
K	4.30	Reactor Makeup Control System dilute mode	3.0
K	4.31	Reactor Makeup Control System blend mode	3.1
K	4.32	Reactor Makeup Control System auto makeup mode	3.2
K	4.33	Reactor Coolant System pressure control during solid plant operation	3.5

K	**5**	**Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Chemical and Volume Control System: (CFR: 41.7 / 45.7)**	
K	5.01	Thermal shock of Reactor Coolant System penetrations	3.6
K	5.02	Demineralizer depletion	2.6
K	5.03	Reactor coolant pump configuration and speed effect on purification loop flow	2.8
K	5.04	Borating fresh demineralizer bed before placing in service (OE-related)	3.2
K	5.05	Temperature effects on demineralizer beds (OE-related)	3.0
K	5.06	Temperature effects on boron solubility (OE-related)	3.0
K	5.07	Reactor Coolant System corrosion, activity, and isotopic control (i.e., hydrogen concentration, oxygen concentration, zinc concentration and pH control)	2.9
K	5.08	Reactor Coolant System pH outside of acceptability range	2.8
K	5.09	Reactor Coolant System pressure control during solid plant operation	3.5

K 6 Knowledge of the effect of a loss or malfunction of the following on Chemical and Volume Control System components: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air System	3.2
K	6.02	Component Cooling Water System	3.1
K	6.03	Diverse Actuation System	3.7
K	6.04	Demineralized Water Transfer and Storage System	2.5
K	6.05	Engineered Safeguards Actuation System	4.0
K	6.06	Special Process Heat Tracing System	2.0
K	6.07	Nuclear Instrumentation System	3.0
K	6.08	Plant Gas System	2.3
K	6.09	Pressurizer Level Control System	3.5
K	6.10	Reactor Coolant System	3.6
K	6.11	Hot leg level during mid-loop	3.8
K	6.12	Normal Residual Heat Removal System	3.2
K	6.13	Spent Fuel Pool Cooling System	3.0
K	6.14	Liquid Radwaste System	2.3
K	6.15	Chemical and Volume Control System makeup pump	3.2
K	6.16	Mixed bed demineralizer	2.6
K	6.17	Reactor coolant filter	2.4
K	6.18	Makeup filter	2.5
K	6.19	Reactor Makeup Control System	3.5
K	6.20	Letdown heat exchanger	3.1
K	6.21	Purification stop valves	3.2
K	6.22	Makeup line containment isolation valves	3.6

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Chemical and Volume Control System including: (CFR: 41.7 / 45.5)

A	1.01	Purification flow rate	2.7
A	1.02	Boration flow rate	3.4
A	1.03	Dilution flow rate	3.1
A	1.04	Chemical and Volume Control System makeup pump flow rate (1 pump)	2.9

A	1.05	Chemical and Volume Control System makeup pump flow rate (2 pumps)	3.0
A	1.06	Letdown water temperatures	2.9
A	1.07	Maximum demineralizer and filter temperatures	2.9
A	1.08	Effluent temperature to Liquid Radwaste System	2.3
A	1.09	Effluent flow rate to Liquid Radwaste System	2.4
A	1.10	Boric acid storage tank boric acid concentration	3.3
A	1.11	Placing cation demineralizer bed in service (OE-related)	2.8
A	1.12	Control rod position	3.7
A	1.13	Reactor power	4.0
A	1.14	Pressurizer auxiliary spray	3.2
A	1.15	Reactor Coolant System temperature	3.6
A	1.16	Reactor Coolant System pressure during solid plant operations	3.7
A	1.17	Pressurizer pressure	3.4
A	1.18	Pressurizer temperature	3.1
A	1.19	Pressurizer level	3.5
A	1.20	Pressurizer spray line temperature	3.0
A	1.21	Total gallons and time required to achieve desired boron concentration	3.2

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Chemical and Volume Control System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13 / 45.13)**	**RO**	**SRO**
A	2.01	Compressed and Instrument Air System	3.4	3.1
A	2.02	Component Cooling Water System	3.0	2.9
A	2.03	Diverse Actuation System	4.0	3.7
A	2.04	Demineralized Water Transfer and Storage System	3.0	2.7
A	2.05	Engineered Safeguards Actuation System	3.8	3.9
A	2.06	Special Process Heat Tracing System	2.2	1.9
A	2.07	Nuclear Instrumentation System	3.4	2.9
A	2.08	Pressurizer Level Control System	3.6	3.5
A	2.09	Plant Gas System	2.4	2.2
A	2.10	Reactor Coolant System	3.8	3.6
A	2.11	Normal Residual Heat Removal System	3.8	3.1

A	2.12	Spent Fuel Pool Cooling System	3.0	2.7
A	2.13	Liquid Radwaste System	2.6	2.2
A	2.14	Chemical and Volume Control System makeup pump	3.4	3.1
A	2.15	Mixed bed demineralizer	2.2	2.6
A	2.16	Reactor coolant filter	2.4	2.4
A	2.17	Makeup filter	2.8	2.4
A	2.18	Reactor Makeup Control System	3.6	3.4
A	2.19	Letdown heat exchanger	3.0	2.9
A	2.20	Inadvertent boration or dilution	3.8	4.0
A	2.21	Containment Isolation Actuation	4.0	4.1
A	2.22	Boron Dilution Block Actuation	3.8	3.9
A	2.23	Chemical and Volume Control System Makeup Isolation Actuation	3.6	3.6
A	2.24	Chemical and Volume Control System Letdown Isolation Actuation	3.6	3.7
A	2.25	Auxiliary Spray and Purification Line Isolation Actuation	3.6	3.3
A	2.26	High Reactor Coolant System activity	3.4	3.6
A	2.27	Accumulator boron concentration out of spec	3.8	3.4
A	2.28	Core makeup tank boron concentration out of spec	3.4	3.4
A	2.29	In-containment refueling water storage tank boron concentration out of spec	4.0	3.7
A	2.30	Spent Fuel Pool Cooling System boron concentration out of spec	3.8	3.3
A	2.31	EOL boron reduction using mixed bed deborating demineralizer	2.4	2.9

A 3 Ability to monitor automatic operation of the Chemical and Volume Control System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Reactor Coolant System boration	3.6
A	3.02	Reactor Coolant System dilution	3.7
A	3.03	Reactor Coolant System makeup	3.4
A	3.04	Chemical and Volume Control System purification	2.9
A	3.05	Chemical and Volume Control System letdown	3.1
A	3.06	Reactor Coolant System pressure control during solid plant operation	3.8
A	3.07	Containment Isolation Actuation	4.1
A	3.08	Boron Dilution Block Actuation	3.8
A	3.09	Chemical and Volume Control System Makeup Isolation Actuation	3.8

A	3.10	Chemical and Volume Control System Letdown Isolation Actuation	3.8
A	3.11	Auxiliary Spray and Purification Line Isolation Actuation	3.3

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Reactor Coolant System boration (including reactivity effects)	3.9
A	4.02	Reactor Coolant System dilution (including reactivity effects)	4.0
A	4.03	EOL boron reduction using mixed bed deborating demineralizer (including reactivity effects)	3.2
A	4.04	Reactor Coolant System makeup	3.5
A	4.05	Chemical and Volume Control System purification	3.0
A	4.06	Chemical and Volume Control System letdown	3.4
A	4.07	Reactor Coolant System pressure control during solid plant operation	3.8
A	4.08	Reactor Coolant System pressure control using auxiliary spray	3.4
A	4.09	Containment Isolation Actuation	4.0
A	4.10	Boron Dilution Block Actuation	3.8
A	4.11	Chemical and Volume Control System Makeup Isolation Actuation	3.8
A	4.12	Auxiliary Spray and Purification Line Isolation Actuation	3.6
A	4.13	Chemical and Volume Control System Letdown Isolation Actuation	3.8
A	4.14	Fill/makeup to the accumulators	3.2
A	4.15	Fill/makeup to the core makeup tank	3.2
A	4.16	Fill/makeup to the in-containment refueling water storage tank	3.5
A	4.17	Fill/makeup to the Spent Fuel Pool Cooling System	3.1
A	4.18	Maintain proper Reactor Coolant System hydrogen/oxygen concentration	2.9
A	4.19	Maintain proper Reactor Coolant System zinc concentration	2.8

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Digital Rod Control System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Main and Startup Feedwater System	2.3
K 1.02	Diverse Actuation System	3.5
K 1.03	Main Turbine System	2.8
K 1.04	Nuclear Instrumentation System	3.5
K 1.05	On-line Power Distribution Monitoring System	3.5
K 1.06	Pressurizer Level Control System	2.7
K 1.07	Pressurizer Pressure Control System	2.5
K 1.08	Reactor Coolant System	3.3
K 1.09	Rod Position Indication System	3.6
K 1.10	Reactor Trip System	4.0
K 1.11	Reactor System	3.2
K 1.12	Steam Dump Control System	3.3
K 1.13	Main Turbine Control and Diagnostics System	2.7
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Control rod drive mechanism M-G set motor	3.1
K 2.02	Control rod drive mechanism	3.1
K 2.03	Reactor Trip breaker control power	3.8
K 2.04	Logic cabinet control power	3.1
K 2.05	Power cabinet control power	3.1
K 2.06	Integrated head package cooling fans	2.5
K 2.07	DC hold bus	2.9

K 3 Knowledge of the effect that a loss or malfunction of the Digital Rod Control System will have on the following systems or system parameters:
(CFR: 41.7 / 45.6)

K 3.01	Reactor Coolant System	3.5
K 3.02	Rod Position Indication System	3.7
K 3.03	Reactor Trip System	3.9
K 3.04	Reactor System	3.2
K 3.05	Steam Dump Control System	3.5
K 3.06	Main Turbine Control and Diagnostics System	2.8

K 4 Knowledge of Digital Rod Control System design feature(s) and/or interlock(s) which provide for the following:
(CFR: 41.7)

K 4.01	Group demand position indication	3.6
K 4.02	Digital rod position indication	3.7
K 4.03	High power rod control mode	3.6
K 4.04	Low power rod control mode	3.6
K 4.05	Rod speed and direction determination	3.7
K 4.06	Load regulation mode	3.0
K 4.07	Axial offset control	3.7
K 4.08	Automatic rod motion	3.9
K 4.09	Manual rod motion	3.8
K 4.10	Bank select rod motion	3.5
K 4.11	Rapid Power Reduction Logic-Rod Control System	3.9
K 4.12	Control bank sequence and overlap	3.8
K 4.13	Control rod insertion limits	4.0
K 4.14	Control rod withdrawal limits	3.8
K 4.15	C-1, High Intermediate Range Flux, Auto and Manual Rod Withdrawal Block	3.8
K 4.16	C-2, High Power Range Flux, Auto and Manual Rod Withdrawal Block	3.8
K 4.17	C-3, Low OTΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.8
K 4.18	C-4, Low OPΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.8
K 4.19	C-5, Low Turbine Power, Rod Block	3.7

K	4.20	C-11, M Bank Rod Out Limit, M Bank Auto Rod Withdrawal Block	3.8
K	4.21	C-15, Axial Offset Bank Insertion Limit, Axial Offset Bank Insertion Block	3.7
K	4.22	C-17, M Bank Rod Insertion Limit, Axial Offset Bank Withdrawal Block	3.6
K	4.23	C-18, M Bank Rod Withdrawal Limit, Axial Offset Bank Insertion Block	3.6
K	4.24	P-3, Reactor Trip Breaker Open	4.1
K	4.25	P-4, Reactor Trip	4.2
K	4.26	P-17, Negative Nuclear Power Rate	4.0
K	4.27	Automatic Withdrawal Permissive – M Banks	3.8
K	4.28	Automatic and Manual Withdrawal Permissive – M Banks	3.8
K	4.29	Automatic and Manual Withdrawal Permissive – Axial Offset Bank	3.7
K	4.30	Automatic Withdrawal Permissive – Axial Offset Bank	3.7
K	4.31	Automatic Insertion Permissive – Axial Offset Bank	3.7
K	4.32	Dropped or misaligned control rod recovery (OE-related)	4.0
K	4.33	Control rod exchange	3.7
K	4.34	Control rod motion inhibit	3.6
K	4.35	Reactor trip	4.5
K	4.36	Reactor trip breaker operability testing	3.7
K	4.37	Rod control startup reset	3.2
K	4.38	Rod control alarm reset	3.1
K	4.39	Sequencing of gripper and lift coil energization during control rod motion	2.9

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Digital Rod Control System:
(CFR: 41.7 / 45.7)

K	5.01	Control rod position change effect on shutdown margin	4.0
K	5.02	Reactor Coolant System boron change effect on shutdown margin	4.0
K	5.03	Dropped or misaligned control rod effect on core poisons (OE-related)	3.7
K	5.04	Dropped or misaligned control rod recovery effect on core poisons (OE-related)	3.7
K	5.05	Control rod position and core poison redistribution effect on AFD	3.6
K	5.06	AFD response to reactor power maneuvers	3.9
K	5.07	Core poison redistribution effect on QPTR	3.7
K	5.08	Control rod position change effect on integral control rod worth	3.2

K	5.09	Control rod position change effect on differential control rod worth	3.3
K	5.10	Control rod bank positions not within the control rod insertion limits of COLR	4.2
K	5.11	MTC not within limits of COLR	4.0
K	5.12	Positive MTC effect on reactor control	4.1
K	5.13	Negative MTC effect on reactor control	4.0
K	5.14	Performing a reactor startup within 24 hrs after a trip from power	3.5
K	5.15	Power mismatch circuit effect on control rod motion	3.5
K	5.16	Control rod exchange	3.7
K	5.17	Inadequate shutdown margin before withdrawing shut down banks	4.2
K	5.18	Axial offset bank movement effect on reactor power	3.7
K	5.19	Erroneous estimated critical position	4.0
K	5.20	Failure to maintain power margin	3.7

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Digital Rod Control System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Main and Startup Feedwater System	3.0
K	6.02	Main Turbine System	3.0
K	6.03	Nuclear Instrumentation System	3.7
K	6.04	On-line Power Distribution Monitoring System	3.8
K	6.05	Pressurizer Level Control System	3.0
K	6.06	Pressurizer Pressure Control System	3.0
K	6.07	Reactor Coolant System	3.3
K	6.08	Rod Position Indication System	3.7
K	6.09	Reactor Trip System	4.0
K	6.10	Reactor System	3.3
K	6.11	Steam Dump Control System	3.3
K	6.12	Main Turbine Control and Diagnostics System	2.9
K	6.13	Control rod exchange	3.5
K	6.14	Dropped control rod (OE-related)	3.8
K	6.15	Misaligned control rod (OE-related)	3.8
K	6.16	Inoperable control rod	3.9

K	6.17	Logic cabinet non-urgent alarm	3.1
K	6.18	Logic cabinet urgent alarm	3.5
K	6.19	Power cabinet non-urgent alarm	3.1
K	6.20	Power cabinet urgent alarm	3.5
K	6.21	Digital rod position indication failure	3.5
K	6.22	Group demand position indication failure	3.5
K	6.23	Control rod drive mechanism failure	3.7
K	6.24	Integrated head package cooling fan failure	2.7
K	6.25	Control rod drive mechanism M-G set	3.1
K	6.26	Reactor trip breaker failure	4.1
K	6.27	Loss of all AC power	3.7

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Digital Rod Control System including: (CFR: 41.7 / 45.5)

A	1.01	Nuclear Instrumentation System indicated power and SUR	4.0
A	1.02	Calculated reactor power	3.9
A	1.03	Reactor Coolant System ΔT	3.7
A	1.04	Reactor Coolant System Tave	3.9
A	1.05	Reactor Coolant System Tref	3.7
A	1.06	AFD	3.8
A	1.07	Axial power margin	3.5
A	1.08	Group demand position indication	3.6
A	1.09	Digital rod position indication	3.8
A	1.10	QPTR	3.7
A	1.11	Control rod insertion and withdrawal limits	3.9
A	1.12	Control bank sequence and overlap	3.9
A	1.13	Group demand positions	3.6
A	1.14	Digital rod position indication rod positions	3.7
A	1.15	Control rod operability	4.0
A	1.16	Peak kw/ft (Z)	3.4
A	1.17	Nuclear enthalpy rise hot channel factor ($F^N_{\Delta H}$)	3.4
A	1.18	DNBR	3.5
A	1.19	Shutdown margin	3.9

A	1.20	Main turbine load	3.2

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Digital Rod Control System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Main and Startup Feedwater System	2.4	3.1
A	2.02	Main Turbine System	2.9	3.2
A	2.03	Nuclear Instrumentation System	3.4	3.6
A	2.04	On-line Power Distribution Monitoring System	3.6	3.8
A	2.05	Pressurizer Level Control System	2.4	3.3
A	2.06	Pressurizer Pressure Control System	2.6	3.2
A	2.07	Reactor Coolant System	3.1	3.4
A	2.08	Rod Position Indication System	3.4	3.9
A	2.09	Reactor Trip System	4.1	4.1
A	2.10	Reactor System	2.9	3.2
A	2.11	Steam Dump Control System	3.4	3.4
A	2.12	Main Turbine Control and Diagnostics System	3.0	3.0
A	2.13	Dropped control rod (OE-related)	3.6	4.1
A	2.14	Misaligned control rod (OE-related)	3.6	4.1
A	2.15	Inoperable control rod	3.8	4.1
A	2.16	Logic cabinet failure	2.9	3.6
A	2.17	Power cabinet failure	2.9	3.6
A	2.18	Digital rod position indication failure	2.9	3.8
A	2.19	Group demand position indication failure	3.0	3.8
A	2.20	Control rod drive mechanism failure	3.3	3.7
A	2.21	Integrated head package cooling fan failure	2.6	2.7
A	2.22	Control rod drive mechanism M-G set	2.8	3.3
A	2.23	Reactor trip breaker failure	4.1	4.3
A	2.24	Control rod exchange	3.0	3.9

A 3 Ability to monitor automatic operation of the Digital Rod Control System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Group demand position indication	3.6
A	3.02	Digital rod position indication	3.7
A	3.03	High power rod control mode	3.8
A	3.04	Low power rod control mode	3.8
A	3.05	Control rod speed and direction determination	3.9
A	3.06	Load regulation mode	3.4
A	3.07	Axial offset control mode	3.7
A	3.08	Automatic control rod motion	3.9
A	3.09	Rapid Power Reduction Logic-Rod Control System	4.0
A	3.10	Control bank sequence and overlap	4.0
A	3.11	Control rod insertion limits	4.1
A	3.12	Control rod withdrawal limits	3.9
A	3.13	C-1, High Intermediate Range Flux, Auto and Manual Rod Withdrawal Block	3.6
A	3.14	C-2, High Power Range Flux, Auto and Manual Rod Withdrawal Block	3.6
A	3.15	C-3, Low OTΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.7
A	3.16	C-4, Low OPΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.7
A	3.17	C-5, Low Turbine Power, Rod Block	3.5
A	3.18	C-11, M Bank Rod Out Limit, M Bank Auto Rod Withdrawal Block	3.6
A	3.19	C-15, Axial Offset Bank Insertion Limit, Axial Offset Bank Insertion Block	3.6
A	3.20	C-17, M Bank Rod Insertion Limit, Axial Offset Bank Withdrawal Block	3.6
A	3.21	C-18, M Bank Rod Withdrawal Limit, Axial Offset Bank Insertion Block	3.6
A	3.22	P-3, Reactor Trip Breaker Open	4.2
A	3.23	P-4, Reactor Trip	4.4
A	3.24	P-17, Negative Nuclear Power Rate	4.0
A	3.25	Automatic Withdrawal Permissive – M Banks	3.6
A	3.26	Automatic and Manual Withdrawal Permissive – M Banks	3.6
A	3.27	Automatic and Manual Withdrawal Permissive – Axial Offset Bank	3.6
A	3.28	Automatic Withdrawal Permissive – Axial Offset Bank	3.6
A	3.29	Automatic Insertion Permissive – Axial Offset Bank	3.5
A	3.30	Control rod motion inhibit	3.6

A	3.31	Reactor trip	4.5
A	3.32	Control rod exchange	3.7

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Group demand position indication	3.6
A	4.02	Digital rod position indication	3.7
A	4.03	High power rod control mode	3.7
A	4.04	Low power rod control mode	3.7
A	4.05	Load regulation mode	3.4
A	4.06	Axial offset control	3.7
A	4.07	Manual rod motion	3.9
A	4.08	Bank select rod motion	3.8
A	4.09	Dropped or misaligned control rod recovery (OE-related)	4.0
A	4.10	Control rod exchange	3.8
A	4.11	Reactor trip	4.7
A	4.12	Reactor trip breaker operability testing	3.7
A	4.13	Integrated head package cooling fans	2.7

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Rod Position Indication System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Digital Rod Control System	3.5
K 1.02	On-line Power Distribution Monitoring System	3.3
K 1.03	Reactor Coolant System	3.0
K 1.04	Reactor System	3.2
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Digital rod position indication data cabinets	2.8
K 2.02	Digital rod position indication logic cabinets	2.8
K 2.03	Digital rod position indication coils	2.8
K 3	**Knowledge of the effect that a loss or malfunction of the Rod Position Indication System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Group demand position indication	3.3
K 3.02	Digital rod position indication	3.4
K 3.03	On-line Power Distribution Monitoring System	3.5
K 3.04	Rod insertion limit monitor	3.4
K 3.05	Rod deviation monitor	3.5
K 3.06	Automatic Withdrawal Permissive – M Banks	3.5
K 3.07	Automatic and Manual Withdrawal Permissive – M Banks	3.5
K 3.08	Automatic and Manual Withdrawal Permissive – AO Bank	3.5
K 3.09	Automatic Withdrawal Permissive – AO Bank	3.5
K 3.10	Automatic Insertion Permissive – AO Bank	3.5

K 4 Knowledge of Rod Position Indication System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Group demand position indication	3.3
K 4.02	Digital rod position indication	3.4
K 4.03	On-line Power Distribution Monitoring System	3.4
K 4.04	Rod insertion limit monitor	3.5
K 4.05	Rod deviation monitor	3.4
K 4.06	Rod at bottom indication	3.3
K 4.07	Digital rod position indication operation with one failed data channel	3.3
K 4.08	C-11, M Bank Rod Out Limit, M Bank Auto Rod Withdrawal Block	3.5
K 4.09	C-15, AO Bank Insertion Limit, AO Bank Insertion Block	3.5
K 4.10	C-17, M Bank Rod Insertion Limit, AO Bank Withdrawal Block	3.5
K 4.11	C-18, M Bank Rod Withdrawal Limit, AO Bank Insertion Block	3.5

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Rod Position Indication System: (CFR: 41.7 / 45.7)

K 5.01	Misaligned/dropped control rod effect on digital rod position indication and group demand position indication	3.7

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Rod Position Indication System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Digital Rod Control System	3.5
K 6.02	Reactor Coolant System	3.0
K 6.03	Reactor System	3.1
K 6.04	Digital rod position indication data cabinet	3.4
K 6.05	Digital rod position indication logic cabinet	3.4
K 6.06	Digital rod position indication coil	3.4
K 6.07	Group demand position indication	3.4

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Rod Position Indication System including: (CFR: 41.7 / 45.5)

A	1.01	Digital rod position indication	3.4
A	1.02	Rod at bottom	3.4
A	1.03	Group demand position indication	3.4

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Rod Position Indication System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13 / 45.13)**	**RO**	**SRO**
A	2.01	Dropped control rod	3.9	4.1
A	2.02	Misaligned control rod	3.9	4.0
A	2.03	Inoperable control rod	3.7	4.1
A	2.04	Digital rod position indication non-urgent alarm	2.6	2.8
A	2.05	Digital rod position indication urgent alarm	3.0	3.5
A	2.06	Digital rod position indication accuracy at Data A + B	2.7	3.2
A	2.07	Digital rod position indication accuracy at Data A only	2.7	3.2
A	2.08	Digital rod position indication accuracy at Data B only	2.7	3.2
A	2.09	Failed digital rod position indication data cabinet	3.0	3.4
A	2.10	Failed digital rod position indication logic cabinet	3.1	3.4
A	2.11	Failed digital rod position indication coil	3.0	3.2
A	2.12	Failed group demand position indication	3.0	3.2
A	2.13	Reactor trip	4.0	3.9
A	2.14	Loss of AC power	3.4	3.6
A	2.15	Loss of power to control rod position monitor	3.0	3.5

A 3 Ability to monitor automatic operation of the Rod Position Indication System, including: (CFR: 41.7 / 45.5 / 45.13)

A	3.01	Digital rod position indication accuracy	3.3

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Digital rod position indication accuracy mode selector	2.9
A	4.02	Rod control startup reset switch	3.1
A	4.03	Group demand position indication	3.0

Safety Function 2:
Reactor Coolant System Inventory Control page

SF2 CVS	Chemical and Volume Control System	3.2-3
SF2 ESAS	Engineered Safeguards Actuation System	3.2-11
SF2 PLCS	Pressurizer Level Control System	3.2-21
SF2 PXS	Passive Core Cooling System	3.2-25
SF2 RCS	Reactor Coolant System	3.2-31

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Chemical and Volume Control System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air System	3.0
K 1.02	Component Cooling Water System	2.9
K 1.03	Diverse Actuation System	3.6
K 1.04	Demineralized Water Transfer and Storage System	2.6
K 1.05	Engineered Safeguards Actuation System	4.0
K 1.06	Special Process Heat Tracing System	1.9
K 1.07	Nuclear Instrumentation System	3.0
K 1.08	Post Accident Monitoring System	3.0
K 1.09	Plant Gas System	2.3
K 1.10	Pressurizer Level Control System	3.6
K 1.11	Plant Sampling System	1.9
K 1.12	Passive Core Cooling System	3.6
K 1.13	Reactor Coolant System	3.7
K 1.14	Normal Residual Heat Removal System	3.3
K 1.15	Spent Fuel Pool Cooling System	3.0
K 1.16	Radiologically Controlled Area Ventilation System	2.2
K 1.17	Liquid Radwaste System	2.1
K 1.18	Radioactive Waste Drain System	2.0
K 1.19	Waste Water System	1.8
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Chemical and Volume Control System makeup pumps	3.2
K 2.02	Boric acid tank heaters	2.0
K 2.03	Purification stop valves	3.1
K 2.04	Containment isolation valves	3.7

K 3 Knowledge of the effect that a loss or malfunction of the Chemical and Volume Control System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)

K 3.01	Component Cooling Water System	2.6
K 3.02	Reactor Coolant System	3.8
K 3.03	Pressurizer Level Control System	3.8
K 3.04	Passive Core Cooling System	3.6
K 3.05	Reactor Coolant System	3.7
K 3.06	Hot leg level during mid-loop	3.7
K 3.07	Normal Residual Heat Removal System	3.2
K 3.08	Radiologically Controlled Area Ventilation System	2.1
K 3.09	Liquid Radwaste System	2.1

K 4 Knowledge of Chemical and Volume Control System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Containment penetration isolation	4.0
K 4.02	Boron Dilution Block Actuation	3.8
K 4.03	Chemical and Volume Control System Makeup Isolation Actuation	3.7
K 4.04	Chemical and Volume Control System Letdown Isolation Actuation	3.8
K 4.05	Auxiliary Spray and Purification Line Isolation Actuation	3.5
K 4.06	Preservation of Reactor Coolant System pressure boundary	4.1
K 4.07	Isolation of excessive makeup	3.5
K 4.08	Chemical and Volume Control System letdown isolation (Hot Leg Level Low 1)	3.7
K 4.09	Reactor Coolant System inventory control	3.8
K 4.10	Reactor Coolant System boration and/or dilution	3.7
K 4.11	Pressurizer auxiliary spray supply	3.1
K 4.12	Reactor coolant purification	2.7
K 4.13	Chemical control	2.8
K 4.14	Oxygen control	2.5
K 4.15	Filling and pressure testing the Reactor Coolant System	2.1
K 4.16	Borated makeup to auxiliary equipment	2.4
K 4.17	Reactor Coolant System degassing	2.6

K	4.18	Chemical and Volume Control System makeup pumps suction header control valve interlocks	3.0
K	4.19	Demineralized water supply isolation valve interlocks	3.0
K	4.20	Purification loop temperature control	2.6
K	4.21	Purification stop valves interlocks	3.0
K	4.22	Pressurizer auxiliary spray valve interlocks	3.1
K	4.23	Letdown line isolation valve - orifice side interlocks	3.4
K	4.24	Makeup line containment isolation valve interlocks	3.7
K	4.25	Letdown line outside containment isolation valve interlocks	3.5
K	4.26	Letdown line inside containment isolation valve interlocks	3.8
K	4.27	Chemical and Volume Control System makeup flow control valve interlocks	3.2
K	4.28	Chemical and Volume Control System makeup pumps interlocks	3.1
K	4.29	Reactor Makeup Control System borate mode	3.5
K	4.30	Reactor Makeup Control System dilute mode	3.0
K	4.31	Reactor Makeup Control System blend mode	3.1
K	4.32	Reactor Makeup Control System auto makeup mode	3.2
K	4.33	Reactor Coolant System pressure control during solid plant operation	3.5

K 5 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Chemical and Volume Control System: (CFR: 41.7 / 45.7)

K	5.01	Thermal shock of Reactor Coolant System penetrations	3.6
K	5.02	Demineralizer depletion	2.6
K	5.03	Reactor coolant pump configuration and speed effect on purification loop flow	2.8
K	5.04	Borating fresh demineralizer bed before placing in service (OE-related)	3.2
K	5.05	Temperature effects on demineralizer beds (OE-related)	3.0
K	5.06	Temperature effects on boron solubility (OE-related)	3.0
K	5.07	Reactor Coolant System corrosion, activity, and isotopic control (i.e., hydrogen concentration, oxygen concentration, zinc concentration and pH control)	2.9
K	5.08	Reactor Coolant System pH outside of acceptability range	2.8
K	5.09	Reactor Coolant System pressure control during solid plant operation	3.5

K 6 Knowledge of the effect of a loss or malfunction of the following on Chemical and Volume Control System components: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air System	3.2
K	6.02	Component Cooling Water System	3.1
K	6.03	Diverse Actuation System	3.7
K	6.04	Demineralized Water Transfer and Storage System	2.5
K	6.05	Engineered Safeguards Actuation System	4.0
K	6.06	Special Process Heat Tracing System	2.0
K	6.07	Nuclear Instrumentation System	3.0
K	6.08	Plant Gas System	2.3
K	6.09	Pressurizer Level Control System	3.5
K	6.10	Reactor Coolant System	3.6
K	6.11	Hot leg level during mid-loop	3.8
K	6.12	Normal Residual Heat Removal System	3.2
K	6.13	Spent Fuel Pool Cooling System	3.0
K	6.14	Liquid Radwaste System	2.3
K	6.15	Chemical and Volume Control System makeup pump	3.2
K	6.16	Mixed bed demineralizer	2.6
K	6.17	Reactor coolant filter	2.4
K	6.18	Makeup filter	2.5
K	6.19	Reactor Makeup Control System	3.5
K	6.20	Letdown heat exchanger	3.1
K	6.21	Purification stop valves	3.2
K	6.22	Makeup line containment isolation valves	3.6

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Chemical and Volume Control System including: (CFR: 41.7 / 45.5)

A	1.01	Purification flow rate	2.7
A	1.02	Boration flow rate	3.4
A	1.03	Dilution flow rate	3.1
A	1.04	Chemical and Volume Control System makeup pump flow rate (1 pump)	2.9
A	1.05	Chemical and Volume Control System makeup pump flow rate (2 pumps)	3.0

A	1.06	Letdown water temperatures	2.9
A	1.07	Maximum demineralizer and filter temperatures	2.9
A	1.08	Effluent temperature to Liquid Radwaste System	2.3
A	1.09	Effluent flow rate to Liquid Radwaste System	2.4
A	1.10	Boric acid storage tank boric acid concentration	3.3
A	1.11	Placing cation demineralizer bed in service (OE-related)	2.8
A	1.12	Control rod position	3.7
A	1.13	Reactor power	4.0
A	1.14	Pressurizer auxiliary spray	3.2
A	1.15	Reactor Coolant System temperature	3.6
A	1.16	Reactor Coolant System pressure during solid plant operations	3.7
A	1.17	Pressurizer pressure	3.4
A	1.18	Pressurizer temperature	3.1
A	1.19	Pressurizer level	3.5
A	1.20	Pressurizer normal spray line temperature	3.0
A	1.21	Total gallons and time required to achieve desired boron concentration	3.2

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Chemical and Volume Control System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Compressed and Instrument Air System	3.4	3.1
A	2.02	Component Cooling Water System	3.0	2.9
A	2.03	Diverse Actuation System	4.0	3.7
A	2.04	Demineralized Water Transfer and Storage System	3.0	2.7
A	2.05	Engineered Safeguards Actuation System	3.8	3.9
A	2.06	Special Process Heat Tracing System	2.2	1.9
A	2.07	Nuclear Instrumentation System	3.4	2.9
A	2.08	Pressurizer Level Control System	3.6	3.5
A	2.09	Plant Gas System	2.4	2.2
A	2.10	Reactor Coolant System	3.8	3.6
A	2.11	Normal Residual Heat Removal System	3.8	3.1
A	2.12	Spent Fuel Pool Cooling System	3.0	2.7

A	2.13	Liquid Radwaste System	2.6	2.2
A	2.14	Chemical and Volume Control System makeup pump	3.4	3.1
A	2.15	Mixed bed demineralizer	2.2	2.6
A	2.16	Reactor coolant filter	2.4	2.4
A	2.17	Makeup filter	2.8	2.4
A	2.18	Reactor Makeup Control System	3.6	3.4
A	2.19	Letdown heat exchanger	3.0	2.9
A	2.20	Inadvertent boration and/or dilution	3.8	4.0
A	2.21	Containment Isolation Actuation	4.0	4.1
A	2.22	Boron Dilution Block Actuation	3.8	3.9
A	2.23	Chemical and Volume Control System Makeup Isolation Actuation	3.6	3.6
A	2.24	Chemical and Volume Control System Letdown Isolation Actuation	3.6	3.7
A	2.25	Auxiliary Spray and Purification Line Isolation Actuation	3.6	3.3
A	2.26	High Reactor Coolant System activity	3.4	3.6
A	2.27	Accumulator boron concentration out of spec	3.8	3.4
A	2.28	Core makeup tank boron concentration out of spec	3.4	3.4
A	2.29	In-containment refueling water storage tank boron concentration out of spec	4.0	3.7
A	2.30	Spent Fuel Pool Cooling System boron concentration out of spec	3.8	3.3
A	2.31	EOL boron reduction using mixed bed deborating demineralizer	2.4	2.9

A 3 Ability to monitor automatic operation of the Chemical and Volume Control System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Reactor Coolant System boration	3.6
A	3.02	Reactor Coolant System dilution	3.7
A	3.03	Reactor Coolant System makeup	3.4
A	3.04	Chemical and Volume Control System purification	2.9
A	3.05	Chemical and Volume Control System letdown	3.1
A	3.06	Reactor Coolant System pressure control during solid plant operation	3.8
A	3.07	Containment Isolation Actuation	4.1
A	3.08	Boron Dilution Block Actuation	3.8
A	3.09	Chemical and Volume Control System Makeup Isolation Actuation	3.8
A	3.10	Chemical and Volume Control System Letdown Isolation Actuation	3.8

