20 PAGES TOTAL

RO EXAM

Facility: Oconee Date of Exam

Tier	Group	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	Total	SRO K	SRO A	SRO A2	SRO G*	SRO Total
1. Emergency & Abnormal Plant Evolutions	1	2	3	3				3	3			4	18					
	2	2	1	2				2	1			1	9					
	Tier Totals	4	4	5				5	4			5	27					
2. Plant Systems	1	3	3	2	3	2	3	3	1	3	3	2	28					
	2	0	0	1	0	1	0	1	3	1	1	2	10					
	Tier Totals	3	3	3	3	3	3	4	4	4	4	4	38					

3. Generic Knowledge and Abilities Category	1	2	3	4	Total	SRO 1	SRO 2	SRO 3	SRO 4	SRO Total
	3	3	2	2	10					

1. Ensure that at least two topics from every K/A category are sampled within each tier of the RO outline (i.e., the "Tier Totals" in each K/A category shall not be less than two). Refer to Section D.1.c for additional guidance regarding SRO sampling.
2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ±1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points and the SRO-only exam must total 25 points.
3. Select topics from many systems and evolutions; avoid selecting more than two K/A topics from a given system or evolution unless they relate to plant-specific priorities.
4. Systems/evolutions within each group are identified on the associated outline.
5. The shaded areas are not applicable to the category/tier.
6.* The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system. The SRO K/As must also be linked to 10 CFR 55.43 or an SRO-level learning objective.
7. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IR) for the applicable license level, and the point totals for each system and category. Enter the group and tier totals for each category in the table above; summarize all the SRO-only knowledge and non-A2 ability categories in the columns labeled "K" and "A". Use duplicate pages for RO and SRO-only exams.
8. For Tier 3, enter the K/A numbers, descriptions, importance ratings, and point totals on Form ES-401-3.
9. Refer to ES-401, Attachment 2, for guidance regarding the elimination of inappropriate K/A

Tier 1 Group 1

	Name/Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
1	Reactor Trip - Stabilization - Recovery / 1	0	1	0	0	0	0	007EK2.02	Knowledge of the interrelations between (EMERGENCY PLANT EVOLUTION) and the following:(CFR: 41.7 / 45.7 / 45.8)	Breakers, relays and disconnects	2.6	2.8
2	Pressurizer Vapor Space Accident / 3	0	1	0	0	0	0	008AK2.02	Knowledge of the interrelations between (ABNORMAL PLANT EVOLUTION) and the following:(CFR: 41.7 / 45.7 / 45.8)	Sensors and detectors	2.7	2.7
	Small Break LOCA / 3	0	0	0	0	0	0	009EG2.1.27	This is a Generic, no stem statement is associated.	K/A Randomly Rejected	2.8	2.9
3	Large Break LOCA / 3	0	0	0	1	0	0	011EA1 06	Ability to operate and / or monitor the following as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	D/Gs	4.2	4.2
4	RCP Malfunctions / 4	0	0	0	0	0	1	015AG2.4.31	This is a Generic, no stem statement is associated.	Knowledge of annunciators alarms and indications and use of the response instructions.	3.3	3.4
5	Loss of Rx Coolant Makeup / 2	0	0	0	0	0	1	022AG2.1.30	This is a Generic, no stem statement is associated.	Ability to locate and operate components, including local controls.	3.9	3.4
6	Loss of RHR System / 4	1	0	0	0	0	0	025AK1.01	Knowledge of the operational implications of the following concepts as they apply to the (ABNORMAL PLANT EVOLUTION):(CFR: 41.8 to 41.10 / 45.3)	Loss of RHRS during all modes of operation	3.9	4.3
7	Loss of Component Cooling Water / 8	0	0	1	0	0	0	026AK3.02	Knowledge of the reasons for the following responses as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	The automatic actions (alignments) within the CCWS resulting from the actuation of the ESFAS	3.6	3.9

Tier 1 Group 1

	Name/Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
8	Pressurizer Pressure Control System Malfunction / 3	0	0	1	0	0	0	027AK3.01	Knowledge of the reasons for the following responses as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	Isolation of PZR spray following loss of PZR heaters	3.5	3.8
9	ATWS / 1	0	1	0	0	0	0	029EK2.06	Knowledge of the interrelations between (EMERGENCY PLANT EVOLUTION) and the following:(CFR: 41.7 / 45.7 / 45.8)	Breakers, relays, and disconnects.	2.9	3.1
10	Steam Gen. Tube Rupture / 3	0	0	0	0	1	0	038EA2.15	Ability to determine and interpret the following as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	Pressure at which to maintain RCS during S/G cooldown	4.2	4.4
11	Steam Line Rupture - Excessive Heat Transfer / 4	0	0	0	0	1	0	040AA2.05	Ability to determine and interpret the following as they apply to ABNORMAL PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	When ESFAS systems may be secured	4.1	4.5
12	Loss of Main Feedwater / 4	1	0	0	0	0	0	054AK1.01	Knowledge of the operational implications of the following concepts as they apply to the (ABNORMAL PLANT EVOLUTION):(CFR: 41.8 to 41.10 / 45.3)	MFW line break depressurizes the S/G (similar to a steam line break)	4.1	4.3
13	Station Blackout / 6	0	0	1	0	0	0	055EK3.02	Knowledge of the reasons for the following responses as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	Actions contained in EOP for loss of offsite and onsite power	4.3	4.6
14	Loss of Off-site Power / 6	0	0	0	0	1	0	056AA2.14	Ability to determine and interpret the following as they apply to ABNORMAL PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	Operational status of ED/Gs (A and B)	4.4	4.6

Tier 1 Group 1

	Name/Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
	Loss of Vital AC Inst. Bus / 6	0	0	0	0	0	0	057AA2.16	Ability to determine and interpret the following as they apply to ABNORMAL PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	K/A Randomly Rejected	3	3.1
15	Loss of DC Power / 6	0	0	0	1	0	0	058AA1.03	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	Vital and battery bus components	3.1	3.3
16	Loss of Nuclear Svc Water / 4	0	0	0	1	0	0	062AA1.02	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	Loads on the SWS in the control room	3.2	3.3
	Loss of Instrument Air / 8	0	0	0	0	0	0	065AA1.03	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	K/A Randomly Rejected	2.9	3.1
17	Reactor Trip - Stabilization - Recovery / 1	0	0	0	0	0	1	BE02EG2.1.32	This is a Generic, no stem statement is associated.	Ability to explain and apply all system limits and precautions.	3.4	3.8
	Reactor Trip - Stabilization - Recovery / 1	0	0	0	0	0	0	BE10EA2.2	Ability to determine and interpret the following as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	K/A Randomly Rejected	3.5	4
	Steam Line Rupture - Excessive Heat Transfer / 4	0	0	0	0	0	0	BE05EA2.1	Ability to determine and interpret the following as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	K/A Randomly Rejected	3	4.2

Tier 1 Group 1

Name/Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
18 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4	0	0	0	0	0	1	BE04EG2.1.27	This is a Generic, no stem statement is associated.	Knowledge of system purpose and or function.	2.8	2.9

Tier 1 Group 2

	Name / Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
	Continuous Rod Withdr	0	0	0	0	0	0	001AK2.05	Knowledge of the interrelations between (ABNORMAL PLANT EVOLUTION) and the following:(CFR: 41.7 / 45.7 / 45.8)	K/A Randomly Rejected	2.9	3.1
	Dropped Control Rod /	0	0	0	0	0	0	003AK3.03	Knowledge of the reasons for the following responses as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	K/A Randomly Rejected	3.4	3.7
19	Inoperable/Stuck Contr	0	0	0	0	1	0	005AA2.02	Ability to determine and interpret the following as they apply to ABNORMAL PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	Difference between jog and run rod speeds effect on CRDM of stuck rod	2.5	3
	Emergency Boration / 1	0	0	0	0	0	0	024AA2.06	Ability to determine and interpret the following as they apply to ABNORMAL PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	K/A Randomly Rejected	3.6	3.7
	Pressurizer Level Malfu	0	0	0	0	0	0	028AG2.1.27	This is a Generic, no stem statement is associated.	K/A Randomly Rejected	2.8	2.9
20	Loss of Source Range I	0	0	1	0	0	0	032AK3.01	Knowledge of the reasons for the following responses as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	Startup termination on source-range loss	3.2	3.6
21	Loss of Intermediate Ra	1	0	0	0	0	0	033AK1.01	Knowledge of the operational implications of the following concepts as they apply to the (ABNORMAL PLANT EVOLUTION):(CFR: 41.8 to 41.10 / 45.3)	Effects of voltage changes on performance	2.7	3
22	Fuel Handling Accident	0	0	0	1	0	0	036AA1.02	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	ARM system	3.1	3.5

Tier 1 Group 2

Name / Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
Steam Generator Tube	0	0	0	0	0	0	037AG2.4.6	This is a Generic, no stem statement is associated.	K/A Randomly Rejected	3.1	4
23 Loss of Condenser Vac	0	0	0	1	0	0	051AA1.04	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	Rod position	2.5	2.5
Accidental Liquid RadW	0	0	0	0	0	0	059AA2.06	Ability to determine and interpret the following as they apply to ABNORMAL PLANT EVOLUTION):(CFR: 41.10 / 43.5 / 45.13)	K/A Randomly Rejected	3.5	3.8
Accidental Gaseous Ra	0	0	0	0	0	0	060AK1.01	Knowledge of the operational implications of the following concepts as they apply to the (ABNORMAL PLANT EVOLUTION):(CFR: 41.8 to 41.10 / 45.3)	K/A Randomly Rejected	2.5	3.1
ARM System Alarms / 7	0	0	0	0	0	0	061AK2.01	Knowledge of the interrelations between (ABNORMAL PLANT EVOLUTION) and the following:(CFR: 41.7 / 45.7 / 45.8)	K/A Randomly Rejected	2.5	2.6
24 Plant Fire On-site / 9 8	0	0	0	0	0	1	067AG2.1.2	This is a Generic, no stem statement is associated.	Knowledge of operator responsibilities during all modes of plant operation.	3	4
Control Room Evac. / 8	0	0	0	0	0	0	068AA1.21	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	K/A Randomly Rejected	3.9	4.1
Loss of CTMT Integrity .	0	0	0	0	0	0	069AA1.01	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	K/A Randomly Rejected	3.5	3.7

