SECTION 5
COMPONENTS page

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COMPONENT: 191001 Valves (CFR 41.3)

		IMPORTANCE	
K/A NO.	**KNOWLEDGE**	**RO**	**SRO**
K1.01	The function and operation of safety valves	3.3	3.4
K1.02	The function and operation of relief valves	3.0	3.3
K1.03	The relationship of valve position to flow rate and back pressure	2.7	2.9
K1.04	The failed-valve positions for different operators (open, closed, and as-is positions; spring loaded valves; hydraulic, pneumatically controlled valves; electric motor-drive valves)	2.8	3.2
K1.05	Equipment protection concerns in the use of valves (protect valve seals, open slowly)	2.6	2.8
K1.06	Manual operation of MOV with motor inoperable	3.3	3.7
K1.07	Principles of operation and purpose of check valves	2.5	2.8
K1.08	Operation of valves and verification of position	3.4	3.4
K1.09	Reason for using globe valves versus gates valves for throttling	2.2	2.4

COMPONENT: 191002 Valves (CFR 41.7)

K/A NO.	KNOWLEDGE	IMPORTANCE RO	IMPORTANCE SRO
	Flow		
K1.01	Characteristics of venturis and orifices	2.2	2.4
K1.02	Temperature/density compensation requirements	2.7	2.9
K1.03	Effects of gas or steam on liquid flow rate indications (erroneous reading)	2.7	2.9
K1.04	Modes of failure	2.7	2.7
K1.05	Explain the operation of a flow D/P cell type flow detector	2.6	2.8
	Level		
K1.06	Temperature/pressure compensation requirements	2.5	2.6
K1.07	Theory and operation of level detectors	2.5	2.6
K1.08	Effects of operating environment (pressure and temperature)	2.8	3.1
K1.09	Modes of failure	2.9	3.0
	Pressure		
K1.10	Theory and operation of pressure detectors (bourdon tubes, diaphragms, bellows, forced balance, and variable capacitance)	2.3	2.5
K1.11	Effects of operating environment (pressure, temperature)	2.7	3.0
K1.12	Modes of failure	2.8	2.9
	Temperature		
K1.13	Theory and operation of T/C, RTD, thermostats	2.6	2.8
K1.14	Failure modes of T/C and RTD	2.8	2.9
	Position Detectors		
K1.15	Failure lodes of reed switches, LVDT, limit switches, and potentiometers	2.3	2.4
K1.16	Applications of reed switches, magnets, LVDT, potentiometers, and limit switches	2.3	2.7
	Nuclear Instrumentation		
K1.17	Effects of core voiding on neutron detection	3.3	3.5

Portable and Personal Radiation Detection

K1.18	Theory and operation of ion chambers, G-M tubes and scintillation detectors	2.6	2.8
K1.19	Use of portable and personal radiation monitoring instruments	3.1	3.3
K1.20	Theory and operation of failed-fuel detectors	2.5	2.7

COMPONENT: 191003 Controllers and Positioners (CFR 41.7)

		IMPORTANCE	
K/A NO.	**KNOWLEDGE**	**RO**	**SRO**
K1.01	Function and operation of flow controller in manual and automatic modes	3.1	3.2
K1.02	Function and operation of a speed controller	2.6	2.7
K1.03	Operation of valves controllers in manual and automatic mode	3.1	3.1
K1.04	Function and operation of pressure and temperature controllers, including pressure and temperature control valves	2.8	3.0
K1.05	Function and characteristics of valve positioners	2.5	2.8
K1.06	Function and characteristics of governors and other mechanical controllers	2.3	2.6
K1.07	Safety precautions with respect to the operation of controllers and positioners	2.3	2.6
K1.08	Theory of operation of the following types of controllers: electronic, electrical, and pneumatic	2.1	2.6
K1.09	Effects on operation of controllers due to proportional, integral (reset), derivative (rate), as well as their combinations	2.4	2.5
K1.10	Function and characteristics of air-operated valves, including failure modes	2.4	2.8
K1.11	Cautions for placing a valve controller in manual mode	2.8	2.9