A	3.11	Auxiliary Spray and Purification Line Isolation Actuation	3.3

A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**	
A	4.01	Reactor Coolant System boration (including reactivity effects)	3.9
A	4.02	Reactor Coolant System dilution (including reactivity effects)	4.0
A	4.03	EOL boron reduction using mixed bed deborating demineralizer (including reactivity effects)	3.2
A	4.04	Reactor Coolant System makeup	3.5
A	4.05	Chemical and Volume Control System purification	3.0
A	4.06	Chemical and Volume Control System letdown	3.4
A	4.07	Reactor Coolant System pressure control during solid plant operation	3.8
A	4.08	Reactor Coolant System pressure control using auxiliary spray	3.4
A	4.09	Containment Isolation Actuation	4.0
A	4.10	Boron Dilution Block Actuation	3.8
A	4.11	Chemical and Volume Control System Makeup Isolation Actuation	3.8
A	4.12	Auxiliary Spray and Purification Line Isolation Actuation	3.6
A	4.13	Chemical and Volume Control System Letdown Isolation Actuation	3.8
A	4.14	Fill/makeup to the accumulators	3.2
A	4.15	Fill/Makeup to the Core Makeup Tank	3.2
A	4.16	Fill/Makeup to the in-containment refueling water storage tank	3.5
A	4.17	Fill/Makeup to the Spent Fuel Pool Cooling System	3.1
A	4.18	Maintain proper Reactor Coolant System hydrogen/oxygen concentration	2.9
A	4.19	Maintain proper Reactor Coolant System zinc concentration	2.8

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Engineered Safeguards Actuation System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Automatic Depressurization System	4.3
K 1.02	Steam Generator Blowdown System	3.3
K 1.03	Compressed and Instrument Air Systems	2.9
K 1.04	Component Cooling Water System	3.0
K 1.05	Containment System	3.5
K 1.06	Chemical and Volume Control System	3.4
K 1.07	Digital Rod Control System	3.4
K 1.08	Diverse Actuation System	3.8
K 1.09	Fuel Handling System	2.7
K 1.10	Fire Protection System	2.6
K 1.11	Main and Startup Feedwater System	3.3
K 1.12	Main Steam System	3.4
K 1.13	Main Turbine System	2.8
K 1.14	Nuclear Instrumentation System	3.6
K 1.15	Passive Containment Cooling System	3.9
K 1.16	Plant Control System	3.2
K 1.17	Pressurizer Level Control System	3.3
K 1.18	Pressurizer Pressure Control System	3.4
K 1.19	Primary Sampling System	2.7
K 1.20	Passive Core Cooling System	4.1
K 1.21	Reactor Coolant System	3.7
K 1.22	Reactor Coolant Pump	3.4
K 1.23	Normal Residual Heat Removal System	3.4
K 1.24	Reactor Trip System	4.0
K 1.25	Remote shutdown workstation	3.4
K 1.26	Reactor System	3.0
K 1.27	Steam Dump Control System	3.0
K 1.28	Spent Fuel Pool Cooling System	2.7
K 1.29	Steam Generator System	3.3
K 1.30	Main Turbine Control and Diagnostics System	3.0

K	1.31	Main Control Room Emergency Habitability System	3.9
K	1.32	Containment Air Filtration System	3.2
K	1.33	Central Chilled Water System	2.7
K	1.34	Gaseous Radwaste System	2.4
K	1.35	Liquid Radwaste System	2.5

K 2 Knowledge of bus or division power supplies to the following: (CFR: 41.7)

K	2.01	Engineered Safeguards Actuation System instrumentation	3.8

K 3 Knowledge of the effect that a loss or malfunction of the Engineered Safeguards Actuation System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)

K	3.01	Automatic Depressurization System	4.3
K	3.02	Steam Generator Blowdown System	3.2
K	3.03	Compressed and Instrument Air Systems	2.7
K	3.04	Component Cooling Water System	3.1
K	3.05	Containment System	3.4
K	3.06	Chemical and Volume Control System	3.0
K	3.07	Digital Rod Control System	3.2
K	3.08	Diverse Actuation System	3.8
K	3.09	Fuel Handling System	2.5
K	3.10	Fire Protection System	2.6
K	3.11	Main and Startup Feedwater System	3.3
K	3.12	Main Steam System	3.3
K	3.13	Main Turbine System	2.8
K	3.14	Nuclear Instrumentation System	3.1
K	3.15	Passive Containment Cooling System	3.9
K	3.16	Plant Control System	3.0
K	3.17	Pressurizer Level Control System	3.1
K	3.18	Pressurizer Pressure Control System	3.1
K	3.19	Primary Sampling System	2.5

K	3.20	Passive Core Cooling System	4.0
K	3.21	Reactor Coolant System	3.6
K	3.22	Reactor Coolant Pump	3.3
K	3.23	Normal Residual Heat Removal System	3.1
K	3.24	Reactor Trip System	3.9
K	3.25	Remote shutdown workstation	3.0
K	3.26	Reactor System	3.0
K	3.27	Steam Dump Control System	3.1
K	3.28	Spent Fuel Pool Cooling System	2.7
K	3.29	Steam Generator System	3.2
K	3.30	Main Turbine Control and Diagnostics System	2.9
K	3.31	Main Control Room Emergency Habitability System	3.7
K	3.32	Containment Air Filtration System	3.2
K	3.33	Central Chilled Water System	2.6
K	3.34	Gaseous Radwaste System	2.3
K	3.35	Liquid Radwaste System	2.5

K 4 Knowledge of Engineered Safeguards Actuation System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Safeguards Actuation	4.4
K	4.02	Core Makeup Tank Actuation	4.4
K	4.03	Containment Isolation Actuation	4.3
K	4.04	Steam Line Isolation Actuation	4.1
K	4.05	Turbine Trip Actuation	3.8
K	4.06	Main Feedwater Control Valve Isolation Actuation	3.9
K	4.07	Main Feedwater Pump Trip and Valve Isolation Actuation	3.9
K	4.08	Startup Feedwater Isolation Actuation	3.9
K	4.09	Automatic Depressurization System Stages 1, 2, & 3 Actuation	4.4
K	4.10	Automatic Depressurization System Stage 4 Actuation	4.5
K	4.11	Reactor Coolant Pump Trip Actuation	3.9
K	4.12	Passive Containment Cooling System Actuation	4.1
K	4.13	Passive Residual Heat Removal Heat Exchanger Actuation	4.1
K	4.14	Steam Generator Blowdown System Isolation Actuation	3.6

K	4.15	Boron Dilution Block Actuation	3.7
K	4.16	Chemical and Volume Control System Makeup Isolation Actuation	3.7
K	4.17	Normal Residual Heat Removal System Isolation Actuation	3.8
K	4.18	P-3, Reactor Trip Breaker Open	3.9
K	4.19	P-4, Reactor Trip	3.9
K	4.20	P-6, Intermediate Range Neutron Flux	3.6
K	4.21	P-11, Pressurizer Pressure below 1970 psig	3.7
K	4.22	P-12, Pressurizer Level	3.7
K	4.23	P-19, Reactor Coolant System Pressure less than 700 psig	3.6
K	4.24	Containment Air Filtration System Isolation Actuation	3.5
K	4.25	Main Control Room isolation and Air Supply Initiation Actuation	4.0
K	4.26	Auxiliary Spray and Purification Line Isolation Actuation	3.4
K	4.27	In-containment Refueling Water Storage Tank Injection Line Valve Actuation	4.1
K	4.28	In-Containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.1
K	4.29	Refueling Cavity Isolation Actuation	3.6
K	4.30	Pressurizer Heater Trip Actuation	3.2
K	4.31	Chemical And Volume Control System Letdown Isolation Actuation	3.5
K	4.32	SG PORV and Block Valve Isolation Actuation	3.5
K	4.33	Reactor Trip Actuation	4.1
K	4.34	Interdivisional communication	3.4
K	4.35	Coincidence, separation, and/or redundancy	3.5

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Engineered Safeguards Actuation System: (CFR: 41.7 / 45.7)

K	5.01	Reactor Trip Actuation	4.0
K	5.02	Anticipated transient without scram	4.2
K	5.03	Anticipated transient without scram coincident with turbine trip failure	4.2
K	5.04	Loss of feedwater anticipated transient without scram	4.2
K	5.05	Placing a channel bypass	3.5
K	5.06	Placing a channel trip	3.4
K	5.07	Engineered Safeguards Actuation System signal with one division in test	3.5

K	5.08	Partial trip	3.5
K	5.09	Loss of coolant accident	4.2
K	5.10	Steam generator tube leak	3.8
K	5.11	Steam generator tube rupture	4.2
K	5.12	Main steam line break	4.1
K	5.13	Feed water line break	4.1
K	5.14	Loss of heat sink	4.2
K	5.15	Inadequate core cooling	4.2
K	5.16	Inadvertent Engineered Safeguards Actuation System actuation	4.0

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Engineered Safeguards Actuation System: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Reactor Trip System	4.0
K	6.02	Safeguards Actuation	4.2
K	6.03	Core Makeup Tank Actuation	4.2
K	6.04	Containment Isolation Actuation	3.9
K	6.05	Steam Line Isolation Actuation	3.8
K	6.06	Turbine Trip Actuation	3.7
K	6.07	Main Feedwater Control Valve Isolation Actuation	3.8
K	6.08	Main Feedwater Pump Trip And Valve Isolation Actuation	3.7
K	6.09	Startup Feedwater Isolation Actuation	3.7
K	6.10	Automatic Depressurization System Stages 1, 2, & 3 Actuation	4.3
K	6.11	Automatic Depressurization System Stage 4 Actuation	4.3
K	6.12	Reactor Coolant Pump Trip Actuation	3.7
K	6.13	Passive Containment Cooling System Actuation	4.1
K	6.14	Passive Residual Heat Removal Heat Exchanger Actuation	4.2
K	6.15	Steam Generator Blowdown System Isolation Actuation	3.4
K	6.16	Boron Dilution Block Actuation	3.5
K	6.17	Chemical and Volume Control System Makeup Isolation Actuation	3.5
K	6.18	Normal Residual Heat Removal System Isolation Actuation	3.5
K	6.19	P-3, Reactor Trip Breaker Open	3.9
K	6.20	P-4, Reactor Trip	3.9

K	6.21	P-6, Intermediate Range Neutron Flux	3.6
K	6.22	P-11, Pressurizer Pressure Below 1970 psig	3.6
K	6.23	P-12, Pressurizer Level	3.6
K	6.24	P-19, Reactor Coolant System Pressure less than 700 psig	3.6
K	6.25	Containment Air Filtration System Isolation Actuation	3.4
K	6.26	Main Control Room Isolation and Air Supply Initiation Actuation	3.7
K	6.27	Auxiliary Spray and Purification Line Isolation Actuation	3.3
K	6.28	In-Containment Refueling Water Storage Tank Injection Line Valve Actuation	4.0
K	6.29	In-Containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.0
K	6.30	Refueling Cavity Isolation Actuation	3.5
K	6.31	Pressurizer Heater Trip Actuation	3.0
K	6.32	Chemical And Volume Control System Letdown Isolation Actuation	3.4
K	6.33	SG PORV and Block Valve Isolation Actuation	3.4
K	6.34	Reactor Trip Actuation	3.8
K	6.35	Interdivisional communication	3.3
K	6.36	Bistable processor logic	3.0
K	6.37	Local coincidence logic	3.1
K	6.38	Integrated logic processor	3.0
K	6.39	Component interface module	2.9

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Engineered Safeguards Actuation System including:
(CFR: 41.7 / 45.5)

A	1.01	Reactor power	3.8
A	1.02	Pressurizer pressure	3.8
A	1.03	Reactor Coolant System temperature	3.7
A	1.04	Pressurizer level	3.7
A	1.05	Steam generator level	3.6
A	1.06	Steam generator pressure	3.6
A	1.07	Control rod positions	3.6
A	1.08	Reactor trip breaker status	3.9
A	1.09	Reactor power	3.9

A	1.10	Startup rate	3.5
A	1.11	Shutdown margin	3.6
A	1.12	Containment pressure, temperature, water level, radiation, and/or humidity	3.6
A	1.13	Hot leg level	3.4
A	1.14	In-containment refueling water storage tank level	3.9
A	1.15	Core makeup tank level	3.9
A	1.16	Control room air supply radiation	3.6
A	1.17	Startup feedwater flow	3.3
A	1.18	Spent fuel pool level	3.1

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Engineered Safeguards Actuation System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Safeguards Actuation	4.3	4.2
A	2.02	Core Makeup Tank Actuation	4.3	4.1
A	2.03	Containment Isolation Actuation	4.2	4.0
A	2.04	Steam Line Isolation Actuation	3.8	3.9
A	2.05	Turbine Trip Actuation	3.7	3.8
A	2.06	Main Feedwater Control Valve Isolation Actuation	3.5	3.7
A	2.07	Main Feedwater Pump Trip And Valve Isolation Actuation	3.7	3.7
A	2.08	Startup Feedwater Isolation Actuation	3.5	3.6
A	2.09	Automatic Depressurization System Stages 1, 2, & 3 Actuation	4.5	4.2
A	2.10	Automatic Depressurization System Stage 4 Actuation	4.5	4.2
A	2.11	Reactor Coolant Pump Trip Actuation	3.3	3.6
A	2.12	Passive Containment Cooling System Actuation	4.2	4.1
A	2.13	Passive Residual Heat Removal Heat Exchanger Actuation	4.2	4.1
A	2.14	Steam Generator Blowdown System Isolation Actuation	3.2	3.4
A	2.15	Boron Dilution Block Actuation	3.5	3.5
A	2.16	Chemical and Volume Control System Makeup Isolation Actuation	3.5	3.4
A	2.17	Normal Residual Heat Removal System Isolation Actuation	3.5	3.6
A	2.18	P-3, Reactor Trip Breaker Open	4.0	3.8
A	2.19	P-4, Reactor Trip	4.0	3.8

A	2.20	P-6, Intermediate Range Neutron Flux	3.8	3.6
A	2.21	P-11, Pressurizer Pressure Below 1970 psig	3.8	3.5
A	2.22	P-12, Pressurizer Level	3.7	3.5
A	2.23	P-19, Reactor Coolant System Pressure less than 700 psig	3.8	3.4
A	2.24	Turbine Island Chemical Feed Isolation Actuation	2.7	2.6
A	2.25	Main Control Room Isolation and Air Supply Initiation Actuation	3.7	3.7
A	2.26	Auxiliary Spray and Purification Line Isolation Actuation	3.7	3.1
A	2.27	In-Containment Refueling Water Storage Tank Injection Line Valve Actuation	4.2	3.9
A	2.28	In-containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.3	3.9
A	2.29	Refueling Cavity Isolation Actuation	3.5	3.3
A	2.30	Pressurizer Heater Trip Actuation	2.8	2.9
A	2.31	Chemical And Volume Control System Letdown Isolation Actuation	3.5	3.3
A	2.32	SG PORV and Block Valve Isolation Actuation	3.5	3.3
A	2.33	Reactor Trip Actuation	3.8	3.9
A	2.34	Loss of coolant accident	4.3	4.2
A	2.35	Steam generator tube leak	4.0	4.0
A	2.36	Steam generator tube rupture	4.3	4.2
A	2.37	Main steam line break	4.2	4.2
A	2.38	Feed water line break	4.2	4.2
A	2.39	Loss of heat sink	4.3	4.2
A	2.40	Inadequate core cooling	4.3	4.2
A	2.41	Loss of divisional power	3.8	3.6

A 3 Ability to monitor automatic operation of the Engineered Safeguards Actuation System, including: (CFR: 41.7 / 45.5 / 45.13)

A	3.01	Safeguards Actuation	4.4
A	3.02	Core Makeup Tank Actuation	4.3
A	3.03	Containment Isolation Actuation	4.2
A	3.04	Steam Line Isolation Actuation	4.1
A	3.05	Turbine Trip Actuation	4.0
A	3.06	Main Feedwater Control Valve Isolation Actuation	3.9

A	3.07	Main Feedwater Pump Trip And Valve Isolation Actuation	3.9
A	3.08	Startup Feedwater Isolation Actuation	3.9
A	3.09	Automatic Depressurization System Stages 1, 2, & 3 Actuation	4.4
A	3.10	Automatic Depressurization System Stage 4 Actuation	4.4
A	3.11	Reactor Coolant Pump Trip Actuation	4.0
A	3.12	Passive Containment Cooling System Actuation	4.3
A	3.13	Passive Residual Heat Removal Heat Exchanger Actuation	4.3
A	3.14	Steam Generator Blowdown System Isolation Actuation	3.5
A	3.15	Boron Dilution Block Actuation	3.7
A	3.16	Chemical and Volume Control System Makeup Isolation Actuation	3.5
A	3.17	Normal Residual Heat Removal System Isolation Actuation	3.6
A	3.18	P-3, Reactor Trip Breaker Open	3.9
A	3.19	P-4, Reactor Trip	4.0
A	3.20	P-6, Intermediate Range Neutron Flux	3.7
A	3.21	P-11, Pressurizer Pressure below 1970 psig	3.7
A	3.22	P-12, Pressurizer Level	3.6
A	3.23	P-19, Reactor Coolant System Pressure less than 700 psig	3.6
A	3.24	Turbine Island Chemical Feed Isolation Actuation	2.7
A	3.25	Main Control Room Isolation and Air Supply Initiation Actuation	4.0
A	3.26	Auxiliary Spray and Purification Line Isolation Actuation	3.4
A	3.27	In-containment Refueling Water Storage Tank Injection Line Valve Actuation	4.1
A	3.28	In-containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.2
A	3.29	Refueling Cavity Isolation Actuation	3.6
A	3.30	Pressurizer Heater Trip Actuation	3.0
A	3.31	Chemical And Volume Control System Letdown Isolation Actuation	3.5
A	3.32	SG PORV and Block Valve Isolation Actuation	3.5
A	3.33	Reactor Trip Actuation	4.1

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Core Makeup Tank Actuation	4.3
A	4.02	Containment Isolation Actuation	4.2
A	4.03	Steam Line Isolation Actuation	4.1
A	4.04	Turbine Trip Actuation	4.1
A	4.05	Main Feedwater Control Valve Isolation Actuation	4.1
A	4.06	Main Feedwater Pump Trip And Valve Isolation Actuation	4.0
A	4.07	Startup Feedwater Isolation Actuation	3.9
A	4.08	Automatic Depressurization System Stages 1, 2, & 3 Actuation	4.5
A	4.09	Automatic Depressurization System Stage 4 Actuation	4.5
A	4.10	Reactor Coolant Pump Trip Actuation	4.0
A	4.11	Passive Containment Cooling System Actuation	4.4
A	4.12	Passive Residual Heat Removal Heat Exchanger Actuation	4.4
A	4.13	Steam Generator Blowdown System Isolation Actuation	3.4
A	4.14	Boron Dilution Block Actuation	3.8
A	4.15	Chemical and Volume Control System Makeup Isolation Actuation	3.6
A	4.16	Normal Residual Heat Removal System Isolation Actuation	3.8
A	4.17	Turbine Island Chemical Feed Isolation Actuation	2.9
A	4.18	Main Control Room Isolation and Air Supply Initiation Actuation	4.0
A	4.19	Auxiliary Spray and Purification Line Isolation Actuation	3.4
A	4.20	In-containment Refueling Water Storage Tank Injection Line Valve Actuation	4.2
A	4.21	In-containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.3
A	4.22	Refueling Cavity Isolation Actuation	3.6
A	4.23	Pressurizer Heater Trip Actuation	3.2
A	4.24	Chemical And Volume Control System Letdown Isolation Actuation	3.6
A	4.25	SG PORV and Block Valve Isolation Actuation	3.7
A	4.26	Reactor Trip Actuation	4.2

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Pressurizer Level Control System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Engineered Safeguards Actuation System	3.4
K 1.02	Chemical and Volume Control System	3.2
K 1.03	Post Accident Monitoring System	2.9
K 1.04	Passive Core Cooling System	3.1
K 1.05	Pressurizer Pressure Control System	3.1
K 1.06	Reactor Coolant System	3.3
K 1.07	Reactor Trip System	3.5
K 1.08	Main Turbine Control and Diagnostic System	2.7
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Chemical and Volume Control System makeup pumps	2.8
K 2.02	Pressurizer heaters	2.7
K 2.03	Pressurizer level channels	3.0
K 3	**Knowledge of the effect that a loss or malfunction of the Pressurizer Level Control System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Engineered Safeguards Actuation System	3.7
K 3.02	Chemical and Volume Control System	3.2
K 3.03	Post Accident Monitoring System	3.1
K 3.04	Passive Core Cooling System	3.3
K 3.05	Pressurizer Pressure Control System	3.1
K 3.06	Reactor Coolant System	3.5

K 4 Knowledge of Pressurizer Level Control System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Pressurizer level program	3.1
K 4.02	Coolant density compensation	2.7
K 4.03	Letdown isolation valve control	3.2
K 4.04	Makeup pump control	3.0
K 4.05	Load Regulation Mode	2.7
K 4.06	Solid plant operation	3.1
K 4.07	Remote shutdown workstation operations	2.5
K 4.08	Sizing of Pressurizer for insurge and outsurge	2.4

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Pressurizer Level Control System: (CFR: 41.7 / 45.7)

K 5.01	Reactor Trip Actuation	3.7
K 5.02	Turbine runback/load rejection	3.4
K 5.03	Voiding in reactor head	3.7

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Pressurizer Level Control System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Engineered Safeguards Actuation System	3.5
K 6.02	Chemical and Volume Control System	3.2
K 6.03	Post Accident Monitoring System	2.7
K 6.04	Passive Core Cooling System	3.0
K 6.05	Pressurizer Pressure Control System	3.2
K 6.06	Reactor Coolant System	3.3
K 6.07	Pressurizer level control	3.3
K 6.08	Loss of coolant accident	3.7
K 6.09	Pressurizer outside program band	3.0

A	**1**	**Ability to predict and/or monitor changes in parameters associated with operation of the Pressurizer Level Control System including: (CFR: 41.7 / 45.5)**	
A	1.01	Pressurizer level	3.5
A	1.02	Reactor Coolant System Tavg	3.2
A	1.03	Reactor Coolant System leakrate	3.3
A	1.04	Reactor Coolant System inventory balance	3.3
A	1.05	Pressurizer liquid temperature	2.9
A	1.06	Pressurizer surge line temperatures	2.9
A	1.07	Reactor power	3.3
A	1.08	Code safety tailpipe temperature	3.1
A	1.09	Turbine load	2.9
A	1.10	Makeup flow	3.0
A	1.11	Letdown flow	3.0
A	1.12	Pressurizer pressure	3.1

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Pressurizer Level Control System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Engineered Safeguards Actuation System	3.3	3.6
A	2.02	Chemical and Volume Control System	3.2	3.1
A	2.03	Post Accident Monitoring System	2.5	2.8
A	2.04	Passive Core Cooling System	3.0	3.3
A	2.05	Pressurizer Pressure Control System	3.2	3.2
A	2.06	Reactor Coolant System	3.2	3.4
A	2.07	Pressurizer level controller	3.0	3.4
A	2.08	Loss of coolant accident	3.8	3.7
A	2.09	Load regulation mode	2.7	2.7
A	2.10	Remote shutdown workstation operations	2.3	2.6
A	2.11	Loss of pressurizer level	3.2	3.6
A	2.12	Loss of pressurizer level temperature compensation	2.7	2.8

A 3 Ability to monitor automatic operation of the Pressurizer Level Control System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Letdown operation	3.1
A	3.02	Makeup to Reactor Coolant System	3.2
A	3.03	Solid plant operations	3.3
A	3.04	Pressurizer heaters	3.0

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Letdown operation	3.4
A	4.02	Makeup to Reactor Coolant System	3.4
A	4.03	Solid plant operations	3.4

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Passive Core Cooling System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	3.1
K 1.02	Chemical and Volume Control System	2.9
K 1.03	Diverse Actuation System	4.3
K 1.04	Engineered Safeguards Actuation System	4.2
K 1.05	Post Accident Monitoring System	3.3
K 1.06	Plant Gas System	2.4
K 1.07	Plant Sampling System	2.2
K 1.08	Reactor Coolant System	4.2
K 1.09	Passive Residual Heat Removal System heat exchanger	3.7
K 1.10	Normal Residual Heat Removal System	3.6
K 1.11	Reactor Trip System	3.7
K 1.12	Spent Fuel Pool Cooling System	2.8
K 1.13	Liquid Radwaste System	1.9
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Core makeup tank inlet isolation valves	3.6
K 2.02	Accumulator discharge isolation valves	3.4
K 2.03	Containment recirculation block valves	3.6
K 2.04	Containment recirculation isolation valves	3.6
K 2.05	In-containment refueling water storage tank line A/B isolation valves	3.6
K 2.06	In-containment refueling water storage tank injection isolation valves	3.6
K 3	**Knowledge of the effect that a loss or malfunction of the Passive Core Cooling System will have on the following: (CFR: 41.7 / 45.6)**	
K 3.01	Reactor Coolant System	4.3
K 3.02	Normal Residual Heat Removal System	3.2
K 3.03	Spent Fuel Pool Cooling System	2.4

K 4 Knowledge of Passive Core Cooling System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Emergency core decay heat removal	4.5
K 4.02	Containment sump pH control	3.4
K 4.03	Post-accident containment flooding	3.8
K 4.04	Reactor Coolant System cooldown	3.6
K 4.05	Non-condensable gas detection	3.3
K 4.06	Sequence of core makeup tank, accumulator, and in-containment refueling water storage tank injection during a loss of coolant accident	4.3
K 4.07	Core Makeup Tank Actuation	4.4
K 4.08	In-containment Refueling Water Storage Tank Containment Injection Line Valve Actuation	4.3
K 4.09	In-containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.2
K 4.10	Containment penetration isolation	3.9

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Passive Core Cooling System: (CFR: 41.7 / 45.7)

K 5.01	In-containment refueling water storage tank heat up by Reactor Coolant System leak	3.4
K 5.02	Small loss of coolant accident (saturated in-containment refueling water storage tank)	3.8
K 5.03	Failure of reactor coolant pump to trip	4.3
K 5.04	Non-condensable gas buildup in system	3.8
K 5.05	Post accident containment pH control	3.4
K 5.06	Core makeup tank water recirculation mode	3.9
K 5.07	Core makeup tank steam drain down mode	3.8
K 5.08	Core makeup tank temperatures and core makeup tank injection flow relationship	3.7

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Passive Core Cooling System: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Automatic Depressurization System	4.6
K	6.02	Compressed and Instrument Air Systems	3.0
K	6.03	Normal Residual Heat Removal System	3.3
K	6.04	Spent Fuel Pool Cooling System	2.7
K	6.05	In-containment Refueling Water Storage Tank Actuation	4.1
K	6.06	In-containment refueling water storage tank	4.3
K	6.07	In-containment refueling water storage tank line A/B isolation valve	4.0
K	6.08	In-containment refueling water storage tank injection isolation valves	4.1
K	6.09	In-containment refueling water storage tank injection check valve	3.7
K	6.10	Containment recirculation isolation valve	3.8
K	6.11	In-containment refueling water storage tank gutter isolation valve	3.6
K	6.12	Containment recirculation check valve	3.3
K	6.13	In-containment refueling water storage tank screens	3.7
K	6.14	Core Makeup Tank Actuation	4.6
K	6.15	Core makeup tank inlet isolation valve	3.9
K	6.16	Core makeup tank discharge isolation valve	4.2
K	6.17	Core makeup tank discharge check valve	3.8
K	6.18	Passive Residual Heat Removal Heat Exchanger Actuation	4.4
K	6.19	Passive Residual Heat Removal System heat exchanger tube leak	4.1
K	6.20	Accumulator discharge isolation valve	3.7
K	6.21	Accumulator discharge check valve	3.3
K	6.22	Direct vessel injection line	4.1
K	6.23	Core makeup tank discharge line	4.1

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Passive Core Cooling System including: (CFR: 41.7 / 45.5)

A	1.01	Accumulator level	3.8
A	1.02	Accumulator pressure	3.8
A	1.03	Accumulator boron concentration	3.6
A	1.04	In-containment refueling water storage tank level	3.9

A	1.05	In-containment refueling water storage tank temperature	3.8
A	1.06	In-containment refueling water storage tank boron concentration	3.6
A	1.07	Core makeup tank inlet, top, mid, and bottom temperatures	3.4
A	1.08	Core makeup tank boron concentration	3.5
A	1.09	Core makeup tank level	4.0
A	1.10	Core makeup tank high point level	3.7
A	1.11	Direct vessel injection line cold and hot temperatures	3.5
A	1.12	Passive Residual Heat Removal System heat exchanger pressure	3.5
A	1.13	Passive Residual Heat Removal System heat exchanger inlet high point temperature	3.5
A	1.14	Passive Residual Heat Removal System heat exchanger temperature	3.6
A	1.15	Passive Residual Heat Removal System heat exchanger flow	3.8
A	1.16	Passive Residual Heat Removal System heat exchanger high point level	3.5
A	1.17	Containment floodup level	3.8
A	1.18	Containment radiation	3.5
A	1.19	Reactor Coolant System level	3.9
A	1.20	Reactor Coolant System pressure	3.8
A	1.21	Reactor Coolant System temperature	3.9
A	1.22	Core exit thermocouples	3.9

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Passive Core Cooling System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Automatic Depressurization System	4.3	4.6
A	2.02	Compressed and Instrument Air Systems	2.8	3.0
A	2.03	Normal Residual Heat Removal System	3.0	3.4
A	2.04	Spent Fuel Pool Cooling System	2.5	3.1
A	2.05	In-containment Refueling Water Storage Tank Actuation	4.2	4.5
A	2.06	In-containment refueling water storage tank parameters out of spec	3.3	3.9
A	2.07	In-containment refueling water storage tank line A/B Isolation Valve	3.5	4.0
A	2.08	In-containment refueling water storage tank injection isolation valves	3.2	4.1
A	2.09	In-containment refueling water storage tank injection check valve	3.0	3.6
A	2.10	Containment recirculation isolation valve	3.2	3.9

A	2.11	In-containment refueling water storage tank gutter isolation valve	3.3	3.8
A	2.12	Containment recirculation check valve	3.3	3.3
A	2.13	Core Makeup Tank Actuation	4.2	4.8
A	2.14	Core makeup tank parameters out of spec	3.5	4.1
A	2.15	Core makeup tank inlet isolation valve	3.2	4.0
A	2.16	Core makeup tank discharge isolation valve	3.8	4.3
A	2.17	Core makeup tank discharge check valve	3.2	3.5
A	2.18	Accumulator discharge isolation valve	3.3	4.2
A	2.19	Accumulator discharge check valve	3.2	3.3
A	2.20	Accumulator parameters out of spec	3.5	4.0
A	2.22	Direct vessel injection line break	4.2	4.6
A	2.23	Core makeup tank discharge line break	4.5	4.5
A	2.24	Non-condensable gas buildup	3.5	3.7
A	2.25	Battery charger undervoltage	3.5	4.1

A 3 Ability to monitor automatic operation of the Passive Core Cooling System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Safeguards Actuation	4.7
A	3.02	Core Makeup Tank Actuation	4.6
A	3.03	Containment Isolation Actuation	4.3
A	3.04	Turbine trip	3.7
A	3.05	Main Feedwater Pump Trip And Valve Isolation Actuation	3.7
A	3.06	Automatic Depressurization System Stages 1, 2, & 3 Actuation	4.7
A	3.07	Automatic Depressurization System Stage 4 Actuation	4.8
A	3.08	Reactor Coolant Pump Trip Actuation	4.3
A	3.09	Passive Residual Heat Removal Heat Exchanger Actuation	4.6
A	3.10	Steam Generator Blowdown Isolation Actuation	3.2
A	3.11	Chemical and Volume Control System Makeup Isolation Actuation	3.3
A	3.12	Normal Residual Heat Removal System Isolation Actuation	3.5
A	3.13	Containment Air Filtration System Isolation Actuation	3.3
A	3.14	In-Containment Refueling Water Storage Tank Injection Line Valve Actuation	4.3

A	3.15	In-containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.3
A	3.16	Pressurizer Heater Trip Actuation	2.9
A	3.17	Reactor Trip Actuation	4.4

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Safeguards Actuation	4.7
A	4.02	Core Makeup Tank Actuation	4.6
A	4.03	Containment Isolation Actuation	4.4
A	4.04	Turbine trip	4.2
A	4.05	Main Feedwater Pump Trip And Valve Isolation Actuation	4.0
A	4.06	Automatic Depressurization System Stages 1, 2, & 3 Actuation	4.6
A	4.07	Automatic Depressurization System Stage 4 Actuation	4.6
A	4.08	Reactor Coolant Pump Trip Actuation	4.3
A	4.09	Steam Generator Blowdown Isolation Actuation	3.4
A	4.10	Chemical and Volume Control System Makeup Isolation Actuation	3.4
A	4.11	Normal Residual Heat Removal System Isolation Actuation	3.6
A	4.12	Containment Air Filtration System Isolation Actuation	3.4
A	4.13	In-Containment Refueling Water Storage Tank Injection Line Valve Actuation	4.3
A	4.14	In-containment Refueling Water Storage Tank Containment Recirculation Valve Actuation	4.3
A	4.15	Pressurizer Heater Trip Actuation	3.1
A	4.16	Reactor Trip Actuation	4.4

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Reactor Coolant System and Reactor Coolant Pumps and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Automatic Depressurization System	4.5
K 1.02	Compressed and Instrument Air Systems	2.9
K 1.03	Component Cooling Water System	3.1
K 1.04	Containment System	3.4
K 1.05	Chemical and Volume Control System	3.6
K 1.06	Diverse Actuation System	4.2
K 1.07	Digital Rod Control System	3.6
K 1.08	Engineered Safeguards Actuation System	4.4
K 1.09	Incore Instrumentation System	3.5
K 1.10	Main Steam System	3.4
K 1.11	Nuclear Instrumentation System	3.7
K 1.12	Post-Accident Monitoring System	3.6
K 1.13	Primary Sampling System	2.4
K 1.14	Passive Core Cooling System	4.3
K 1.15	Pressurizer Level Control System	3.5
K 1.16	Pressurizer Pressure Control System	3.6
K 1.17	Reactor coolant pumps	3.7
K 1.18	Normal Residual Heat Removal System	3.6
K 1.19	Rod Position Indication System	3.4
K 1.20	Reactor Trip System	4.2
K 1.21	Reactor System	3.8
K 1.22	Steam Generator System	3.9
K 1.23	Spent Fuel Pool Cooling System	2.8
K 1.24	Special Monitoring System	2.5
K 1.25	Containment Recirculation Cooling System	2.8
K 1.26	Containment Air Filtration System	2.7
K 1.27	Liquid Radwaste System	2.4

K 2 Knowledge of bus or division power supplies to the following: (CFR: 41.7)

K 2.01	Reactor vessel head vent valves	3.2
K 2.02	Reactor Coolant System wide range pressure channels	2.9
K 2.03	Reactor Coolant System loop flow channels	3.0
K 2.04	Reactor Coolant System cold leg wide range temperature channels	2.9
K 2.05	Reactor Coolant System hot leg wide range temperatures channels	2.9
K 2.06	Reactor Coolant System cold leg narrow range temperatures channels	3.0
K 2.07	Reactor Coolant System hot leg narrow range temperatures channels	3.0
K 2.08	Hot leg level instrumentation channels	3.2

K 3 Knowledge of the effect that a loss or malfunction of the Reactor Coolant System and Reactor Coolant Pumps will have on the following: (CFR: 41.7 / 45.6)

K 3.01	Automatic Depressurization System	4.2
K 3.02	Compressed and Instrument Air Systems	2.5
K 3.03	Component Cooling Water System	2.6
K 3.04	Containment System	3.7
K 3.05	Chemical and Volume Control System	3.3
K 3.06	Digital Rod Control System	3.4
K 3.07	Engineered Safeguards Actuation System	4.3
K 3.08	Post Accident Monitoring System	3.7
K 3.09	Primary Sampling System	2.5
K 3.10	Passive Core Cooling System	4.4
K 3.11	Pressurizer Level Control System (OE-related)	3.4
K 3.12	Pressurizer Pressure Control System	3.4
K 3.13	Reactor coolant pump	3.8
K 3.14	Radiation Monitoring System	3.2
K 3.15	Normal Residual Heat Removal System	3.5
K 3.16	Reactor Trip System	4.0
K 3.17	Reactor System	3.6
K 3.18	Steam Generator System	3.5
K 3.19	Containment Recirculation Cooling System	3.2