Tier 1 Group 2

Name / Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
Inad. Core Cooling / 4	0	0	0	0	0	0	074EA1.25	Ability to operate and / or monitor the following as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	K/A Randomly Rejected	3.8	3.8
High Reactor Coolant A	0	0	0	0	0	0	076AK3.06	Knowledge of the reasons for the following responses as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	K/A Randomly Rejected	3.2	3.8
Plant Runback / 1	0	0	0	0	0	0	BA01AA1.3	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	K/A Randomly Rejected	3.7	3.7
Loss of NNI-X/Y / 7	0	1	0	0	0	0	BA02AK2.2	Knowledge of the interrelations between (ABNORMAL PLANT EVOLUTION) and the following:(CFR: 41.7 / 45.7 / 45.8)	Facility s heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility.	3.8	3.8
Turbine Trip / 4	0	0	0	0	0	0	BA04AK1.1	Knowledge of the operational implications of the following concepts as they apply to the (ABNORMAL PLANT EVOLUTION):(CFR: 41.8 to 41.10 / 45.3)	K/A Randomly Rejected	3	3.3
Emergency Diesel Actu	0	0	0	0	0	0	BE05EK2.1	Knowledge of the interrelations between (EMERGENCY PLANT EVOLUTION) and the following:(CFR: 41.7 / 45.7 / 45.8)	K/A Randomly Rejected	3.8	4
Flooding / 8	0	0	0	0	0	0	BA07AG2.4.6	This is a Generic, no stem statement is associated.	K/A Randomly Rejected	3.1	4

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Tier 1 Group 2

	Name / Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
	Inadequate Subcooling	0	0	0	0	0	0	BE03EK3.4	Knowledge of the reasons for the following responses as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	K/A Randomly Rejected	3.2	3.5
26	LOCA Cooldown - Depi	1	0	0	0	0	0	BE08EK1.1	Knowledge of the operational implications of the following concepts as they apply to the EMERGENCY PLANT EVOLUTION):(CFR: 41.8 to 41.10 / 45.3)	Components, capacity, and function of emergency systems.	3.5	3.8
27	Natural Circ. / 4	0	0	1	0	0	0	BE09EK3.4	Knowledge of the reasons for the following responses as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.	3.8	3.8
	EOP Rules and Enclosı	0	0	0	0	0	0	BE13EA1.2	Ability to operate and / or monitor the following as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	K/A Randomly Rejected	2.8	3
	Loss of NNI-X/Y / 7	0	0	0	0	0	0	BA03AA1.1	Ability to operate and / or monitor the following as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.7 / 45.5 / 45.6)	K/A Randomly Rejected	4	4
	EOP Rules and Enclosı	0	0	0	0	0	0	BE14EK3.4	Knowledge of the reasons for the following responses as they apply to (EMERGENCY PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)	K/A Randomly Rejected	3.5	3.5
	Control Room Evac. / 8	0	0	0	0	0	0	BA06AG2.1.27	This is a Generic, no stem statement is associated.	K/A Randomly Rejected	2.8	2.9
	Fuel Handling Accident	0	0	0	0	0	0	BA08AK3.4	Knowledge of the reasons for the following	K/A Randomly Rejected	3.6	3.6

Tier 1 Group 2

Name / Safety Function	K1	K2	K3	A1	A2	G	KA	Question Type	K/A Topic(s)	RO	SRO
								responses as they apply to (ABNORMAL PLANT EVOLUTION):(CFR: 41.5 / 41.10 / 45.6 / 45.13)			

Tier 2 Group 1

	Name / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
	Reactor Coolant Pump	0	0	0	0	0	0	0	0	0	0	0		K/A Rejected	003A4.06	0	0
28	Chemical and Volume Control	1	0	0	0	0	0	0	0	0	0	0	Knowledge of the physical connections and/or cause-effect relationships between (SYSTEM) and the following:(CFR: 41.2 to 41.9 / 45.7 to 45.8)	CCWS	004K1.18	2.9	3.2
29	Residual Heat Removal	0	0	0	0	1	0	0	0	0	0	0	Knowledge of the operational implications of the following concepts as they apply to the (SYSTEM):(CFR: 41.5 / 45.7)	Need for adequate subcooling	005K5.02	3.4	3.5
30	Emergency Core Cooling	0	0	0	0	0	0	0	1	0	0	0	Ability to (a) predict the impacts of the following on the (SYSTEM) and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal operation:(CFR: 41.5 / 43.5 / 45.3 / 45.13)	Effect of electric power loss on valve position	006A2.08	3.0	3.3
31	Pressurizer Relief/Quench Tank	0	0	0	0	0	0	0	0	0	1	0	Ability to manually operate and/or monitor in the control room:(CFR: 41.7 / 45.5 to 45.8)	PRT spray supply valve	007A4.01	2.7	2.7
32	Component Cooling Water	0	0	0	0	0	0	0	0	0	1	0	Ability to manually operate and/or monitor in the control room:(CFR: 41.7 / 45.5 to 45.8)	Remote operation of hand-operated throttle valves to regulate CCW flow rate	008A4.06	2.5	2.5
33	Pressurizer Pressure Control	1	0	0	0	0	0	0	0	0	0	0	Knowledge of the physical connections and/or cause-effect relationships between (SYSTEM) and the following:(CFR: 41.2 to 41.9 / 45.7 to 45.8)	RCS	010K1.03	3.6	3.7

Tier 2 Group 1

#	lame / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
34	Reactor Protection	0	0	0	1	0	0	0	0	0	0	0	Knowledge of (SYSTEM) design feature(s) and or interlock(s) which provide for the following:(CFR: 41.7)	Automatic reactor trip when RPS setpoints are exceeded for each RPS function; basis for each	012K4.02	3.9	4.3
35	Engineered Safety Features Actuation	0	0	0	0	1	0	0	0	0	0	0	Knowledge of the operational implications of the following concepts as they apply to the (SYSTEM):(CFR: 41.5 / 45.7)	Safety system logic and reliability	013K5.02	2.9	3.3
36	Containment Cooling	0	0	0	0	0	0	0	0	0	0	1	This is a Generic, no stem statement is associated.	Ability to perform specific system and integrated plant procedures during all modes of plant operation.	022GG2.1.23	3.9	4.0
	Ice Condenser	0	0	0	0	0	0	0	0	0	0	0		K/A Rejected	025GG2.1.23	0	0
37	Containment Spray	0	0	0	1	0	0	0	0	0	0	0	Knowledge of (SYSTEM) design feature(s) and or interlock(s) which provide for the following:(CFR: 41.7)	Prevention of material from clogging nozzles during recirculation	026K4.05	2.8	3.3
38	Main and Reheat Steam	0	0	0	0	0	0	0	0	1	0	0	Ability to monitor automatic operations of the (SYSTEM) including:(CFR: 41.7 / 45.5)	Isolation of the MRSS	039A3.02	3.1	3.5
39	Main Feedwater	0	0	0	0	0	0	0	0	1	0	0	Ability to monitor automatic operations of the (SYSTEM) including:(CFR: 41.7 / 45.5)	Programmed levels of the S/G	059A3.02	2.9	3.1
40	Auxiliary/Emergency Feedwater	0	0	1	0	0	0	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the (SYSTEM) will have on the following:(CFR: 41.7 / 45.6)	RCS	061K3.01	4.4	4.6
41	AC Electrical Distribution	1	0	0	0	0	0	0	0	0	0	0	Knowledge of the physical connections and/or cause-effect relationships	DC distribution	062K1.03	3.5	4.0

Tier 2 Group 1

No.	Name / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
													between (SYSTEM) and the following:(CFR: 41.2 to 41.9 / 45.7 to 45.8)				
42	DC Electrical Distribution	0	1	0	0	0	0	0	0	0	0	0	Knowledge of electrical power supplies to the following:(CFR: 41.7)	Major DC loads	063K2.01	2.9	3.1
43	Emergency Diesel Generator	0	0	0	0	0	0	1	0	0	0	0	Ability to predict and/or monitor changes in parameters associated with operating the (SYSTEM) controls including:(CFR: 41.5 / 45.5)	ED/G lube oil temperature and pressure	064A1.01	3.0	3.1
44	Process Radiation Monitoring	0	0	0	0	0	0	1	0	0	0	0	Ability to predict and/or monitor changes in parameters associated with operating the (SYSTEM) controls including:(CFR: 41.5 / 45.5)	Radiation levels	073A1.01	3.2	3.5
45	Service Water	0	0	0	0	0	0	1	0	0	0	0	Ability to predict and/or monitor changes in parameters associated with operating the (SYSTEM) controls including:(CFR: 41.5 / 45.5)	Reactor and turbine building closed cooling water temperatures.	076A1.02	2.6	2.6
46	Instrument Air	0	1	0	0	0	0	0	0	0	0	0	Knowledge of electrical power supplies to the following:(CFR: 41.7)	Instrument air compressor	078K2.01	2.7	2.9
47	Containment	0	0	0	0	0	0	0	0	0	1	0	Ability to manually operate and/or monitor in the control room:(CFR: 41.7 / 45.5 to 45.8)	Phase A and phase B resets	103A4.04	3.5	3.5
48	Reactor Coolant Pump	0	0	0	0	0	1	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the following will have on the (SYSTEM):(CFR: 41.7 / 45.7)	Containment isolation valves affecting RCP operation	003K6.04	2.8	3.1
49	Instrument Air	0	1	0	0	0	0	0	0	0	0	0	Knowledge of electrical power supplies	Emergency air compressor	078K2.02	3.3	3.5