COMPONENT: 191004 Pumps (CFR 41.3)

K/A NO.	KNOWLEDGE	IMPORTANCE RO	IMPORTANCE SRO
	Centrifugal		
K1.01	Identification, symptoms, and consequences of cavitation	3.3	3.5
K1.02	Reasons for venting a centrifugal pump	3.1	3.4
K1.03	Consequences of air steam binding	3.1	3.3
K1.04	Consequences of operating a pump dead headed or for extended times without adequate recirculation	3.3	3.4
K1.05	Discuss relationships among head, flow, and power as related to pump speed	2.3	2.4
K1.06	Need for net positive suction head (NPSH); effects of loss of suction	3.2	3.3
K1.07	Starting current and operating current interpretation	2.9	2.9
K1.08	Purpose of starting a pump with discharge valve closed	2.4	2.6
K1.09	Pressure and flow relationship of pumps in parallel	2.4	2.2
K1.10	Pressure and flow relationship of pumps in series	2.4	2.4
K1.11	Definition of pump shutoff head	2.3	2.4
K1.12	"Runout" of a centrifugal pump (definition, indications, causes, effects, and corrective measures)	2.5	2.7
K1.13	Theory of operation of a centrifugal pump	2.1	2.1
K1.14	Using a centrifugal pump characteristic curve and a system characteristic curve, illustrate how the system operating point changes due to system changes	2.3	2.5
K1.15	Relationship between flow from a pump and suction heads	2.5	2.8
K1.16	Safety procedures and precautions associated with centrifugal pumps	2.8	2.9
K1.17	Define pump efficiency	1.8	1.9
K1.18	Explain the difference between ideal and real pumping process	1.4	1.7
	Positive Displacement		
K1.19	Discuss the relationship among head, flow, speed, and power	2.4	2.4
K1.20	Net positive suction head (NPSH) requirements for a positive displacement pump	2.8	2.8
K1.21	Consequences of operating a positive displacement pump against a closed flow path	3.0	3.1

K1.22	Applications and characteristics of positive displacement pumps	2.3	2.5
K1.23	Reason for starting a positive displacement pump with the discharge valve open	2.8	2.9
K1.24	Safety procedures and precautions associated with positive displacement pumps	3.0	3.1
K1.25	Basic operation of positive displacement pumps	2.3	2.4
K1.26	Theory of operation of positive displacement pumps	1.9	2.0
K1.27	Discuss the characteristic curve for a typical positive displacement pump and explain the reason for its shape	2.1	2.1
	Jet Pumps		
K1.28	Describe the principles of operation of a jet pump	1.8	1.8

COMPONENT: 191005 Motor and Generators (CFR 41.7)

		IMPORTANCE	
K/A NO.	**KNOWLEDGE**	**RO**	**SRO**
K1.01	Indication of a locked rotor	2.8	3.1
K1.02	Potential consequences of overheating insulation or bearings	2.8	2.9
K1.03	Causes of excessive current in motors and generators, such as low voltage, overloading, and mechanical binding	2.7	2.8
K1.04	Relationship between pump motor current (ammeter reading) and the following: pump fluid flow, head, speed, and stator temperature	2.7	2.8
K1.05	Explain the difference between starting current and operating (running) current in a motor	2.8	2.7
K1.06	Reason for limiting the number of motor starts in a given time period	3.0	3.1
K1.07	Electrical units: Volts, Amps, VARs, Watts, and Hertz	2.1	2.3
K1.08	Consequences of overexcited/under excited	2.1	2.3
K1.09	Interrelations of the following: VARs, Watts, Amps, Volts, Power factor	1.9	2.1
K1.10	Load sharing with parallel generators	2.3	2.4
K1.11	Motor and generator protective devices	2.3	2.4

COMPONENT: 191006 Heat Exchangers and Condensers (CFR 41.4)