K	3.20	Containment Air Filtration System	3.0
K	3.21	Liquid Radwaste System	2.4
K	3.22	Reactor fuel	4.3

K 4 Knowledge of Reactor Coolant System and Reactor Coolant Pumps design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Reactor coolant pressure boundary	4.2
K	4.02	Core cooling	4.3
K	4.03	Reactivity control	4.4
K	4.04	Process monitoring	3.4
K	4.05	Emergency letdown	3.4
K	4.06	Reactor Coolant System venting	3.4
K	4.07	Reactor Coolant System temperature control	3.7
K	4.08	Pressurizer heater control	3.6
K	4.09	Pressurizer normal spray control (OE-related)	3.7
K	4.10	Pressurizer level control	3.7
K	4.11	Safety valve discharge drain header isolation	3.6
K	4.12	Over pressure protection	4.4
K	4.13	Reactor Coolant System vacuum refill	3.0
K	4.14	Reactor Coolant System level control	3.5
K	4.15	Filling and draining of Reactor Coolant System, refueling cavity, and refueling canal	3.0
K	4.16	Reactor Coolant System leak detection	4.0
K	4.17	Solid plant operation	3.9
K	4.18	Pressurizer cooldown	3.3
K	4.19	Establishing a pressurizer bubble	3.3
K	4.20	Reduced inventory operation	4.0

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Reactor Coolant System and Reactor Coolant Pumps: (CFR: 41.7 / 45.7)

K	5.01	Pressurizer normal spray transients	3.5
K	5.02	Direct vessel injection nozzle transients	3.4
K	5.03	Steam generator Passive Residual Heat Removal System heat exchanger nozzle transients	3.3
K	5.04	Passive Residual Heat Removal System heat exchanger nozzle transients	3.3
K	5.05	Chemical and Volume Control System nozzle transients	3.2
K	5.06	Leak before break	3.5
K	5.07	Pressurizer cooldown	3.4
K	5.08	Solid plant operation	3.8
K	5.09	Reactor coolant pump trip (OE-related)	3.8
K	5.10	Reactor coolant pump start	3.5
K	5.11	Hard bubble in pressurizer	3.4
K	5.12	Mid-loop operation	4.0
K	5.13	Changes in core cooling between normal operations and a loss of coolant accident	4.2
K	5.14	Changes in core cooling between normal operations and a steam generator tube rupture (OE-related)	4.2
K	5.15	Changes in core cooling between normal operations and faulted steam generator	4.1
K	5.16	Changes in core cooling between normal operations and loss of heat sink event	4.4
K	5.17	Loss of forced circulation	4.1
K	5.18	Natural circulation Reactor Coolant System and steam generator indications	4.1
K	5.19	Downcomer voiding effects on Nuclear Instrumentation System	3.9
K	5.20	Cold leg opening with no Reactor Coolant System vent path	3.7
K	5.21	Inadequate Reactor Coolant System venting during Reactor Coolant System drain down	3.6
K	5.22	Effects of leaking pressurizer safety on tailpipe temperature	3.8
K	5.23	Vacuum refill	3.1
K	5.24	Operating with pressurizer level outside the normal operating band	3.5
K	5.25	Effects of reactor power changes on Thot, Tcold, Tavg, and ΔT	4.0
K	5.26	Changing pressurizer temperature and the effect on pressurizer pressure	3.6

K	5.27	Changing Reactor Coolant System temperature and the effect on pressurizer pressure and level	3.6
K	5.28	Changing Reactor Coolant System temperature and effect on non-condensable gases	3.1
K	5.29	Changing Reactor Coolant System pressure and effect on non-condensable gases	3.3
K	5.30	Boration and/or dilution effect on shutdown margin	4.0
K	5.31	Xenon and samarium effect on shutdown margin	3.9
K	5.32	Boration and/or dilution effect on MTC	3.8
K	5.33	Failure to recognize the need for Reactor Coolant System depressurization during a small loss of coolant accident or loss of high-pressure heat removal system (PRA related)	4.4
K	5.34	Failure to recognize the need for Reactor Coolant System depressurization during a shutdown condition with failure of core makeup tank and the Normal Residual Heat Removal System (PRA related)	4.4
K	5.35	Failure to recognize the need and failure to initiate gravity injection via Normal Residual Heat Removal System hot leg connection during shutdown events (PRA related)	4.3

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Reactor Coolant System and Reactor Coolant Pumps: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Automatic Depressurization System	4.6
K	6.02	Compressed and Instrument Air Systems	2.9
K	6.03	Component Cooling Water System	3.1
K	6.04	Chemical and Volume Control System	3.3
K	6.05	Diverse Actuation System	4.1
K	6.06	Digital Rod Control System	3.5
K	6.07	Engineered Safeguards Actuation System	4.4
K	6.08	Incore Instrumentation System	3.3
K	6.09	Main Steam System (OE-related)	3.6
K	6.10	Passive Core Cooling System	4.5
K	6.11	Pressurizer Level Control System	3.6
K	6.12	Pressurizer Pressure Control System	3.7
K	6.13	Reactor coolant pump	3.7
K	6.14	Reactor Trip System	4.3

K	6.15	Reactor System	3.6
K	6.16	Steam Generator System	3.7
K	6.17	Containment Recirculation Cooling System	3.0
K	6.18	Liquid Radwaste System	2.3
K	6.19	Pressurizer code safety valve	4.0
K	6.20	Reactor fuel failure	4.2
K	6.21	Reactor Coolant System hot leg level indication	3.5
K	6.22	Reactor Coolant System head vent valve	3.5

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Reactor Coolant System and Reactor Coolant Pumps including:
(CFR: 41.7 / 45.5)

A	1.01	Pressurizer pressure	4.1
A	1.02	Reactor Coolant System wide range pressure	3.8
A	1.03	Reactor Coolant System loop flow	3.7
A	1.04	Reactor Coolant System cold leg wide range temperatures	3.6
A	1.05	Reactor Coolant System hot leg wide range temperatures	3.6
A	1.06	Core exit thermocouples	4.0
A	1.07	Reactor Coolant System cold leg narrow range temperatures	3.5
A	1.08	Reactor Coolant System hot leg narrow range temperatures	3.6
A	1.09	Reactor Coolant System loop Tavg	3.7
A	1.10	Auctioneered Reactor Coolant System loop Tavg	3.5
A	1.11	Reactor Coolant System loop ΔT	3.6
A	1.12	Auctioneered Reactor Coolant System loop ΔT	3.5
A	1.13	Reactor Coolant System Tref	3.6
A	1.14	Diverse hot leg temperature	3.5
A	1.15	Reactor Vessel head vent line temperature	3.0
A	1.16	Passive Residual Heat Removal System return line temperature	3.8
A	1.17	Reactor Coolant System Automatic Depressurization System discharge temperature	3.9
A	1.18	Safety valve discharge temperatures	3.9
A	1.19	Pressurizer temperature	3.3
A	1.20	Pressurizer normal spray line temperatures	3.2

A	1.21	Pressurizer surge line temperatures	3.2
A	1.22	Pressurizer level reference leg temperature	2.8
A	1.23	Pressurizer level	3.8
A	1.24	Diverse pressurizer level	3.4
A	1.25	Cold calibrated pressurizer level	3.0
A	1.26	Reactor Coolant System hot leg level	3.5
A	1.27	Nuclear Instrumentation System	3.9
A	1.28	Steam generator pressure	3.5
A	1.29	Reactor Coolant System subcooling (OE-related)	4.2
A	1.30	In-containment refueling water storage tank level, Reactor Coolant System level, reactor cavity level relationships during outage	3.6

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Reactor Coolant System and Reactor Coolant Pumps and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Automatic Depressurization System	4.3	4.6
A	2.02	Compressed and Instrument Air Systems	2.8	2.7
A	2.03	Component Cooling Water System	3.0	3.1
A	2.04	Chemical and Volume Control System	3.3	3.6
A	2.05	Diverse Actuation System	3.9	4.3
A	2.06	Digital Rod Control System	3.6	3.6
A	2.07	Engineered Safeguards Actuation System	4.1	4.5
A	2.08	Incore Instrumentation System	3.1	3.3
A	2.09	Main Steam System (OE-related)	3.1	3.7
A	2.10	Passive Core Cooling System	4.0	4.6
A	2.11	Pressurizer Level Control System	3.6	3.8
A	2.12	Pressurizer Pressure Control System	3.6	3.8
A	2.13	Reactor coolant pump	3.8	3.7
A	2.14	Reactor Trip System	4.5	4.5
A	2.15	Reactor System	3.5	4.1
A	2.16	Steam Generator System	3.4	4.0
A	2.17	Containment Recirculation Cooling System	2.5	3.3

A	2.18	Liquid Radwaste System	1.9	2.4
A	2.19	Pressurizer safety valve	4.0	4.3
A	2.20	Reactor fuel failure	4.3	4.4
A	2.21	Reactor Coolant System level indication	3.5	3.8
A	2.22	Failure of a pressurizer normal spray valve	3.4	4.0
A	2.23	Failure of pressurizer heaters	3.0	3.6
A	2.24	Reactor Coolant System pressure boundary valve leakage	3.9	4.1
A	2.25	Water solid operation	3.8	3.8
A	2.26	Reactor coolant pump trip (OE-related)	3.8	3.9
A	2.27	Loss of coolant accident	4.3	4.6
A	2.28	Faulted steam generator	4.3	4.6
A	2.29	Steam generator tube rupture (OE-related)	4.4	4.6
A	2.30	Loss of heat sink	4.4	4.6
A	2.31	Reactor vessel flange leakage	3.6	3.7

A 3 Ability to monitor automatic operation of the Reactor Coolant System and Reactor Coolant Pumps, including: (CFR: 41.7 / 45.5 / 45.13)

A	3.01	Pressurizer pressure control and protection functions	4.1
A	3.02	Pressurizer level control and protection functions	4.1
A	3.03	Reactor Coolant System Tavg control and protection functions	4.0
A	3.04	Reactor Coolant System ΔT control and protection functions	4.0
A	3.05	Reactor Coolant System hot leg level control and protection functions	4.0
A	3.06	Core Makeup Tank Actuation	4.5
A	3.07	Passive Residual Heat Removal Heat Exchanger Actuation	4.6
A	3.08	Automatic Depressurization System Actuation	4.6
A	3.09	Pressurizer Safety Valve Actuation	4.5
A	3.10	Solid plant operation	4.0

4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Pressurizer pressure	3.9
A	4.02	Pressurizer level	3.9
A	4.03	Reactor Coolant System Tavg	3.9
A	4.04	Reactor Coolant System ΔT	3.8
A	4.05	Reactor Coolant System flow	3.7
A	4.06	Reactor power	4.5
A	4.07	Steam generator level	4.0
A	4.08	Steam generator pressure	3.8
A	4.09	Reactor Coolant System hot leg level	3.8
A	4.10	Core Makeup Tank Actuation	4.6
A	4.11	Passive Residual Heat Removal Heat Exchanger Actuation	4.6
A	4.12	Automatic Depressurization System Actuation	4.7
A	4.13	Pressurizer Safety Valve Actuation	4.2
A	4.14	Head Vent System	3.6
A	4.15	Drain Reactor Coolant System to midloop	3.7
A	4.16	Fill and cool the pressurizer to solid plant	3.5
A	4.17	Establish a pressurizer bubble	3.3
A	4.18	Reactor Coolant System vacuum refill	3.1
A	4.19	Plant startup	4.0
A	4.20	Normal operation	3.9
A	4.21	Plant shutdown	3.8
A	4.22	Reduced inventory operations	4.0
A	4.23	Reactor Coolant System heatup	3.4
A	4.24	Reactor Coolant System cooldown	3.5
A	4.25	Refueling	3.4
A	4.26	Solid plant operation	3.8
A	4.26	Pressurizer cooldown	3.3
A	4.27	Establishing a pressurizer bubble	3.3

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Safety Function 3:
Reactor Pressure Control

		page
SF3 ADS	Automatic Depressurization System	3.3-3
SF3 PPCS	Pressurizer Pressure Control System	3.3-7

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical connections between the Automatic Depressurization System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Diverse Actuation System	4.0
K 1.02	Engineered Safeguards Actuation System	4.2
K 1.03	Post Accident Monitoring System	2.8
K 1.04	Passive Core Cooling System	3.8
K 1.05	Reactor Cooling System	4.1
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Automatic Depressurization System Stage 1 valves	3.5
K 2.02	Automatic Depressurization System Stage 1 Isolation valves	3.5
K 2.03	Automatic Depressurization System Stage 2 valves	3.5
K 2.04	Automatic Depressurization System Stage 2 isolation valves	3.5
K 2.05	Automatic Depressurization System Stage 3 valves	3.5
K 2.06	Automatic Depressurization System Stage 3 isolation valves	3.5
K 2.07	Automatic Depressurization System Stage 4 valves	3.6
K 2.08	Automatic Depressurization System Stage 4 isolation valves	3.6
K 3	**Knowledge of the effect that a loss or malfunction of the Automatic Depressurization System will have on the following: (CFR: 41.7 / 45.6)**	
K 3.01	Engineered Safeguards Actuation System	4.0
K 3.02	Passive Core Cooling System	4.2
K 3.03	Reactor fuel	4.4
K 3.04	Reactor Cooling System	4.3

K	**4**	**Knowledge of Automatic Depressurization System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K	4.01	Automatic Depressurization System Actuation	4.5
K	4.02	Manual operation of the Automatic Depressurization System	4.4
K	4.03	Automatic Depressurization System valve discharge drain header isolation	3.4
K	4.04	Automatic Depressurization System valve isolation	3.9
K	**5**	**Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Automatic Depressurization System: (CFR: 41.7 / 45.7)**	
K	5.01	Effects of leaking Automatic Depressurization System valve on tailpipe temperature	3.4
K	5.02	Failure to recognize the need for Reactor Cooling System depressurization during a small loss of coolant accident or loss of high-pressure heat removal system (PRA related)	4.3
K	5.03	Failure to recognize the need for Reactor Cooling System depressurization during a shutdown condition with failure of the core makeup tank and the Normal Residual Heat Removal System (PRA related)	4.2
K	**6**	**Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Automatic Depressurization System: (CFR: 41.7 / 45.5 TO 45.8)**	
K	6.01	Diverse Actuation System	4.2
K	6.02	Engineered Safeguards Actuation System	4.2

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Automatic Depressurization System including: (CFR: 41.7 / 45.5)

A 1.01	Reactor Cooling System wide range pressure	4.0
A 1.02	Reactor Cooling System Automatic Depressurization System discharge temperature	3.6
A 1.03	Reactor Cooling System hot leg level	3.9
A 1.04	Class 1E battery charger voltage	3.7

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Automatic Depressurization System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

		RO	SRO
A 2.01	Diverse Actuation System	4.0	3.9
A 2.02	Engineered Safeguards Actuation System	4.1	4.2
A 2.03	Passive Core Cooling System	4.0	3.8
A 2.04	Loss of coolant accident	4.3	4.2
A 2.05	Reactor Cooling System hot leg level	3.9	3.9
A 2.06	Extended undervoltage to class 1E battery chargers	4.0	3.9

A 3 Ability to monitor automatic operation of the Automatic Depressurization System, including: (CFR: 41.7 / 45.5 / 45.13)

A 3.01	Automatic Depressurization System Actuation	4.4

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A 4.01	Reactor Cooling System hot leg level	3.9
A 4.02	Automatic Depressurization System Actuation	4.5
A 4.03	Core makeup tank level	4.0
A 4.04	Reactor Cooling System pressure	4.1
A 4.05	Class 1E battery charger voltage	3.9

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Pressurizer Pressure Control System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Engineered Safeguards Actuation System	3.9
K 1.02	Chemical and Volume Control System	2.9
K 1.03	Main Turbine System	2.1
K 1.04	Nuclear Instrumentation System	2.7
K 1.05	Post Accident Monitoring System	3.3
K 1.06	Passive Core Cooling System	3.2
K 1.07	Pressurizer Level Control System	3.1
K 1.08	Reactor Coolant System	3.3
K 1.09	Reactor Trip System	4.0
K 1.10	Main Turbine Control and Diagnostics System	2.2
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Pressurizer normal spray valves	2.5
K 2.02	Pressurizer normal spray block valves	3.0
K 2.03	Pressurizer heaters	2.8
K 2.04	Pressurizer pressure channels	3.1

K	**3**	**Knowledge of the effect that a loss or malfunction of the Pressurizer Pressure Control System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K	3.01	Engineered Safeguards Actuation System	4.1
K	3.02	Main Turbine System	2.2
K	3.03	Nuclear Instrumentation System	2.5
K	3.04	Post Accident Monitoring System	3.4
K	3.05	Passive Core Cooling System	3.6
K	3.06	Pressurizer Level Control System	2.9
K	3.07	Reactor Coolant System	3.7
K	3.08	Reactor Trip System	4.0

K	**4**	**Knowledge of Pressurizer Pressure Control System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K	4.01	Pressurizer heater and normal spray valve operation	3.5
K	4.02	Anticipatory pressurizer spray	3.3
K	4.03	Anticipatory pressurizer spray interlock	3.3
K	4.04	Pressurizer water level interlock	3.2
K	4.05	Pressurizer heater interlock	3.3
K	4.06	Load regulation mode	2.9
K	4.07	Remote shutdown workstation operations	3.2
K	4.08	Bypass spray	2.8

K	**5**	**Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Pressurizer Pressure Control System: (CFR: 41.7 / 45.7)**	
K	5.01	Leaking pressurizer normal spray valve	3.3
K	5.02	Insurge / outsurge effect on pressure and temperature	3.1
K	5.03	Difference between pressurizer pressure and Reactor Coolant System pressure	2.8
K	5.04	Hard pressurizer bubble	3.0
K	5.05	Reactor coolant pump speed effect on pressurizer normal spray flow	3.1

K	5.06	Changing pressurizer pressure effect on OTΔT setpoints	3.6
K	5.07	Effects of leaking pressurizer safety valve on tailpipe temperature	3.6
K	5.08	Reactor trip	3.9
K	5.09	Turbine runback/load rejection	3.4
K	5.10	Differences between Reactor Coolant System and pressurizer boron concentrations	3.2

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Pressurizer Pressure Control System: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Engineered Safeguards Actuation System	3.5
K	6.02	Main Turbine System	2.6
K	6.03	Nuclear Instrumentation System	2.5
K	6.04	Passive Core Cooling System	3.1
K	6.05	Pressurizer Level Control System	3.0
K	6.06	Reactor Coolant System	3.3
K	6.07	Reactor Trip System	3.5
K	6.08	Main Turbine Control and Diagnostics System	2.6
K	6.09	Pressurizer pressure instrument	3.6
K	6.10	Loss of coolant accident	3.9
K	6.11	Pressurizer code safety failure	3.9
K	6.12	Pressurizer normal spray valve	3.6
K	6.13	Pressurizer heaters	3.3

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Pressurizer Pressure Control System including: (CFR: 41.7 / 45.5)

A	1.01	Pressurizer pressure	3.8
A	1.02	Reactor Coolant System pressure	3.7
A	1.03	Pressurizer liquid temperature	3.0
A	1.04	Pressurizer vapor temperature	3.0
A	1.05	Pressurizer surge line temperatures	3.1

A	1.06	Pressurizer normal spray line temperatures	2.9
A	1.07	Pressurizer / spray line ΔT	3.3
A	1.08	Pressurizer level	3.3
A	1.09	Reactor Coolant System temperature	3.1
A	1.10	Reactor Coolant System leakrate	3.3
A	1.11	Reactor power	3.1
A	1.12	Code safety tailpipe temperature	3.6
A	1.13	Turbine load	2.9
A	1.14	Makeup flow	3.0
A	1.15	Letdown flow	3.0
A	1.16	Pressurizer and Reactor Coolant System boron concentration	3.3
A	1.17	Spray flow	3.2

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Pressurizer Pressure Control System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Engineered Safeguards Actuation System	3.5	3.6
A	2.02	Main Turbine System	2.8	2.7
A	2.03	Nuclear Instrumentation System	2.8	2.6
A	2.04	Passive Core Cooling System	3.2	3.4
A	2.05	Pressurizer Level Control System	3.2	3.2
A	2.06	Reactor Coolant System	3.2	3.3
A	2.07	Reactor Trip System	3.2	3.6
A	2.08	Pressurizer pressure instrument failure	3.2	3.4
A	2.09	Loss of coolant accident	3.5	4.0
A	2.10	Pressurizer code safety failure	3.8	4.1
A	2.11	Load regulation mode	2.8	2.8
A	2.12	Remote shutdown workstation operations	2.8	3.1
A	2.13	Pressurizer normal spray valve failure	3.5	3.6
A	2.14	Pressurizer heaters failure	3.3	3.4

A 3 Ability to monitor automatic operation of the Pressurizer Pressure Control System, including:
(CFR: 41.7 / 45.5 / 45.13)

A 3.01	Pressurizer normal spray valve operation	3.6
A 3.02	Pressurizer heater operation	3.4

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A 4.01	Pressurizer normal spray valve operation	3.7
A 4.02	Pressurizer heater operation	3.5

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Safety Function 4:
Heat Removal From Reactor Core page

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PRIMARY SYSTEMS

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical connections between the Passive Residual Heat Removal System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Automatic Depressurization System	3.5
K 1.02	Compressed and Instrument Air Systems	2.9
K 1.03	Diverse Actuation System	3.8
K 1.04	Engineering Safeguards Actuation System	4.0
K 1.05	Post Accident Monitoring System	2.9
K 1.06	Passive Core Cooling System	3.8
K 1.07	Reactor Coolant System	3.9
K 1.08	Steam Generator System	3.0
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Passive Residual Heat Removal System heat exchanger inlet isolation valves	3.2
K 3	**Knowledge of the effect that a loss or malfunction of the Passive Residual Heat Removal System will have on the following: (CFR: 41.7 / 45.6)**	
K 3.01	Reactor Coolant System	4.1
K 4	**Knowledge of Passive Residual Heat Removal System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K 4.01	Emergency core decay heat removal	4.3
K 4.02	Reactor Coolant System cooldown	3.8
K 4.03	Non-condensable gas detection	3.2
K 4.04	Passive Residual Heat Removal System Actuation	4.2
K 4.05	Passive Residual Heat Removal System flow control	3.6

K	**5**	**Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Passive Residual Heat Removal System: (CFR: 41.7 / 45.7)**	
K	5.01	Passive Residual Heat Removal System heat exchanger leakage at power	3.6
K	5.02	Inadvertent Passive Residual Heat Removal System Actuation at power	4.1
K	5.03	Non-condensable gas buildup in system	3.2
K	**6**	**Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Passive Residual Heat Removal System: (CFR: 41.7 / 45.5 TO 45.8)**	
K	6.01	Compressed and Instrument Air Systems	3.0
K	6.02	Passive Residual Heat Removal System Actuation	4.1
K	6.03	Passive Residual Heat Removal System heat exchanger	3.7
K	6.04	Passive Residual Heat Removal System heat exchanger inlet isolation	3.6
K	6.05	Passive Residual Heat Removal System control valve	3.4
A	**1**	**Ability to predict and/or monitor changes in parameters associated with operation of the Passive Residual Heat Removal System including: (CFR: 41.7 / 45.5)**	
A	1.01	Passive Residual Heat Removal System heat exchanger pressure	3.2
A	1.02	Passive Residual Heat Removal System heat exchanger inlet high point temperature	3.4
A	1.03	Passive Residual Heat Removal System heat exchanger temperature	3.5
A	1.04	Passive Residual Heat Removal System heat exchanger flow	3.6
A	1.05	Passive Residual Heat Removal System heat exchanger high point level	3.4
A	1.06	Reactor Coolant System level	3.5
A	1.07	Reactor Coolant System pressure	3.5
A	1.08	Reactor Coolant System temperature	3.4
A	1.09	Core exit thermocouples	3.6

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Passive Residual Heat Removal System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Compressed and Instrument Air Systems	3.3	2.8
A	2.02	Passive Residual Heat Removal System Actuation	4.0	4.2
A	2.03	Passive Residual Heat Removal System heat exchanger	3.7	4.1
A	2.04	Passive Residual Heat Removal System heat exchanger inlet isolation	3.7	3.9
A	2.05	Passive Residual Heat Removal System control valve	3.7	3.8
A	**3**	**Ability to monitor automatic operation of the Passive Residual Heat Removal System, including: (CFR: 41.7 / 45.5 / 45.13)**		
A	3.01	Passive Residual Heat Removal System Actuation		4.2
A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**		
A	4.01	Passive Residual Heat Removal System Actuation		4.2
A	4.02	Passive Residual Heat Removal System flow control valves		3.8

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical connections between the Reactor Coolant Pump System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Component Cooling Water System	2.6
K 1.02	Diverse Actuation System	3.1
K 1.03	Engineered Safeguards Actuation System	3.3
K 1.04	Reactor Coolant System	3.1
K 1.05	Special Monitoring System	2.4
K 1.06	Steam Generator System	2.7
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Reactor coolant pumps	2.3
K 3	**Knowledge of the effect that a loss or malfunction of the Reactor Coolant Pump System will have on the following: (CFR: 41.7 / 45.6)**	
K 3.01	Reactor Coolant System (OE-related)	3.3
K 3.02	Special Monitoring System	2.1
K 3.03	Steam Generator System	2.7
K 4	**Knowledge of Reactor Coolant Pump System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K 4.01	Reactor coolant pump speed control	2.8
K 4.02	Reactor Coolant Pump Trip Actuation due to Safeguards Actuation	3.7
K 4.03	Reactor Coolant Pump Trip Actuation due to Automatic Depressurization System stages 1, 2, & 3 Actuation	3.8
K 4.04	Reactor Coolant Pump Trip Actuation due to Reactor Coolant Pump bearing water high temperature	3.0
K 4.05	Reactor Coolant Pump Trip Actuation due to Core Makeup Tank Actuation	3.6
K 4.06	Reactor Coolant Pump Trip Actuation due to low pressurizer water level	3.2

K	**5**	**Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Reactor Coolant Pump System: (CFR: 41.7 / 45.7)**	
K	5.01	Changing reactor coolant pump speed on Chemical and Volume Control System letdown flow	2.3
K	5.02	Changing reactor coolant pump speed on pressurizer normal spray flow	2.7
K	5.03	Reactor coolant pump operation effect on Passive Residual Heat Removal System heat exchanger operation	3.1
K	5.04	Reactor coolant pump start effect on reactivity/boron (OE-related)	3.2
K	5.05	Starting a reactor coolant pump when all Reactor coolant pumps are stopped, Reactor Coolant System temperature is above 200°F, and pressurizer level is greater than 92%	3.0
K	5.06	Running 2 reactor coolant pumps in the same loop at low Reactor Coolant System pressure during a Reactor Coolant System cooldown (OE-related)	2.5

K	**6**	**Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Reactor Coolant Pump System: (CFR: 41.7 / 45.5 TO 45.8)**	
K	6.01	Component Cooling Water System	2.9
K	6.02	Reactor Coolant Pump Trip Actuation due to Engineered Safeguards Actuation	3.6
K	6.03	Reactor coolant pump trip for reasons other than Engineered Safeguards Actuation	3.0
K	6.04	High reactor coolant pump vibration or bearing temperatures	2.6

A	**1**	**Ability to predict and/or monitor changes in parameters associated with operation of the Reactor Coolant Pump System including: (CFR: 41.7 / 45.5)**	
A	1.01	Reactor coolant pump speed	2.7
A	1.02	Reactor coolant pump bearing temperatures, motor current, and/or vibration	2.7
A	1.03	Reactor Coolant System flow	3.3
A	1.04	Pressurizer normal spray flow	2.9

A	1.05	Chemical and Volume Control System letdown flow	2.4
A	1.06	Passive Residual Heat Removal System heat exchanger flow	3.1

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Reactor Coolant Pump System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Loss of component cooling water	2.3	2.9
A	2.02	Reactor Coolant Pump Trip Actuation due to Engineered Safeguards Actuation	3.3	3.4
A	2.03	Reactor coolant pump trip for reasons other than Engineered Safeguards Actuation	2.2	2.8

A	**3**	**Ability to monitor automatic operation of the Reactor Coolant Pump System, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	Reactor Coolant Pump Trip Actuation due to Engineered Safeguards Actuation	3.6

A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**	
A	4.01	Reactor coolant pump start and speed control	2.9
A	4.02	Reactor coolant pump shutdown	2.9

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Reactor Coolant System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Automatic Depressurization System	4.5
K 1.02	Compressed and Instrument Air Systems	2.9
K 1.03	Component Cooling Water System	3.1
K 1.04	Containment System	3.4
K 1.05	Chemical and Volume Control System	3.6
K 1.06	Diverse Actuation System	4.2
K 1.07	Digital Rod Control System	3.6
K 1.08	Engineered Safeguards Actuation System	4.4
K 1.09	Incore Instrumentation System	3.5
K 1.10	Main Steam System	3.4
K 1.11	Nuclear Instrumentation System	3.7
K 1.12	Post Accident Monitoring System	3.6
K 1.13	Primary Sampling System	2.4
K 1.14	Passive Core Cooling System	4.3
K 1.15	Pressurizer Level Control System	3.5
K 1.16	Pressurizer Pressure Control System	3.6
K 1.17	Reactor coolant pumps	3.7
K 1.18	Normal Residual Heat Removal System	3.6
K 1.19	Rod Position Indication System	3.4
K 1.20	Reactor Trip System	4.2
K 1.21	Reactor System	3.8
K 1.22	Steam Generator System	3.9
K 1.23	Spent Fuel Pool Cooling System	2.8
K 1.24	Special Monitoring System	2.5
K 1.25	Containment Recirculation Cooling System	2.8
K 1.26	Containment Air Filtration System	2.7
K 1.27	Liquid Radwaste System	2.4

K 2 Knowledge of bus or division power supplies to the following: (CFR: 41.7)

K 2.01	Reactor vessel head vent valves	3.2
K 2.02	Reactor Coolant System wide range pressure channels	2.9
K 2.03	Reactor Coolant System loop flow channels	3.0
K 2.04	Reactor Coolant System cold leg wide range temperature channels	2.9
K 2.05	Reactor Coolant System hot leg wide range temperatures channels	2.9
K 2.06	Reactor Coolant System cold leg narrow range temperatures channels	3.0
K 2.07	Reactor Coolant System hot leg narrow range temperatures channels	3.0
K 2.08	Hot leg level instrumentation channels	3.2

K 3 Knowledge of the effect that a loss or malfunction of the Reactor Coolant System will have on the following: (CFR: 41.7 / 45.6)

K 3.01	Automatic Depressurization System	4.2
K 3.02	Compressed and Instrument Air Systems	2.5
K 3.03	Component Cooling Water System	2.6
K 3.04	Containment System	3.7
K 3.05	Chemical and Volume Control System	3.3
K 3.06	Digital Rod Control System	3.4
K 3.07	Engineered Safeguards Actuation System	4.3
K 3.08	Post Accident Monitoring System	3.7
K 3.09	Primary Sampling System	2.5
K 3.10	Passive Core Cooling System	4.4
K 3.11	Pressurizer Level Control System (OE-related)	3.4
K 3.12	Pressurizer Pressure Control System	3.4
K 3.13	Reactor coolant pump	3.8
K 3.14	Radiation Monitoring System	3.2
K 3.15	Normal Residual Heat Removal System	3.5
K 3.16	Reactor Trip System	4.0
K 3.17	Reactor System	3.6
K 3.18	Steam Generator System	3.5
K 3.19	Containment Recirculation Cooling System	3.2
K 3.20	Containment Air Filtration System	3.0

K	3.21	Liquid Radwaste System	2.4
K	3.22	Reactor fuel	4.3

K 4 Knowledge of Reactor Coolant System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Reactor coolant pressure boundary	4.2
K	4.02	Core cooling	4.3
K	4.03	Reactivity control	4.4
K	4.04	Process monitoring	3.4
K	4.05	Emergency letdown	3.4
K	4.06	Reactor Coolant System venting	3.4
K	4.07	Reactor Coolant System temperature control	3.7
K	4.08	Pressurizer heater control	3.6
K	4.09	Pressurizer normal spray control (OE-related)	3.7
K	4.10	Pressurizer level control	3.7
K	4.11	Safety valve discharge drain header isolation	3.6
K	4.12	Over pressure protection	4.4
K	4.13	Reactor Coolant System vacuum refill	3.0
K	4.14	Reactor Coolant System level control	3.5
K	4.15	Filling and draining of Reactor Coolant System, refueling cavity, and refueling canal	3.0
K	4.16	Reactor Coolant System leak detection	4.0
K	4.17	Solid plant operation	3.9
K	4.18	Pressurizer cooldown	3.3
K	4.19	Establishing a pressurizer bubble	3.3
K	4.20	Reduced inventory operation	4.0

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Reactor Coolant System:
(CFR: 41.7 / 45.7)

K	5.01	Pressurizer spray transients	3.5
K	5.02	Direct vessel injection nozzle transients	3.4
K	5.03	Steam generator Passive Residual Heat Removal System heat exchanger nozzle transients	3.3
K	5.04	Passive Residual Heat Removal System heat exchanger nozzle transients	3.3
K	5.05	Chemical and Volume Control System nozzle transients	3.2
K	5.06	Leak before break	3.5
K	5.07	Pressurizer cooldown	3.4
K	5.08	Solid plant operation	3.8
K	5.09	Reactor coolant pump trip (OE-related)	3.8
K	5.10	Reactor coolant pump start	3.5
K	5.11	Hard bubble in pressurizer	3.4
K	5.12	Mid-loop operation	4.0
K	5.13	Changes in core cooling between normal operations and a loss of coolant accident	4.2
K	5.14	Changes in core cooling between normal operations and a steam generator tube rupture (OE-related)	4.2
K	5.15	Changes in core cooling between normal operations and faulted steam generator	4.1
K	5.16	Changes in core cooling between normal operations and loss of heat sink event	4.4
K	5.17	Loss of forced circulation	4.1
K	5.18	Natural circulation Reactor Coolant System and steam generator indications	4.1
K	5.19	Downcomer voiding effects on Nuclear Instrumentation System	3.9
K	5.20	Cold leg opening with no Reactor Coolant System vent path	3.7
K	5.21	Inadequate Reactor Coolant System venting during Reactor Coolant System drain down	3.6
K	5.22	Effects of leaking pressurizer safety on tailpipe temperature	3.8
K	5.23	Vacuum refill	3.1
K	5.24	Operating with pressurizer level outside the normal operating band	3.5
K	5.25	Effects of reactor power changes on Thot, Tcold, Tavg, and ΔT	4.0
K	5.26	Changing pressurizer temperature and the effect on pressurizer pressure	3.6

K	5.27	Changing Reactor Coolant System temperature and the effect on pressurizer pressure and level	3.6
K	5.28	Changing Reactor Coolant System temperature and effect on non-condensable gases	3.1
K	5.29	Changing Reactor Coolant System pressure and effect on non-condensable gases	3.3
K	5.30	Boration and/or dilution effect on shutdown margin	4.0
K	5.31	Xenon and Samarium effect on shutdown margin	3.9
K	5.32	Boration and/or dilution effect on MTC	3.8
K	5.33	Failure to recognize the need for Reactor Coolant System depressurization during a small loss of coolant accident or loss of high-pressure heat removal system (PRA related)	4.4
K	5.34	Failure to recognize the need for Reactor Coolant System depressurization during a shutdown condition with failure of core makeup tank and the Normal Residual Heat Removal System (PRA related)	4.4
K	5.35	Failure to recognize the need and failure to initiate gravity injection via Normal Residual Heat Removal System hot leg connection during shutdown events (PRA related)	4.3