Tier 2 Group 1

	Name / Safety Function	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
													to the following:(CFR: 41.7)				
50	Component Cooling Water	0	0	0	0	0	0	0	0	0	0	1	This is a Generic, no stem statement is associated.	Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.	008GG2.4.50	3.3	3.3
51	Engineered Safety Features Actuation	0	0	0	0	0	1	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the following will have on the (SYSTEM):(CFR: 41.7 / 45.7)	Sensors and detectors	013K6.01	2.7	3.1
52	Chemical and Volume Control	0	0	0	0	0	1	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the following will have on the (SYSTEM):(CFR: 41.7 / 45.7)	Principle of recirculation valve: (permit emergency flow even if valve is blocked by crystallized boric acid)	004K6.12	2.6	2.9
53	Pressurizer Pressure Control	0	0	0	0	0	0	0	0	1	0	0	Ability to monitor automatic operations of the (SYSTEM) including:(CFR: 41.7 / 45.5)	PZR pressure	010A3.02	3.6	3.5
	Pressurizer Pressure Control	0	0	0	0	0	0	0	0	0	0	0					
54	Containment Cooling	0	0	0	1	0	0	0	0	0	0	0	Knowledge of (SYSTEM) design feature(s) and or interlock(s) which provide for the following:(CFR: 41.7)	Cooling of containment penetrations	022K4.01	2.5	3.0
	Chemical and Volume Control	0	0	0	0	0	0	0	0	0	0	0					
	Engineered Safety Features Actuation	0	0	0	0	0	0	0	0	0	0	0					
	Containment Cooling	0	0	0	0	0	0	0	0	0	0	0					

Tier 2 Group 1

Name / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
Main Feedwater	0	0	1	0	0	0	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the (SYSTEM) will have on the following:(CFR: 41.7 / 45.6)	S/GS	059K3.03	3.5	3.7.

55

Tier 2 Group 2

Name / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
Hydrogen Recombiner and Purge Control	0	0	0	0	0	0	0	0	0	0	0	Knowledge of the operational implications of the following concepts as they apply to the (SYSTEM):(CFR: 41.5 / 45.7)	K/A Randomly Rejected	028K5.04	2.6	3.2
Containment Purge	0	0	0	0	0	0	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the (SYSTEM) will have on the following:(CFR: 41.7 / 45.6)	K/A Randomly Rejected	029K3.01	2.9	3.1
Spent Fuel Pool Cooling	0	0	0	0	0	0	0	0	0	0	0	Ability to manually operate and/or monitor in the control room:(CFR: 41.7 / 45.5 to 45.8)	K/A Randomly Rejected	033A4	0	0
Fuel Handling Equipment	0	0	0	0	0	0	0	0	0	0	0	Ability to monitor automatic operations of the (SYSTEM) including:(CFR: 41.7 / 45.5)	K/A Randomly Rejected	034A3.02	2.5	3.1
Steam Generator	0	0	0	0	0	0	0	0	0	0	0	Ability to monitor automatic operations of the (SYSTEM) including:(CFR: 41.7 / 45.5)	K/A Randomly Rejected	035A3.02	3.7	3.5
56 Steam Dump/Turbine Bypass Control	0	0	0	0	1	0	0	0	0	0	0	Knowledge of the operational implications of the following concepts as they apply to the (SYSTEM):(CFR: 41.5 / 45.7)	Use of steam tables for saturation temperature and pressure	041K5.02	2.5	2.8
57 Main Turbine Generator	0	0	0	0	0	0	0	0	1	0	0	Ability to monitor automatic operations of the (SYSTEM) including:(CFR: 41.7 / 45.5)	Electrohydraulic control	045A3.05	2.6	2.9
58 Condenser Air Removal	0	0	0	0	0	0	0	0	0	0	1	This is a Generic, no stem statement is associated.	Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.	055G2.4.50	3.3	3.3
59 Liquid Radwaste	0	0	0	0	0	0	0	1	0	0	0	Ability to (a) predict the impacts of the	Failure of automatic isolation	068A2.04	3.3	3.3

Tier 2 Group 2

Name / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
												following on the (SYSTEM) and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal operation:(CFR: 41.5 / 43.5 / 45.3 / 45.13)				
Waste Gas Disposal	0	0	0	0	0	0	0	0	0	0	0	Ability to monitor automatic operations of the (SYSTEM) including:(CFR: 41.7 / 45.5)	K/A Randomly Rejected	071A3.02	2.8	2.8
Area Radiation Monitoring	0	0	0	0	0	0	0	0	0	0	0	Knowledge of electrical power supplies to the following:(CFR: 41.7)	K/A Randomly Rejected	072K2	0	0
Circulating Water	0	0	0	0	0	0	0	0	0	0	0	Ability to predict and/or monitor changes in parameters associated with operating the (SYSTEM) controls including:(CFR: 41.5 / 45.5)	K/A Randomly Rejected	075A1	0	0
Station Air 60	0	0	0	0	0	0	0	0	0	1	0	Ability to manually operate and/or monitor in the control room:(CFR: 41.7 / 45.5 to 45.8)	Cross-tie valves with IAS	079A4.01	2.7	2.7
Fire Protection 61	0	0	0	0	0	0	0	0	0	0	1	This is a Generic, no stem statement is associated.	Knowledge of the purpose and function of major system components and controls.	086GG2.1.28	3.2	3.3
Control Rod Drive 62	0	0	0	0	0	0	0	1	0	0	0	Ability to (a) predict the impacts of the following on the (SYSTEM) and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal operation:(CFR: 41.5 / 43.5 / 45.3 / 45.13)	Possible causes of mismatched control rods	001A2.16	3.0	3.8
Reactor Coolant	0	0	0	0	0	0	0	0	0	0	0	Ability to monitor automatic operations of	K/A Randomly Rejected	002A3.02	2.6	2.8

Tier 2 Group 2

	Name / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO
													the (SYSTEM) including:(CFR: 41.7 / 45.5)				
63	Pressurizer Level Control	0	0	0	0	0	0	1	0	0	0	0	Ability to predict and/or monitor changes in parameters associated with operating the (SYSTEM) controls including:(CFR: 41.5 / 45.5)	T-ave	011A1.04	3.1	3.3
	Rod Position Indication	0	0	0	0	0	0	0	0	0	0	0	Knowledge of electrical power supplies to the following:(CFR: 41.7)	K/A Randomly Rejected	014K2.02	3.0	3.3
64	Nuclear Instrumentation	0	0	0	0	0	0	0	1	0	0	0	Ability to (a) predict the impacts of the following on the (SYSTEM) and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal operation:(CFR: 41.5 / 43.5 / 45.3 / 45.13)	Xenon oscillations	015A2.03	3.2	3.5
65	Non-nuclear Instrumentation	0	0	1	0	0	0	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the (SYSTEM) will have on the following:(CFR: 41.7 / 45.6)	ECCS	016K3.07	3.6	3.7
	In-core Temperature Monitor	0	0	0	0	0	0	0	0	0	0	0	Knowledge of the effect that a loss or malfunction of the (SYSTEM) will have on the following:(CFR: 41.7 / 45.6)	K/A Randomly Rejected	017K3.01	3.5	3.7
	Containment Iodine Removal	0	0	0	0	0	0	0	0	0	0	0	Ability to manually operate and/or monitor in the control room:(CFR: 41.7 / 45.5 to 45.8)	K/A Randomly Rejected	027A4.01	3.3	3.3
	Condensate	0	0	0	0	0	0	0	0	0	0	0	Ability to predict and/or monitor changes in parameters associated with operating the (SYSTEM) controls including:(CFR: 41.5 / 45.5)	K/A Randomly Rejected	056A1	0	0

Tier 2 Group 2

lame / Safety Functio	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	Question Type	K/A Topic(s)	KA	RO	SRO

Tier 3

	Group	KA	Topic	RO	SRO
66	Conduct of Operations	G2.1.7	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior and instrument interpretation.	3.7	4.4
67	Conduct of Operations	G2.1.1	Knowledge of conduct of operations requirements.	3.7	3.8
68	Conduct of Operations	G2.1.11	Knowledge of less than one hour technical specification action statements for systems.	3	3.8
69	Equipment Control	G2.2.24	Ability to analyze the affect of maintenance activities on LCO status.	2.6	3.8
70	Equipment Control	G2.2.33	Knowledge of control rod programming.	2.5	2.9
71	Equipment Control	G2.2.11	Knowledge of the process for controlling temporary changes.	2.5	3.4
72	Radiation Control	G2.3.11	Ability to control radiation releases.	2.7	3.2
73	Radiation Control	G2.3.1	Knowledge of 10 CFR: 20 and related facility radiation control requirements.	2.6	3
74	Emergency Procedures/Plan	G2.4.22	Knowledge of the bases for prioritizing safety functions during abnormal/emergency operations.	3	4
75	Emergency Procedures/Plan	G2.4.13	Knowledge of crew roles and responsibilities during EOP flowchart use.	3.3	3.9