		IMPORTANCE	
K/A NO.	**KNOWLEDGE**	**RO**	**SRO**
K1.01	Startup/shutdown of a heat exchanger	2.1	2.3
K1.02	Proper filling of a shell-and-tube heat exchanger	2.1	2.3
K1.03	Basic heat transfer in a heat exchanger	2.2	2.3
K1.04	Effects of heat exchanger flow rates that are too high or too low and methods of proper flow adjustment	2.5	2.7
K1.05	Flow paths for the heat exchanger (counterflow and U-types)	1.8	1.9
K1.06	Components of a heat exchanger (shells, tubes, plates, etc.)	1.7	1.9
K1.07	Control of heat exchanger temperatures	2.4	2.6
K1.08	Relationship between flow rates and temperatures	2.4	2.4
K1.09	Definition of thermal shock	2.8	2.8
K1.10	Principle of operation of condensers	2.3	2.4
K1.11	Relationship between condenser vacuum and backpressure	2.1	2.1
K1.12	Effects of tube fouling and tube failure scaling on heat exchanger operation	2.5	2.7
K1.13	Consequences of heat exchanger tube failure	2.8	2.9
K1.14	Reasons for non-condensable gas removal	2.4	2.6

COMPONENT: 191007 Demineralizers and Ion Exchangers (CFR 41.3)

		IMPORTANCE	
K/A NO.	**KNOWLEDGE**	**RO**	**SRO**
K1.01	Effect of excessive differential pressure on demineralizer performance	2.3	2.5
K1.02	Effects of channeling in a demineralizer	2.1	2.3
K1.03	Reason for sampling inlet and outlet of demineralizer	2.2	2.5
K1.04	Reason for demineralizer temperature and flow limits	2.4	2.4
K1.05	Principles of demineralizer operation	2.0	2.2
K1.06	Demineralizer D/P to determine condition of demineralizer resin bed	2.1	2.5
K1.07	Effects of demineralizer operation on water conductivity	2.1	2.2
K1.08	Demineralizer characteristics that can cause a change in boron concentration	3.2	3.1
K1.09	Reasons for bypassing demineralizers	2.5	2.7
K1.10	Reasons for using mixed-bed demineralizers to process primary water	2.1	2.3
K1.11	Plant evolutions which can cause crud bursts and the effect on demineralizers	2.5	2.8
K1.12	Definition of "boron saturated" as it relates to a demineralizer	2.7	2.9
K1.13	Definition of "lithium saturated" as it relates to a demineralizer	2.1	2.1
K1.14	Effect of temperature on saturated ion exchangers	2.4	2.6

COMPONENT: 191008 Breakers, Relays and Disconnects (CFR 41.7)

K/A NO.	KNOWLEDGE	IMPORTANCE RO	IMPORTANCE SRO
K1.01	Purpose of racking out breakers (de-energize components and associated control and indication circuits)	2.6	2.8
K1.02	Local indication that breaker is open, closed or tripped	2.8	2.9
K1.03	Loss of power supply circuit breaker indicator lights and capability in remotely open and close	2.9	3.1
K1.04	Operation of various push buttons, switches and handles and the resulting action on breakers	2.9	3.0
K1.05	Function of thermal overload protection device	2.3	2.4
K1.06	Interpretation of symbols for breakers, relays and disconnects in a one-line diagram	2.3	2.6
K1.07	Safety procedures and precautions associated with breakers, including MCC bus breakers, high medium and low voltage breakers, relays and disconnects	3.0	3.3
K1.08	Effects of closing breakers with current out of phase, different frequencies, high voltage differential, low current, or too much load	3.3	3.5
K1.09	Effect of racking out breakers on control and indicating circuits and removal of control power on breaker operation	2.8	3.1
K1.10	Function, control, and precautions associated with disconnects	2.7	3.1
K1.11	Control room indication of a breaker status	3.1	3.3
K1.12	Trip indicators for circuit breakers and protective relays	2.9	2.9