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Reactor Coolant System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Automatic Depressurization System	4.6
K	6.02	Compressed and Instrument Air Systems	2.9
K	6.03	Component Cooling Water System	3.1
K	6.04	Chemical and Volume Control System	3.3
K	6.05	Diverse Actuation System	4.1
K	6.06	Digital Rod Control System	3.5
K	6.07	Engineered Safeguards Actuation System	4.4
K	6.08	Incore Instrumentation System	3.3
K	6.09	Main Steam System (OE-related)	3.6
K	6.10	Passive Core Cooling System	4.5
K	6.11	Pressurizer Level Control System	3.6
K	6.12	Pressurizer Pressure Control System	3.7
K	6.13	Reactor coolant pump	3.7
K	6.14	Reactor Trip System	4.3

K	6.15	Reactor System	3.6
K	6.16	Steam Generator System	3.7
K	6.17	Containment Recirculation Cooling System	3.0
K	6.18	Liquid Radwaste System	2.3
K	6.19	Pressurizer code safety valve	4.0
K	6.20	Reactor fuel failure	4.2
K	6.21	Reactor Coolant System hot leg level indication	3.5
K	6.22	Reactor Coolant System head vent valve	3.5

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Reactor Coolant System including: (CFR: 41.7 / 45.5)

A	1.01	Pressurizer pressure	4.1
A	1.02	Reactor Coolant System wide range pressure	3.8
A	1.03	Reactor Coolant System loop flow	3.7
A	1.04	Reactor Coolant System cold leg wide range temperatures	3.6
A	1.05	Reactor Coolant System hot leg wide range temperatures	3.6
A	1.06	Core Exit Thermocouples	4.0
A	1.07	Reactor Coolant System cold leg narrow range temperatures	3.5
A	1.08	Reactor Coolant System hot leg narrow range temperatures	3.6
A	1.09	Reactor Coolant System loop Tavg	3.7
A	1.10	Auctioneered Reactor Coolant System loop Tavg	3.5
A	1.11	Reactor Coolant System loop ΔT	3.6
A	1.12	Auctioneered Reactor Coolant System loop ΔT	3.5
A	1.13	Reactor Coolant System Tref	3.6
A	1.14	Diverse hot leg temperature	3.5
A	1.15	Reactor vessel head vent line temperature	3.0
A	1.16	Passive Residual Heat Removal System heat exchanger return line temperature	3.8
A	1.17	Automatic Depressurization System discharge temperature	3.9
A	1.18	Safety valve discharge temperatures	3.9
A	1.19	Pressurizer temperature	3.3
A	1.20	Pressurizer spray line temperatures	3.2
A	1.21	Pressurizer surge line temperatures	3.2

A	1.22	Pressurizer level reference leg temperature	2.8
A	1.23	Pressurizer level	3.8
A	1.24	Diverse pressurizer level	3.4
A	1.25	Cold calibrated pressurizer level	3.0
A	1.26	Reactor Coolant System hot leg level	3.5
A	1.27	Nuclear Instrumentation System	3.9
A	1.28	Steam generator pressure	3.5
A	1.29	Reactor Coolant System subcooling (OE-related)	4.2
A	1.30	In-containment refueling water storage tank level, Reactor Coolant System level, reactor cavity level relationships during outage	3.6

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Reactor Coolant System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Automatic Depressurization System	4.3	4.6
A	2.02	Compressed and Instrument Air Systems	2.8	2.7
A	2.03	Component Cooling Water System	3.0	3.1
A	2.04	Chemical and Volume Control System	3.3	3.6
A	2.05	Diverse Actuation System	3.9	4.3
A	2.06	Digital Rod Control System	3.6	3.6
A	2.07	Engineered Safeguards Actuation System	4.1	4.5
A	2.08	Incore Instrumentation System	3.1	3.3
A	2.09	Main Steam System (OE-related)	3.1	3.7
A	2.10	Passive Core Cooling System	4.0	4.6
A	2.11	Pressurizer Level Control System	3.6	3.8
A	2.12	Pressurizer Pressure Control System	3.6	3.8
A	2.13	Reactor coolant pump	3.8	3.7
A	2.14	Reactor Trip System (OE-related)	4.5	4.5
A	2.15	Reactor System	3.5	4.1
A	2.16	Steam Generator System	3.4	4.0
A	2.17	Containment Recirculation Cooling System	2.5	3.3
A	2.18	Liquid Radwaste System	1.9	2.4
A	2.19	Pressurizer safety valve	4.0	4.3

A	2.20	Reactor fuel failure	4.3	4.4
A	2.21	Reactor Coolant System level indication	3.5	3.8
A	2.22	Failure of a pressurizer normal spray valve	3.4	4.0
A	2.23	Failure of pressurizer heaters	3.0	3.6
A	2.24	Reactor Coolant System pressure boundary valve leakage	3.9	4.1
A	2.25	Water solid operation	3.8	3.8
A	2.26	Reactor coolant pump trip (OE-related)	3.8	3.9
A	2.27	Loss of coolant accident	4.3	4.6
A	2.28	Faulted steam generator	4.3	4.6
A	2.29	Steam generator tube rupture (OE-related)	4.4	4.6
A	2.30	Loss of heat sink	4.4	4.6
A	2.31	Reactor vessel flange leakage	3.6	3.7

A 3 Ability to monitor automatic operation of the Reactor Coolant System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Pressurizer pressure control and protection functions	4.1
A	3.02	Pressurizer level control and protection functions	4.1
A	3.03	Reactor Coolant System Tavg control and protection functions	4.0
A	3.04	Reactor Coolant System ΔT control and protection functions	4.0
A	3.05	Reactor Coolant System hot leg level control and protection functions	4.0
A	3.06	Core Makeup Tank Actuation	4.5
A	3.07	Passive Residual Heat Removal Heat Exchanger Actuation	4.6
A	3.08	Automatic Depressurization System Actuation	4.6
A	3.09	Pressurizer safety valve Actuation	4.5
A	3.10	Solid plant operation	4.0

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Pressurizer pressure	3.9
A	4.02	Pressurizer level	3.9
A	4.03	Reactor Coolant System Tavg	3.9
A	4.04	Reactor Coolant System ΔT	3.8

A	4.05	Reactor Coolant System flow	3.7
A	4.06	Reactor power	4.5
A	4.07	Steam generator level	4.0
A	4.08	Steam generator pressure	3.8
A	4.09	Reactor Coolant System hot leg Level	3.8
A	4.10	Core Makeup Tank Actuation	4.6
A	4.11	Passive Residual Heat Removal Heat Exchanger Actuation	4.6
A	4.12	Automatic Depressurization System Actuation	4.7
A	4.13	Pressurizer Safety Valve Actuation	4.2
A	4.14	Head Vent System	3.6
A	4.15	Drain Reactor Coolant System to midloop	3.7
A	4.16	Fill and cool the pressurizer to solid plant	3.5
A	4.17	Establish a pressurizer bubble	3.3
A	4.18	Reactor Coolant System vacuum refill	3.1
A	4.19	Plant startup	4.0
A	4.20	Normal operation	3.9
A	4.21	Plant shutdown	3.8
A	4.22	Reduced inventory operations	4.0
A	4.23	Reactor Coolant System heatup	3.4
A	4.24	Reactor Coolant System cooldown	3.5
A	4.25	Refueling	3.4
A	4.26	Solid plant operation	3.8
A	4.26	Pressurizer cooldown	3.3
A	4.27	Establishing a pressurizer bubble	3.3

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Normal Residual Heat Removal System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	3.1
K 1.02	Component Cooling Water System	3.5
K 1.03	Chemical and Volume Control System	3.1
K 1.04	Engineered Safeguards Actuation System	3.9
K 1.05	Post Accident Monitoring System	3.0
K 1.06	Passive Core Cooling System	3.8
K 1.07	Reactor Coolant System	3.8
K 1.08	Spent Fuel Pool Cooling System	3.3
K 1.09	Radiologically Controlled Area Ventilation System	2.4
K 1.10	Liquid Radwaste System	2.1
K 1.11	Main Generation System	2.6
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Normal Residual Heat Removal System pumps	3.2
K 2.02	Containment isolation valves	3.6
K 2.03	Reactor Coolant System isolation valves	3.7
K 2.04	In-containment refueling water storage tank isolation valves	3.6
K 2.05	Spent Fuel Pool Cooling System cask loading pit isolation valve	2.6
K 3	**Knowledge of the effect that a loss or malfunction of the Normal Residual Heat Removal System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Chemical and Volume Control System	2.8
K 3.02	Passive Core Cooling System	3.6
K 3.03	Reactor Coolant System	3.8
K 3.04	Spent Fuel Pool Cooling System	2.8
K 3.05	Radiologically Controlled Area Ventilation System	2.0

K	3.06	Liquid Radwaste System	1.9

K	**4**	**Knowledge of Normal Residual Heat Removal System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K	4.01	In-containment refueling water storage tank isolation	3.7
K	4.02	Containment penetration isolation	4.1
K	4.03	Reactor Coolant System isolation	4.1
K	4.04	Low temperature overpressure protection	4.0
K	4.05	Post loss of coolant accident containment makeup	3.6
K	4.06	Post accident Reactor Coolant System makeup	3.7
K	4.07	In-containment refueling water storage tank cooling	3.8
K	4.08	Containment recirculation	3.6
K	4.09	Reactor Coolant System heat removal during refueling	3.5
K	4.10	Reactor Coolant System drain down during refueling	3.3
K	4.11	Shutdown Reactor Coolant System purification	2.6
K	4.12	Normal Reactor Coolant System cooldown	3.4
K	4.13	Post accident Reactor Coolant System heat removal	3.7
K	4.14	Spent Fuel Pool cooling	3.1
K	4.15	Minimum flow protection	2.8
K	4.16	Reactor Coolant System loop suction valve interlocks for overpressure protection	3.9

K	**5**	**Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Normal Residual Heat Removal System: (CFR: 41.7 / 45.7)**	
K	5.01	Normal Residual Heat Removal System pump startup for shutdown cooling (Normal Residual Heat Removal System temperature changes)	2.9
K	5.02	Aligning Normal Residual Heat Removal System from Reactor Coolant System shutdown cooling mode to post-accident makeup mode (OE-related)	3.6
K	5.03	Plant response to Reactor Coolant System temperature change during solid plant operation	3.9
K	5.04	Reactor Coolant System vacuum refill	2.8

K	5.05	Low temperature overpressure protection event	3.9
K	5.06	Normal Residual Heat Removal System suction vortexing during reduced Reactor Coolant System inventory (OE-related)	3.7
K	5.07	Draindown flow rate restrictions with reactor internals installed	3.3
K	5.08	Using Normal Residual Heat Removal System to delay core makeup tank discharge and Automatic Depressurization System Stage 4 Actuation	4.1
K	5.09	Two Normal Residual Heat Removal System trains aligned for spent fuel pool cooling	2.9

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Normal Residual Heat Removal System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	3.1
K	6.02	Component Cooling Water System	3.5
K	6.03	Main Generation System	2.6
K	6.04	Pump flow rate instrument	2.7
K	6.05	Normal Residual Heat Removal System pump	3.3
K	6.06	Normal Residual Heat Removal System Heat Exchanger	3.4
K	6.07	Containment isolation valves	3.9
K	6.08	Reactor Coolant System isolation valves	4.1
K	6.09	In-containment refueling water storage tank isolation valve	3.6
K	6.10	Spent Fuel Pool Cooling System cask loading pit isolation valve	2.8

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Normal Residual Heat Removal System controls including:
(CFR: 41.7 / 45.5)

A	1.01	Reactor Coolant System cold leg wide range temperature	3.3
A	1.02	Reactor Coolant System hot leg wide range temperature	3.2
A	1.03	Reactor Coolant System heatup and cooldown rates	3.6
A	1.04	Reactor Coolant System wide range pressure	3.4
A	1.05	Reactor Coolant System hot leg level	3.7
A	1.06	Pressurizer level	3.4
A	1.07	Core exit thermocouples	3.5

A	1.08	Normal Residual Heat Removal System heatup and cooldown rates	3.2
A	1.09	Normal Residual Heat Removal System flow	3.3
A	1.10	Normal Residual Heat Removal System pump amps	2.8
A	1.11	Component Cooling Water System flow	3.2
A	1.12	Component Cooling Water System temperature	3.0
A	1.13	Reactor Coolant System level during shutdown cooling	3.9
A	1.14	Normal Residual Heat Removal System pressure during shutdown cooling	3.5
A	1.15	Chemical and Volume Control System flow during shutdown Reactor Coolant System purification	2.5
A	1.16	Spent Fuel Pool temperature	2.7

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Normal Residual Heat Removal System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Compressed and Instrument Air Systems	3.0	3.3
A	2.02	Component Cooling Water System	3.5	3.6
A	2.03	Main Generation System	2.5	2.7
A	2.04	Mid loop level instrumentation	3.5	4.0
A	2.05	Pump flow rate instrument	2.7	3.1
A	2.06	Normal Residual Heat Removal System pump (OE-related)	3.5	3.4
A	2.07	Normal Residual Heat Removal System heat exchanger (OE-related)	3.5	3.2
A	2.08	Containment isolation valves	3.3	3.9
A	2.09	Reactor Coolant System isolation valves	3.7	4.1
A	2.10	In-containment refueling water storage tank isolation valve	3.2	3.7
A	2.11	Spent Fuel Pool Cooling System cask loading pit isolation valve	2.3	2.7

A	**3**	**Ability to monitor automatic operation of the Normal Residual Heat Removal System, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	Reactor Coolant System temperature during shutdown cooling	3.4
A	3.02	Reactor Coolant System heat up and cooldown rate during shutdown cooling	3.5

A	3.03	Normal Residual Heat Removal System pump start	3.2
A	3.04	Normal Residual Heat Removal System Isolation Actuation	3.7
A	3.05	Low Temperature Overpressure Protection Actuation	4.3

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Reactor Coolant System temperature during shutdown cooling	3.6
A	4.02	Reactor Coolant System heat up and cooldown rate during shutdown cooling	3.7
A	4.03	Normal Residual Heat Removal System heatup and cooldown rates	3.2
A	4.04	Normal Residual Heat Removal System flow during shutdown cooling	3.4
A	4.05	Normal Residual Heat Removal System Isolation Actuation	3.8
A	4.06	Containment isolation	4.1
A	4.07	Post loss of coolant accident containment makeup	3.5
A	4.08	Post accident Reactor Coolant System makeup	3.7
A	4.09	In-containment refueling water storage tank cooling	3.6
A	4.10	Containment recirculation	3.8
A	4.11	Post accident Reactor Coolant System heat removal	3.8

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Steam Generator System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Steam Generator Blowdown System	3.3
K 1.02	Compressed and Instrument Air Systems	2.7
K 1.03	Chemical and Volume Control System	2.1
K 1.04	Diverse Actuation System	3.5
K 1.05	Engineered Safeguards Actuation System	4.0
K 1.06	Main and Startup Feedwater System	3.4
K 1.07	Main Steam System	3.5
K 1.08	Main Turbine System	3.0
K 1.09	Post Accident Monitoring System	3.3
K 1.10	Plant Gas System	2.0
K 1.11	Passive Core Cooling System	3.4
K 1.12	Reactor Coolant System	3.4
K 1.13	Radiation Monitoring System	3.4
K 1.14	Reactor Trip System	3.3
K 1.15	Secondary Sampling System	2.3
K 1.16	Steam Dump Control System	3.2
K 1.17	Special Monitoring System	2.5
K 1.18	Turbine Island Vents, Drains and Relief Valve System	2.0
K 1.19	Annex/Auxiliary Building Nonradioactive Ventilation System	1.8
K 1.20	Waste Water System	1.9
K 1.21	Transmission Switchyard and Offsite Power System	2.0
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	SG PORV control power	2.7
K 2.02	SG PORV block valves	3.1
K 2.03	MSIV control power	2.8
K 2.04	MSIV hydraulic pump	2.8
K 2.05	MSIV bypass valve control power	2.6
K 2.06	MFIV control power	2.8

K	2.07	MFIV hydraulic pump	2.7
K	2.08	MFCV control power	2.5
K	2.09	Startup Feedwater isolation valves	2.9
K	2.10	SFCV control power	2.6
K	2.11	Steam generator blowdown isolation valves	2.9

K 3 Knowledge of the effect that a loss or malfunction of the Steam Generator System will have on the following systems or system parameters:
(CFR: 41.7 / 45.6)

K	3.01	Steam Generator Blowdown System	3.0
K	3.02	Main and Startup Feedwater System	3.3
K	3.03	Main Steam System	3.5
K	3.04	Main Turbine System	2.7
K	3.05	Passive Core Cooling System	3.6
K	3.06	Reactor Coolant System	3.8
K	3.07	Radiation Monitoring System	3.3
K	3.08	Turbine Island Vents, Drains and Relief Valve System	1.9
K	3.09	Annex/Auxiliary Building Nonradioactive Ventilation System	1.8
K	3.10	Waste Water System	1.6

K 4 Knowledge of Steam Generator System design feature(s) and/or interlock(s) which provide for the following:
(CFR: 41.7)

K	4.01	Containment isolation	3.9
K	4.02	Steam line isolation	4.1
K	4.03	Feedwater isolation	4.1
K	4.04	Secondary side overpressure protection	3.6
K	4.05	Steam flow measurement	3.0
K	4.06	Steam pressure measurement	3.2
K	4.07	Steam Generator level measurement	3.3
K	4.08	Provide signals to Diverse Actuation System	3.7
K	4.09	Decay heat removal	3.4
K	4.10	Blowdown to the Steam Generator Blowdown System	2.8

K	4.11	Main steam line warming	2.5
K	4.12	Main steam line drainage	2.4
K	4.13	Steam line sampling	2.1

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Steam Generator System:
(CFR: 41.7 / 45.7)

K	5.01	Steam generator tube leak detection	4.0
K	5.02	Steam generator level shrink and swell	3.1
K	5.03	Plant response to a steam line break	4.1
K	5.04	Plant response to a feedwater line break	4.1
K	5.05	Steam Generator System response to a loss of coolant accident	3.9
K	5.06	Natural circulation	4.0
K	5.07	Feedwater flow changes on Reactor Coolant System natural circulation flow rate	3.5
K	5.08	Feedwater flow changes on reactor power	3.3
K	5.09	Feedwater flow changes on Reactor Coolant System pressure	3.1
K	5.10	Feedwater flow changes on Reactor Coolant System temperature	3.4
K	5.11	Feedwater flow changes on pressurizer level	3.1
K	5.12	Feedwater flow changes on steam generator level	3.3
K	5.13	Feedwater flow changes on steam generator pressure	3.1
K	5.14	Chemistry and corrosion control	2.6
K	5.15	Failure to diagnose a faulted steam generator	4.3
K	5.16	Failure to diagnose a steam generator tube rupture event (PRA related)	4.4
K	5.17	Failure to close the MSIV to isolate the faulted Steam Generator, given a steam generator tube rupture event (PRA related)	4.4

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Steam Generator System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Steam Generator Blowdown System	2.8
K	6.02	Compressed and Instrument Air Systems	2.8
K	6.03	Diverse Actuation System	3.4

K	6.04	Engineered Safeguards Actuation System	4.0
K	6.05	Main and Startup Feedwater System	3.4
K	6.06	Main Steam System	3.3
K	6.07	Main Turbine System	2.9
K	6.08	Plant Gas System	2.0
K	6.09	Reactor Coolant System	3.3
K	6.10	Reactor Trip System	3.7
K	6.11	Steam Dump Control System	3.3
K	6.12	Annex/Auxiliary Building Nonradioactive Ventilation System	1.9
K	6.13	Transmission Switchyard and Offsite Power System	2.1
K	6.14	Containment isolation	3.7
K	6.15	Step load changes	3.1
K	6.16	Main and Startup Feedwater System line break	4.3
K	6.17	Main Steam System line break	4.3
K	6.18	Inadvertent opening/failure to close of a SG PORV or Main Steam safety valve	4.2
K	6.19	Steam generator tube rupture	4.3
K	6.20	Loss of forced Reactor Coolant System flow	3.6
K	6.21	Reactor coolant pump shaft seizure	3.6
K	6.22	Inadvertent Passive Residual Heat Removal System heat exchanger operation	3.6
K	6.23	Loss of one feedwater pump	3.0
K	6.24	Feedwater heater out of service	2.8
K	6.25	Excessive feedwater flow	3.2
K	6.26	Loss of normal feedwater flow	3.3
K	6.27	Startup feedwater control valve failure	3.0
K	6.28	Turbine trip	3.4
K	6.29	SG PORV failure	3.8
K	6.30	MSIV failure	3.9

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Steam Generator System including: (CFR: 41.7 / 45.5)

A	1.01	Reactor Coolant System natural circulation flow rate	3.4
A	1.02	Pressurizer level	3.1

A	1.03	Reactor power	3.5
A	1.04	Reactor Coolant System pressure	3.2
A	1.05	Reactor Coolant System temperature	3.4
A	1.06	Steam Generator level	3.5
A	1.07	Steam Generator pressure	3.5
A	1.08	Feedwater flow	3.4
A	1.09	Steam flow	3.4

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Steam Generator System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Steam Generator Blowdown System	3.0	2.7
A	2.02	Compressed and Instrument Air Systems	3.0	2.6
A	2.03	Diverse Actuation System	3.5	3.5
A	2.04	Engineered Safeguards Actuation System	3.8	4.0
A	2.05	Main and Startup Feedwater System	3.5	3.6
A	2.06	Main Steam System	3.3	3.6
A	2.07	Main Turbine System	3.0	3.0
A	2.08	Plant Gas System	2.3	2.0
A	2.09	Reactor Coolant System	3.5	3.6
A	2.10	Reactor Trip System	3.5	3.8
A	2.11	Steam Dump Control System	3.7	3.7
A	2.12	Annex/Auxiliary Building Nonradioactive Ventilation System	2.2	1.6
A	2.13	Transmission Switchyard and Offsite Power System	2.7	1.7
A	2.14	Containment isolation	3.3	3.9
A	2.15	Step load changes	3.2	3.1
A	2.16	Main and Startup Feedwater System line break	4.2	4.3
A	2.17	Main Steam System line break	4.2	4.3
A	2.18	Inadvertent opening/failure to close of a SG PORV or main steam safety valve	4.2	4.1
A	2.19	Steam generator tube rupture	4.3	4.4
A	2.20	Loss of forced Reactor Coolant System flow	3.8	3.6
A	2.21	Reactor coolant pump trip	3.7	3.6

A	2.22	Inadvertent Passive Residual Heat Removal System heat exchanger operation	3.8	3.7
A	2.23	Loss of one feedwater pump	3.0	3.1
A	2.24	Feedwater heater out of service	3.0	2.8
A	2.25	Excessive feedwater flow	3.3	3.3
A	2.26	Loss of normal feedwater flow	3.3	3.5
A	2.27	Startup feedwater control valve failure	3.2	3.1
A	2.28	Turbine trip	3.5	3.3
A	2.29	Steam Generator System response to a loss of coolant accident	4.2	4.0

A 3 Ability to monitor automatic operation of the Steam Generator System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Safeguards Actuation	4.2
A	3.02	Steam Line Isolation Actuation	4.2
A	3.03	Turbine trip	3.8
A	3.04	MFCV isolation	3.7
A	3.05	MFW Pump Trip And Valve Isolation Actuation	3.5
A	3.06	Startup Feedwater Isolation Actuation	3.9
A	3.07	Passive Residual Heat Removal Heat Exchanger Actuation	4.0
A	3.08	Steam Generator Blowdown Isolation Actuation	3.7
A	3.09	Chemical and Volume Control System Makeup Isolation Actuation	3.3
A	3.10	SG PORV and Block Valve Isolation Actuation	3.9
A	3.11	SG PORV operation and control	3.5
A	3.12	Steam Generator narrow range water level low reactor trip	4.1
A	3.13	Steam Generator narrow range water level high reactor trip	4.0

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Steam Line Isolation Actuation	4.4
A	4.02	MFCV isolation	4.0
A	4.03	MFW Pump Trip And Valve Isolation Actuation	3.7
A	4.04	Startup Feedwater Isolation Actuation	4.0

A	4.05	Steam Generator Blowdown Isolation Actuation	3.8
A	4.06	SG PORV and Block Valve Isolation Actuation	4.1
A	4.07	SG PORV operation and control	3.7
A	4.08	Main steam line warming and pressurization	2.8

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SECONDARY SYSTEMS

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Condensate System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Auxiliary Steam System	2.1
K 1.02	Steam Generator Blowdown System	2.3
K 1.03	Compressed and Instrument Air Systems	2.4
K 1.04	Component Cooling Water System	2.3
K 1.05	Condenser Tube Cleaning System	1.8
K 1.06	Turbine Island Chemical Feed System	1.8
K 1.07	Condenser Air Removal System	2.5
K 1.08	Condensate Polishing System	2.1
K 1.09	Circulating Water System	2.3
K 1.10	Demineralized Water Transfer and Storage System	2.1
K 1.11	Main and Startup Feedwater System	2.8
K 1.12	Gland Seal System	2.3
K 1.13	Heater Drain System	2.4
K 1.14	Main Steam System	2.5
K 1.15	Main Turbine System	2.3
K 1.16	Steam Dump Control System	2.7
K 1.17	Secondary Sampling System	1.7
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Condensate pumps	2.3
K 2.02	Condensate pump discharge valves	2.0
K 2.03	1st and 2nd stage Feedwater heater inlet and outlet isolation valves	1.8
K 2.04	1st and 2nd stage Feedwater heater bypass valve	1.7

K 3 Knowledge of the effect that a loss or malfunction of the Condensate System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)

K 3.01	Steam Generator Blowdown System	2.4
K 3.02	Turbine Island Chemical Feed System	1.7
K 3.03	Condensate Polishing System	2.2
K 3.04	Main and Startup Feedwater System	2.8
K 3.05	Gland Seal System	2.3
K 3.06	Heater Drain System	2.3
K 3.07	Main Steam System	2.5
K 3.08	Main Turbine System	2.3

K 4 Knowledge of Condensate System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Condenser hotwell level control	2.5
K 4.02	Deaerator storage tank level control	2.5
K 4.03	Hotwell recirculation	1.9
K 4.04	Deaerator storage tank recirculation	2.0
K 4.05	Long cycle recirculation	2.0
K 4.06	Low pressure feedwater heating	2.3
K 4.07	Feedwater heater automatic isolation and bypass	2.6
K 4.08	Condensate polisher automatic isolation and bypass	2.4
K 4.09	Removing heat from the Gland Seal System condenser	2.1
K 4.10	Removing heat from the Steam Generator Blowdown System heat exchanger	2.2
K 4.11	Condensate pump auto start	2.7
K 4.12	Condensate pump manual start	2.6
K 4.13	C-9, Condenser Available	3.0

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Condensate System:
(CFR: 41.7 / 45.7)

K	5.01	Reactor response to loss of feedwater heating	3.1
K	5.02	Reactor response to returning feedwater heating to service	3.0
K	5.03	Plant response to a loss of feedwater flow	3.4
K	5.04	Water hammer prevention	2.8
K	5.05	Condenser tube leaks	2.6
K	5.06	Steam generator tube leak	3.4
K	5.07	Chemistry control	2.4

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Condensate System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Auxiliary Steam System	2.0
K	6.02	Steam Generator Blowdown System	2.2
K	6.03	Compressed and Instrument Air Systems	2.4
K	6.04	Condenser Tube Cleaning System	1.8
K	6.05	Turbine Island Chemical Feed System	1.7
K	6.06	Condenser Air Removal System	2.5
K	6.07	Condensate Polishing System	2.3
K	6.08	Circulating Water System	2.5
K	6.09	Demineralized Water Transfer and Storage System	2.1
K	6.10	Main and Startup Feedwater System	2.8
K	6.11	Gland Seal System	2.1
K	6.12	Heater Drain System	2.3
K	6.13	Main Steam System	2.5
K	6.14	Main Turbine System	2.5
K	6.15	Steam Dump Control System	2.7
K	6.16	Condensate pump failure	2.6
K	6.17	Feedwater heater isolation and bypass	2.5
K	6.18	Diversion of heater drains to the condenser	2.3
K	6.19	Abnormal hotwell level	2.5

K	6.20	Abnormal deaerator storage tank level	2.5
K	6.21	Loss of condenser vacuum	2.4
K	6.22	Abnormal condensate pump discharge header pressure	2.3
K	6.23	High condensate outlet temperature from Steam Generator Blowdown System heat exchanger	2.3
K	6.24	Low condensate flow	2.5

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Condensate System including: (CFR: 41.7 / 45.5)

A	1.01	Deaerator storage tank level	2.6
A	1.02	Hotwell level	2.6
A	1.03	Gland Seal System steam condenser pressure	2.1
A	1.04	Feedwater temperatures	2.3
A	1.05	Deaerator storage tank recirculation	1.9
A	1.06	Long cycle recirculation	2.1
A	1.07	Condensate pump amps	2.2
A	1.08	Condensate pump discharge pressure	2.4

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Condensate System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Steam Generator Blowdown System	2.3	2.2
A	2.02	Compressed and Instrument Air Systems	3.0	2.4
A	2.03	Turbine Island Chemical Feed System	1.7	1.8
A	2.04	Condenser Air Removal System	2.8	2.4
A	2.05	Condensate Polishing System	2.7	2.1
A	2.06	Circulating Water System	2.5	1.4
A	2.07	Demineralized Water Transfer and Storage System	2.5	2.1
A	2.08	Main and Startup Feedwater System	2.8	2.8
A	2.09	Gland Seal System	2.5	2.1
A	2.10	Heater Drain System	2.7	2.3

A	2.11	Main Steam System	2.7	2.4
A	2.12	Main Turbine System	2.5	2.6
A	2.13	Steam Dump Control System	2.7	2.7
A	2.14	Condensate pump failure	3.0	2.4
A	2.15	Feedwater heater isolation and bypass	3.0	2.4
A	2.16	Diversion of heater drains to the condenser	2.7	2.4
A	2.17	Abnormal hotwell level	3.0	2.2
A	2.18	Abnormal deaerator storage tank level	2.8	2.3
A	2.19	Loss of condenser vacuum	2.8	2.4
A	2.20	Abnormal condensate pump discharge header pressure	2.8	2.1
A	2.21	High condensate outlet temperature from Steam Generator Blowdown System heat exchanger	2.7	2.2
A	2.22	Low condensate flow	2.7	2.3

A 3 Ability to monitor automatic operation of the Condensate System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Condensate pump start	2.7
A	3.02	Hotwell recirculation control	2.3
A	3.03	Hotwell level control	2.6
A	3.04	Deaerator storage tank level control	2.7

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Hotwell recirculation	2.1
A	4.02	Deaerator storage tank recirculation	2.1
A	4.03	Long cycle recirculation	1.9
A	4.04	Condensate pumps	2.8
A	4.05	Deaerator storage tank level control	2.7
A	4.06	Hotwell level control	2.5
A	4.07	Feedwater heater isolation and bypass	2.3
A	4.08	Condensate polisher flow control and bypass valves	2.2

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Condenser Air Removal System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.0
K 1.02	Condensate System	2.6
K 1.03	Circulating Water System	2.3
K 1.04	Demineralized Water Transfer and Storage System	1.6
K 1.05	Gland Seal System	2.3
K 1.06	Radiation Monitoring System	3.3
K 1.07	Turbine Island Vent, Drain and Relief Valve System	1.7
K 1.08	Main Turbine Control and Diagnostics System	2.3
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Condenser vacuum pumps	2.1
K 2.02	Seal water pumps	2.0
K 3	**Knowledge of the effect that a loss or malfunction of the Condenser Air Removal System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Condensate System	2.4
K 3.02	C-9, Condenser Available	3.4
K 3.03	Main turbine availability	2.9
K 4	**Knowledge of Condenser Air Removal System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K 4.01	Vacuum pump start	2.3
K 4.02	Vacuum pump inlet valve opening	2.2
K 4.03	Vacuum pump seal water	2.0
K 4.04	Effluent monitoring and local grab sample	2.8

K	4.05	C-9, Condenser Available	3.2
K	4.06	Main turbine trip	3.2

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Condenser Air Removal System:
(CFR: 41.7 / 45.7)

K	5.01	Steam generator tube leak	3.8
K	5.02	Loss of condenser vacuum	3.3
K	5.03	Condensate and Feedwater oxygen levels	2.6

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Condenser Air Removal System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	2.1
K	6.02	Condensate System	2.4
K	6.03	Circulating Water System	2.3
K	6.04	Demineralized Water Transfer and Storage System	1.9
K	6.05	Turbine Island Vent, Drain and Relief Valve System	1.7
K	6.06	Vacuum pump trip	2.7
K	6.07	Loss of vacuum pump seal water or seal water cooling	2.4
K	6.08	Condenser vacuum breakers	2.6

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Condenser Air Removal System including:
(CFR: 41.7 / 45.5)

A	1.01	Main condenser vacuum	3.1
A	1.02	Radiation in the Turbine Island Vent, Drain and Relief Valve System	3.3
A	1.03	C-9, Condenser Available	3.4

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Condenser Air Removal System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Vacuum pump trip	2.3	2.8
A	2.02	Loss of vacuum pump seal water or seal water cooling	2.3	2.4
A	2.03	Loss of condenser vacuum	3.0	3.2
A	2.04	Loss of Gland Seal System	2.3	2.5
A	2.05	Loss of Circulating Water System	2.7	2.5
A	2.06	Condenser vacuum breaker	2.3	2.5
A	2.07	Loss of Demineralized Water Transfer and Storage System	2.0	2.1
A	2.08	Loss of Compressed and Instrument Air Systems	2.4	2.2

A	**3**	**Ability to monitor automatic operation of the Condenser Air Removal System, including: (CFR: 41.7 / 45.5 / 45.13)**		
A	3.01	Vacuum pump start		2.4

A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**		
A	4.01	Vacuum pump start		2.3
A	4.02	Condenser vacuum breaker		2.3

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KA NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Main and Startup Feedwater System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Auxiliary Steam System	1.7
K 1.02	Steam Generator Blowdown System	2.2
K 1.03	Compressed and Instrument Air Systems	2.6
K 1.04	Condensate System	2.9
K 1.05	Demineralized Water Transfer and Storage System	2.2
K 1.06	Engineered Safeguards Actuation System	3.6
K 1.07	Fire Protection System	1.9
K 1.08	Heater Drain System	2.4
K 1.09	Main Steam System	2.7
K 1.10	Main Turbine System	2.4
K 1.11	Post Accident Monitoring System	2.9
K 1.12	Steam Generator System	3.2
K 1.13	Secondary Sampling System	1.9
K 1.14	Turbine Building Closed Cooling Water System	1.9
K 1.15	Transmission Switchyard and Offsite Power System	2.0
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Booster/main feedwater pumps	2.6
K 2.02	Booster/main feedwater pump discharge isolation valves	2.3
K 2.03	Startup feedwater pumps	2.9
K 2.04	Startup feedwater isolation valves	2.8
K 2.05	Startup feedwater control valve control power	2.7
K 2.06	Main feedwater isolation valve control power	2.7
K 2.07	Main feedwater isolation valve hydraulic pump	2.6
K 2.08	Main feedwater control valve control power	2.5

K 3 Knowledge of the effect that a loss or malfunction of the Main and Startup Feedwater System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)

K 3.01	Auxiliary Steam System	1.6
K 3.02	Condensate System	2.5
K 3.03	Engineered Safeguards Actuation System	3.7
K 3.04	Heater Drain System	2.0
K 3.05	Main Steam System	2.6
K 3.06	Main Turbine System	2.4
K 3.07	Reactor Coolant System	3.5
K 3.08	Steam Generator System	3.4