RO EXAM

Tier / Group	Randomly Selected K/A	Reason for Rejection
T1/G1	027AK3.01 (Q8) **027AK3.03 (new)**	Oconee does not isolate PZR spray on loss of PZR heaters. New KA supplied by Rick Baldwin
T1/G2	033AK1.01(Q21) **061AK1.01 (new)**	Oconee no longer has Intermediate Range NIs New KA supplied by Rick Baldwin
	005K5.02 (29) **005K5.09 (new)**	Cannot write a discriminating question on this KA. New KA supplied by Rick Baldwin - 6/19/2007
T2/G1	007A4.01 (Q31) **007A4.10 (new)**	Oconee does not have a QT spray valve New KA supplied by Rick Baldwin
T2/G1	064A1.01 (Q43) **064A1.08 (new)** **064A1.03 (new)**	Oconee does not have indication of Keowee lube oil temperature and pressure Cannot write a discriminating question on this KA. New KA supplied by Rick Baldwin Little guidance on reverse power for the Keowee Units. Cannot write a discriminating question on this KA. New KA supplied by Rick Baldwin - 6/19/2007
T2/G1	004K6.12 (Q52) **004K6.13 (new)**	Oconee does not have a recirculation valve on this system (chemical and volume control) New KA supplied by Rick Baldwin
T3	G2.4.22 (Q74) **G2.4.20 (new)**	Cannot write a discriminating question on this KA. New KA supplied by Rick Baldwin - 7/9/2007

Question 1
T1/G1 - gcw

007EK2.02, Reactor Trip - Stabilization / 1 **Knowledge of the interrelations between a reactor trip and the following: Breakers, relays and disconnects** (2.6/2.8)

K/A MATCH ANALYSIS
Question requires knowledge of plant response following a reactor trip with $2N_1$ and $2N_2$ breakers AUTO/MAN transfer switches in MANUAL.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect, would be correct for a situation where the CT transformer was not available. This could be assumed with the transfer switches in MANUAL. For ALL other A/M manual switches auto transfer will not occur when switches are in MANUAL.

B. Incorrect, would be correct for a load rejection at 40% power.

C. Correct, with $2N_1$ and $2N_2$ AUTO/MAN transfer switches in MANUAL when the reactor trips power will transfer to the startup transformer (CT-2) after a load shed signal is generated. The Main Feeder Bus Monitor Panel will cause a Load Shed Signal in 21 seconds.

D. Incorrect, first part is correct and the second part would be correct if the switches were in AUTO.

Technical Reference(s): **EL-PSL Page 38/39 of 56**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EL-PSL R28**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

4. State the following about the Main Feeder Bus Monitor Panel Logic:
   4.1 Purpose (R11)
   4.2 Location of panel (R12)
   4.3 The conditions that will initiate a MFBMP signal. (R13)
   4.4 The events which will occur following a MFBMP actuation. (R14)

5. Concerning Emergency Power Switching Logic, state the following:
   5.1 Purpose (R15)
   5.2 Location of panel (R16)

6. For the Startup Breaker Anti-Recycle Relay, recall the following:
   6.1 Purpose (R17)
   6.2 The conditions that will generate a STAR relay signal. (R18)
   6.3 The events that will occur following a STAR relay actuation. (R19)

7. For the Transfer to Standby and Retransfer to Startup Logic, state the following: (R20)
   7.1 The conditions which will initiate a transfer to Standby operation.
   7.2 The conditions which will initiate a retransfer to startup operation.

8. Discuss the operation of the N and E breakers as they relate to power switching logic. (R28)
   8.1 Evaluate the response of the power system to N/E Auto/Manual selector switch being in the Manual position.

9. Discuss the operation of the SK breakers as they relate to power switching logic. (R21)

(3) The logic that determines if the closing of the (E) breakers is fast or delayed previously looked at the position of both of the generator output breakers. Under certain scenarios a fast transfer could occur between two sources that are out of sync. On a Switchyard Isolation the Red Bus Generator tie PCB's do not trip. Because of this Keowee connecting to the Main Feeder Bus prior to adequate decay of residual voltage on the MFB immediately following a unit trip could result in to two power sources tied together out of sync.

(4) To prevent this, two changes were made to the (E) breaker auto closing logic.

(i) Remove the logic that considers the status of PCB-20 (Unit 1) and PCB-23 (Unit 2) from the (E) breaker automatic close circuitry for Units 1 and 2.

(ii) Install switchyard isolate logic in the auto closing circuit of each startup (E) breaker of Unit 3 to prevent fast transfer if a switchyard isolation signal is generated from either switchyard isolation channels.

(d) Normal Breaker (N1) is open (52S N1). This signal protects the generator from being motorized.

(e) Standby Breaker (S1) is open (52SS1). This signal prevents inadvertent automatic paralleling of the startup and standby sources.

3) (**Obj. R28**) Manual Mode

(a) The E1 breaker can be closed with the N1/E1 auto-manual selector switch (S130) in the MANUAL position when all of the following conditions are met:

(1) All permissives are satisfied (refer to 2.a.1. above).

(2) Either the E1 control switch (S141) is in the CLOSE position, or a load shed signal (RLS1X1) is present.

(i) The load shed signal is provided to allow automatic transfer to the startup source when an ESG signal is present with both normal and startup breakers open, even though manual control is selected for E1.

(3) Either both the normal breaker (N1) and the standby breaker (S1) are open, or the N1/E1 sync check relay (25X) indicates satisfactory phase relationship for paralleling sources.

(i) The sync check relay protects the unit generator and/or the Keowee generator from being paralleled out of phase across the E1 breaker (overhead power path only).

(ii) A sync check is not necessary when both the normal breaker (N1) and the standby breaker (S1) are open.

b) Tripping

1) Trip Coil 1

Any of the following will energize trip coil 1 to trip the E1 breaker:

(a) The E1 control switch (S141) is in the TRIP position with the N1/E1 auto-manual selector switch in MANUAL.

(b) A Channel 1 close signal (SBC/1AX) to the standby breaker (S1) is present. This signal assures that E1 is opened when a close signal is initiated for the standby breaker.

(c) A trip signal from the time delay trip circuit (94Y1) is present.

(1) When transferring from the startup source to the normal source, tripping relay 94Y1 will trip the E1 breaker 0.3 seconds after the N1 breaker has closed. This prevents prolonged operation with sources paralleled. (Refer to the description of the Time Delay Trip circuit).

(d) Normal breaker lockout relay (86N1) is tripped. This trip signal protects the Main Feeder Bus from over-current.

(e) Startup breaker lockout relay (86E1) is tripped. This trip signal protects the Main Feeder Bus from over-current.

1 POINT

Question 2

Unit 2 initial conditions:

- Time = 1000
- Rx Power = 80%

Current conditions:

- Time = 1005
- Rx Power = 77% decreasing
- 1SA2/D3 (RC PRESS HIGH/LOW) in alarm
- 2RC-1 (PZR SPRAY) OPEN
- Control Rods Inserting
- Feedwater flow increasing
- OTSG levels = 73% increasing
- Tave 577 ºF decreasing
- RCS pressure 2140 psig decreasing

Based on the current conditions, which ONE of the following describes the event cause?

A. Controlling NI failed HIGH

B. Main FDW Valve failed OPEN

C. Turbine Bypass Valve failed OPEN

D. Controlling NR RCS pressure failed HIGH

Question 2
T1/G1 - kds

008AK2.02, Pressurizer Vapor Space Accident / 3 **Knowledge of the interrelations between the Pressurizer Vapor Space Accident and the following: Sensors and detectors** (2.7*/2.7)

K/A MATCH ANALYSIS
Question requires knowledge of how a sensor failure (NR RCS Press) can affect the Pressurizer vapor space (PORV opening).

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: Pzr spray valve will not be open at 2140 psig for a failed NI. Plausible because controlling NI failed HIGH will cause CR to insert and Feedwater to increase (an associated effects on the RCS).

B. Incorrect: Pzr spray valve will not be open at 2140 psig for an overfeed condition. Plausible because an overfeed will cause SG level to increase and Tave to decrease.

C. Incorrect: Pzr spray valve will not be open at 2140 psig for an TBV failed open. Plausible because a TBV failed open will reduce THP which will cause feedwater to increase.

D. **Correct: The conditions presented are indicative of controlling NR RCS pressure signal failing high. This results in SA (RC PRESS HI/LO), PORV opening, Pzr Spray valve opening, Pzr heaters turning OFF and ICS RCS Pressure Error "Kicker" Signal at 2250 psig which reacts to an apparent RCS overpressure condition by Inserting Control Rods, increasing Feedwater Flow and increasing Steam Demand, all in an effort to cool down the RCS.**

Technical Reference(s): **Lesson STG-ICS**
IC-RCI (RCS Pressure Inst)
SAE-L061 (Simr Guide for Controlling NR ICS failure)

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SAEL061 (R1)**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

CAE

CONTROLLING RCS PRESSURE SIGNAL FAILS HIGH

SAE-L 061

PREPARED BY:	Greg Baumgarner	Date:	10/05/2005
REVIEWED/VALIDATED BY:		Date:	
TRAINING APPROVAL:		Date:	

1.0 OBJECTIVES:

Terminal:

1.1 Upon successful completion of this exercise, the student will be able to correctly identify and diagnose the Controlling NR RCS Pressure failure. Additionally, using proper team skills, communications, and human performance techniques, the student will be able to perform the respective RO/SRO actions to respond to and mitigate the effects of the plant transient associated with the instrument failure in accordance with plant transient & abnormal response procedures. (T1)

Enabling:

1.2 With a high failure of the Controlling Narrow Range RCS pressure signal present, **EXPLAIN** the effect on the following parameters: (R1)

A. Effect on ICS

1. Feedwater demand signals
2. Reactor demand signal

B. Effect on RCS temperature and pressure

1.3 After the ICS/RCS instrument failure has occurred, **PERFORM** Plant Transient Response IAW SOMP 1-2, Reactivity Management. (R2)

1.4 When Statalarm 1SA-18/A1, PRESSURIZER RELIEF VALVE FLOW is received, **PERFORM** the required actions per the Alarm Response Guide. (R3)

1.5 **DIAGNOSE** a high failure of the Controlling Narrow Range RCS pressure signal by recognizing: (R4)

A. NR RC pressure recorder indicating high with WR RC pressure decreasing.

B. 1RC-1 (PZR SPRAY) open

C. 1RC-66 (PORV) open

D. RPS single channel actuation and no reactor trip on high pressure

E. Statalarm 1SA-2/D3, RC PRESS HIGH/LOW

F. Statalarm 1SA-18/A1, PRESSURIZER RELIEF VALVE FLOW

1.6 After the unit has been stabilized **PERFORM** required actions of AP/28, ICS Instrument Failure. (R5)

1.7 While acting as the CR SRO, **SUPERVISE** the crew while responding to an instrument failure in accordance with abnormal response procedures by: (R6)

A. Evaluating abnormal system operating parameters

B. Independently verifying proper corrective actions are taken

C. Determining Tech Spec applicability

9.0 SUPPORT INFORMATION

9.1 Plant response to a Controlling RCS Pressure signal failing high:

A. The controlling RCS pressure signal is provided by the median select of three narrow range (1700 - 2500 psig) RCS pressure transmitters channel “A” , “B” , and channel “E”:

1. The channel “E” transmitter is located on the “B” RCS hot leg.
2. The channel “A” transmitter is located on the “A” RCS hot leg.
3. The channel “B” transmitter is located on the “A” RCS hot leg.

B. The STAR module median select process normally controls selection of the controlling RCS pressure signal.

1. If two signals failed in the same direction, the middle signal (controlling signal), would become one of the failed signals.
2. The operator cannot select alternate signals to control, and must have I&E respond to provide a reliable RCS pressure-controlling signal.

C. The controlling RCS pressure signal controls operation of the PZR heaters (in auto), the PZR spray valve (in auto), and the PORV to control RCS pressure. The selected transmitter provides a signal to the following controls and indications:

1. PZR heaters auto circuit
2. PZR spray valve auto circuit
3. PORV “High” opening circuit
4. Control room narrow range RCS pressure chart recorder
5. Auxiliary Shutdown Panel NR RCS pressure gauge
6. Statalarm 1SA-2/D3, RC PRESS HIGH/LOW
7. ICS inputs to Turbine, Feedwater, and Reactor demands

D. A single signal failure will not affect the above equipment/indications.

E. Two RCS NR pressure signals failing HIGH (1 RPS and 1 Non-RPS) will cause the following:

1. PZR heater auto circuitry will de-energize PZR heaters; however, PZR Heater Bank Two (2) will function as required via the controlling signal from the PZR Water Space Saturation Recovery Circuit. This circuit detects subcooled conditions in the PZR. IF predicted saturation pressure (based on PZR liquid temp) is significantly lower than RCS pressure (50 psig), then PZR Heater Bank Two (2) energizes to compensate. There is a 20°F deadband to minimize heater cycle.

2. The operators still have the capability to manually energize the PZR heaters.

3. PZR spray valve auto circuitry will open 1RC-1, (PZR SPRAY) valve.

   a. The RCS pressure signal of 2500 psig is higher than the 1RC-1 OPEN setpoint of 2205 psig.

   b. The operators still have the capability to manually close 1RC-1.

4. PZR PORV, 1RC-66 will open.

   a. The RCS pressure signal of 2500 psig is higher than the 1RC-66 “High” (open) setpoint of 2450 psig.

   b. The 1RC-66 “Low” (open) setpoint of 475 psig receives a signal from the low range cooldown RC pressure transmitter.

5. Flow will be indicated for 1RC-66 on the Pressurizer Relief Valve Flow Monitor.

   a. A peizo-electric transducer mounted on the PORV tailpipe converts flow induced vibration into a flow signal.

   b. When indicated PZR relief valve flow exceeds 25%, Statalarm 1SA-18/A1, PRESSURIZER RELIEF VALVE FLOW, actuates.

6. NR RCS pressure chart recorder fails high and Statalarm 1SA-2/D3, RC PRESS HIGH/LOW actuates. The chart recorder and the Statalarm receive input from the selected RCS pressure signal.

7. Actual RCS pressure decreases.

   a. PZR spray is quenching the PZR steam bubble, but primarily the RCS pressure decrease is due to an open flowpath from the PZR PORV to the quench tank.

   b. The PZR heaters are unable to automatically respond as they are de-energized by the failed high RCS pressure signal. Remember, the PZR Water Space Saturation Recovery Circuit will still provide a control signal for PZR Heater Bank #2.

   c. RCS pressure >2250 psig inputs to ICS to:

      1) Increase turbine demand, increase steam flow

      2) Increase FDW demand, increase FDW flow

      3) Decrease reactor demand, decrease reactor power

      4) Actions to mitigate (prevent reactor trip on variable low RCS pressure trip) require manual operation of the ICS. A reactor trip will occur in ≈ 27 seconds if no operator action is taken.

   d. The volume of water in the quench tank will quench the steam being relieved from the PZR until it reaches saturation temperature. At that time the quench tank pressure will increase until the rupture disk bursting pressure of 55 psig is exceeded.

   e. At 1600 psig decreasing, ES channels 1 and 2 will actuate.

8. Feedwater flow will be maximized and the standby CBP <u>may</u> start on Low FWPT suction pressure while control rods continuously insert.

   a. Unit reverts to “Track” from a large negative neutron error (reactor crosslimit) and also a large FDW flow error (Flow < Demand by 5%).

   b. The Main Turbine Control Valves open fully to reduce THP

   c. Unit tracks CTP Best which is predominantly FDW flow @ 100% but CTPD set is limited to 101% even though Thermal Power Secondary power indicates ~110% as FDW Flow is inputting to Thermal Power Secondary.

F. Operator actions for the failure of the controlling RCS pressure signal.

1. The operators must first analyze plant indications to determine that a failure of the controlling RCS signal has occurred.

   a. As previously described, the immediate plant response would indicate that an RCS high pressure event has occurred, i.e., high RCS pressure on the narrow range chart recorder, high RCS pressure Statalarm, PORV open, etc.

   b. However, by observing independent and diverse indications, the operators will be able to deduce that the plant is responding to a failed signal, not an <u>actual</u> plant event.

   c. Examples of independent and diverse indications include:

      1) Reactor Protective System. An <u>actual</u> RCS high pressure condition would result in an RPS high pressure trip (2345 psig). With this particular instrument failure, only RPS channel 'A' will indicate tripped.

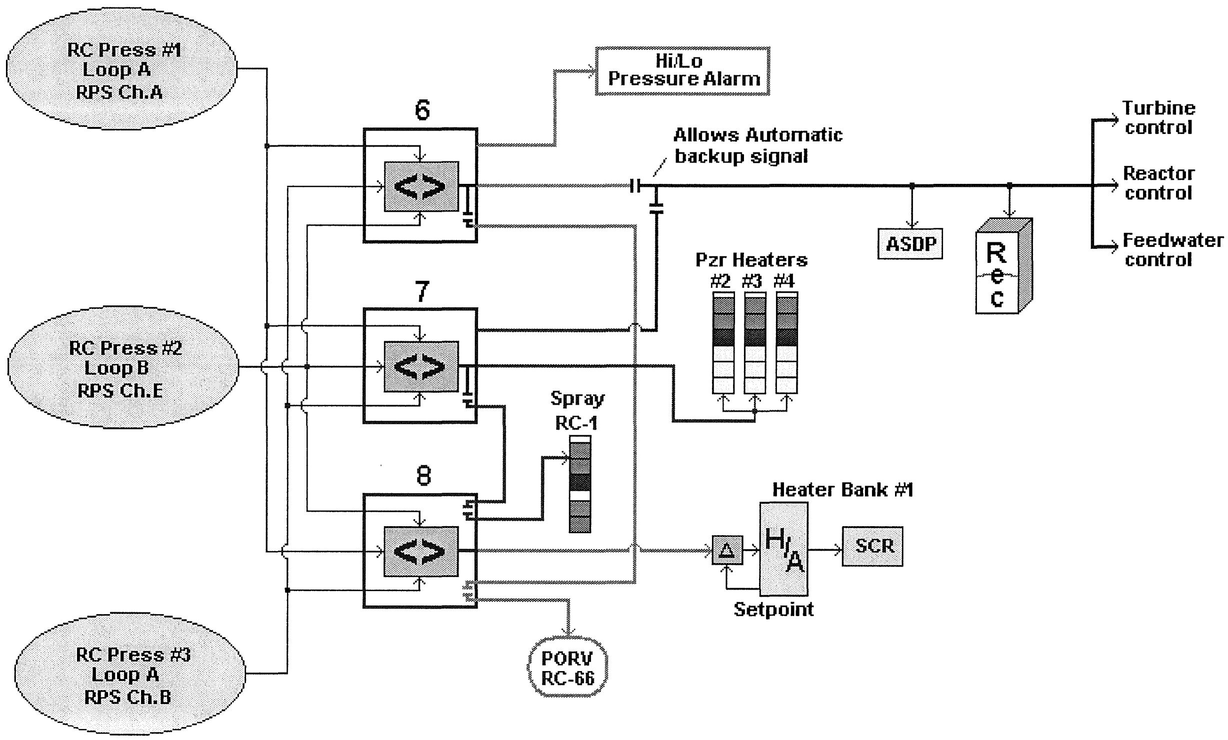
      2) Reactor Power and/or RCS Temperature. A rapid increase in RCS pressure would normally be accompanied by an increase in reactor power or RCS temperature. With the instrument failure, power may increase, but it is due to increasing FDW flow and reduced Tave.