K 4 Knowledge of Main and Startup Feedwater System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Trip of the booster/main feedwater pumps	3.1
K 4.02	Trip of the startup feedwater pumps	3.1
K 4.03	Decay heat removal	3.7
K 4.04	Feedwater heating	2.5
K 4.05	Long cycle recirculation	2.0
K 4.06	Feedwater flow measurement	2.9
K 4.07	Steam generator water level control in the low power mode (OE-related)	3.3
K 4.08	Steam generator water level control in the high power mode	3.4
K 4.09	Feedwater flowpath selection	2.6
K 4.10	Reactor Trip over ride	3.4
K 4.11	Startup feedwater pump auto start	3.1
K 4.12	Trip of booster/main feedwater pumps runback	3.3

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Main and Startup Feedwater System:
(CFR: 41.7 / 45.7)

K 5.01	Feedwater flow changes on Reactor Coolant System natural circulation flow rate	3.5
K 5.02	Feedwater flow changes on reactor power	3.8
K 5.03	Feedwater flow changes on Reactor Coolant System pressure	3.2
K 5.04	Feedwater flow changes on Reactor Coolant System temperature	3.5
K 5.05	Feedwater flow changes on pressurizer level	2.9
K 5.06	Feedwater flow changes on steam generator level	3.5
K 5.07	Feedwater flow changes on steam generator pressure	3.2
K 5.08	Water hammer	3.4
K 5.09	Effect opening booster/main feedwater pump minimum flow has on feedwater flow to the steam generator	2.9

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Main and Startup Feedwater System:
(CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Auxiliary Steam System	1.7
K 6.02	Compressed and Instrument Air Systems	2.8
K 6.03	Condensate System	2.9
K 6.04	Engineered Safeguards Actuation System	3.6
K 6.05	Heater Drain System	2.5
K 6.06	Main Steam System	2.9
K 6.07	Main Turbine System	2.8
K 6.08	Steam Generator System	3.3
K 6.09	Turbine Building Closed Cooling Water System	2.1
K 6.10	Transmission Switchyard and Offsite Power System	2.4
K 6.11	Turbine impulse pressure instrument	2.7
K 6.12	Main Feedwater flow instrument	3.0
K 6.13	Steam flow instrument	2.9
K 6.14	Main Feedwater temperature instrument	2.4
K 6.15	Wide range Steam Generator level instrument	2.9
K 6.16	Narrow range Steam Generator level instrument	3.0

K	6.17	Steam pressure instrument	2.9
K	6.18	Main feedwater flow instrument	2.8
K	6.19	Startup feedwater flow instrument	2.8
K	6.20	Trip of one booster/main feedwater pump train at full power	3.2
K	6.21	Loss of offsite power concurrent with main generator trip	3.4
K	6.22	Reactor Trip at full power	3.6
K	6.23	Turbine trip at full power without Reactor Trip	3.7
K	6.24	Main feedwater pump low lube oil supply pressure	2.5
K	6.25	Startup feedwater pump high discharge temperature	2.5
K	6.26	Feedwater heaters out of service	2.5

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Main and Startup Feedwater System including: (CFR: 41.7 / 45.5)

A	1.01	Reactor Coolant System natural circulation flow rate	3.3
A	1.02	Reactor power	3.7
A	1.03	Reactor Coolant System pressure	3.2
A	1.04	Reactor Coolant System temperature	3.5
A	1.05	Pressurizer level	3.0
A	1.06	Steam generator level	3.5
A	1.07	Steam generator pressure	3.3
A	1.08	Booster/main feedwater pump suction pressure	3.1
A	1.09	Main feedwater pump discharge pressure	2.9
A	1.10	Main feedwater header pressure	3.0
A	1.11	Main steam pressure	3.1
A	1.12	Main feedwater flow	3.3
A	1.13	Startup feedwater pump high discharge temperature	2.6
A	1.14	Startup feedwater pump high discharge pressure	2.6
A	1.15	Startup feedwater flow	3.3

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Main and Startup Feedwater System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Auxiliary Steam System	1.7	1.7
A	2.02	Compressed and Instrument Air Systems	3.0	2.8
A	2.03	Condensate System	2.7	3.0
A	2.04	Engineered Safeguards Actuation System	3.7	3.7
A	2.05	Heater Drain System	2.3	2.7
A	2.06	Main Steam System	2.6	2.9
A	2.07	Main Turbine System	2.4	2.8
A	2.08	Steam Generator System	3.0	3.4
A	2.09	Turbine Building Closed Cooling Water System	2.1	2.2
A	2.10	Transmission Switchyard and Offsite Power System	2.6	2.3
A	2.11	Turbine impulse pressure	2.9	2.8
A	2.12	Main feedwater flow	3.1	3.2
A	2.13	Steam flow	3.0	3.0
A	2.14	Main feedwater temperature	2.3	2.8
A	2.15	Steam generator wide range level	3.1	3.1
A	2.16	Steam generator narrow range level	3.1	3.2
A	2.17	Steam pressure	3.1	3.0
A	2.18	Main feedwater flow	3.3	3.1
A	2.19	Startup feedwater flow	3.1	3.2
A	2.20	Startup feedwater temperature	2.4	2.4
A	2.21	Trip of one booster/main feedwater pump train at full power	3.3	3.4
A	2.22	Trip of all booster/main feedwater pump trains at full power	3.4	3.5
A	2.23	Loss of offsite power concurrent with main generator trip	3.4	3.5
A	2.24	Reactor trip from full power	3.4	3.5
A	2.25	Turbine trip at full power without Reactor Trip	3.6	3.6
A	2.26	Main feedwater pump low lube oil supply pressure	3.7	2.5
A	2.27	Startup feedwater pump high discharge temperature	2.6	2.4
A	2.28	Main feedwater pump high lube oil supply temperature	2.3	2.4
A	2.29	Booster or main feedwater pump high bearing oil temperature	2.1	2.3
A	2.30	Booster/main feedwater pump motor or gear high bearing temperature	2.3	2.2
A	2.31	Booster/main feedwater pump motor high stator temperature	2.4	2.2

A	2.32	Main feedwater pump low flow	2.6	2.7
A	2.33	Startup feedwater pump low and high flow	2.6	3.1
A	2.34	Booster/main feedwater pump/motor/gear high radial vibration	2.3	2.2
A	2.35	Booster/main feedwater pump or gear high axial vibration	2.3	2.2
A	2.36	Feedwater heaters out of service	2.4	2.8

A 3 Ability to monitor automatic operation of the Main and Startup Feedwater System, including: (CFR: 41.7 / 45.5 / 45.13)

A	3.01	Main feedwater control valve	3.4
A	3.02	Booster/main feedwater pump trip	3.3
A	3.03	Startup feedwater control valve	3.3
A	3.04	Startup feedwater from startup feedwater pumps	3.2
A	3.05	Main feedwater pump minimum flow control valves	2.7

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Booster/main feedwater pump operation	3.2
A	4.02	Startup feedwater pumps	3.4
A	4.03	Long cycle recirculation valve	2.2
A	4.04	Main feedwater pump minimum flow control valves	2.2
A	4.05	Main feedwater control valve	3.3
A	4.06	Startup feedwater control valve	3.4

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Main Steam System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Auxiliary Steam System	2.0
K 1.02	Compressed and Instrument Air Systems	2.4
K 1.03	Condensate System	2.2
K 1.04	Engineered Safeguards Actuation System	3.2
K 1.05	Gland Seal System	2.0
K 1.06	Heater Drain System	2.0
K 1.07	Main Turbine System	2.5
K 1.08	Post Accident Monitoring System	2.4
K 1.09	Plant Gas Systems	1.8
K 1.10	Steam Dump Control System	3.0
K 1.11	Steam Generator System	3.0
K 1.12	Secondary Sampling System	1.9
K 1.13	Turbine Island Vents, Drains, and Relief Valve System	1.8
K 1.14	Turbine Building Ventilation System	1.7
K 1.15	Hot Water Heating System	1.5
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	MSR 2nd stage reheating steam main isolation valve control power	1.9
K 2.02	Extraction steam power operated shutoff valves	1.8
K 2.03	Main turbine stop valve control power	2.2
K 2.04	Main Steam System to auxiliary steam supply header isolation valve	1.8
K 3	**Knowledge of the effect that a loss or malfunction of the Main Steam System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Auxiliary Steam System	2.0
K 3.02	Condensate System	2.3
K 3.03	Gland Seal System	2.1

K	3.04	Heater Drain System	2.1
K	3.05	Main Turbine System	2.5
K	3.06	Steam Dump Control System	3.0
K	3.07	Steam Generator System	3.0
K	3.08	Secondary Sampling System	1.7
K	3.09	Turbine Island Vents, Drains, and Relief Valve System	1.8
K	3.10	Turbine Building Ventilation System	1.7
K	3.11	Hot Water Heating System	1.5

K 4 Knowledge of Main Steam System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Steam line isolation	3.7
K	4.02	Moisture separation and reheat	2.1
K	4.03	Extraction steam	2.0
K	4.04	Turbine protection	3.0
K	4.05	Main steam line drains	1.9
K	4.06	Auxiliary and Gland Seal System steam supply	2.0

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Main Steam System: (CFR: 41.7 / 45.7)

K	5.01	Changing steam flow effect on Reactor Coolant System natural circulation flow rate	3.4
K	5.02	Changing steam flow effect on pressurizer level	2.9
K	5.03	Changing steam flow effect on reactor power	3.7
K	5.04	Changing steam flow effect on Reactor Coolant System pressure	3.1
K	5.05	Changing steam flow effect on Reactor Coolant System temperature	3.4
K	5.06	Changing steam flow effect on Steam Generator level	3.1
K	5.07	Changing steam flow effect on Steam Generator pressure	3.0
K	5.08	Changing 2nd Stage Reheating steam flow effect on Main Turbine System	2.2
K	5.09	Water hammer	3.0

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Main Steam System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Auxiliary Steam System	2.0
K	6.02	Compressed and Instrument Air Systems	2.5
K	6.03	Condensate System	2.3
K	6.04	Engineered Safeguards Actuation System	3.2
K	6.05	Heater Drain System	2.1
K	6.06	Main Turbine System	2.7
K	6.07	Steam Dump Control System	3.0
K	6.08	Steam Generator System	3.0
K	6.09	Turbine Island Vents, Drains, and Relief Valve System	1.8
K	6.10	Turbine Building Ventilation System	1.7
K	6.11	100% load rejection	3.4
K	6.12	Turbine trip	3.4
K	6.13	Reactor Trip from 100% power	3.5
K	6.14	Power transients involving less than 100% load reduction	3.2
K	6.15	High and Low Auxiliary Steam System/Gland Seal System supply pressure	2.0
K	6.16	Feedwater heater High-2 Level	2.3
K	6.17	MSR 2nd stage reheat steam valve failure	2.3

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Main Steam System including:
(CFR: 41.7 / 45.5)

A	1.01	Hot reheat steam temperatures	2.0
A	1.02	LP turbine temperatures	2.0
A	1.03	Reheating steam temperatures	2.0
A	1.04	Reheating steam pressure	2.1
A	1.05	Main Steam System temperature	2.0
A	1.06	Main Steam System pressure	2.7
A	1.07	Reactor Coolant System temperature	3.0
A	1.08	Auxiliary Steam System pressure	2.0
A	1.09	Gland Seal System pressure	2.0

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Main Steam System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Auxiliary Steam System	2.0	1.9
A	2.02	Compressed and Instrument Air Systems	2.7	2.4
A	2.03	Condensate System	2.3	2.4
A	2.04	Engineered Safeguards Actuation System	3.1	3.3
A	2.05	Heater Drain System	2.1	2.3
A	2.06	Main Turbine System	2.7	2.7
A	2.07	Steam Dump Control System	3.1	3.0
A	2.08	Steam Generator System	3.0	2.9
A	2.09	Turbine Island Vents, Drains, and Relief Valve System	1.9	1.8
A	2.10	Turbine Building Ventilation System	1.9	1.6
A	2.11	100% load rejection	3.3	3.3
A	2.12	Turbine trip	3.3	3.3
A	2.13	Reactor trip from 100% power	3.3	3.4
A	2.14	Power transients involving less than 100% load reduction	3.3	3.1
A	2.15	High and Low Auxiliary Steam System/Gland Seal System supply pressure	1.9	1.9
A	2.16	Feedwater heater high-2 level	2.0	2.3
A	2.17	MSR 2nd stage reheat steam valve failure	2.1	2.2
A	2.18	MSR shell relief valve failure	2.0	2.2

A	**3**	**Ability to monitor automatic operation of the Main Steam System, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	MSR 2nd stage reheat steam flow	2.0
A	3.02	Pressure control valves for Auxiliary Steam System/Gland Seal System supply	2.0
A	3.03	Extraction steam power operated shutoff valves	2.0
A	3.04	Automatic low point drain valves	1.8
A	3.05	Steam Line Isolation Actuation	3.5

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Warming and pressurizing Main Steam System	2.2
A	4.02	MSR 2nd stage reheat supply steam flow	2.0
A	4.03	MSR 2nd stage reheat steam air-operated isolation valves	1.9
A	4.04	Pressure control valves for Auxiliary Steam System/Gland Seal System supply	2.0
A	4.05	Extraction steam power operated shutoff valves	2.0
A	4.06	Automatic low point drain valves	1.8
A	4.07	Steam line isolation	3.6

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Main Turbine and Main Turbine Control Systems and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Condensate System	2.4
K 1.02	Diverse Actuation System	3.1
K 1.03	Digital Rod Control System	2.6
K 1.04	Engineered Safeguards Actuation System	3.3
K 1.05	Main and Startup Feedwater System	2.6
K 1.06	Heater Drain System	2.2
K 1.07	Main Turbine and Generator Lube Oil System	2.2
K 1.08	Main Steam System	2.6
K 1.09	Nuclear Instrumentation System	2.3
K 1.10	Post Accident Monitoring System	2.1
K 1.11	Reactor Coolant System	2.3
K 1.12	Reactor Trip System (OE-related)	3.4
K 1.13	Steam Dump Control System	2.9
K 1.14	Main Generation System	2.4
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Main Turbine Control and Diagnostics System	2.1
K 3	**Knowledge of the effect that a loss or malfunction of the Main Turbine and Main Turbine Control Systems will have on the following: (CFR: 41.7 / 45.6)**	
K 3.01	Condensate System	2.2
K 3.02	Digital Rod Control System	2.4
K 3.03	Engineered Safeguards Actuation System	3.0
K 3.04	Main and Startup Feedwater System	2.4
K 3.05	Heater Drain System	2.1
K 3.06	Main Turbine and Generator Lube Oil System	2.0

K	3.07	Main Steam System	2.5
K	3.08	Nuclear Instrumentation System	2.2
K	3.09	Reactor Coolant System (OE-related)	2.5
K	3.10	Reactor Trip System	3.2
K	3.11	Steam Dump Control System	2.8
K	3.12	Main Generation System	2.4

K 4 Knowledge of Main Turbine and Main Turbine Control Systems design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	C-3, Low OTΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.1
K	4.02	C-4, Low OPΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.1
K	4.03	C-5, Low Turbine Power, Rod Block	3.1
K	4.04	C-7, Steam Dump Control System Load Reject Arming Signal	3.1
K	4.05	C-16, Low Tavg Turbine Stop Loading	3.1
K	4.06	C-20, Feedwater Pump Trip Turbine Runback	3.1
K	4.07	Isolation of steam to the main turbine, reheat steam, and/or extraction steam due to a turbine trip	3.2
K	4.08	Turbine trip	3.5
K	4.09	Turbine overspeed protection	3.3
K	4.10	Normal load control mode or load regulation mode	2.7
K	4.11	Tref signal generation	3.1

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Main Turbine and Main Turbine Control Systems: (CFR: 41.7 / 45.7)

K	5.01	Operating turbine at critical speeds	2.7
K	5.02	Turbine trip	3.3

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Main Turbine and Main Turbine Control Systems: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Condensate System	2.5
K	6.02	Engineered Safeguards Actuation System	3.1
K	6.03	Main and Startup Feedwater System	2.7
K	6.04	Heater Drain System	2.3
K	6.05	Main Turbine and Generator Lube Oil System	2.2
K	6.06	Main Steam System	2.5
K	6.07	Reactor Trip System	3.3
K	6.08	Main Generation System	2.6
K	6.09	C-3, Low OTΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.1
K	6.10	C-4, Low OPΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	3.1
K	6.11	C-5, Low Turbine Power, Rod Block	3.0
K	6.12	C-7, Steam Dump Control System Load Reject Arming Signal	2.9
K	6.13	C-16, Low Tavg Turbine Stop Loading	2.9
K	6.14	C-20, Feedwater Pump Trip Turbine Runback	2.8
K	6.15	Isolation of steam to the main turbine, reheat steam, and/or extraction steam	3.1
K	6.16	High turbine vibration	2.6
K	6.17	Turbine trip	3.3
K	6.18	Turbine overspeed	3.0
K	6.19	Load regulation mode	2.4

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Main Turbine and Main Turbine Control Systems including: (CFR: 41.7 / 45.5)

A	1.01	Reactor Coolant System Tavg and/or pressure	3.2
A	1.02	Reactor power	3.4
A	1.03	Margin to OTΔT Reactor Trip	3.2
A	1.04	Margin to OPΔT Reactor Trip	3.2
A	1.05	Turbine first stage pressure/power	3.0

A	1.06	Reactor Coolant System parameters	2.9
A	1.07	Generator load	2.6
A	1.08	Steam generator pressure	2.8

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Main Turbine and Main Turbine Control Systems and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	C-3, Low OTΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	2.6	2.9
A	2.02	C-4, Low OPΔT Margin, Auto and Manual Rod Withdrawal Block and Turbine Runback	2.6	2.9
A	2.03	C-5, Low Turbine Power, Rod Block	2.6	2.9
A	2.04	C-7, Steam Dump Control System Load Reject Arming Signal	2.4	3.0
A	2.05	C-16, Low Tavg Turbine Stop Loading	2.4	2.9
A	2.06	C-20, Feedwater Pump Trip Turbine Runback	2.6	2.9
A	2.07	Isolation of main steam, reheat steam, and/or extraction steam	2.6	3.0
A	2.08	Turbine vibration	2.2	2.4
A	2.09	Turbine trip	2.6	3.3
A	2.10	Turbine overspeed	2.2	2.7
A	2.11	Normal load control mode or load regulation mode	2.2	2.4
A	2.12	Power load imbalance	2.0	2.3

A	**3**	**Ability to monitor automatic operation of the Main Turbine and Main Turbine Control Systems, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	Turbine trip (OE-related)	3.6
A	3.02	Turbine runback	3.3
A	3.03	Turbine Overspeed Protection Actuation	3.2
A	3.04	Load regulation mode	2.6

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Turbine trip (OE-related)	3.6

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Steam Dump Control System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.7
K 1.02	Condensate System	2.3
K 1.03	Engineered Safeguards Actuation System	3.4
K 1.04	Main Steam System	3.0
K 1.05	Post Accident Monitoring System	2.5
K 1.06	Reactor Coolant System	2.5
K 1.07	Reactor Trip System	3.0
K 1.08	Steam Generator System	2.8
K 1.09	Main Turbine Control and Diagnostics System	2.5
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Turbine bypass control valve control power	2.2
K 3	**Knowledge of the effect that a loss or malfunction of the Steam Dump Control System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Condensate System	2.0
K 3.02	Main Steam System	2.7
K 3.03	Reactor Coolant System	3.1
K 3.04	Steam Generator System	3.0
K 3.05	Main Turbine Control and Diagnostics System	2.3
K 3.06	Reactor power	3.4

K 4 Knowledge of Steam Dump Control System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Load rejection control in Tavg mode	2.9
K	4.02	Plant trip control in Tavg mode	3.1
K	4.03	Header pressure control in steam pressure mode	3.0
K	4.04	Cooldown control in steam pressure mode	2.9
K	4.05	Manual control in steam pressure mode	3.0
K	4.06	Steam Pressure Mode Arming Signal	2.9
K	4.07	P-4, Steam Dump Control System Plant Trip Arming signal	3.1
K	4.08	C-7, Steam Dump Control System Load Reject Arming signal	2.9
K	4.09	C-9, Condenser Available	3.0
K	4.10	Steam Generator Wide Range Lo Level Block Actuation	2.9
K	4.11	Reactor Coolant System Lo Tavg Block Actuation	3.0
K	4.12	Steam Dump Bank Trip Open Actuation	2.9

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Steam Dump Control System: (CFR: 41.7 / 45.7)

K	5.01	Changing steam flow effect on Reactor Coolant System natural circulation flow rate	3.3
K	5.02	Changing steam flow effect on pressurizer level	2.9
K	5.03	Changing steam flow effect on reactor power	3.5
K	5.04	Changing steam flow effect on control rod position	3.0
K	5.05	Changing steam flow effect on Reactor Coolant System pressure	3.0
K	5.06	Changing steam flow effect on Reactor Coolant System temperature and/or cooldown rate	3.5
K	5.07	Changing steam flow effect on steam generator level	3.0
K	5.08	Changing steam flow effect on steam generator pressure	3.1
K	5.09	Effect of turbine bypass flow on condenser vacuum	2.7
K	5.10	Effect of turbine bypass flow on main turbine vibration	2.1

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Steam Dump Control System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	2.7
K	6.02	Condensate System	2.5
K	6.03	Main Steam System	2.8
K	6.04	Reactor Coolant System	2.7
K	6.05	Reactor Trip System	3.1
K	6.06	Steam Generator System	2.9
K	6.07	Main Turbine Control and Diagnostics System	2.6
K	6.08	Main steam header pressure	3.0
K	6.09	Reactor Coolant System Tavg	3.1
K	6.10	Turbine impulse pressure	3.1
K	6.11	Primary controller failure	2.9
K	6.12	Controller transfer failure	2.9
K	6.13	Reactor trip breaker	3.3
K	6.14	P-4, Steam Dump Control System Plant Trip Arming signal	3.3
K	6.15	C-7, Steam Dump Control System Load Reject Arming signal	3.1
K	6.16	C-9, Condenser Available	3.2
K	6.17	Steam Generator Wide Range Lo Level Block	3.0
K	6.18	Reactor Coolant System Lo Tavg Block	3.3
K	6.19	Steam Dump Bank Trip Open Actuation	2.9
K	6.20	Turbine bypass control valve failure	3.0
K	6.21	Loss of power	2.7
K	6.22	Turbine bypass control valve downstream high temperature	2.2

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Steam Dump Control System including:
(CFR: 41.7 / 45.5)

A	1.01	Reactor Coolant System natural circulation flow rate	3.1
A	1.02	Pressurizer level	3.0
A	1.03	Reactor power	3.6
A	1.04	Reactor Coolant System pressure	3.1
A	1.05	Reactor Coolant System temperature and/or cooldown rate	3.5

A	1.06	Steam generator level	3.0
A	1.07	Steam flow	3.0
A	1.08	Main Steam System header pressure	3.0
A	1.09	Feedwater flow	2.5
A	1.10	Condenser vacuum	2.7

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Steam Dump Control System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Compressed and Instrument Air Systems	3.0	2.7
A	2.02	Condensate System	2.3	2.3
A	2.03	Main Steam System	2.6	2.8
A	2.04	Reactor Coolant System	2.9	2.8
A	2.05	Reactor Trip System	3.1	3.2
A	2.06	Steam Generator System	2.7	2.9
A	2.07	Main Turbine Control and Diagnostics System	2.4	2.5
A	2.08	Main steam header pressure	2.7	2.9
A	2.09	Reactor Coolant System Tavg	3.3	3.2
A	2.10	Turbine impulse pressure	3.0	3.1
A	2.11	Primary controller failure	2.9	2.8
A	2.12	Controller transfer failure	2.9	2.8
A	2.13	Reactor trip breaker	3.0	3.2
A	2.14	P-4, Steam Dump Control System Plant Trip Arming signal	3.3	3.3
A	2.15	C-7, Steam Dump Control System Load Reject Arming signal	3.3	3.2
A	2.16	C-9, Condenser Available	3.0	3.1
A	2.17	Steam Generator Wide Range Lo Level Block	3.1	3.0
A	2.18	Reactor Coolant System Lo Tavg Block	3.1	3.1
A	2.19	Steam Dump Bank Trip Open Actuation	2.7	2.8
A	2.20	Turbine bypass control valve failure	3.0	3.0
A	2.21	Loss of power	2.7	2.7
A	2.22	Turbine bypass control valve downstream high temperature	2.4	2.1

A 3 Ability to monitor automatic operation of the Steam Dump Control System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Steam pressure mode	3.1
A	3.02	Load rejection control in Tavg mode	3.1
A	3.03	Plant trip control in Tavg mode	3.3
A	3.04	Steam dump arming	3.2
A	3.05	Steam dump blocking	3.3
A	3.06	Steam Line Isolation Actuation	3.6

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Transfer between steam pressure control mode and Tavg control mode	3.1
A	4.02	Transfer between primary and backup steam dump controllers	2.9
A	4.03	Initiate an automatic Reactor Coolant System cooldown or heat up	2.9
A	4.04	Manual temperature control in steam pressure mode	3.2
A	4.05	Manual reactor power control in steam pressure mode	3.1

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Service Water System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.8
K 1.02	Component Cooling Water System	3.4
K 1.03	Circulating Water System	2.7
K 1.04	Special Process Heat Tracing System	2.2
K 1.05	Fire Protection System	2.6
K 1.06	Radiation Monitoring System	3.0
K 1.07	Raw Water System	2.4
K 1.08	Waste Water System	2.2
K 1.09	Transmission Switchyard and Offsite Power System	2.3
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Service Water System pumps	3.1
K 2.02	Service Water System pump discharge valves	2.9
K 2.03	Service Water System cooling tower inlet control valves	2.7
K 2.04	Service Water System cooling tower fans	2.7
K 2.05	Service Water System strainers	2.3
K 3	**Knowledge of the effect that a loss or malfunction of the Service Water System will have on the following systems or system parameters systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Component Cooling Water System	3.6
K 3.02	Raw Water System	2.4

K 4 Knowledge of Service Water System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Service Water System pump start	3.2
K 4.02	Service Water System strainer backwash	2.4
K 4.03	Service Water System blowdown	2.3
K 4.04	Service Water System water temperature control	2.8
K 4.05	Service Water System freeze protection	2.4
K 4.06	Service Water System tower makeup	2.7

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Service Water System: (CFR: 41.7 / 45.7)

K 5.01	Water hammer	3.3
K 5.02	Pump run out	3.3
K 5.03	Radiation alarms on Service Water System	3.4

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Service Water System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Compressed and Instrument Air Systems	2.8
K 6.02	Circulating Water System	2.4
K 6.03	Special Process Heat Tracing System	2.3
K 6.04	Fire Protection System	2.6
K 6.05	Radiation Monitoring System	3.0
K 6.06	Raw Water System	2.4
K 6.07	Waste Water System	2.0
K 6.08	Transmission Switchyard and Offsite Power System	2.5
K 6.09	Service Water System pumps	3.3
K 6.10	Service Water System pump discharge valves	3.2
K 6.11	Service Water System cooling tower inlet control valves	3.0
K 6.12	Service Water System cooling tower fans	2.9
K 6.13	Service Water System strainer	2.6

K	6.14	Service Water System strainer backwash feature	2.5
K	6.15	Service Water System tower makeup valve	2.8
K	6.16	Component Cooling Water System heat exchanger	3.3
K	6.17	Service Water System pump discharge pressure instrument	2.5
K	6.18	Service Water System water hot return temperature instrument	2.4
K	6.19	Service Water System blowdown flow instrument	2.3
K	6.20	Service Water System cooling tower basin level instrument	2.5
K	6.21	Service Water pump high or low discharge pressure	2.9
K	6.22	Automatic strainer high-high differential pressure	2.6
K	6.23	Service Water System cold water supply high or low temperature	2.5
K	6.24	Component Cooling Water System heat exchanger high outlet temperature	3.0
K	6.25	Service water pump high or low flow	3.0
K	6.26	Cooling tower basin high or low level	2.7

A	**1**	**Ability to predict and/or monitor changes in parameters associated with operation of the Service Water System including: (CFR: 41.7 / 45.5)**	
A	1.01	Service Water System pressure	2.9
A	1.02	Service Water System cold water supply temperature	2.4
A	1.03	Service Water System hot water return temperature	2.6
A	1.04	Service Water System cooling tower basin level	2.7
A	1.05	Component Cooling Water System heat exchanger outlet temperature	3.1

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Service Water System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Compressed and Instrument Air Systems	3.0	2.7
A	2.02	Circulating Water System	2.2	2.6
A	2.03	Special Process Heat Tracing System	2.1	2.1
A	2.04	Fire Protection System	2.8	2.4
A	2.05	Radiation Monitoring System	3.0	3.2

A	2.06	Raw Water System	2.3	2.6
A	2.07	Waste Water System	1.9	2.2
A	2.08	Transmission Switchyard and Offsite Power System	2.9	2.5
A	2.09	Service Water System pumps	3.3	3.4
A	2.10	Service Water System pump discharge valves	3.2	3.1
A	2.11	Service Water System cooling tower inlet control valves	2.8	3.0
A	2.12	Service Water System cooling tower fans	2.8	3.1
A	2.13	Service Water System strainer	2.4	2.6
A	2.14	Service Water System strainer backwash feature	2.2	2.4
A	2.15	Service Water System tower makeup valve	2.7	2.7
A	2.16	Component Cooling Water System heat exchanger tube failure	3.3	3.6
A	2.17	Service Water System pump discharge pressure instrument	2.4	2.7
A	2.18	Service Water System water hot return temperature instrument	2.3	2.6
A	2.19	Service Water System blowdown flow instrument	2.2	2.4
A	2.20	Service Water System cooling tower basin level instrument	2.4	2.6
A	2.21	Service water pump high or low discharge pressure	2.9	3.0
A	2.22	Automatic strainer high-high differential pressure (OE-related)	2.7	2.8
A	2.23	Service Water System cold water supply high or low temperature	2.2	2.7
A	2.24	Component Cooling Water System heat exchanger high outlet temperature	2.9	3.1
A	2.25	Service water pump high or low flow (OE-related)	2.9	3.0
A	2.26	Cooling tower basin high or low Level	2.8	2.9
A	2.27	Service Water System high radiation	3.1	3.6

A 3 Ability to monitor automatic operation of the Service Water System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Service Water System pump and discharge valve operation	3.0
A	3.02	Service Water System strainer backwash	2.4
A	3.03	Service Water System blowdown	2.4
A	3.04	Service Water System tower inlet control valve	2.8
A	3.05	Service Water System tower fans	2.9
A	3.06	Service Water System cooling tower makeup	2.7

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Service Water System pump and discharge valve	3.2
A	4.02	Service Water System strainer backwash	2.3
A	4.03	Service Water System blowdown	2.2
A	4.04	Service Water System tower inlet control valve	2.7
A	4.05	Service Water System tower fans	2.7
A	4.06	Service Water System cooling tower makeup	2.6

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Safety Function 5: Containment Integrity

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SF5 VLS	Containment Hydrogen Control System	3.5-13

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Containment System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Steam Generator Blowdown System	2.9
K 1.02	Compressed and Instrument Air Systems	3.1
K 1.03	Component Cooling Water System	3.0
K 1.04	Chemical and Volume Control System	3.1
K 1.05	Diverse Actuation System	3.5
K 1.06	Demineralized Water Transfer and Storage System	2.9
K 1.07	Main AC Power System	2.6
K 1.08	Non Class 1E DC and UPS System	2.5
K 1.09	Engineered Safeguards Actuation System	3.6
K 1.10	Fuel Handling System	3.0
K 1.11	Fire Protection System	3.0
K 1.12	Class 1E DC and UPS System	2.9
K 1.13	Post Accident Monitoring System	2.8
K 1.14	Passive Containment Cooling System	3.8
K 1.15	Protection and Safety Monitoring System	3.6
K 1.16	Plant Sampling System	2.8
K 1.17	Passive Core Cooling System	3.2
K 1.18	Normal Residual Heat Removal System	3.2
K 1.19	Spent Fuel Pool Cooling System	3.1
K 1.20	Steam Generator System	3.3
K 1.21	Containment Recirculation Cooling System	3.0
K 1.22	Containment Air Filtration System	2.9
K 1.23	Containment Hydrogen Control System	3.0
K 1.24	Containment Leak Rate Test System	2.5
K 1.25	Central Chilled Water System	2.8
K 1.26	Liquid Radwaste System	2.7
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Containment equipment hatch closure hoists	2.1

K 3 Knowledge of the effect that a loss or malfunction of the Containment System will have on the following systems or system parameters:
(CFR: 41.7 / 45.6)

K 3.01	Containment integrity	4.0
K 3.02	Containment closure	3.8

K 4 Knowledge of Containment System design feature(s) and/or interlock(s) which provide for the following:
(CFR: 41.7)

K 4.01	Containment isolation	4.0
K 4.02	Containment Air Filtration System isolation	3.4
K 4.03	Normal Residual Heat Removal System containment isolation	3.7
K 4.04	Refueling cavity isolation	3.4
K 4.05	Containment closure	3.4
K 4.06	Personnel access	2.9
K 4.07	Containment evacuation	3.3

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Containment System:
(CFR: 41.7 / 45.7)

K 5.01	Passive Residual Heat Removal System heat exchanger operation	3.6
K 5.02	Automatic Depressurization System operation	4.1
K 5.03	Hydrogen detonation inside containment	3.9
K 5.04	Loss of coolant accident	4.3
K 5.05	Main Steam Line Break inside containment	4.3
K 5.06	Loss of containment integrity	4.1
K 5.07	Loss of containment closure capability	3.8

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Containment System:
(CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Containment isolation	4.1
K 6.02	Containment Air Filtration System isolation	3.3
K 6.03	Normal Residual Heat Removal System containment isolation	3.6
K 6.04	Refueling Cavity isolation	3.4
K 6.05	Containment closure	3.4
K 6.06	Containment isolation valve failure	3.6
K 6.07	Containment mechanical penetration failure	3.4
K 6.08	Containment electrical penetration failure	3.3
K 6.09	Containment airlock seal failure	3.4
K 6.10	Containment equipment hatch closure hoist failure	2.8

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Containment System including:
(CFR: 41.7 / 45.5)

A 1.01	Containment pressure	4.1
A 1.02	Containment temperature	3.6
A 1.03	Containment radiation	3.6
A 1.04	Containment water level	3.9

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Containment System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
(CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

		RO	SRO
A 2.01	Containment isolation	4.0	3.9
A 2.02	Containment Air Filtration System isolation	3.5	3.4
A 2.03	Normal Residual Heat Removal System containment isolation	3.7	3.6
A 2.04	Refueling Cavity isolation	3.5	3.5
A 2.05	Containment closure	3.3	3.5
A 2.06	Containment entry in modes 1, 2, 3, or 4	2.7	3.6
A 2.07	Containment entry in modes 5, 6, or defueled	2.7	2.9

A 3 Ability to monitor automatic operation of the Containment System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Containment isolation	4.1
A	3.02	Containment Air Filtration System isolation	3.6
A	3.03	Normal Residual Heat Removal System containment isolation	3.6
A	3.04	Refueling Cavity isolation	3.5

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Containment isolation	4.2
A	4.02	Containment Air Filtration System isolation	3.6
A	4.03	Normal Residual Heat Removal System containment isolation	3.7
A	4.04	Refueling Cavity isolation	3.6
A	4.05	Containment closure	3.4

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical connections between the Passive Containment Cooling System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.6
K 1.02	Containment System	3.3
K 1.03	Diverse Actuation System	3.2
K 1.04	Storm Drain System	1.9
K 1.05	Demineralized Water Transfer and Storage System	2.3
K 1.06	Special Process Heat Tracing System	1.9
K 1.07	Engineered Safeguards Actuation System	3.7
K 1.08	Fire Protection System	2.7
K 1.09	Post Accident Monitoring System	2.7
K 1.10	Spent Fuel Pool Cooling System	2.6
K 1.11	Nuclear Island Nonradioactive Ventilation System	2.2
K 1.12	Containment Recirculation Cooling System	2.7
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Passive containment cooling water storage tank outlet air-operated isolation valves control power	2.7
K 2.02	Passive containment cooling water storage tank outlet motor-operated isolation valves	3.1
K 2.03	Passive containment cooling water storage tank recirculation heater	2.1
K 2.04	Passive containment cooling water storage tank recirculation pump	2.1
K 2.05	Passive containment cooling ancillary water storage tank heater	2.1