      3) Diverse Scram System. (An actual RCS high pressure condition would result in actuation of DSS at 2450 psig ,1SA-8/C9, C10)

   d. Wide Range RCS Pressure Indication – Wide range RCS pressure indication would increase in response to an <u>actual</u> high RCS pressure condition. With the PZR spray valve and the PORV open, wide range RCS pressure will actually be decreasing for this event.

   e. Pressurizer Level – In addition to reactor power and RCS temperature, a rapid increase in RCS pressure would normally be accompanied by increasing PZR level.

9.2 RCS Pressure Loop Drawing



10.0 QUESTIONS/DISCUSSION ITEMS

10.1 Ensure the terminal, enabling, and applicable generic objectives have been covered, are discussed, and understood.

10.2 Ensure Tech Spec/SLC items are correctly identified and/or discussed.

A. Although no Tech Spec ACTION will be taken, Tech Spec 3.3.1, RPS Instrumentation should be referred to, to ensure the required number of operable channels is met.

10.3 Question(s):

A. What Tech Spec RPS trip signals are affected by the RCS NR pressure failure?

1. Answer: RCS High Pressure, Low Pressure, and Variable Low Pressure

1 POINT

Question 3

Plant initial conditions:

- Both Keowee Units generating to the grid at ≈ 60 MWs
- ACB-4 closed

Current conditions:

- A LBLOCA occurs on Oconee Unit 2
- Keowee Unit #2 emergency locks out
- The Keowee main transformer locks out

Within thirty (30) seconds of the current conditions, which ONE of the following Keowee breaker combinations should exist?

A. ACB-1 open and ACB-2 closed

B. ACB-1 closed and ACB-3 closed

C. ACB-3 open and ACB-4 closed

D. ACB-3 closed and ACB-4 open

Question 3
T1/G1-kds

011EA1.06, Large Break LOCA / 3 **Ability to operate and monitor the following as they apply to a Large Break LOCA: D/Gs** (4.2/4.2)

K/A MATCH ANALYSIS
Question required knowledge of the Keowee's (ONS's emergency power source) response following a Large Break LOCA.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect - ACB-2 can't close KU2 locked out

B. Incorrect - ACB-1 won't close because Keowee Main Xfmer LO signal.

C. Incorrect - KU2 Emergency Locked out

D. Correct – ACB-3 closes 8.5 sec after the Emergency start signal if ACB-4 opens due to Emergency Lock Out and the Keowee Main Xfmer is Locked out. (Zone overlap Protection)

Technical Reference(s): **EL-KHG**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EL-KHG R11**

Question Source: **Mods028**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

1. Demonstrate an understanding of the basic operation of the Keowee Hydro units during both normal and emergency operation. (T1)

2. Assess the operation of the Keowee Hydro units during normal and emergency operations. (T2)

ENABLING OBJECTIVES

1. State the purpose of the Keowee Hydro Generators. (R1)

2. Explain the basic operation of the Keowee Waterwheel Turbine. (R2)

3. Describe the basic operation of the Keowee CO2 Fire Protection System. (R3)

4. Given a set of conditions, determine when the Keowee CO2 Fire Protection System will automatically actuate and when manual operation is required. (R17)

5. Describe the purpose and function of Oconee control board switches associated with Keowee Hydro unit. (R7)

6. Determine the response of the Keowee Hydro Units from operation of the KHU switches located in the ONS control room. (R19)

7. Describe the purpose and function of all panel board indications in the control room associated with Keowee Hydro Generators. (R8)

8. Given indications from available ONS control room instrumentation, assess the status of the KHUs. (R20)

9. Determine the sequencing of actions required to regain normal control of the Keowee Hydro unit following an emergency start signal. (R9)

10. Verify proper operation of ACB 1-4 during all modes of operation. (R11)

11. Evaluate the intent of any given limits and precautions associated with OP/0/A/1106/19, Keowee Hydro at Oconee. (R12)

12. For an emergency lockout (ELO) or normal lockout (NLO) of a KHU: (R10)

    12.1Describe automatic actions that occur.

    12.2Determine events that that will cause an ELO or NLO.

16. Output Breakers **(OBJ.R11)**

a) ACB #3 and #4

1) Trip Open

(a) Emergency Lockout

(b) CT-4 Lockout

(c) Underground feeder Lockout

(d) Manually

(e) Unit is generating to the grid and an emergency start signal is received

2) Close - Note that frequency must be ≤ 66 cycles to close.

(a) Manually

(b) ACB #3 and #4 are interlocked so that both can not be closed at the same time

(c) Automatically when ≤ 66 cycles with an Emergency start

(d) Actuation of the Zone Overlap Protection Circuitry

(1) This circuitry ensures there is an onsite emergency power supply available.

(2) An automatic closure of the underground breaker (ACB 3/4) on the designated overhead unit will occur if all of the following are true.

(i) An Emergency Start Signal is present and the 8.5 second timer associated with PCB-9 has timed out.

(ii) The Keowee Main Transformer has locked out.

(iii) The designated underground unit has emergency locked out (ELO).

b) ACB #1 and #2

1) Trip Open

(a) Emergency Lockout

(b) Normal Lockout, except during an Emergency Start

(c) Main Step-up Transformer Lockout

(d) Emergency Startup

MODS028

Plant conditions:

INITIAL CONDITIONS:

- Both Keowee Units generating to the grid at ≈ 60 MWs
- Keowee Unit 2 is aligned to the Underground (CT-4)

CURRENT CONDITIONS:

- A SBLOCA occurs on Unit 2
- When ES channels 1&2 actuate
  - ➢ Keowee Unit #2 emergency locks out
  - ➢ The Keowee main transformer locks out

Within thirty (30) seconds of these actions, which ONE of the following Keowee breaker combinations should exist? (.25)

A. ACB-1 open and ACB-2 closed

B. ACB-1 closed and ACB-3 closed

C. ACB-3 open and ACB-4 closed

D. ACB-3 closed and ACB-4 open

D

A. Incorrect - ACB-2 can't close KU2 locked out

B. Incorrect - ACB-1 won't close because Keowee Main Xfmer LO signal.

C. Incorrect - KU2 Emergency Locked out

D. Correct - ACB-3 closes 8.5 sec after the Emerg start signal if ACB-4 opens due to Emerg LO and the Keowee Main Xfmer is Locked out.

1 POINT

Question 4

Unit 1 plant conditions:

Reactor power:
- NI 5 = 68%
- NI 6 = 69%
- NI 7 = 72%
- NI 8 = 71%
- NI 9 = 69%

Statalarms actuated:
- 1SA-9/D2 (RCP VIBRATION HIGH)
- 1SA-9/E2 (RC PUMP VIBRATION EMERGENCY HIGH)
- 1SA-6/E-6 (RC PUMP 1B1 SEAL RETURN TEMP HIGH)

1B1 RCP parameters:
- SEAL RETURN FLOW
  - ➢ 1.7 gpm
- HIGHEST VIBRATIONS
  - ➢ Motor Stand = 5.2 mils steady
  - ➢ Spool piece = 15.6 mils steady
  - ➢ Upper bearing = 16.3 mils steady
- SEAL RETURN TEMPERATURE
  - ➢ 204°F increasing

Based on the above conditions, which ONE of the following operator actions is required and why?

A. Trip the reactor, and then trip 1B1 RCP due to high seal return temperature.

B. Trip the 1B1 RCP due to high sustained vibration, the reactor is not required to be tripped.

C. Trip the 1B1 RCP due to high seal return temperature, the reactor is not required to be tripped.

D. Trip the reactor, and then trip 1B1 RCP due to high sustained vibration

Question 4
T1/G1 - kds

015AG2.4.31, RCP Malfunctions / 4 **Knowledge of annunciators alarms and indications, and use of the response instructions.** (3.3/3.4)

K/A MATCH ANALYSIS
Determine from the Alarm Response Guide that RCP Immediate Trip Criteria is met which directs securing of the RCP per AP16 (Abnormal RCP Ops)

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect - With the current conditions, seal return temperature does not warrant an immediate RCP trip. RCP Immediate trip criteria is 260ºF for seal return temperature. Plausible because > 190 ºF is immediate trip criteria for Thrust Bearing Temperature.

B. Incorrect - RCP Immediate trip criteria is met per the ARG however, AP-16 states that with any NI > 70%, the reactor is tripped first.

C. Incorrect - With the current conditions, seal return temperature does not warrant an immediate RCP trip. RCP Immediate trip criteria is 260ºF for seal return temperature. Also, per AP16, the Reactor is required to be tripped first. Plausible because > 190 ºF is immediate trip criteria for Thrust Bearing Temperature

D. Correct –With the current plant conditions, the 2B1 RCP meets immediate trip criteria of the Alarm Response Guide: 2SA9/E2: RC PUMP VIBRATION EMERGENCY HIGH (RCPM Motor Stand ≥ 5 mils). AP-16 (Abnormal Reactor Coolant Pump Operation) Step 4.1 "IAAT any RCP meets immediate trip criteria of Encl 5.1 THEN perform steps 4.2-4.6 step 4.2 "Verify Rx power is ≤ 70% on all NIs. RNO Trip Rx, Stop affected RCP, Exit this procedure" Median Selected NI power = 69% which adds plausibility to criteria for NOT tripping the Rx

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Technical Reference(s): **2AP/16 (Abnormal RCP Operation) Step 4.1-4.2**
2SA9/E2 RC PUMP VIBRATION EMERGENCY HIGH

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP APG R7, R9**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

4. Subsequent Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1 __ **IAAT** <u>any</u> RCP meets immediate trip criteria of Encl 5.1 (RCP Immediate Trip Criteria), **THEN** perform Steps 4.2 - 4.6.	__ **GO TO** Step 4.7.
4.2 __ Verify Rx power is ≤ 70% as indicated on <u>all</u> NIs.	1.__ Trip Rx. 2.__ Stop affected RCP. 3.__ **EXIT** this procedure.
4.3 __ Verify four RCPs operating.	1.__ Trip Rx. 2.__ Stop affected RCP. 3.__ **EXIT** this procedure.
4.4 __ Stop affected RCP.	
4.5 __ Verify ICS re-ratios feedwater to establish ≈ 0° ΔT_c.	1.__ Place DELTA T_c station in HAND. 2.__ Manually adjust DELTA T_c station to achieve ≈ 0° ΔT_c. **<u>CAUTION</u>** <u>Total</u> feedwater flow should be maintained constant to prevent changes in core reactivity. 3.__ **IF** DELTA T_c station does **NOT** control, **THEN** perform the following: A. Place the following in HAND: __ 2A FDW MASTER __ 2B FDW MASTER B. __ Manually adjust FDW masters to achieve ≈ 0° ΔT_c. 4.__ Initiate AP/28 (ICS Instrument Failure).
4.6 __ Initiate Encl 4.3 (Special Instructions for < 4 RCP Operation) of OP/2/A/1102/004 (Operation at Power).	
4.7 __ Notify OSM to request evaluation by RCP Component Engineer.	

E-2

RC

PUMP VIBRATION EMERGENCY HIGH

NOTE: This alarm will reflash.

1. Alarm Setpoint

Parameter	2A1 RCP		2B1 RCP		2A2 RCP		2B2 RCP	
RCPM Upper Bearing Displacement (MOX)	20 mils	A2136	20 mils	A2154	20 mils	A2145	20 mils	A2163
RCPM Upper Bearing Displacement (MOY)	20 mils	A2137	20 mils	A2155	20 mils	A2146	20 mils	A2164
RCPM Motor Coupling Displacement (MIX)	20 mils	A2138	20 mils	A2156	20 mils	A2147	20 mils	A2165
RCPM Motor Coupling Displacement (MIY)	20 mils	A2139	20 mils	A2157	20 mils	A2148	20 mils	A2166
RCP Spool Piece Displacement (IPX)	20 mils	A2140	20 mils	A2158	20 mils	A2149	20 mils	A2167
RCP Spool Piece Displacement (IPY)	20 mils	A2141	20 mils	A2159	20 mils	A2150	20 mils	A2168
RCPM Motor Stand Velocity Probe (MIZX)	5 mils .310 in/sec	A2142	5 mils .310 in/sec	A2160	5 mils .310 in/sec	A2151	5 mils .310 in/sec	A2169
RCPM Motor Stand Velocity Probe (MIZY)	5 mils .310 in/sec	A2143	5 mils .310 in/sec	A2161	5 mils .310 in/sec	A2152	5 mils .310 in/sec	A2170

2. Automatic Action

None

3. Manual Action

3.1 Use one of the following means to verify RCP vibration Conditions:

3.1.1 Verify condition on RCP OAC Display Group RCP.

3.1.2 Verify condition on RCP by referring to OP/0/A/1103/007 (RCP Machine View Monitor Operation).

3.2 **IF** RCP vibration is verified per step 3.1, secure the RCP per AP/2/A/1700/016 (Abnormal RCP Operation).

3.3 Contact PM2 Group for analysis of RCP parameters.

3.4 Monitor RCS Flow for flow degradation (Digital Trend and Transient Monitor, if available).

3.5 Perform the following:

- Type ITC on an OAC Screen, this will display an Incore Thermocouple Map. Print the Map (F2).
- Analyze the Map for indications of RCS flow blockage (i.e., any Incore TC > ≈ 630°F.
- **IF** Incore TC > 630°F, contact Reactor Engineering.

3.6 Perform the following:

3.6.1 Check Computer Parameter Display Group and Control Room Indications for RCP operational information:

A. MWe usage

B. Motor Bearing Temps.

C. Seal Supply Flow and Temperature

D. Seal Return Flow and Temperature

3.6.2 Initiate corrective actions for any of the above that are **NOT** in normal range.

3.7 Contact Reactor Engineering and Primary Systems Engineering Groups **IF** any RCS Flow changes are observed.

4. Alarm Sources and Referneces

4.1 Two (2) velocity sensors on each RCP motor stand

4.2 Seven (7) Proximity Probes on each RCP pump shaft

4.3 One (1) Phase Reference Probe on each RCP

4.4 OP/2/A/1103/006 (RCP Operation)

1 POINT

Question 5

Unit 1 initial conditions:

- Reactor Power = 90%
- 1HP-120 failed CLOSED
- AP/14 (Loss of Normal HPI Makeup and/or RCP Seal Injection) has been entered

Current conditions:

- The operator determines that 1HP-26 fails to operate from the control room.

Which ONE of the following actions is directed by AP/14 for the current plant conditions?

A. Dispatch an operator to manually throttle 1HP-26 (1A HP INJECTION)

B. Dispatch an operator to throttle 1HP-122 (RC VOLUME CONTROL BYPASS)

C. Throttle 1HP-410 (1HP-26 BYPASS)

D. Close 1HP-5 (Letdown Isolation)

Question 5
T1/G1-kds

022AG2.1.30, Loss of Reactor Coolant Makeup / 2
Ability to locate and operate components, including local controls. (3.9/3.4)

K/A MATCH ANALYSIS
Relates a failure of 1HP-120 (Loss of M/U) which requires entry into the abnormal procedure. Upon subsequent failure of 1HP-26, the AP directs operation of the local makeup bypass valve.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect – AP-14 does not mention manual operation of 1HP-26. Plausible because manual operation of 1HP-26 would provide makeup. AP/32 (Loss of Letdown) does required manual operation of 1HP-5.

B. Correct – Step in AP-14 directs the following: Perform the following as necessary to maintain Pzr level > 200": Close 1HP-6 / Throttle 1HP-7 /Throttle 1HP-26. The RNO for this step: IF makeup is necessary AND 1HP-26 fails to open, THEN dispatch an operator to throttle 1HP-122 (RC VOLUME CONTROL BYPASS)

C. Incorrect - AP-14 does not mention manual operation of 1HP-410. Plausible because manual operation of 1HP-410 would provide makeup.

D. Incorrect, AP/14 directs reduction of letdown flow by closing 1HP-6 and throttling 1HP-7. 1HP-5 would be closed if NO HPI pumps were operating.

Technical Reference(s): **AP/14, Loss of Normal HPI Makeup and/or RCP Seal Injection**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-APG R9**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.183 Perform the following as necessary to maintain Pzr level > 200″: __ Close 1HP-6. __ Throttle 1HP-7. __ Throttle 1HP-26.	__ **IF** makeup is necessary, **AND** 1HP-26 fails to open, **THEN** dispatch an operator to throttle 1HP-122 (RC VOLUME CONTROL BYPASS) (Unit 1 Pen Rm, SW of 1HP-120).
4.184 __ Place 1HP-120 in HAND and close.	
4.185 __ Notify SPOC to investigate and repair 1HP-120.	
4.186 __ **WHEN** 1HP-120 is repaired, **THEN** slowly re-establish flow through 1HP-120.	
4.187 __ Place 1HP-120 in AUTO.	
4.188 __ Close 1HP-26.	
4.189 __ Verify 1HP-122 (RC VOLUME CONTROL BYPASS) throttled.	__ **GO TO** Step 4.191.
4.190 __ Dispatch an operator to close 1HP-122 (RC VOLUME CONTROL BYPASS) (Unit 1 Pen Rm, SW of 1HP-120).	
4.191 __ Open 1HP-5.	
4.192 __ Throttle open 1HP-7 for ≈ 20 gpm letdown flow.	
4.193 __ Open 1HP-6.	
4.194 __ Adjust 1HP-7 for desired letdown flow.	
4.195 __ **WHEN** conditions permit, **THEN EXIT** this procedure.	

• • • END • • •

G. Locate and identify the answers to specific questions on applicable limits, cautions, notes, etc., within the procedures

3.5 In addition, become familiar with the content of each so as to be able to answer questions relating to general systems alignments, available operator controls and instrumentation, and the bases for specific actions.

4. Given a copy of AP/*/A/1700/05, 06, 08, 10, 11, 13, 14, 16, 19, 22, 23, 24, 25, 27, 31, and 2000/02, walkthrough steps, locate equipment, instrumentation and controls outside the Control Room referred to in the AP. Especially address those devices, which require manual operation. (R5)

5. Explain the basis for limits, cautions, notes and major steps in the AP. (R6)

6. Given a set of parameters, determine if immediate Rx trip criteria is met for applicable AP's and OMP guidance. (R7)

7. Discuss major mitigation strategy associated with each AP. (R8)

8. Without the use of reference, when an AP is required to be utilized by the operator be able to demonstrate the following: (R9)

   8.1 State the Entry Conditions and Immediate Manual Actions in the AP.

   8.2 Explain the basis for limits, cautions, notes and major steps in the AP.

   8.3 Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.