K 3 Knowledge of the effect that a loss or malfunction of the Passive Containment Cooling System will have on the following: (CFR: 41.7 / 45.6)

K 3.01	Containment System	3.8
K 3.02	Storm Drain System	1.7
K 3.03	Demineralized Water Transfer and Storage System	2.0
K 3.04	Fire Protection System	2.1
K 3.05	Spent Fuel Pool Cooling System	2.6
K 3.06	Containment Recirculation Cooling System	2.4

K 4 Knowledge of Passive Containment Cooling System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Containment vessel heat removal	3.9
K 4.02	Process monitoring	2.8
K 4.03	Spent Fuel pit inventory makeup	3.0
K 4.04	Fire protection water supply	2.8
K 4.05	Recirculate contents of the passive containment cooling water storage tank and passive containment cooling ancillary water storage tank	3.1
K 4.06	Passive Containment Cooling System Actuation	4.1

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Passive Containment Cooling System: (CFR: 41.7 / 45.7)

K 5.01	Heat transfer via conduction	2.7
K 5.02	Heat transfer via convection	2.7
K 5.03	Heat transfer via radiation	2.5
K 5.04	Heat transfer via water evaporation	2.7

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Passive Containment Cooling System: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	3.3
K	6.02	Containment System	3.4
K	6.03	Diverse Actuation System	3.6
K	6.04	Demineralized Water Transfer and Storage System	2.6
K	6.05	Special Process Heat Tracing System	2.3
K	6.06	Engineered Safeguards Actuation System	3.9
K	6.07	Fire Protection System	2.7
K	6.08	Spent Fuel Pool Cooling System	2.9
K	6.09	Nuclear Island Nonradioactive Ventilation System	2.2
K	6.10	Containment Recirculation Cooling System	2.6
K	6.11	Reactor Trip with loss of all AC power	3.3
K	6.12	Automatic Depressurization System Actuation	3.8
K	6.13	Loss of coolant accident	4.1
K	6.14	Main Steam Line Break	3.9
K	6.15	Inadvertent Passive Containment Cooling System Actuation	3.5
K	6.16	Passive containment cooling water storage tank abnormal levels	3.1
K	6.17	Passive containment cooling ancillary water storage tank abnormal levels	2.8
K	6.18	Passive containment cooling water storage tank abnormal temperature	3.0
K	6.19	Passive containment cooling ancillary water storage tank abnormal temperature	2.8
K	6.20	Abnormal passive containment cooling water storage tank recirculation flow rate	2.7
K	6.21	Valve room abnormal temperature	2.3
K	6.22	Abnormal isolation valve leakage	2.7
K	6.23	Passive containment cooling water storage tank discharge path blockage	3.8
K	6.24	Water storage tank auxiliary line freezing	2.9
K	6.25	Weir blockage	3.1
K	6.26	Annulus drain blockage	3.1
K	6.27	Passive containment cooling water storage tank makeup lines blockage	3.3

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Passive Containment Cooling System including:
(CFR: 41.7 / 45.5)

A 1.01	Containment pressure	3.9
A 1.02	Containment temperature	3.9
A 1.03	Passive Containment Cooling System water delivery flow	2.6
A 1.04	Passive containment cooling water storage tank wide range water level	2.9

A 2	**Ability to (a) predict the impacts of the following malfunctions or operations on the Passive Containment Cooling System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A 2.01	Compressed and Instrument Air Systems	3.3	3.1
A 2.02	Containment System	3.5	3.9
A 2.03	Diverse Actuation System	3.0	3.9
A 2.04	Demineralized Water Transfer and Storage System	2.5	2.6
A 2.05	Special Process Heat Tracing System	2.3	2.1
A 2.06	Engineered Safeguards Actuation System	3.8	3.7
A 2.07	Fire Protection System	2.8	2.9
A 2.08	Spent Fuel Pool Cooling System	2.8	2.9
A 2.09	Nuclear Island Nonradioactive Ventilation System	2.3	2.7
A 2.10	Containment Recirculation Cooling System	2.0	3.4
A 2.11	Reactor Trip with loss of all AC power	3.3	3.7
A 2.12	Automatic Depressurization System Actuation	3.8	4.0
A 2.13	Loss of coolant accident	3.8	4.1
A 2.14	Main Steam Line Break	3.8	4.0
A 2.15	Inadvertent Passive Containment Cooling System Actuation	3.3	3.9
A 2.16	Passive containment cooling water storage tank abnormal levels	2.8	3.4
A 2.17	Passive containment cooling ancillary water storage tank abnormal levels	2.5	3.1
A 2.18	Passive containment cooling water storage tank abnormal temperature	3.0	2.9
A 2.19	Passive containment cooling ancillary water storage tank abnormal temperature	2.8	2.7
A 2.20	Abnormal passive containment cooling water storage tank recirculation flow rate	2.8	3.0

A	2.21	Valve room abnormal temperature	2.8	2.4
A	2.22	Abnormal isolation valve leakage	2.8	2.7
A	2.23	Passive containment cooling water storage tank discharge path blockage	3.5	3.7
A	2.24	Water storage tank auxiliary line freezing	2.8	3.0
A	2.25	Weir blockage	3.0	3.0
A	2.26	Annulus drain blockage	3.0	3.3
A	2.27	Passive containment cooling water storage tank makeup lines blockage	2.8	3.3

A 3 Ability to monitor automatic operation of the Passive Containment Cooling System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Passive Containment Cooling System Actuation	4.2
A	3.02	Containment isolation	4.1

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Passive Containment Cooling System Actuation	4.3
A	4.02	Makeup to passive containment cooling water storage tank from passive containment cooling ancillary water storage tank	3.0
A	4.03	Makeup to passive containment cooling water storage tank from demineralized water transfer and storage system	2.7
A	4.04	Makeup to passive containment cooling water storage tank from fire protection system	2.8
A	4.05	Passive containment cooling ancillary water storage tank flow to water distribution bucket	3.1
A	4.06	Passive containment cooling water storage tank flow to Spent Fuel Pool Cooling System	3.2

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Containment Hydrogen Control System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Containment System	3.3
K 1.02	Diverse Actuation System	3.3
K 1.03	Incore Instrumentation System	2.4
K 1.04	Primary Sampling System	2.4
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Containment hydrogen igniters	3.1
K 2.02	Containment hydrogen monitors	3.1
K 3	**Knowledge of the effect that a loss or malfunction of the Containment Hydrogen Control System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Containment hydrogen concentration	3.7
K 4	**Knowledge of Containment Hydrogen Control System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K 4.01	Containment hydrogen concentration monitoring	3.5
K 4.02	Passive containment hydrogen concentration control	3.6
K 4.03	Containment hydrogen concentration control using containment hydrogen igniters	3.9

K 5	**Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Containment Hydrogen Control System: (CFR: 41.7 / 45.7)**		
K 5.01	Explosive hydrogen concentration (OE-related)	4.0	
K 5.02	Flammable hydrogen concentration (OE-related)	3.8	
K 5.03	Sources of hydrogen into the containment atmosphere (OE-related)	3.4	
K 6	**Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Containment Hydrogen Control System: (CFR: 41.7 / 45.5 TO 45.8)**		
K 6.01	Containment hydrogen monitor failure	3.5	
K 6.02	Passive autocatalytic recombiner failure	3.4	
K 6.03	Containment hydrogen igniter failure	3.2	
A 1	**Ability to predict and/or monitor changes in parameters associated with operation of the Containment Hydrogen Control System including: (CFR: 41.7 / 45.5)**		
A 1.01	Core exit temperature	3.8	
A 1.02	Containment hydrogen concentration	3.8	
A 1.03	Containment temperature	3.1	
A 1.04	Containment pressure	3.5	
A 2	**Ability to (a) predict the impacts of the following malfunctions or operations on the Containment Hydrogen Control System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A 2.01	Containment hydrogen monitor failure	3.3	3.5
A 2.02	Passive autocatalytic recombiner failure	3.4	3.5
A 2.03	Containment hydrogen igniter failure	3.1	3.5
A 2.04	Loss of coolant accident	3.9	4.2

A 3 Ability to monitor automatic operation of the Containment Hydrogen Control System, including: (CFR: 41.7 / 45.5 / 45.13)

A 3.01 N/A

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A 4.01	Containment hydrogen monitor	3.6
A 4.02	Containment hydrogen igniter	3.6

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Safety Function 6: Electrical

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the AC Electrical Distribution Systems and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Standby Diesel and Auxiliary Boiler Fuel Oil System	3.0
K 1.02	Non Class 1E DC and UPS System	3.3
K 1.03	Grounding and Lightning Protection System	2.2
K 1.04	Engineered Safeguards Actuation System	3.8
K 1.05	Fire Protection System	3.0
K 1.06	Class 1E DC and UPS System	3.9
K 1.07	Post Accident Monitoring System	3.2
K 1.08	Remote shutdown workstation	3.4
K 1.09	Nuclear Island Nonradioactive Ventilation System	2.5
K 1.10	Turbine Building Ventilation System	2.1
K 1.11	Annex/Auxiliary Building Nonradioactive Ventilation System	2.1
K 1.12	Main Generation System	3.1
K 1.13	Transmission Switchyard and Offsite Power System	3.2
K 1.14	Onsite Standby Power System	3.4
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Major bus or motor control center power supplies (6.9 kV, 4.16kV, 480V)	3.2
K 2.02	Major bus or motor control center loads (6.9 kV, 4.16kV, 480V)	3.2
K 2.03	Breaker control power (6.9 kV, 4.16kV, 480V)	2.9
K 2.04	Ancillary diesel generator starting battery charger	2.9
K 3	**Knowledge of the effect that a loss or malfunction of the AC Electrical Distribution Systems will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Standby Diesel and Auxiliary Boiler Fuel Oil System	3.0
K 3.02	Non Class 1E DC and UPS System	3.0
K 3.03	Engineered Safeguards Actuation System	3.9

K	3.04	Class 1E DC and UPS System	4.0
K	3.05	Main Generation System	2.9
K	3.06	Transmission Switchyard and Offsite Power System	3.1
K	3.07	Onsite Standby Power System	3.6
K	3.08	Major bus or motor control center loads (6.9 kV, 4.16kV, 480V)	3.3

K 4 Knowledge of AC Electrical Distribution Systems design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Load shedding	3.4
K	4.02	Back feeding buses from the grid	3.2
K	4.03	Electrical containment penetration protection	3.0
K	4.04	Protective relaying and/or bus lockout due to a fault	3.3
K	4.05	Automatic or manual transfer of buses between multiple power sources	3.2
K	4.06	Paralleling the onsite standby diesel generators with the grid	3.1
K	4.07	Supplying bus power from the onsite standby diesel generators during loss of offsite power	3.6
K	4.08	Supplying bus power from the ancillary diesel generator during loss of offsite power	3.5

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the AC Electrical Distribution Systems: (CFR: 41.7 / 45.7)

K	5.01	Fault on a bus load	3.3
K	5.02	Fault on a bus	3.3
K	5.03	Fault on a reserve auxiliary transformer	3.2
K	5.04	Fault on a unit auxiliary transformer	3.3
K	5.05	Fault on a main step up transformer	3.2
K	5.06	Loss of all AC power	4.1
K	5.07	Operating above or below the current or voltage operating limits	3.3
K	5.08	Energizing a faulted or grounded bus or motor control center	3.4
K	5.09	Paralleling out of phase	3.6

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the AC Electrical Distribution Systems:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Standby Diesel and Auxiliary Boiler Fuel Oil System	3.0
K	6.02	Non Class 1E DC and UPS System	3.0
K	6.03	Fire Protection System	2.9
K	6.04	Class 1E DC and UPS System	3.8
K	6.05	Nuclear Island Nonradioactive Ventilation System	2.4
K	6.06	Turbine Building Ventilation System	2.2
K	6.07	Annex/Auxiliary Building Nonradioactive Ventilation System	2.2
K	6.08	Main Generation System	3.1
K	6.09	Transmission Switchyard and Offsite Power System	3.2
K	6.10	Onsite Standby Power System	3.3

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the AC Electrical Distribution Systems including:
(CFR: 41.7 / 45.5)

A	1.01	Bus, motor control center and/or load electrical operating parameters	2.9
A	1.02	Ancillary Diesel Generator electrical operating parameters	3.0

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the AC Electrical Distribution Systems and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
(CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

			RO	SRO
A	2.01	Loss of circuit breaker control power	2.7	3.2
A	2.02	Loss of offsite power	3.7	4.1
A	2.03	Fault on a bus load or motor control center load	3.1	3.3
A	2.04	Fault on a bus or motor control center or transformer	3.1	3.4

A	**3**	**Ability to monitor automatic operation of the AC Electrical Distribution Systems, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	Bus transfer from unit Auxiliary transformer to reserve auxiliary transformer	3.2
A	3.02	Tripping of loads, buses, or transformers due to protective relaying	3.3
A	3.03	Start and loading of standby diesel generator	3.6

A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**	
A	4.01	Bus transfer from reserve auxiliary transformer to unit auxiliary transformer	3.2
A	4.02	Paralleling the grid with the onsite standby diesel generator	3.2
A	4.03	Paralleling the onsite standby diesel generator with the grid	3.2
A	4.04	Energize a bus	3.4
A	4.05	Energize a reserve auxiliary transformer	3.3
A	4.06	Restore the plant electrical system after a loss of offsite power	3.7

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Class 1E and Non 1E DC and UPS System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Main AC Power System	3.2
K 1.02	Grounding and Lightning Protection System	2.2
K 1.03	Engineered Safeguards Actuation System	4.0
K 1.04	Post Accident Monitoring System	3.4
K 1.05	Nuclear Island Nonradioactive Ventilation System	2.4
K 1.06	Annex/Auxiliary Building Nonradioactive Ventilation System	2.2
K 1.07	Onsite Standby Power System	3.2
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Major Class 1E DC and UPS System loads	3.6
K 2.02	Nuclear Island Nonradioactive Ventilation System equipment	2.0
K 2.03	Class 1E battery chargers	3.5
K 2.04	Class 1E instrument bus Inverters (OE-related)	3.7
K 2.05	Class 1E regulated transformers	3.3
K 2.06	Major Non Class 1E DC and UPS System loads	2.8
K 2.07	Annex/Auxiliary Building Nonradioactive Ventilation System equipment	2.0
K 2.08	Non class 1E battery chargers	2.4
K 2.09	Non class 1E instrument bus inverters (OE-related)	2.5
K 2.10	Non class 1E regulated transformers	2.4
K 3	**Knowledge of the effect that a loss or malfunction of the Class 1E and Non 1E DC and UPS System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Main AC Power System (OE-related)	3.1
K 3.02	Engineered Safeguards Actuation System (OE-related)	4.0
K 3.03	Non Class 1E DC and UPS System loads (OE-related)	2.8
K 3.04	Class 1E DC and UPS System loads (OE-related)	3.7

K	3.05	Post Accident Monitoring System (OE-related)	3.3
K	3.06	Nuclear Island Nonradioactive Ventilation System (OE-related)	2.4
K	3.07	Annex/Auxiliary Building Nonradioactive Ventilation System (OE-related)	2.2
K	3.08	Onsite Standby Power System (OE-related)	3.1
K	3.09	Class 1E battery chargers (OE-related)	3.5
K	3.10	Class 1E Instrument bus Inverters (OE-related)	3.6
K	3.11	Non Class 1E battery chargers (OE-related)	2.4
K	3.12	Non Class 1E instrument bus inverters (OE-related)	2.5

K 4 Knowledge of Class 1E and Non 1E DC and UPS System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Monitoring battery health	3.0
K	4.02	Placing spare battery in service	2.8
K	4.03	Placing spare battery charger in service	2.8
K	4.04	Maintaining an Instrument bus energized with its inverter removed from service	3.3
K	4.05	Automatic Depressurization System Actuation	4.1
K	4.06	System ground detection	2.6
K	4.07	Class 1E DC division separation	3.3

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Class 1E and Non 1E DC and UPS System: (CFR: 41.7 / 45.7)

K	5.01	Extended undervoltage on Class 1E battery chargers	3.8
K	5.02	Loss of one or more Class 1E instrument buses	3.7
K	5.03	Removing a battery cell from service	2.2
K	5.04	System ground	2.6
K	5.05	Loss of Nuclear Island Nonradioactive Ventilation System	2.5
K	5.06	Loss of Annex/Auxiliary Building Nonradioactive Ventilation System	2.3

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Class 1E and Non 1E DC and UPS System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Nuclear Island Nonradioactive Ventilation System	2.3
K	6.02	Class 1E battery charger failure	3.5
K	6.03	Class 1E battery failure	3.9
K	6.04	Class 1E Inverter failure (OE-related)	3.8
K	6.05	Loss of Class 1E battery bus	4.0
K	6.06	Loss of offsite power	3.3
K	6.07	Loss of all AC power	3.9
K	6.08	Annex/Auxiliary Building Nonradioactive Ventilation System	2.3
K	6.09	Non class 1E battery charger failure	2.4
K	6.10	Non class 1E battery failure	2.5
K	6.11	Non class 1E Inverter failure (OE-related)	2.5
K	6.12	Loss of non class 1E battery bus	2.6

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Class 1E and Non 1E DC and UPS System including:
(CFR: 41.7 / 45.5)

A	1.01	Battery voltage and/or current	3.0
A	1.02	Battery bus voltage and/or current	3.0
A	1.03	Battery charger voltage and/or current	2.9
A	1.04	Instrument bus current and/or voltage	3.0

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Class 1E and Non 1E DC and UPS System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
(CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

			RO	SRO
A	2.01	Main AC Power System	3.0	3.3
A	2.02	Grounding and Lightning Protection System	2.3	2.4
A	2.03	Nuclear Island Nonradioactive Ventilation System	2.3	2.3
A	2.04	Class 1E battery charger failure	3.3	3.6

A	2.05	Class 1E battery failure	3.7	3.9
A	2.06	Class 1E Inverter failure (OE-related)	3.7	3.8
A	2.07	Loss of class 1E battery bus	3.7	3.9
A	2.08	Loss of offsite power	3.4	3.4
A	2.09	Loss of all AC power	3.7	3.9
A	2.10	Annex/Auxiliary Building Nonradioactive Ventilation System	2.3	2.4
A	2.11	Non class 1E battery charger failure	2.1	2.6
A	2.12	Non class 1E battery failure	2.3	2.7
A	2.13	Non class 1E inverter failure (OE-related)	2.3	2.7
A	2.14	Loss of non class 1E battery bus	2.3	2.7

A 3 Ability to monitor automatic operation of the Class 1E and Non 1E DC and UPS System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Inverter input transfer between battery and regulated transformer (OE-related)	3.0

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A 4.01 N/A

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Onsite Standby Power System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Standby Diesel and Auxiliary Boiler Fuel Oil System	2.9
K 1.02	Main AC Power System	3.1
K 1.03	Non Class 1E DC and UPS System	2.9
K 1.04	Fire Protection System	2.6
K 1.05	Plant Control System	2.8
K 1.06	Diesel Generator Building Heating and Ventilation System	2.3
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Onsite Standby Power System control power	2.8
K 2.02	Starting air compressor	2.6
K 2.03	Pre-lubrication oil pump	2.2
K 2.04	Backup pre-lubrication oil pump	2.1
K 2.05	Keep warm lube oil heater	2.2
K 2.06	Jacket water heater	2.1
K 2.07	Jacket water heater pump	2.1
K 2.08	Jacket water radiator fan	2.2
K 2.09	Diesel fuel oil pump (Standby Diesel and Auxiliary Boiler Fuel Oil System)	2.5
K 2.10	Diesel fuel oil electric heater (Standby Diesel and Auxiliary Boiler Fuel Oil System)	2.1

K 3 Knowledge of the effect that a loss or malfunction of the Onsite Standby Power System will have on the following systems or system parameters:
(CFR: 41.7 / 45.6)

K 3.01	Standby Diesel and Auxiliary Boiler Fuel Oil System	2.6
K 3.02	Main AC Power System	3.1
K 3.03	Non Class 1E DC and UPS System	2.7
K 3.04	Fire Protection System	2.5
K 3.05	Diesel Generator Building Heating and Ventilation System	2.2
K 3.06	Load sequencing	3.1

K 4 Knowledge of Onsite Standby Power System design feature(s) and/or interlock(s) which provide for the following:
(CFR: 41.7)

K 4.01	Engine prelube and keep warm	2.4
K 4.02	Diesel engine starting	3.0
K 4.03	Combustion air supply	2.6
K 4.04	Fuel oil supply	2.6
K 4.05	Exhaust gas elimination	2.3
K 4.06	Engine cooling	2.6
K 4.07	Engine lubrication	2.6
K 4.08	Engine speed/load control	2.8
K 4.09	Diesel engine protection	3.0
K 4.10	Generator loading	2.9
K 4.11	Generator voltage control	2.8
K 4.12	Generator protection	3.0
K 4.13	Automatic load sequencing (operating or shutdown mode)	3.1

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Onsite Standby Power System:
(CFR: 41.7 / 45.7)

K 5.01	Loss of off-site AC power	3.4
K 5.02	Operating while overloaded or under loaded	3.4
K 5.03	Number of diesel starts from the available volume of starting air	3.2

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Onsite Standby Power System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Standby Diesel and Auxiliary Boiler Fuel Oil System	2.9
K	6.02	Main AC Power System	3.2
K	6.03	Non Class 1E DC and UPS System	2.9
K	6.04	Fire Protection System	2.5
K	6.05	Plant Control System	2.9
K	6.06	Diesel Generator Building Heating and Ventilation System	2.4
K	6.07	Diesel Engine Fuel Oil System failure	3.0
K	6.08	Starting Air System failure	3.0
K	6.09	Pre-lubrication Oil System failure	2.7
K	6.10	Lubrication Oil System failure	3.0
K	6.11	Jacket Water Keep Warm System failure	2.7
K	6.12	Jacket Water Cooling System failure	3.0
K	6.13	Combustion Air Supply System failure	2.9
K	6.14	Engine Speed/Load Control System failure	3.1
K	6.15	Generator Loading System failure	3.1
K	6.16	Generator voltage control failure	3.1

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Onsite Standby Power System including:
(CFR: 41.7 / 45.5)

A	1.01	Diesel engine operating parameters	2.8
A	1.02	Generator operating parameters	2.9
A	1.03	Fuel oil storage and/or day tank levels and/or temperatures	2.6

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Onsite Standby Power System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Standby Diesel and Auxiliary Boiler Fuel Oil System	2.8	2.9
A	2.02	Main AC Power System	3.3	3.1
A	2.03	Non Class 1E DC and UPS System	2.6	2.9
A	2.04	Fire Protection System	2.6	2.5
A	2.05	Plant Control System	2.9	3.0
A	2.06	Diesel Generator Building Heating and Ventilation System	2.4	2.4
A	2.07	Starting Air System failure	2.8	3.1
A	2.08	Pre-lubrication Oil System failure	2.5	2.7
A	2.09	Lubrication Oil System failure	2.6	3.0
A	2.10	Jacket Water Keep Warm System failure	2.5	2.8
A	2.11	Jacket Water Cooling System failure	2.6	3.0
A	2.12	Combustion Air Supply System failure	2.5	2.8
A	2.13	Engine Speed/Load Control System failure	2.9	3.2
A	2.14	Generator Loading System failure	2.9	3.2
A	2.15	Generator voltage control failure	2.8	3.2
A	2.16	Loss of off-site AC power	3.1	3.4
A	2.17	Parallel operation of onsite standby diesel generator	2.9	3.1
A	2.18	Automatic/manual loading	3.0	3.4

A	**3**	**Ability to monitor automatic operation of the Onsite Standby Power System, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	Standby Diesel Generator starting and loading	3.2
A	3.02	Standby Diesel Generator day tank level control	2.8
A	3.03	Frequency and voltage control during parallel operation	3.0
A	3.04	Load sequencing	3.2

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Standby diesel generator starting and loading	3.3
A	4.02	Standby diesel generator unloading and shutdown	3.0
A	4.03	Adjusting exciter voltage	2.9
A	4.04	Synchronizing the standby diesel to the grid	3.2
A	4.05	Synchronizing the grid to the standby diesel generator	3.2

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Safety Function 7: Instrumentation

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical connections between the Diverse Actuation System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Chemical and Volume Control System	2.4
K 1.02	Digital Rod Control System	3.0
K 1.03	Incore Instrument System	2.9
K 1.04	Passive Containment Cooling System	3.3
K 1.05	Passive Core Cooling System	3.3
K 1.06	Reactor Coolant System	3.1
K 1.07	Reactor Coolant Pump	2.9
K 1.08	Steam Generator System	3.0
K 1.09	Main Turbine Control and Diagnostics System	3.0
K 1.10	Containment Recirculation Cooling System	2.6
K 1.11	Containment Air Filtration System	2.7
K 1.12	Containment Hydrogen Control System	2.8
K 1.13	Liquid Radwaste System	2.4
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Diverse Actuation System	3.1
K 3	**Knowledge of the effect that a loss or malfunction of the Diverse Actuation System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Digital Rod Control System	3.0
K 3.02	Incore Instrument System	2.6
K 3.03	Passive Containment Cooling System	3.3
K 3.04	Passive Core Cooling System	3.3
K 3.05	Reactor Coolant System	3.0
K 3.06	Reactor coolant pump	3.0
K 3.07	Reactor Trip System	3.4
K 3.08	Steam Generator System	2.9

K	3.09	Main Turbine Control and Diagnostics System	2.9
K	3.10	Containment Recirculation Cooling System	2.4
K	3.11	Containment Air Filtration System	2.5
K	3.12	Containment Hydrogen Control System	2.8
K	3.13	Liquid Radwaste System	2.2

K 4 Knowledge of Diverse Actuation System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Reactor and Turbine Trip Actuations	3.7
K	4.02	Core Makeup Tank Actuation and Reactor Coolant Pump Trip Actuation	3.6
K	4.03	Passive Residual Heat Removal Heat Exchanger Actuation and In-Containment Refueling Water Storage Tank gutter isolation	3.6
K	4.04	Containment Isolation Actuation	3.6
K	4.05	Passive Containment Cooling System Actuation	3.7
K	4.06	Hydrogen igniter control	3.1
K	4.07	Automatic Depressurization System Stage 1 Actuation	3.8
K	4.08	Automatic Depressurization System Stage 2 Actuation	3.8
K	4.09	Automatic Depressurization System Stage 3 Actuation	3.8
K	4.10	Automatic Depressurization System Stage 4 Actuation	3.8
K	4.11	In-Containment Refueling Water Storage Tank Injection Line Valve Actuation	3.7
K	4.12	Containment recirculation	3.6
K	4.13	In-containment refueling water storage tank drain to containment	3.4

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Diverse Actuation System: (CFR: 41.7 / 45.7)

K	5.01	Failure of Protection and Safety Monitoring System	3.8

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Diverse Actuation System:
(CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Reactor Coolant System	3.4
K 6.02	Steam Generator System	3.2
K 6.03	Containment Recirculation Cooling System	2.9

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Diverse Actuation System including:
(CFR: 41.7 / 45.5)

A 1.01	Reactor Coolant System hot leg temperature	3.3
A 1.02	Pressurizer level	3.4
A 1.03	SG wide range water level	3.4
A 1.04	Containment temperature	3.1
A 1.05	Core exit thermocouples	3.5
A 1.06	Control rod drive M-G set output voltage	3.2

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Diverse Actuation System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
(CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

		RO	SRO
A 2.01	Anticipated transient without scram (OE-related)	3.9	3.8
A 2.02	Reactor and turbine trip	3.3	3.5
A 2.03	Core Makeup Tank Actuation and Reactor Coolant Pump Trip Actuation	3.4	3.4
A 2.04	Passive Residual Heat Removal Actuation and In-Containment Refueling Water Storage Tank gutter isolation	3.3	3.4
A 2.05	Containment isolation	3.4	3.3
A 2.06	Passive Containment Cooling System Actuation	3.1	3.5
A 2.07	Hydrogen igniter control	2.9	3.0
A 2.08	Automatic Depressurization System Stage 1 Actuation	3.4	3.5
A 2.09	Automatic Depressurization System Stage 2 Actuation	2.3	3.5
A 2.10	Automatic Depressurization System Stage 3 Actuation	3.4	3.5
A 2.11	Automatic Depressurization System Stage 4 Actuation	3.6	3.5

A	2.12	In-Containment Refueling Water Storage Tank Injection Line Valve Actuation	3.1	3.5
A	2.13	Containment recirculation	3.1	3.3
A	2.14	In-containment refueling water storage tank drain to containment	3.1	3.1

A 3 Ability to monitor automatic operation of the Diverse Actuation System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Reactor and turbine trip (OE-related)	3.6
A	3.02	Core Makeup Tank Actuation and Reactor Coolant Pump Trip Actuation	3.5
A	3.03	Passive Residual Heat Removal Actuation and In-Containment Refueling Water Storage Tank gutter isolation	3.5
A	3.04	Containment isolation and Passive Containment Cooling System Actuation	3.5

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Reactor and turbine trip (OE-related)	4.1
A	4.02	Core Makeup Tank Actuation and Reactor Coolant Pump Trip Actuation	4.1
A	4.03	Passive Residual Heat Removal Actuation and In-Containment Refueling Water Storage Tank gutter isolation	4.1
A	4.04	Containment isolation	4.0
A	4.05	Passive Containment Cooling System Actuation	4.0
A	4.06	Hydrogen igniter control	3.4
A	4.07	Automatic Depressurization System Stage 1 Actuation	4.1
A	4.08	Automatic Depressurization System Stage 2 Actuation	4.1
A	4.09	Automatic Depressurization System Stage 3 Actuation	4.1
A	4.10	Automatic Depressurization System Stage 4 Actuation	4.2
A	4.11	In-Containment Refueling Water Storage Tank Injection Line Valve Actuation	4.0
A	4.12	Containment recirculation	3.8
A	4.13	In-containment refueling water storage tank drain to containment	3.7

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Incore Instrumentation System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Diverse Actuation System	2.9
K 1.02	Data Display and Processing System	2.6
K 1.03	Fuel Handling System	1.9
K 1.04	Post Accident Monitoring System	3.0
K 1.05	Protection and Safety Monitoring System	3.4
K 1.06	Reactor System	3.1
K 1.07	Special Monitoring System	2.5
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Diverse Actuation System	3.3
K 2.02	Incore Instrumentation System	2.8
K 2.03	Qualified Data Processing System	3.0
K 2.04	Data Display and Processing System	2.5
K 3	**Knowledge of the effect that a loss or malfunction of the Incore Instrumentation System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Diverse Actuation System	3.3
K 3.02	Data Display and Processing System	2.6
K 3.03	Post Accident Monitoring System	3.3
K 3.04	Protection and Safety Monitoring System	3.6
K 3.05	Reactor System	2.9
K 3.06	Special Monitoring System	2.4

K 4 Knowledge of Incore Instrumentation System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Post accident monitoring	3.5
K 4.02	Core power distribution monitoring	3.5
K 4.03	Predictive capability for power maneuvers	3.0
K 4.04	Refueling operations	2.4
K 4.05	Incore instrument thimble assembly replacement	1.9
K 4.06	Core exit thermocouple operability range	3.1

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Incore Instrumentation System: (CFR: 41.7 / 45.7)

K 5.01	Failed core exit thermocouple	3.1
K 5.02	Failed self-powered detector	2.9

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Incore Instrumentation System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Data Display and Processing System	2.7
K 6.02	Fuel Handling System	2.0
K 6.03	Post Accident Monitoring System	3.1
K 6.04	Protection and Safety Monitoring System	3.2
K 6.05	Reactor System	2.6
K 6.06	Special Monitoring System	2.3

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Incore Instrumentation System including: (CFR: 41.7 / 45.5)

A	1.01	Core exit temperatures	3.8
A	1.02	Peak kw/ft (Z)	3.0
A	1.03	Nuclear enthalpy rise hot channel factor ($F^N_{\Delta H}$)	3.0
A	1.04	DNBR (OE-related)	3.2
A	1.05	Shutdown margin (OE-related)	3.4

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Incore Instrumentation System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

			RO	SRO
A	2.01	Loss of core exit thermocouples	3.7	3.2
A	2.02	Loss of self-powered detector	3.0	2.9
A	2.03	Loss of On-line Power Distribution Monitoring System	3.5	3.4
A	2.04	Core damage	4.0	3.9

A 3 Ability to monitor automatic operation of the Incore Instrumentation System, including: (CFR: 41.7 / 45.5 / 45.13)

A 3.01 N/A

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A 4.01 N/A

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Nuclear Instrumentation System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Chemical and Volume Control System	2.8
K 1.02	Digital Rod Control System	3.3
K 1.03	Engineered Safeguards Actuation System	3.9
K 1.04	On-line Power Distribution Monitoring System	3.1
K 1.05	Post Accident Monitoring System	3.4
K 1.06	Reactor Coolant System	3.0
K 1.07	Reactor Trip System	4.0
K 1.08	Remote shutdown workstation	3.5
K 1.09	Special Monitoring System	2.6
K 1.10	Main Turbine Control and Diagnostics System	2.8
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Nuclear Instrumentation System	3.4
K 3	**Knowledge of the effect that a loss or malfunction of the Nuclear Instrumentation System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Chemical and Volume Control System	2.8
K 3.02	Digital Rod Control System	3.5
K 3.03	Engineered Safeguards Actuation System	3.9
K 3.04	Post Accident Monitoring System	3.3
K 3.05	Reactor Coolant System	3.0
K 3.06	Reactor Trip System	4.0
K 3.07	Main Turbine Control and Diagnostics System	3.0

K 4 Knowledge of Nuclear Instrumentation System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	P-6, Intermediate Range Neutron Flux	3.7
K 4.02	P-10, Power Range Neutron Flux	3.7
K 4.03	P-17, Negative Flux Rate Alert	3.5
K 4.04	C-1, High Flux Intermediate Range	3.2
K 4.05	C-2, High Flux Power Range	3.2
K 4.06	C-3, Low OTΔT Margin	3.1
K 4.07	C-4, Low OPΔT Margin	3.1
K 4.08	Source range neutron flux high Reactor Trip	4.0
K 4.09	Intermediate range neutron flux high Reactor Trip	4.0
K 4.10	Power Range high neutron flux low setpoint Reactor Trip	4.0
K 4.11	Power Range high neutron flux high setpoint Reactor Trip	4.1
K 4.12	Power Range positive flux rate high Reactor Trip	4.1
K 4.13	OTΔT Reactor Trip	4.1
K 4.14	OPΔT Reactor Trip	4.1
K 4.15	Boron Dilution Block Actuation	3.5
K 4.16	Chemical and Volume Control System Makeup Isolation Actuation	3.4
K 4.17	SUR calculation	3.2
K 4.18	AFD calculation	3.3
K 4.19	QPTR calculation	3.3
K 4.20	Plant load regulation mode	2.8
K 4.21	Power Range nuclear instrumentation cold-leg temperature compensation	3.0
K 4.22	Power Range nuclear Instrumentation calibration based on calorimetric	3.2
K 4.23	Audible indication of neutron flux in containment and in the control room (OE-related)	3.4

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Nuclear Instrumentation System: (CFR: 41.7 / 45.7)

K 5.01	Nuclear Instrumentation System response to reactor core voiding	3.4
K 5.02	Downcomer density changes effect on neutron leakage	3.2

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Nuclear Instrumentation System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Chemical and Volume Control System	2.7
K 6.02	Digital Rod Control System	3.2
K 6.03	Engineered Safeguards Actuation System	3.6
K 6.04	Reactor Coolant System	3.1
K 6.05	Reactor Trip System	3.7
K 6.06	Main Turbine Control and Diagnostics System	2.8
K 6.07	Source Range nuclear Instrumentation failure	3.4
K 6.08	Intermediate range nuclear instrumentation failure	3.4
K 6.09	Power Range nuclear Instrumentation failure	3.5
K 6.10	Tcold failure	3.0
K 6.11	Power supply failure	3.3
K 6.12	Xenon oscillations	3.3

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Nuclear Instrumentation System including: (CFR: 41.7 / 45.5)

A 1.01 N/A

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Nuclear Instrumentation System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

		RO	SRO
A 2.01	Chemical and Volume Control System	3.3	2.8
A 2.02	Digital Rod Control System	3.3	3.1
A 2.03	Engineered Safeguards Actuation System	3.7	3.7
A 2.04	Reactor Coolant System	3.3	3.3
A 2.05	Reactor Trip System	3.7	3.7
A 2.06	Main Turbine Control and Diagnostics System	3.3	2.9
A 2.07	Source Range nuclear instrumentation detector failure (OE-related)	3.5	3.3
A 2.08	Intermediate range nuclear instrumentation detector failure (OE-related)	3.5	3.5

A	2.09	Power Range nuclear Instrumentation detector failure (OE-related)	3.5	3.6
A	2.10	Tcold failure	3.0	3.3
A	2.11	Power supply failure	3.2	3.3
A	2.12	Xenon oscillations	3.3	3.4

A 3 Ability to monitor automatic operation of the Nuclear Instrumentation System, including: (CFR: 41.7 / 45.5 / 45.13)

A	3.01	P-6, Intermediate Range Neutron Flux	3.7
A	3.02	P-10, Power Range Neutron Flux	3.8
A	3.03	P-17, Negative Flux Rate Alert	3.6
A	3.04	C-1, High Flux Intermediate Range	3.3
A	3.05	C-2, High Flux Power Range	3.3
A	3.06	C-3, Low OTΔT Margin	3.3
A	3.07	C-4, Low OPΔT Margin	3.3
A	3.08	Source Range Neutron Flux High Reactor Trip	4.1
A	3.09	Intermediate Range Neutron Flux High Reactor Trip	4.1
A	3.10	Power Range High Neutron Flux Low Setpoint Reactor Trip	4.1
A	3.11	Power Range High Neutron Flux High Setpoint Reactor Trip	4.1
A	3.12	Power Range Positive Flux Rate High Reactor Trip	4.1
A	3.13	Boron Dilution Block Actuation	3.6
A	3.14	Chemical and Volume Control System Makeup Isolation Actuation	3.5

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Block Source Range Neutron Flux High Reactor Trip	3.7
A	4.02	Block Intermediate Range Neutron Flux High Reactor Trip	3.7
A	4.03	Block Power Range High Neutron Flux Low Setpoint Reactor Trip	3.7

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Radiation Monitoring System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Steam Generator Blowdown System	3.2
K 1.02	Component Cooling Water System	3.0
K 1.03	Chemical and Volume Control System	3.0
K 1.04	Engineered Safeguards Actuation System	3.4
K 1.05	Operation and control centers	2.9
K 1.06	Post Accident Monitoring System	3.1
K 1.07	Plant Control System	3.0
K 1.08	Primary Sampling System	2.8
K 1.09	Passive Core Cooling System	2.7
K 1.10	Normal Residual Heat Removal System	2.9
K 1.11	Steam Generator System	3.1
K 1.12	Service Water System	2.5
K 1.13	Turbine Island Vents, Drains and Relief System	2.4
K 1.14	Radiologically Controlled Area Ventilation System	3.2
K 1.15	Nuclear Island Nonradioactive Ventilation System	2.5
K 1.16	Main Control Room Emergency Habitability System	3.3
K 1.17	Containment Air Filtration System	3.1
K 1.18	Health Physics and Hot Machine Shop HVAC System	2.3
K 1.19	Radwaste Building HVAC System	2.7
K 1.20	Gaseous Radwaste System	3.2
K 1.21	Liquid Radwaste System	3.3
K 1.22	Solid Radwaste System	2.8
K 1.23	Waste Water System	2.6

K	**2**	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K	2.01	Radiation monitors that provide Engineered Safeguards Actuation System Actuations	3.1
K	2.02	Post Accident Monitoring System radiation monitors	2.9
K	2.03	Containment atmosphere monitor	2.9
K	2.04	Non 1E radiation monitors	1.9

K	**3**	**Knowledge of the effect that a loss or malfunction of the Radiation Monitoring System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K	3.01	Steam Generator Blowdown System	3.1
K	3.02	Engineered Safeguards Actuation System	3.6
K	3.03	Post Accident Monitoring System	3.2
K	3.04	Primary Sampling System	2.7
K	3.05	Radiologically Controlled Area Ventilation System	3.2
K	3.06	Nuclear Island Nonradioactive Ventilation System	2.6
K	3.07	Main Control Room Emergency Habitability System	3.3
K	3.08	Gaseous Radwaste System	3.1
K	3.09	Liquid Radwaste System	3.2
K	3.10	Waste Water System	2.7

K	**4**	**Knowledge of Radiation Monitoring System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K	4.01	Steam Generator Blowdown System Isolation Actuation	3.4
K	4.02	Main Control Room Isolation and Air Supply Initiation Actuation	3.6
K	4.03	Containment Air Filtration System Isolation Actuation	3.5
K	4.04	Gaseous Radwaste System or Liquid Radwaste System Release Isolation	3.4
K	4.05	Primary Sampling System liquid sample isolation	2.8
K	4.06	Detection of Reactor Coolant System leakage into containment	3.7
K	4.07	Steam generator tube leak detection	3.8
K	4.08	Plant effluent monitoring	3.4

K	4.09	Fuel handling area HVAC isolation	3.4
K	4.09	Normal Residual Heat Removal System Isolation Actuation	3.2
K	4.10	Chemical and Volume Control System isolation	3.2

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Radiation Monitoring System:
(CFR: 41.7 / 45.7)

K	5.01	Steam Generator tube leak effect on secondary system radiation monitors	3.8
K	5.02	Reactor Coolant System leakage into containment effect on radiation levels	3.6
K	5.03	Reactor Coolant System leakage outside containment effect on radiation levels	3.7
K	5.04	Radiation monitor failure on fuel handling operations	3.3

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Radiation Monitoring System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Reactor Coolant System leakage into containment	3.8
K	6.02	Reactor Coolant System leakage outside containment	3.8
K	6.03	Steam Generator tube leak	3.8
K	6.04	Excessive activity in Liquid Radwaste System or Gaseous Radwaste System effluent during a release	3.5
K	6.05	High radiation detected in the MCR air supply duct	3.8
K	6.06	Loss of power to radiation monitor	3.1
K	6.07	Loss of sample pump	2.8
K	6.08	Loss of radiation detector	3.0
K	6.09	High radiation setpoint exceeded	3.6
K	6.10	Intermediate radiation setpoint exceeded	3.0

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Radiation Monitoring System including: (CFR: 41.7 / 45.5)

A 1.01 N/A

			RO	SRO
A 2		**Ability to (a) predict the impacts of the following malfunctions or operations on the Radiation Monitoring System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Steam Generator tube leak	4.0	3.9
A	2.02	Reactor Coolant System leakage into containment	3.8	3.8
A	2.03	Reactor Coolant System leakage outside containment	3.9	3.9
A	2.04	Plant effluent radiation levels exceed intermediate or high level setpoints	3.4	3.6
A	2.05	Activity detected in plant process systems	3.5	3.2

A 3 Ability to monitor automatic operation of the Radiation Monitoring System, including: (CFR: 41.7 / 45.5 / 45.13)

A 3.01 Changes in system alignment 3.0

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A 4.01 N/A

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Reactor Trip System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Chemical and Volume Control System	3.0
K 1.02	Digital Rod Control System	3.7
K 1.03	Engineered Safeguards Actuation System	4.3
K 1.04	Main and Startup Feedwater System	3.0
K 1.05	Main Steam System	3.0
K 1.06	Nuclear Instrumentation System	3.9
K 1.07	Pressurizer Level Control System	3.3
K 1.08	Plant Control System	3.3
K 1.09	Pressurizer Pressure Control System	3.4
K 1.10	Passive Core Cooling System	3.2
K 1.11	Reactor Coolant System	3.5
K 1.12	Reactor Coolant Pump	3.5
K 1.13	Rod Position Indication System	2.9
K 1.14	Remote shutdown workstation	3.3
K 1.15	Steam Dump Control System	3.1
K 1.16	Steam Generator System	3.5
K 1.17	Main Turbine Control and Diagnostics System	3.3
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Reactor trip breaker control power (OE-related)	3.6
K 2.02	Reactor Trip System Instrumentation	3.6
K 2.03	Protection and Safety Monitoring System division	3.7
K 3	**Knowledge of the effect that a loss or malfunction of the Reactor Trip System will have on the following: (CFR: 41.7 / 45.6)**	
K 3.01	Digital Rod Control System	3.5
K 3.02	Engineered Safeguards Actuation System	4.1

K	3.03	Nuclear Instrumentation System	3.5
K	3.04	Pressurizer Level Control System	3.0
K	3.05	Pressurizer Pressure Control System	3.1
K	3.06	Passive Core Cooling System	3.5
K	3.07	Reactor Coolant System	3.4
K	3.08	Reactor Coolant Pump	3.3
K	3.09	Steam Dump Control System	3.1
K	3.10	Main Turbine Control and Diagnostics System	3.0
K	3.11	Main Feedwater Control Valve Isolation Actuation	3.0
K	3.12	Main Feedwater Pump Trip And Valve Isolation Actuation	3.0
K	3.13	Boron Dilution Block Actuation	3.5
K	3.14	P-3, Reactor Trip Breaker Open	3.9
K	3.15	P-4, Reactor Trip	4.0

K 4 Knowledge of Reactor Trip System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Power Range Neutron Flux Reactor Trip	4.2
K	4.02	Power Range Neutron Flux High Positive Rate Reactor Trip	4.2
K	4.03	Intermediate Range Neutron Flux Reactor Trip	4.1
K	4.04	Source Range Neutron Flux High Reactor Trip	4.1
K	4.05	OTΔT Reactor Trip	4.2
K	4.06	OPΔT Reactor Trip	4.2
K	4.07	Pressurizer Pressure Reactor Trip	4.2
K	4.08	Pressurizer Water Level High 3 Reactor Trip	4.2
K	4.09	Reactor Coolant Flow - Low Reactor Trip	4.2
K	4.10	Reactor Coolant Pump Bearing Water Temperature – High Reactor Trip	4.2
K	4.11	Reactor Coolant Pump Speed – Low Reactor Trip	4.2
K	4.12	Steam Generator Narrow Range Water Level – Low Reactor Trip	4.2
K	4.13	Steam Generator Narrow Range Water Level – High 2 Reactor Trip	4.2
K	4.14	Automatic Safeguards Actuation Reactor Trip	4.2
K	4.15	Manual Safeguards Actuation Reactor Trip	4.2
K	4.16	Automatic ADS Actuation Reactor Trip	4.2
K	4.17	Manual ADS Actuation Reactor Trip	4.2

K	4.18	Automatic Core Makeup Tank Actuation Reactor Trip	4.2
K	4.19	Manual Core Makeup Tank Actuation Reactor Trip	4.2
K	4.20	Manual Reactor Trip	4.2
K	4.21	Manual Reactor Trip from Remote shutdown workstation	4.0
K	4.22	P-3, Reactor Trip Breaker Open	4.0
K	4.23	P-4, Reactor Trip	4.1
K	4.24	P-6, Intermediate Range Neutron Flux	3.9
K	4.25	P-10, Power Range Neutron Flux	3.9
K	4.26	P-11, Pressurizer Pressure Below 1970 psig	3.9
K	4.27	Reactor trip breaker undervoltage and shunt trip	3.9
K	4.28	First out annunciator	3.1
K	4.29	Placing a channel bypass	3.2
K	4.30	Placing a channel trip	3.2
K	4.31	Placing a division in test	3.2
K	4.32	Coincidence, separation, and/or redundancy	3.2

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Reactor Trip System:
(CFR: 41.7 / 45.7)

K	5.01	Reactor trip	4.2
K	5.02	Anticipated transient without scram (OE-related)	4.2
K	5.03	Anticipated transient without scram coincident with turbine trip failure	4.3
K	5.04	Loss of feedwater anticipated transient without scram	4.3
K	5.05	Placing a channel bypass	3.2
K	5.06	Placing a channel trip	3.2
K	5.07	Reactor trip signal during reactor trip breaker testing	3.6
K	5.08	Reactor trip signal with one division in test	3.5
K	5.09	Partial trip	3.5

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Reactor Trip System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Digital Rod Control System	3.6
K	6.02	Engineered Safeguards Actuation System	4.1
K	6.03	Pressurizer Level Control System	3.4
K	6.04	Pressurizer Pressure Control System	3.4
K	6.05	Steam Dump Control System	3.2
K	6.06	Reactor Coolant System	3.5
K	6.07	Main Turbine Control and Diagnostics System	3.3
K	6.08	P-6, Intermediate Range Neutron Flux	3.6
K	6.09	P-10, Power Range Neutron Flux	3.7
K	6.10	P-11, Pressurizer Pressure Below 1970 psig	3.6
K	6.11	Bistable processor logic	3.0
K	6.12	Local coincidence logic	3.0
K	6.13	Integrated logic processor	3.0
K	6.14	Component interface module	3.0
K	6.15	Reactor trip breaker	3.8
K	6.16	Undervoltage trip coil	3.5
K	6.17	Shunt trip coil	3.5

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Reactor Trip System including:
(CFR: 41.7 / 45.5)

A	1.01	OTΔT setpoints	3.6
A	1.02	OPΔT setpoints	3.6
A	1.03	Reactor power (OE-related)	4.0
A	1.04	Pressurizer pressure	3.9
A	1.05	Reactor Coolant System temperature	3.8
A	1.06	Pressurizer level	3.8
A	1.07	Steam generator level	3.7
A	1.08	Steam generator pressure	3.7
A	1.09	Control rod positions (OE-related)	4.0
A	1.10	Reactor trip breaker status (OE-related)	4.0

A	1.11	Reactor power (OE-related)	4.0
A	1.12	SUR	3.6
A	1.13	Shutdown margin	3.5

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Reactor Trip System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Plant heatup	3.0	3.1
A	2.02	Reactor startup to full power	3.3	3.5
A	2.03	Reactor shutdown	3.2	3.4
A	2.04	Plant cooldown	3.0	3.3
A	2.05	Digital Rod Control System	3.3	3.4
A	2.06	Engineered Safeguards Actuation System	3.5	3.9
A	2.07	Diverse Actuation System	3.7	3.7
A	2.08	Pressurizer Level Control System	3.3	3.4
A	2.09	Pressurizer Pressure Control System	3.3	3.5
A	2.10	Steam Dump Control System	3.0	3.3
A	2.11	Reactor Coolant System	3.0	3.3
A	2.12	Main Turbine Control and Diagnostics System	3.0	3.1
A	2.13	P-6, Intermediate Range Neutron Flux	3.7	3.5
A	2.14	P-10, Power Range Neutron Flux	3.7	3.5
A	2.15	P-11, Pressurizer Pressure Below 1970 psig	3.5	3.4
A	2.16	Bistable processor logic	2.8	3.1
A	2.17	Local coincidence logic	2.8	3.0
A	2.18	Integrated logic processor	2.8	3.0
A	2.19	Component interface module	2.8	3.9
A	2.20	Reactor trip breaker	3.7	3.6
A	2.21	Undervoltage trip coil	3.2	3.4
A	2.22	Shunt trip coil	3.2	3.4
A	2.23	Failure of Reactor Trip System signal to trip the reactor (OE-related)	4.5	4.2
A	2.24	Loss of control power	3.7	3.5

A 3 Ability to monitor automatic operation of the Reactor Trip System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Power Range Neutron Flux Reactor Trip	4.1
A	3.02	Power Range Neutron Flux High Positive Rate Reactor Trip	4.1
A	3.03	Intermediate Range Neutron Flux Reactor Trip	4.0
A	3.04	Source Range Neutron Flux High Reactor Trip	4.0
A	3.05	OTΔT Reactor Trip	4.1
A	3.06	OPΔT Reactor Trip	4.1
A	3.07	Pressurizer Pressure Reactor Trip	4.1
A	3.08	Pressurizer Water Level High 3 Reactor Trip	4.1
A	3.09	Reactor Coolant Flow - Low Reactor Trip	4.1
A	3.10	Reactor Coolant Pump Bearing Water Temperature – High Reactor Trip	4.1
A	3.11	Reactor Coolant Pump Speed – Low Reactor Trip	4.1
A	3.12	Steam Generator Narrow Range Water Level – Low Reactor Trip	4.1
A	3.13	Steam Generator Narrow Range Water Level – High 2 Reactor Trip	4.1
A	3.14	Safeguards Actuation from Protection and Safety Monitoring System Reactor Trip	4.2
A	3.15	Manual Safeguards Actuation Reactor Trip	4.1
A	3.16	Automatic Depressurization System Actuation from Protection and Safety Monitoring System Reactor Trip	4.2
A	3.17	Manual Automatic Depressurization System Actuation Reactor Trip	4.1
A	3.18	Core Makeup Tank Actuation from Protection and Safety Monitoring System Reactor Trip	4.2
A	3.19	P-3, Reactor Trip Breaker Open (OE-related)	4.0
A	3.20	P-4, Reactor Trip (OE-related)	4.1
A	3.21	P-6, Intermediate Range Neutron Flux	3.8
A	3.22	P-10, Power Range Neutron Flux	3.9
A	3.23	P-11, Pressurizer Pressure Below 1970 psig	3.9
A	3.24	Reactor Trip breaker undervoltage and shunt trip	3.6

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Manual Core Makeup Tank Actuation Reactor Trip	4.1
A	4.02	Manual Reactor Trip	4.3
A	4.03	Manual Reactor Trip from Remote shutdown workstation	4.1
A	4.04	Divisional blocks and/or resets	3.5
A	4.05	Bistable, bypasses, trips, and/or resets	3.5

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Safety Function 8:
Plant Service Systems

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Compressed Air System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Steam Generator Blowdown System	2.1
K 1.02	Component Cooling Water System	2.2
K 1.03	Condensate System	2.1
K 1.04	Condenser Air Removal System	2.0
K 1.05	Condensate Polishing System	1.9
K 1.06	Chemical and Volume Control System	2.3
K 1.07	Circulating Water System	2.0
K 1.08	Engineered Safeguards Actuation System	3.0
K 1.09	Fuel Handling System	2.2
K 1.10	Fire Protection System	2.1
K 1.11	Main and Startup Feedwater System	2.2
K 1.12	Generator Hydrogen and CO2 System	1.9
K 1.13	Heater Drain System	2.1
K 1.14	Main Turbine and Generator Lube Oil System	1.9
K 1.15	Main Steam System	2.1
K 1.16	Post Accident Monitoring System	1.9
K 1.17	Passive Containment Cooling System	2.5
K 1.18	Plant Gas System	2.1
K 1.19	Passive Core Cooling System	2.9
K 1.20	Reactor Coolant System	2.7
K 1.21	Steam Generator System	2.5
K 1.22	Service Water System	2.1
K 1.23	Radiologically Controlled Area Ventilation System	2.2
K 1.24	Main Control Room Emergency Habitability System	2.5
K 1.25	Containment Air Filtration System	1.9
K 1.26	Health Physics and Hot Machine Shop HVAC System	1.7
K 1.27	Radwaste Building HVAC System	1.7
K 1.28	Turbine Building Ventilation System	1.7
K 1.29	Central Chilled Water System	1.8
K 1.30	Annex/Auxiliary Building Nonradioactive Ventilation System	1.6
K 1.31	Hot Water Heating System	1.6

K	1.32	Gaseous Radwaste System	1.9
K	1.33	Liquid Radwaste System	1.8
K	1.34	Radioactive Waste Drain System	1.7
K	1.35	Main Generation System	1.8
K	1.36	Transmission Switchyard and Offsite Power System	1.7

K 2 Knowledge of bus or division power supplies to the following: (CFR: 41.7)

K	2.01	Instrument air compressor package	2.4
K	2.02	Instrument air dryer package	2.1
K	2.03	Service air compressor package	1.9
K	2.04	Service air dryer package	1.7
K	2.05	High pressure air compressor and filter package	1.9

K 3 Knowledge of the effect that a loss or malfunction of the Compressed Air System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)

K	3.01	Steam Generator Blowdown System (OE-related)	2.4
K	3.02	Component Cooling Water System (OE-related)	2.7
K	3.03	Condensate System (OE-related)	2.3
K	3.04	Condenser Air Removal System (OE-related)	2.2
K	3.05	Condensate Polishing System (OE-related)	2.1
K	3.06	Chemical and Volume Control System (OE-related)	2.8
K	3.07	Circulating Water System (OE-related)	2.0
K	3.08	Fuel Handling System (OE-related)	2.1
K	3.09	Fire Protection System (OE-related)	2.3
K	3.10	Main and Startup Feedwater System (OE-related)	2.7
K	3.11	Generator Hydrogen and CO2 System (OE-related)	2.1
K	3.12	Heater Drain System (OE-related)	2.1
K	3.13	Main Turbine and Generator Lube Oil System (OE-related)	2.0
K	3.14	Main Steam System (OE-related)	2.6
K	3.15	Passive Containment Cooling System (OE-related)	2.8

K	3.16	Plant Gas System (OE-related)	2.2
K	3.17	Passive Core Cooling System (OE-related)	3.1
K	3.18	Reactor Coolant System (OE-related)	2.7
K	3.19	Steam Generator System (OE-related)	2.5
K	3.20	Service Water System (OE-related)	2.5
K	3.21	Radiologically Controlled Area Ventilation System (OE-related)	2.1
K	3.22	Main Control Room Emergency Habitability System (OE-related)	2.5
K	3.23	Containment Air Filtration System (OE-related)	2.3
K	3.24	Health Physics and Hot Machine Shop HVAC System (OE-related)	1.8
K	3.25	Radwaste Building HVAC System (OE-related)	1.9
K	3.26	Turbine Building Ventilation System (OE-related)	1.7
K	3.27	Central Chilled Water System (OE-related)	1.9
K	3.28	Annex/Auxiliary Building Nonradioactive Ventilation System (OE-related)	1.7
K	3.29	Hot Water Heating System (OE-related)	1.6
K	3.30	Gaseous Radwaste System (OE-related)	1.9
K	3.31	Liquid Radwaste System (OE-related)	1.9
K	3.32	Radioactive Waste Drain System (OE-related)	1.7
K	3.33	Main Generation System (OE-related)	1.9

K 4 Knowledge of Compressed Air System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Containment isolation	3.7
K	4.02	Supplying instrument air from service air	2.7
K	4.03	Instrument air compressor auto start	2.7
K	4.04	Service air compressor auto start	2.0

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Compressed Air System: (CFR: 41.7 / 45.7)

K	5.01	Loss of instrument air	3.5
K	5.02	Loss of service air	2.3

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Compressed Air System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Component Cooling Water System	2.6
K	6.02	Transmission Switchyard and Offsite Power System	2.1
K	6.03	Instrument air compressor package	2.7
K	6.04	Instrument air dryer package	2.3
K	6.05	Instrument air high dew point	2.0
K	6.06	Loss of instrument air supply pressure	2.7
K	6.07	Instrument air total flow high	2.1
K	6.08	Instrument air to containment flow high	2.2
K	6.09	Service air compressor package	1.7
K	6.10	Service air dryer package	1.6
K	6.11	Service air high dew point	1.5
K	6.12	Loss service air supply pressure	1.9
K	6.13	High pressure air compressor and filter package	2.1

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Compressed Air System including:
(CFR: 41.7 / 45.5)

A	1.01	Instrument air compressor package parameters	2.6
A	1.02	Instrument air dryer package parameters	2.3
A	1.03	Instrument air supply pressure	2.9
A	1.04	Service air supply pressure	1.9
A	1.05	Instrument air total flow	2.1
A	1.06	Instrument air to containment flow	2.2
A	1.07	Instrument air dew point	1.9

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Compressed Air System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Component Cooling Water System	3.0	2.7
A	2.02	Transmission Switchyard and Offsite Power System	2.7	1.9
A	2.03	Instrument air compressor package	2.8	2.7
A	2.04	Instrument air dryer package	2.5	2.2
A	2.05	Instrument air high dew point	2.2	2.1
A	2.06	Loss of instrument air supply pressure	3.0	2.7
A	2.07	Instrument air total flow high	2.3	2.1
A	2.08	Instrument air to containment flow high	2.3	2.2
A	2.09	Service air compressor package	1.8	1.8
A	2.10	Service air dryer package	1.7	1.8
A	2.11	Service air high dew point	1.7	1.7
A	2.12	Loss service air supply pressure	2.0	1.8
A	2.13	High pressure air compressor and filter package	2.5	1.9
A	2.14	Containment isolation	3.5	3.4

A	**3**	**Ability to monitor automatic operation of the Compressed Air System, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	Instrument Air System	3.1
A	3.02	Service Air System	2.1
A	3.03	Containment isolation	3.9

A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**	
A	4.01	Instrument Air System	3.1
A	4.02	Service Air System	2.2
A	4.03	Containment isolation	4.0

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Component Cooling Water System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.4
K 1.02	Condensate System	2.2
K 1.03	Chemical and Volume Control System	2.8
K 1.04	Demineralized Water Transfer and Storage System	2.3
K 1.05	Engineered Safeguards Actuation System	3.6
K 1.06	Fire Protection System	2.4
K 1.07	Post Accident Monitoring System	2.8
K 1.08	Primary Sampling System	2.0
K 1.09	Reactor coolant pump	3.2
K 1.10	Radiation Monitoring System	2.8
K 1.11	Normal Residual Heat Removal System	3.4
K 1.12	Spent Fuel Pool Cooling System	3.2
K 1.13	Service Water System	2.9
K 1.14	Central Chilled Water System	2.3
K 1.15	Liquid Radwaste System	2.1
K 1.16	Transmission Switchyard and Offsite Power System	2.3
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Component Cooling Water System pump	2.9
K 2.02	Containment isolation valves	3.2
K 2.03	Reactor coolant pump cooling line isolation valves	2.9
K 3	**Knowledge of the effect that a loss or malfunction of the Component Cooling Water System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Compressed and Instrument Air Systems	2.5
K 3.02	Condensate System	2.2

K	3.03	Chemical and Volume Control System	2.9
K	3.04	Primary Sampling System	2.0
K	3.05	Reactor Coolant Pump	3.2
K	3.06	Radiation Monitoring System	2.6
K	3.07	Normal Residual Heat Removal System	3.3
K	3.08	Spent Fuel Pool Cooling System	3.2
K	3.09	Central Chilled Water System	2.3
K	3.10	Liquid Radwaste System	2.0
K	3.11	Reactor Coolant Pump variable frequency drive	3.1

K 4 Knowledge of Component Cooling Water System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Containment isolation	3.7
K	4.02	Normal Reactor Coolant System cooldown	3.0
K	4.03	Refueling Reactor Coolant System heat removal	3.2
K	4.04	Reactor Coolant System heat removal during reduced Reactor Coolant System inventory	3.7
K	4.05	Chemical and Volume Control System makeup pump protection	3.0
K	4.06	Spent Fuel Pool cooling	3.1
K	4.07	In-containment refueling water storage tank cooling	3.2
K	4.08	Post accident Reactor Coolant System heat removal	3.5
K	4.09	Component Cooling Water System pump auto start	3.0
K	4.10	Component Cooling Water System pump trip on low Component Cooling Water System surge tank level	2.9
K	4.11	Component Cooling Water System surge tank level control	2.7
K	4.12	Component Cooling Water System protection due to Reactor Coolant System in-leakage from reactor coolant pump	3.3
K	4.13	Component Cooling Water System protection due to Reactor Coolant System in-leakage from Chemical and Volume Control System	3.1
K	4.14	Reactor Coolant System shut down cooling during a total loss of Component Cooling Water System	3.5

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Component Cooling Water System: (CFR: 41.7 / 45.7)

K 5.01	Water hammer	2.7

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Component Cooling Water System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Compressed and Instrument Air Systems	2.7
K 6.02	Demineralized Water Transfer and Storage System	2.3
K 6.03	Central Chilled Water System	2.2
K 6.04	Service Water System	3.0
K 6.05	Transmission Switchyard and Offsite Power System	2.6
K 6.06	Component Cooling Water System pump discharge pressure instrument	2.6
K 6.07	Component Cooling Water System pump outlet flow instrument	2.5
K 6.08	Reactor Coolant Pump cooling water flow instrument	2.8
K 6.09	Chemical and Volume Control System letdown heat exchanger cooling water flow instrument	2.6
K 6.10	Component Cooling Water System surge tank level instrument	2.7
K 6.11	Component Cooling Water System flow instrument failure	2.5
K 6.12	Component Cooling Water System surge tank level instrument failure	2.8
K 6.13	Loss of Component Cooling Water System pump	3.1
K 6.14	Component Cooling Water System heat exchanger tube leak	3.0
K 6.15	Loss of cooling to Normal Residual Heat Removal System pump	3.2
K 6.16	Loss of cooling to Normal Residual Heat Removal System heat exchanger	3.3
K 6.17	Normal Residual Heat Removal System heat exchanger tube leak	3.1
K 6.18	Loss of cooling to Spent Fuel Pool Cooling System heat exchanger	3.2
K 6.19	Spent Fuel Pool Cooling System heat exchanger tube leak	3.0
K 6.20	Loss of cooling to Chemical and Volume Control System makeup pump minimum flow heat exchanger	2.9
K 6.21	Loss of cooling to Chemical and Volume Control System letdown heat exchanger	2.9
K 6.22	Chemical and Volume Control System letdown heat exchanger tube leak	3.0

K	6.23	Loss of cooling to reactor coolant drain tank heat exchanger	2.6
K	6.24	Reactor coolant drain tank heat exchanger tube leak	2.6
K	6.25	Loss of cooling to condensate pump motor	2.3
K	6.26	Loss of cooling to reactor coolant pump	3.4
K	6.27	Loss of cooling to reactor coolant pump variable frequency drive	3.2
K	6.28	Reactor coolant pump external heat exchanger tube leak	3.2
K	6.29	Loss of cooling to Central Chilled Water System chillers	2.4

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Component Cooling Water System including: (CFR: 41.7 / 45.5)

A	1.01	Component Cooling Water System surge tank level	2.8
A	1.02	Component Cooling Water System flow	2.7
A	1.03	Component Cooling Water System temperature	2.6

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Component Cooling Water System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Compressed and Instrument Air Systems	2.7	2.8
A	2.02	Demineralized Water Transfer and Storage System	2.0	2.4
A	2.03	Central Chilled Water System	2.3	2.2
A	2.04	Service Water System	3.3	2.9
A	2.05	Transmission Switchyard and Offsite Power System	2.6	2.5
A	2.06	Component Cooling Water System pump outlet flow instrument	2.6	2.6
A	2.07	Reactor Coolant Pump cooling water flow instrument	2.9	2.8
A	2.08	Chemical and Volume Control System letdown heat exchanger cooling water flow instrument	2.6	2.5
A	2.09	Component Cooling Water System surge tank level instrument	3.0	2.8
A	2.10	Component Cooling Water System flow instrument failure	2.7	2.6
A	2.11	Component Cooling Water System surge tank level instrument failure	3.0	2.8
A	2.12	Loss of Component Cooling Water System pump	3.3	3.2
A	2.13	Component Cooling Water System heat exchanger tube leak	3.1	2.8

A	2.14	Loss of cooling to Normal Residual Heat Removal System pump	3.3	3.2
A	2.15	Loss of cooling to Normal Residual Heat Removal System heat exchangers	3.3	3.2
A	2.16	Normal Residual Heat Removal System heat exchanger tube leak	3.4	3.1
A	2.17	Loss of cooling to Spent Fuel Pool Cooling System heat exchanger	3.3	3.2
A	2.18	Spent Fuel Pool Cooling System heat exchanger tube leak	3.4	2.9
A	2.19	Loss of cooling to Chemical and Volume Control System makeup pump minimum flow heat exchanger	3.0	2.9
A	2.20	Loss of cooling to Chemical and Volume Control System letdown heat exchanger	2.9	2.9
A	2.21	Chemical and Volume Control System letdown heat exchanger tube leak	3.3	2.9
A	2.22	Loss of cooling to reactor coolant drain tank heat exchanger	2.7	2.7
A	2.23	Reactor coolant drain tank heat exchanger tube leak	2.7	2.7
A	2.24	Loss of cooling to condensate pump motor	2.3	2.5
A	2.25	Loss of cooling to reactor coolant pump	3.1	3.4
A	2.26	Loss of cooling to reactor coolant pump variable frequency drive	3.0	3.3
A	2.27	Reactor coolant pump external heat exchanger tube leak	3.3	3.2
A	2.28	Loss of cooling to Central Chilled Water System chillers	2.3	2.4

A 3 Ability to monitor automatic operation of the Component Cooling Water System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Component Cooling Water System pump start	3.0
A	3.02	Component Cooling Water System pump trip	3.1
A	3.03	Component Cooling Water System surge tank makeup	2.5
A	3.04	Reactor coolant pump isolation	3.3
A	3.05	Reactor coolant pump variable frequency drive cooling flow	3.0
A	3.06	Containment isolation	3.7

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Component Cooling Water System pump start	2.9
A	4.02	Component Cooling Water System pump trip	3.0
A	4.03	Component Cooling Water System surge tank makeup	2.6
A	4.04	Reactor coolant pump isolation	3.3
A	4.05	Containment isolation	3.8
A	4.06	Component Cooling Water System dual train operation	2.8

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Circulating Water System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.0
K 1.02	Condensate System	2.6
K 1.03	Condenser Tube Cleaning System	2.0
K 1.04	Condenser Air Removal System	2.4
K 1.05	Condensate Polishing System	1.9
K 1.06	Raw Water System	2.0
K 1.07	Service Water System	2.4
K 1.08	Turbine Building Closed Cooling Water System	2.3
K 1.09	Waste Water System	1.7
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Circulating water pumps	2.1
K 2.02	Circulating water pump discharge valves	1.8
K 2.03	Turbine plant cooling tower bypass valve	1.6
K 2.04	Condenser waterbox isolation valves	1.7
K 3	**Knowledge of the effect that a loss or malfunction of the Circulating Water System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Condensate System	2.5
K 3.02	Condenser Tube Cleaning System	1.7
K 3.03	Condenser Air Removal System	2.3
K 3.04	Condensate Polishing System	1.7
K 3.05	Raw Water System	1.6
K 3.06	Service Water System	2.4
K 3.07	Turbine Building Closed Cooling Water System	2.2
K 3.08	Waste Water System	1.6
K 3.09	C-9, Condenser Available	2.9

K 4 Knowledge of Circulating Water System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	C-9, Condenser Available	3.1
K 4.02	Freeze protection	2.1
K 4.03	Pump start or stop	2.4

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Circulating Water System: (CFR: 41.7 / 45.7)

K 5.01	Isolation of a condenser waterbox at power	2.5
K 5.02	Condenser tube leak	2.7

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Circulating Water System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Compressed and Instrument Air Systems	2.2
K 6.02	Condensate System	2.4
K 6.03	Condenser Tube Cleaning System	1.9
K 6.04	Raw Water System	1.9
K 6.05	Service Water System	2.4
K 6.06	Turbine Building Closed Cooling Water System	2.2
K 6.07	Waste Water System	1.7
K 6.08	Circ water pump trip	2.8

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Circulating Water System including: (CFR: 41.7 / 45.5)

A 1.01	Main condenser vacuum	3.1
A 1.02	C-9, Condenser Available	3.4
A 1.03	Circ water temperature	2.4
A 1.04	Circ water pump motor current	2.1

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Circulating Water System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Loss of condenser vacuum	3.7	3.3
A	2.02	High or low circ water temperature	2.7	2.4
A	2.03	Cooling tower basin level and makeup flow	2.8	2.3
A	2.04	Circ water pump trip (OE-related)	3.0	2.6
A	2.05	Condenser tube leak	3.0	2.8
A	**3**	**Ability to monitor automatic operation of the Circulating Water System, including: (CFR: 41.7 / 45.5 / 45.13)**		
A	3.01	C-9, Condenser Available		3.2
A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**		
A	4.01	Circ water pump start or stop		2.9

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SYSTEM: SF8 FHS Fuel Handling System

K/A NO.	KNOWLEDGE	IMPORTANCE RO	IMPORTANCE SRO
K 1	**Knowledge of the physical or control/protection logic relationship between the Fuel Handling System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**		
K 1.01	Compressed and Instrument Air Systems	2.3	2.1
K 1.02	Containment System	3.3	3.3
K 1.03	Demineralized Water Transfer and Storage System	1.9	2.1
K 1.04	Nuclear Instrument System	3.0	2.6
K 1.05	Reactor Coolant System	2.7	2.7
K 1.06	Reactor System	2.7	2.7
K 1.07	Spent Fuel Pool Cooling System	3.3	3.0
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**		
K 2.01	Refueling machine	2.1	2.1
K 2.02	Fuel handling machine	2.3	2.1
K 2.03	New fuel jib crane	1.9	1.7
K 2.04	New fuel elevator	2.0	1.8
K 2.05	Fuel Transfer System	2.3	2.0
K 3	**Knowledge of the effect that a loss or malfunction of the Fuel Handling System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**		
K 3.01	Reactor System	2.0	2.5
K 3.02	Spent Fuel Pool Cooling System	2.4	2.7
K 4	**Knowledge of Fuel Handling System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**		
K 4.01	Fuel movement	2.6	3.1
K 4.02	Fuel storage	2.4	2.9
K 4.03	Reactor Vessel head and/or Internals handling	2.3	2.7

K	4.04	Reactor cavity seal	2.4	2.9
K	4.05	Containment integrity	3.3	3.3
K	4.06	Protection from dropping a fuel assembly	2.9	3.5
K	4.07	Hoist overload and/or underload protection	2.4	2.9

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Fuel Handling System:
(CFR: 41.7 / 45.7)

K	5.01	HVAC effects on containment pressure, Fuel Handling Building pressure, refueling cavity, and/or spent fuel pool level	2.6	2.6
K	5.02	Nuclear Instrument System response to core offload/reload	3.4	3.3
K	5.03	Area radiation monitors response to fuel handling event	3.3	3.6
K	5.04	Containment closure requirements	3.3	3.7
K	5.05	Loss of Spent Fuel Pool and/or reactor cavity level	3.7	3.7
K	5.06	Loss of Containment Air Filtration System	2.7	3.0
K	5.07	Low Spent Fuel Pool and/or refueling cavity boron concentration	3.1	3.3

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Fuel Handling System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	2.7	2.3
K	6.02	Containment System	2.7	2.8
K	6.03	Demineralized Water Transfer and Storage System	1.6	1.9
K	6.04	Nuclear Instrument System	3.3	3.0
K	6.05	Reactor Coolant System	2.4	2.8
K	6.06	Containment Air Filtration System	2.3	2.5
K	6.07	Bridge, trolley, and/or hoist encoder failure	2.3	2.5
K	6.08	Load cell failure	2.1	2.7
K	6.09	Reactor cavity seal failure	3.3	3.1
K	6.10	Mechanically bound fuel assembly	2.9	3.1

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Fuel Handling System including: (CFR: 41.7 / 45.5)

A	1.01	Refueling machine mast load and/or speed	2.3	2.7
A	1.02	Refueling machine position, speed, and/or direction	2.3	2.7
A	1.03	Fuel handling machine hoist load and/or speed	2.1	2.7
A	1.04	Fuel handling machine position, speed, and/or direction	2.3	2.7
A	1.05	Fuel Transfer System position, speed, and/or direction	2.1	2.5
A	1.06	Fuel Transfer System load	2.0	2.4

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Fuel Handling System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

A	2.01	Compressed and Instrument Air Systems	2.4	2.5
A	2.02	Containment System	2.9	2.9
A	2.03	Demineralized Water Transfer and Storage System	1.7	2.0
A	2.04	Nuclear Instrument System	3.4	3.2
A	2.05	Reactor Coolant System	2.7	2.8
A	2.06	Reactor cavity seal	3.0	3.2
A	2.07	Transfer car stuck in transfer tube	2.6	2.7
A	2.08	Fuel assembly gripper mast stuck in refueling machine mast	2.3	2.7
A	2.09	Fuel assembly gripper mast stuck in fuel handling machine mast	2.3	2.6
A	2.10	Emergency operation of bridge and trolley	2.4	3.0
A	2.11	Fuel assembly or RCCA stuck on gripper	2.4	2.9
A	2.12	Refueling machine mast overload or underload	2.4	3.0
A	2.13	Fuel handling machine hoist overload or underload	2.4	3.0
A	2.14	Loss of reactor cavity level	3.4	3.7
A	2.15	Loss of Normal Residual Heat Removal System	3.3	3.2
A	2.16	Dropped and/or damaged fuel assembly	3.7	3.9

A 3 Ability to monitor automatic operation of the Fuel Handling System, including:
(CFR: 41.7 / 45.5 / 45.13)

A 3.01 N/A

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Refueling machine bridge and/or trolley motion	2.0	2.3
A	4.02	Refueling machine hoist operation	1.9	2.2
A	4.03	Fuel Transfer System operation	1.9	2.2
A	4.04	Fuel handling machine hoist operation	1.9	2.1
A	4.05	Fuel elevator operation	1.9	2.0

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Fire Protection System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.3
K 1.02	Component Cooling Water System	2.2
K 1.03	Containment System	2.7
K 1.04	Special Process Heat Tracing System	1.4
K 1.05	Passive Containment Cooling System	2.7
K 1.06	Raw Water System	2.0
K 1.07	Radiologically Controlled Area Ventilation System	2.0
K 1.08	Nuclear Island Nonradioactive Ventilation System	1.6
K 1.09	Containment Air Filtration System	2.0
K 1.10	Health Physics and Hot Machine Shop HVAC System	1.5
K 1.11	Radwaste Building HVAC System	1.6
K 1.12	Annex/Auxiliary Building Nonradioactive Ventilation System	1.6
K 1.13	Diesel Generator Building Heating and Ventilation System	1.7
K 1.14	Gaseous Radwaste System	1.6
K 1.15	Liquid Radwaste System	1.7
K 1.16	Solid Radwaste System	1.5
K 1.17	Onsite Standby Power System	2.1
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Fire jockey pump	2.2
K 2.02	Motor driven fire pump	2.6
K 3	**Knowledge of the effect that a loss or malfunction of the Fire Protection System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Component Cooling Water System	2.0
K 3.02	Containment System	2.5
K 3.03	Passive Containment Cooling System	2.6

K	3.04	Raw Water System	1.7
K	3.05	Nuclear Island Nonradioactive Ventilation System	1.6
K	3.06	Containment Air Filtration System	1.9
K	3.07	Health Physics and Hot Machine Shop HVAC System	1.5
K	3.08	Radwaste Building HVAC System	1.5
K	3.09	Annex/Auxiliary Building Nonradioactive Ventilation System	1.5
K	3.10	Diesel Generator Building Heating and Ventilation System	1.8
K	3.11	Gaseous Radwaste System	1.5
K	3.12	Liquid Radwaste System	1.6
K	3.13	Solid Radwaste System	1.5
K	3.14	Onsite Standby Power System	2.1

K 4 Knowledge of Fire Protection System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Containment isolation	3.4
K	4.02	Fire suppression	2.9
K	4.03	Fire detection and alarm	2.9
K	4.04	Cooling water for the Normal Residual Heat Removal Heat Exchanger	2.9
K	4.05	Alternate source of makeup for the Passive Containment Cooling System storage tank	3.1
K	4.06	Spent Fuel Pool makeup and spray	2.9
K	4.07	Containment spray	2.7
K	4.08	Seismic qualified fire suppression	2.6
K	4.09	Fire pump automatic start	2.7
K	4.10	Makeup to the fire water storage tanks	2.3

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Fire Protection System: (CFR: 41.7 / 45.7)

K 5.01 N/A

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Fire Protection System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	2.4
K	6.02	Special Process Heat Tracing System	1.4
K	6.03	Passive Containment Cooling System	2.5
K	6.04	Raw Water System	1.9
K	6.05	Radiologically Controlled Area Ventilation System	1.7
K	6.06	Nuclear Island Nonradioactive Ventilation System	1.5
K	6.07	Fire jockey pump failure	2.3
K	6.08	Motor driven fire pump failure	2.8
K	6.09	Diesel driven fire pump failure	3.0

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Fire Protection System including:
(CFR: 41.7 / 45.5)

A	1.01	Fire Suppression System pressure	2.7
A	1.02	Fire water tank temperature	1.9
A	1.03	Fire water tank level	2.7

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Fire Protection System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
(CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

A 2.01 N/A

A 3 Ability to monitor automatic operation of the Fire Protection System, including:
(CFR: 41.7 / 45.5 / 45.13)

A	3.01	Motor driven fire pump start	3.0
A	3.02	Diesel driven fire pump start	3.0
A	3.03	Fire Suppression System Actuation	3.3

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Motor driven fire pump start	3.0
A	4.02	Diesel driven fire pump start	3.0

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Spent Fuel Pool Cooling System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Component Cooling Water System	3.1
K 1.02	Containment System	3.1
K 1.03	Chemical and Volume Control System	2.7
K 1.04	Demineralized Water Transfer and Storage System	2.4
K 1.05	Engineered Safeguards Actuation System	3.2
K 1.06	Fuel Handling System	2.5
K 1.07	Fire Protection System	2.4
K 1.08	Post Accident Monitoring System	2.5
K 1.09	Passive Containment Cooling System	3.0
K 1.10	Passive Core Cooling System	3.1
K 1.11	Reactor Coolant System	2.8
K 1.12	Normal Residual Heat Removal System	3.0
K 1.13	Radiologically Controlled Area Ventilation System	2.5
K 1.14	Liquid Radwaste System	2.2
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Spent fuel pool cooling pump suction line containment isolation valves	2.6
K 2.02	Spent Fuel Pool Cooling System discharge line containment isolation valves	2.6
K 2.03	Spent fuel pool cooling pumps	2.4
K 3	**Knowledge of the effect that a loss or malfunction of the Spent Fuel Pool Cooling System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Component Cooling Water System	2.4
K 3.02	Containment System	3.0
K 3.03	Chemical and Volume Control System	2.3

K	3.04	Fuel Handling System	2.6
K	3.05	Fire Protection System	2.0
K	3.06	Passive Containment Cooling System	2.6
K	3.07	Passive Core Cooling System	2.9
K	3.08	Radiation Monitoring System	2.9
K	3.09	Normal Residual Heat Removal System	2.7
K	3.10	Radiologically Controlled Area Ventilation System	2.7
K	3.11	Liquid Radwaste System	2.2
K	3.12	Spent fuel temperatures	3.0

K 4 Knowledge of Spent Fuel Pool Cooling System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Safety-related makeup to the Spent Fuel Pool Cooling System	3.4
K	4.02	Containment isolation	3.6
K	4.03	Prevent flooding of the refueling cavity during containment flooding	3.0
K	4.04	Maintain refueling cavity level during refueling operations	3.0
K	4.05	Maintain spent fuel pool water level above the top of the spent fuel racks	3.5
K	4.06	Provide drain path from the refueling cavity to containment during non-refueling plant operations	2.6
K	4.07	Remove the decay heat from the spent and irradiated fuel stored in the spent fuel pool	3.5
K	4.08	Terminate boiling and reduce the spent fuel pool temperatures to normal after loss of normal spent fuel pool cooling	3.4
K	4.09	Remove the decay heat from the fuel in the reactor vessel and/or refueling cavity during a loss of Normal Residual Heat Removal System with the cavity flooded	3.1
K	4.10	Clarify the spent fuel pool water	2.3
K	4.11	Transfer water between the in-containment refueling water storage tank and the refueling cavity, the fuel transfer canal, the cask loading pit, and the cask washdown pit.	2.7
K	4.12	In-containment refueling water storage tank cooling and purification	2.9
K	4.13	Fill the Integrated head storage tank	2.3
K	4.14	Drain the refueling cavity during an accident	3.1
K	4.15	Adequate shutdown margin	3.5

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Spent Fuel Pool Cooling System:
(CFR: 41.7 / 45.7)

K	5.01	ΔP between containment and fuel handling buildings	2.8
K	5.02	Improper loading of fuel in the spent fuel racks effect on Keff	3.2
K	5.03	Spent fuel pool level on area dose rates	3.0

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Spent Fuel Pool Cooling System:
(CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Component Cooling Water System	3.1
K	6.02	Containment System	3.0
K	6.03	Demineralized Water Transfer and Storage System	2.2
K	6.04	Engineered Safeguards Actuation System	3.4
K	6.05	Fire Protection System	2.3
K	6.06	Passive Containment Cooling System	2.7
K	6.07	Passive Core Cooling System	2.7
K	6.08	Normal Residual Heat Removal System	2.8
K	6.09	Radiologically Controlled Area Ventilation System	2.7
K	6.10	Liquid Radwaste System	2.1
K	6.11	Loss of offsite power	2.9
K	6.12	Station blackout	3.0
K	6.13	Loss of spent fuel pool cooling	3.3
K	6.14	Leakage from the spent fuel pool	3.2

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Spent Fuel Pool Cooling System including: (CFR: 41.7 / 45.5)

A	1.01	Spent fuel pool cooling pump discharge flow	2.4
A	1.02	Spent fuel pool cooling purification loop flow	2.2
A	1.03	Spent fuel pool level	3.2
A	1.04	Spent fuel pool temperature	3.1
A	1.05	Cask washdown pit level	2.2
A	1.06	Cask loading pit level	2.2
A	1.07	Fuel handling building area radiation levels	3.1

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Spent Fuel Pool Cooling System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Component Cooling Water System	3.2	3.3
A	2.02	Containment System	3.0	3.1
A	2.03	Demineralized Water Transfer and Storage System	2.0	2.3
A	2.04	Engineered Safeguards Actuation System	3.5	3.3
A	2.05	Fire Protection System	2.3	2.4
A	2.06	Passive Containment Cooling System	2.3	3.2
A	2.07	Passive Core Cooling System	2.7	3.0
A	2.08	Normal Residual Heat Removal System	2.5	3.1
A	2.09	Radiologically Controlled Area Ventilation System	2.0	2.7
A	2.10	Liquid Radwaste System	1.8	2.2
A	2.11	Loss of offsite power	3.0	3.0
A	2.12	Station blackout	3.0	3.1
A	2.13	Loss of spent fuel pool cooling	3.3	3.4
A	2.14	Leakage from the spent fuel pool	3.3	3.3
A	2.15	Loss of shutdown margin	3.0	3.5
A	2.16	Abnormal spent fuel pool level	3.2	3.1

A 3 Ability to monitor automatic operation of the Spent Fuel Pool Cooling System, including:
(CFR: 41.7 / 45.5 / 45.13)

A 3.01	Containment isolation	3.6
A 3.02	Refueling Cavity Isolation Actuation	3.4

A 4 Ability to manually operate and monitor in the control room:
(CFR: 41.7 / 45.5 TO 45.8)

A 4.01	Spent Fuel Pool cooling by the Normal Residual Heat Removal System	3.1
A 4.02	Makeup to Spent Fuel Pool Cooling System	3.0
A 4.03	Spent Fuel Pool cooling pump	2.9
A 4.04	Containment isolation	3.6

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SYSTEM: SF8 VES Main Control Room HVAC

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical connections between the Main Control Room HVAC Systems and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.6
K 1.02	Demineralized Water Transfer and Storage System	1.9
K 1.03	Engineered Safeguards Actuation System	3.7
K 1.04	Radiation Monitoring System	3.3
K 1.05	Radiologically Controlled Area Ventilation System	2.5
K 1.06	Nuclear Island Nonradioactive Ventilation System	2.7
K 1.07	Main Control Room Emergency Habitability System	3.6
K 1.08	Central Chilled Water System	2.3
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	N/A	-
K 3	**Knowledge of the effect that a loss or malfunction of the Main Control Room HVAC Systems will have on the following: (CFR: 41.7 / 45.6)**	
K 3.01	Control room habitability	3.6
K 4	**Knowledge of Main Control Room HVAC Systems design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K 4.01	Main Control Room Isolation and Air Supply Initiation Actuation	3.6
K 4.02	Main control room supply air radiation monitoring	3.4
K 4.03	Main control room outside air Intake smoke detection and/or main control room smoke purge	2.9
K 4.04	Maintaining positive pressure in the main control room	2.9
K 4.05	Maintaining main control Room temperature and/or humidity limits	2.6

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Main Control Room HVAC Systems: (CFR: 41.7 / 45.7)

K	5.01	High or high-high radiation in the main control room air supply duct	3.6
K	5.02	Smoke detected in main control room outside air Intake	3.2
K	5.03	Loss of normal main control room HVAC	2.8
K	5.04	Loss of offsite power effect on normal main control room HVAC	2.5
K	5.05	Loss of all AC power on the Main Control Room Emergency Habitability System	3.1
K	5.06	Fire detected in main control room or control support area	3.4
K	5.07	Loss of main control room Δ P	2.7
K	5.08	Main control room temperature outside the normal band	2.5
K	5.09	Main control room access restrictions during an event	3.1

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Main Control Room HVAC Systems: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	2.6
K	6.02	Demineralized Water Transfer and Storage System	2.0
K	6.03	Engineered Safeguards Actuation System	3.4
K	6.04	Radiation Monitoring System	3.2
K	6.05	Radiologically Controlled Area Ventilation System	2.5
K	6.06	Nuclear Island Nonradioactive Ventilation System	2.8
K	6.07	Main Control Room Emergency Habitability System	3.4
K	6.08	Central Chilled Water System	2.4

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Main Control Room HVAC Systems including: (CFR: 41.7 / 45.5)

A	1.01	Main control room Δ P	2.5
A	1.02	Main control room air temperature	2.5
A	1.03	Main control room air supply duct radiation	2.9
A	1.04	Main Control Room Emergency Habitability System emergency air storage tank pressure	3.4

A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Main Control Room HVAC Systems and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	High radiation in the main control room air supply duct	3.2	3.7
A	2.02	Smoke detected in main control room outside air Intake	2.8	2.9
A	2.03	Loss of normal main control room HVAC	2.0	2.8
A	2.04	Loss of offsite power effect on normal main control room HVAC	1.8	2.3
A	2.05	Loss of all AC power on the Main Control Room Emergency Habitability System	3.0	2.9
A	2.06	Fire detected in main control room or control support area	3.0	3.0
A	2.07	Loss of main control room ΔP	2.2	2.3
A	2.08	Main control room temperature outside the normal band	2.2	2.3

A 3 Ability to monitor automatic operation of the Main Control Room HVAC Systems, including: (CFR: 41.7 / 45.5 / 45.13)

A	3.01	Main Control Room Isolation and air Supply Initiation Actuation	3.5
A	3.02	Response to high or high-high radiation in the main control room air supply duct	3.4
A	3.03	Response to smoke detected in main control room outside air Intake	3.0
A	3.04	Response to loss of normal main control room HVAC	2.5
A	3.05	Loss of offsite power effect on normal main control room HVAC	2.4
A	3.06	Loss of all AC power on the Main Control Room Emergency Habitability System	3.0
A	3.07	Fire detected in main control room or control support area	3.1

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Main Control Room Isolation and Air Supply Initiation Actuation	3.6
A	4.02	Place main control room normal HVAC in service	2.5
A	4.03	Align main control room normal HVAC in the smoke purge mode	2.7

K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Containment Air Filtration System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.4
K 1.02	Diverse Actuation System	3.2
K 1.03	Engineered Safeguards Actuation System	3.5
K 1.04	Fire Protection System	2.3
K 1.05	Post Accident Monitoring System	2.7
K 1.06	Radiation Monitoring System	3.1
K 1.07	Radiologically Controlled Area Ventilation System	3.1
K 1.08	Containment Recirculation Cooling System	2.6
K 1.09	Central Chilled Water System	2.3
K 1.10	Hot Water Heating System	2.0
K 1.11	Gaseous Radwaste System	2.5
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Containment supply fans	2.1
K 2.02	Containment exhaust fans	2.1
K 3	**Knowledge of the effect that a loss or malfunction of the Containment Air Filtration System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Fire Protection System	2.0
K 3.02	Radiation Monitoring System	2.8
K 3.03	Radiologically Controlled Area Ventilation System	3.0
K 3.04	Gaseous Radwaste System	2.3
K 3.05	Containment exhaust fan flow	2.4
K 3.06	Containment supply fan flow	2.4
K 3.07	Containment isolation	3.4
K 3.08	Radiological control	3.1

K	3.09	Monitor plant vent effluent	3.2
K	3.10	Containment pressure	2.9
K	3.11	Containment humidity	2.5
K	3.12	Containment temperature	2.7
K	3.13	Pressure in the fuel handling area, and the radiologically controlled areas of the auxiliary and annex building	2.6

K 4 Knowledge of Containment Air Filtration System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K	4.01	Containment isolation	3.7
K	4.02	Radiological control	3.2
K	4.03	Monitor plant vent effluent	3.1
K	4.04	Maintain the fuel handling area, and the radiologically controlled areas of the Auxiliary and annex building at a slight negative pressure	2.8
K	4.05	Containment pressure control during normal operation	2.8
K	4.06	Containment humidity control during normal operation	2.5
K	4.07	Containment temperature control during normal operation	2.6

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Containment Air Filtration System: (CFR: 41.7 / 45.7)

K 5.01 N/A

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Containment Air Filtration System: (CFR: 41.7 / 45.5 TO 45.8)

K	6.01	Compressed and Instrument Air Systems	2.5
K	6.02	Engineered Safeguards Actuation System	3.4
K	6.03	Fire Protection System	2.3
K	6.04	Radiation Monitoring System	3.3
K	6.05	Radiologically Controlled Area Ventilation System	2.9

K	6.06	Containment Recirculation Cooling System	2.6
K	6.07	Central Chilled Water System	2.2
K	6.08	Hot Water Heating System	1.8
K	6.09	Transmission Switchyard and Offsite Power System	2.2
K	6.10	Loss of coolant accident	3.7
K	6.11	Fuel Handling Area exhaust air high radiation	3.1
K	6.12	Auxiliary building area exhaust air high radiation	3.1
K	6.13	Annex/Auxiliary building exhaust air high radiation	3.1
K	6.14	Containment purge exhaust air high radiation	3.2
K	6.15	Plant vent exhaust air high radiation	3.1
K	6.16	High ambient air pressure differentials	2.5
K	6.17	Containment Air Filtration System charcoal absorber fire	3.1
K	6.18	Abnormal Reactor Coolant System leakage inside containment	3.4
K	6.19	Air filter high pressure differential	2.5
K	6.20	Fan low airflow	2.4
K	6.21	Supply air low temperature	2.1
K	6.22	Exhaust air temperature	2.2
K	6.23	Charcoal absorber humidity	2.2

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Containment Air Filtration System including: (CFR: 41.7 / 45.5)

A	1.01	Secondary building ambient pressure differential	2.5
A	1.02	Containment supply air temperature	2.4
A	1.03	Charcoal absorber temperature	2.4
A	1.04	Containment exhaust fan flow	2.2
A	1.05	Containment supply fan flow	2.3
A	1.06	Exhaust air relative humidity	2.2
A	1.07	Containment supply air smoke	2.5

			RO	SRO
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Containment Air Filtration System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**		
A	2.01	Compressed and Instrument Air Systems	2.3	2.6
A	2.02	Engineered Safeguards Actuation System	3.5	3.6
A	2.03	Fire Protection System	2.2	2.3
A	2.04	Radiation Monitoring System	3.2	3.1
A	2.05	Radiologically Controlled Area Ventilation System	3.2	3.1
A	2.06	Containment Recirculation Cooling System	2.5	2.6
A	2.07	Central Chilled Water System	2.3	2.3
A	2.08	Hot Water Heating System	1.7	1.8
A	2.09	Transmission Switchyard and Offsite Power System	2.7	2.5
A	2.10	Loss of coolant accident	3.8	3.9
A	2.11	Fuel Handling Area exhaust air high radiation	3.2	3.3
A	2.12	Auxiliary building area exhaust air high radiation	3.2	3.3
A	2.13	Annex/Auxiliary building exhaust air high radiation	3.2	3.3
A	2.14	Containment purge exhaust air high radiation	3.2	3.5
A	2.15	Plant vent exhaust air high radiation	3.2	3.3
A	2.16	High ambient air pressure differentials	2.3	2.7
A	2.17	Containment Air Filtration System charcoal absorber fire	3.3	3.1
A	2.18	Abnormal Reactor Coolant System leakage inside containment	3.3	3.4
A	2.19	Air filter high pressure differential	2.2	2.5
A	2.20	Fan low airflow	2.2	2.3
A	2.21	Supply air low temperature	2.3	2.2
A	2.22	Exhaust air temperature	2.2	2.1
A	2.23	Charcoal absorber humidity	2.3	2.3

A	**3**	**Ability to monitor automatic operation of the Containment Air Filtration System, including: (CFR: 41.7 / 45.5 / 45.13)**	
A	3.01	Auto fan operation	2.5
A	3.02	Containment Air Filtration System Isolation Actuation	3.6

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Containment isolation	3.8
A	4.02	Auto fan operation	2.5
A	4.03	Secondary building ambient pressure differential	2.4
A	4.04	Containment supply air temperature	2.3
A	4.05	Charcoal absorber temperature	2.4
A	4.06	Containment exhaust fan flow	2.3
A	4.07	Containment supply fan flow	2.3
A	4.08	Exhaust air relative humidity	2.2
A	4.09	Containment supply air smoke	2.6

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Safety Function 9: Radioactivity Release

		page
SF9 WGS	Gaseous Radwaste System	3.9-3
SF9 WLS	Liquid Radwaste System	3.9-7

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Gaseous Radwaste System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.4
K 1.02	Plant Gas Systems	2.6
K 1.03	Radiation Monitoring System	3.3
K 1.04	Inputs from ventilation systems (such as Radiologically Controlled Area Ventilation System, Containment Air Filtration System, Health Physics and Hot Machine Shop HVAC System, Radwaste Building HVAC System)	3.1
K 1.05	Central Chilled Water System	2.3
K 1.06	Liquid Radwaste System	2.6
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	N/A	
K 3	**Knowledge of the effect that a loss or malfunction of the Gaseous Radwaste System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Plant Gas Systems	2.6
K 3.02	Radiation Monitoring System	3.0
K 3.03	Liquid Radwaste System	2.7
K 4	**Knowledge of Gaseous Radwaste System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)**	
K 4.01	Gaseous Radwaste System release isolation	3.5
K 4.02	Nitrogen purging operations	2.4
K 4.03	Prevention of hydrogen ignition	3.1
K 4.04	Activated carbon bed moisture protection	2.5

K	**5**	**Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Gaseous Radwaste System: (CFR: 41.7 / 45.7)**	
K	5.01	Fuel defects	3.3
K	5.02	Hydrogen / Oxygen concentrations within flammability limits	3.3
K	5.03	Charcoal absorption efficiency	2.3

K	**6**	**Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Gaseous Radwaste System: (CFR: 41.7 / 45.5 TO 45.8)**	
K	6.01	Compressed and Instrument Air Systems	2.5
K	6.02	Plant Gas Systems	2.8
K	6.03	Radiation Monitoring System	3.3
K	6.04	Inputs from Ventilation Systems (such as Radiologically Controlled Area Ventilation System, Containment Air Filtration System, Health Physics and Hot Machine Shop HVAC System, Radwaste Building HVAC System)	3.0
K	6.05	Central Chilled Water System	2.3
K	6.06	Liquid Radwaste System	2.7
K	6.07	Activated carbon bed fire	3.0
K	6.08	Loss of hydrogen concentration monitor	3.0
K	6.09	Loss of oxygen concentration monitor	2.9
K	6.10	Wetted activated carbon bed	2.5
K	6.11	Loss of sample pump function	2.5
K	6.12	Activated carbon bed vessel failure	2.8

A	**1**	**Ability to predict and/or monitor changes in parameters associated with operation of the Gaseous Radwaste System including: (CFR: 41.7 / 45.5)**	
A	1.01	Gaseous Radwaste System pressure and input flow rates	2.4
A	1.02	Carbon bed and/or vault temperatures	2.5
A	1.03	Gas cooler outlet dew point	2.2

A	1.04	Hydrogen / oxygen concentrations	3.0	
A	1.05	Gaseous Radwaste System discharge radiation and/or flow rate	3.3	
A	**2**	**Ability to (a) predict the impacts of the following malfunctions or operations on the Gaseous Radwaste System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)**	**RO**	**SRO**
A	2.01	Compressed and Instrument Air Systems	2.4	2.5
A	2.02	Plant Gas Systems	2.1	2.6
A	2.03	Radiation Monitoring System	3.1	3.3
A	2.04	Inputs from Ventilation Systems (such as Radiologically Controlled Area Ventilation System, Containment Air Filtration System, Health Physics and Hot Machine Shop HVAC System, Radwaste Building HVAC System)	2.6	2.9
A	2.05	Central Chilled Water System	2.1	2.4
A	2.06	Liquid Radwaste System	2.1	2.7
A	2.07	Activated carbon bed fire	3.0	3.0
A	2.08	Loss of hydrogen concentration monitor	3.0	3.0
A	2.09	Loss of oxygen concentration monitor	3.0	3.0
A	2.10	Wetted activated carbon bed	2.4	2.6
A	2.11	Loss of sample pump	2.1	2.4
A	2.12	Activated carbon bed vessel failure	2.9	2.9
A	**3**	**Ability to monitor automatic operation of the Gaseous Radwaste System, including: (CFR: 41.7 / 45.5 / 45.13)**		
A	3.01	Nitrogen purge	2.5	
A	3.02	Gaseous Radwaste System discharge isolation	3.5	
A	**4**	**Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)**		
A	4.01	Place Gaseous Radwaste System in service	2.6	
A	4.02	Nitrogen purge	2.5	
A	4.03	Recover from automatic Gaseous Radwaste System release isolation	2.8	

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K/A NO.	KNOWLEDGE	IMPORTANCE
K 1	**Knowledge of the physical or control/protection logic relationship between the Liquid Radwaste System and the following systems: (CFR: 41.2 to 41.9 / 45.7 to 45.8)**	
K 1.01	Compressed and Instrument Air Systems	2.3
K 1.02	Chemical and Volume Control System	2.8
K 1.03	Diverse Actuation System	2.9
K 1.04	Engineered Safeguards Actuation System	3.3
K 1.05	Post Accident Monitoring System	2.9
K 1.06	Gaseous Radwaste System	2.6
K 1.07	Dilution flow sources (such as; circ water or raw water)	2.6
K 1.08	Waste holdup tank inputs, (such as; Containment sump, Auxiliary bldg sump, or Steam Generator blowdown)	2.7
K 1.09	Chemical Waste System	2.3
K 2	**Knowledge of bus or division power supplies to the following: (CFR: 41.7)**	
K 2.01	Reactor coolant drain tank pump	2.0
K 2.02	Containment sump pump	2.1
K 3	**Knowledge of the effect that a loss or malfunction of the Liquid Radwaste System will have on the following systems or system parameters: (CFR: 41.7 / 45.6)**	
K 3.01	Chemical and Volume Control System	2.8
K 3.02	Reactor coolant drain tank	2.7
K 3.03	Waste holdup tank inputs, (such as; Containment sump, Auxiliary bldg sump, or Steam Generator blowdown)	2.5
K 3.04	Chemical Waste System	2.2
K 3.05	Reactor coolant pressure boundary leak detection	3.3

K 4 Knowledge of Liquid Radwaste System design feature(s) and/or interlock(s) which provide for the following: (CFR: 41.7)

K 4.01	Containment isolation	3.6
K 4.02	Reactor coolant pressure boundary leak detection	3.5
K 4.03	Chemical and Volume Control System letdown / reactor coolant drain tank influent priority	2.9
K 4.04	Degasifier inlet isolation due to degasifier column hi-3 level	2.4

K 5 Knowledge of the operational implications or cause and effect relationships of the following as they apply to the Liquid Radwaste System: (CFR: 41.7 / 45.7)

K 5.01 N/A

K 6 Knowledge of the effect of the following plant conditions, system malfunctions, or component malfunctions on the Liquid Radwaste System: (CFR: 41.7 / 45.5 TO 45.8)

K 6.01	Compressed and Instrument Air Systems	2.4
K 6.02	Engineered Safeguards Actuation System	3.3
K 6.03	Radiation Monitoring System	3.2
K 6.04	Gaseous Radwaste System	2.8
K 6.05	Transmission Switchyard and Offsite Power System	2.3
K 6.06	Dilution flow sources (such as; circ water or raw water	2.5
K 6.07	Waste holdup tank inputs, (such as; Containment sump, Auxiliary bldg sump, or Steam Generator blowdown)	2.6
K 6.08	Chemical Waste System	2.3
K 6.09	Degasifier column level control	2.1

A 1 Ability to predict and/or monitor changes in parameters associated with operation of the Liquid Radwaste System including: (CFR: 41.7 / 45.5)

A 1.01	Reactor coolant drain tank parameters	2.6
A 1.02	Effluent holdup tank, waste holdup tank, or waste monitor tank parameters	2.4
A 1.03	Reactor Coolant System inventory balance	3.2
A 1.04	Containment radiation, pressure, temperature, and/or humidity monitors	3.1

A 2 Ability to (a) predict the impacts of the following malfunctions or operations on the Liquid Radwaste System and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: (CFR: 41.5 / 43.5 / 45.3 / 45.5 / 45.13)

		RO	SRO
A 2.01	Compressed and Instrument Air Systems	2.5	2.5
A 2.02	Chemical and Volume Control System	2.9	2.9
A 2.03	Engineered Safeguards Actuation System	3.4	3.3
A 2.04	Reactor coolant drain tank	2.9	2.7
A 2.05	Radiation Monitoring System	3.1	3.2
A 2.06	Gaseous Radwaste System	2.9	2.8
A 2.07	Transmission Switchyard and Offsite Power System	2.5	2.3
A 2.08	Degasifier column level hi-3	2.4	2.3
A 2.09	Failure of automatic Liquid Radwaste System release isolation	3.4	3.4
A 2.10	Inadequate dilution flow	2.9	3.0

A 3 Ability to monitor automatic operation of the Liquid Radwaste System, including: (CFR: 41.7 / 45.5 / 45.13)

A 3.01	Reactor coolant drain tank level control	2.6
A 3.02	Containment sump or auxiliary bldg sump level control	2.7
A 3.03	Liquid Radwaste System release isolation	3.3
A 3.04	Align effluent holdup tank, waste holdup tank, or waste monitor tank for service	2.3

A 4 Ability to manually operate and monitor in the control room: (CFR: 41.7 / 45.5 TO 45.8)

A	4.01	Containment sump or auxiliary bldg sump level control	2.6
A	4.02	Reactor coolant drain tank level and/or temperature control	2.6
A	4.03	Align effluent holdup tank, waste holdup tank, waste monitor tank or chemical waste tank for service	2.2
A	4.04	Process a effluent holdup tank, waste holdup tank, waste monitor tank, or chemical waste tank	2.3
A	4.05	Containment isolation	3.7
A	4.06	Align monitor tank for Liquid Radwaste System release	2.7
A	4.07	Recover from automatic Liquid Radwaste System release isolation	2.6