   8.4 Utilizing available operator controls and instrumentation both inside and outside the control room interpret the indications and take proper actions per the AP that should mitigate the abnormal condition.

   8.5 Provide proper directions to operators and supporting groups performing actions of the AP outside the control room.

1 POINT

Question 6

Unit 1 initial conditions:

- The plant tripped from 100% power due to a trip of all RCPs
- Operators subsequently began a cooldown
- LPI high pressure mode was aligned

Current conditions:

- All LPI pumps have lost power
- Operators have entered AP/26 (Loss of Decay Heat Removal), Section 4A (RCS Intact and RC Loops Full)
- RCS Temperature = 250ºF and increasing
- RCS Pressure = 295 psig and increasing
- Condenser is still available

Which ONE of the following correctly describes the required position of 1LP-3 (LPI HOTLEG SUCTION) and the path for steam generator feedwater supply based on the given plant conditions?

A. The 1LP-3 is required to be closed.
SGs shall be fed via MFW nozzles

B. The 1LP-3 is required to be closed.
SGs shall be fed via AFW nozzles

C. The 1LP-3 is NOT required to be closed.
SGs shall be fed via MFW nozzles.

D. The 1LP-3 is NOT required to be closed.
SGs shall be fed via AFW nozzles.

Question 6
T1/G1 - gcw

025AK1.01, Loss of RHR System / 4
Knowledge of the operational implications of the following concepts as they apply to Loss of Residual Heat Removal System: Loss of RHRS during all modes of operation (3.9/4.3)

K/A MATCH ANALYSIS
Knowledge of AP/26 (Loss of Decay Heat Removal) for the case of loss of suction to the LPI pumps is required for this question.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect. RCPs must be operating to feed via MFW nozzles. Plausible because SGs are required to be fed.

B. Correct. 1LP-3 is required to be closed based on Section 4A, Step 5. Based on RCPs not running, the AFW nozzles must be used.

C. Incorrect. RCPs must be operating to feed via MFW nozzles. Plausible because SGs are required to be fed. Also plausible because applicant may not know the closure requirements for 1LP-3.

D. Incorrect, 1LP-3 is required to be closed based on Section 4A, Step 5. Plausible because applicant may not know the closure requirements for 1LP-3.

Technical Reference(s): **AP/26, Loss of Decay Heat Removal**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **TA-DHR R16**

Question Source: **Bank**, **2006 ONS RO NRC Exam**

Question History: Last NRC Exam: **2006 ONS RO NRC Exam**

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. __Initiate Encl 5.21 (RCS Temperature and Pressure Indications).	
2. **GO TO** the appropriate Step based on reason for the loss of DHR:	

☑	Condition	Step
	Loss of Power	3
	Loss of LPI Pumps **OR** LPI flow	37
	LPSW Malfunction	127
	Loss of RC Inventory	170

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3. __Initiate EOP Encl 5.38 (Restoration of Power).	
4. __**IAAT** power is restored, **THEN GO TO** Step 12.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE
Closing 1LP-3 isolates the DHR drop line to prevent over pressurization of the LPI system.

5. __ **IAAT** the RCS approaches any of the following limits based on the LPI DHR alignment:

✓	Normal	High Pressure, Series, or Switchover
	246°F	246°F
	125 psig	295 psig

THEN dispatch an operator to close 1LP-3 (LPI HOTLEG SUCTION) (A-4/W-70A, West Pen Rm, 8' N, 3' off floor). {3}

6. __ Place 1HP-31 in HAND and reduce demand to 0.

7. Trip LPI pump breakers using CR switches:

   __ 1A LPI Pump

   __ 1B LPI Pump

   __ 1C LPI Pump

8. __ Initiate Encl 5.9 (DHR Using SGs) to feed and steam SGs.

CAUTION
Reactor Vessel integrity could be challenged if RCS pressure is allowed to exceed the NDT limit in the Unit 1 RCS Heatup/Cooldown Curves enclosure of OP/0/A/1108/001 (Curves and General Information).

9. __ Cycle PORV as necessary to keep RCS pressure < NDT limit.

1 POINT

Question 7

Unit 1 plant conditions:
- Reactor power = 100%
- Inadvertent ES channel 6 actuation occurs

Which ONE of the following will occur as a result of the above conditions and why?

A. LPSW cooling to two RCPs is isolated to prevent condensation in the windings of any non-operating RCP.

B. 1A, 1B and 1C RBCUs will start/switch to low speed in preparation for operation in a high density environment.

C. Letdown will isolate to prevent reaching the letdown high temperature interlock.

D. The operating CC pump will stop to prevent deadheading the pump.

Question 7
T1/G1 - kds

026AK3.02, Loss of Component Cooling Water / 8
Knowledge of the reasons for the following responses as they apply to the Loss of Component Cooling Water: The automatic actions (alignments) within the CCWS resulting from the actuation of the ESFAS (3.6/3.9)

K/A MATCH ANALYSIS
Automatic actions for the CC system on ES signal (inadvertent ES in this instance) is CC-8 closing witch results in the running CC pump tripping off.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: Either ES Channel 5 or 6 will isolate LPSW to all RCPs. Plausible because in the EOP, LPSW is isolated to non operating RCPs to prevent condensation buildup.

B. Incorrect. 1A RBCU receives its signal from ES Ch 5. Plausible because the RBCUs receive the signal to start in low speed for the stated reason.

C. Incorrect. Letdown will isolate because of the high temperature interlock, not to prevent it. Plausible because letdown will isolate upon losing CC on high temp and will isolate due to ES Ch 1 or 2.

D. Correct. Upon receiving an ES Ch 6 signal, 1CC8 will receive a closed signal. When CC8 closes, the operating CC pump will stop to prevent it from running at shutoff head.

Technical Reference(s): **PNS-CC page 19 of 26**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-CC R13**

Question Source: **Modified PNS 659**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

2.7 Procedural Limits and Precautions:

A. Caution must be exercised to prevent repositioning of any component flow control valve from the balanced flow position. Any change in position of any flow control valve(s) will alter the flow balance through all other parallel flow paths.

B. Component cooling system temperatures and affected equipment (RCPs, letdown temperature, quench tank temperature, and CRD temperatures) must be monitored closely when removing or placing component coolers in service. Any change in the system will alter the flow balance and may result in temperature changes. Caution must be exercised to ensure operational limits are not exceeded.

C. **(OBJ R16)** The component cooling system must be in operation for any of the following conditions:

1. Control rod drives energized. There is an interlock to prevent the CRDs from being energized without component cooling water, but will not de-energize the drive upon loss of cooling water.
   - Prevents thermal damage to the CRD stators

Instructor note:

This interlock can be overridden by pressing green "CC Interlock button" located in System Logic Cabinet No. 3 in the cable room to allow I&E testing of CRDs during unit outage.

2. Prior to operating any RC Pump.
   - RCP starting interlock which ensures that the seal coolers are operational prior to pump start.
3. Prior to establishing RC letdown flow if RC temperature is above 120°F.
   - Prevent isolation of letdown on high temperature interlock.
4. When RC temperature is greater than 190° F.
   - Prevents thermal damage to the CRD stators

D. Component cooling contains a corrosion inhibitor. Avoid getting CC water on skin and particularly in the eyes by utilizing proper safety equipment.

E. If CC-7 or CC-8 goes closed, then both A and B CC pumps will trip. CC pumps cannot be restarted if either CC-7 or CC-8 is in the full closed position.

10. Describe the sequence and precautions necessary while valving in the spare CC cooler. (R10)

11. Explain the reason for draining the CRD service structure prior to pulling the reactor vessel head prior to refueling. (R11)

12. Describe the method of draining the CRD service structure. (R12)

13. Explain how CC-8 failing closed at power affects plant operation. (R13)

14. Describe briefly the steps involved in reopening CC-8 after the valve has failed closed because of a loss of Instrument Air. (R14)

15. Describe the six (6) interlocks and/or automatic actions associated with the CC System. (R15)

16. Explain why the CC System must be in operation: (R16)

    16.1 Before letdown is established if RCS temperature is > 120° F

    16.2 If RCS temperature is > 190° F

17. Given a set of plant conditions, diagnose the cause of a CC System problem and/or determine the required corrective action. (R17)

18. Evaluate the overall affect on other plant systems based on the normal and/or abnormal operation of the CC system. (R18, R19)

19. When AP/1700/20, Loss of CC, is required to be utilized by the operator be able to demonstrate the following: (R20)

    - State the Entry Conditions, Immediate Manual Actions, and Contingency Actions in the AP.
    - Explain the basis for limits, cautions, notes and major steps in the AP
    - Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.
    - Describe general system alignments, available operator controls and instrumentation both inside and outside the control room.
    - Provide proper directions to operators and supporting groups performing actions of the AP outside the control room.

20. Given a copy of TS/SLCs, analyze a given set of conditions for applicable TS/SLC LCOs. (R21)

21. Apply all TS/SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R22)

22. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS/SLCs. (R23)

PNS659

The following conditions exist on Unit 1:

MODE 1 at 100%
Inadvertent ES channel 6 actuation has occurred

Assuming Rx does NOT trip and no operator actions are taken, which ONE of the following will occur over the next 5 minutes. (.25)

A) CC CRD Return Flow Low Statalarm will be actuated.

B) Standby CC Pump will be running.

C) Letdown flow will increase.

D) Makeup flow will increase.

A
A. Correct. Both CC Pumps trip on CC-8 closing.
B. Incorrect. Both CC Pumps have tripped.
C. Incorrect. HP-5 will be closed due to high Letdown temp, Letdown flow will decrease.
D. Incorrect. With HP-5 closed, Pzr level will be increasing due to Seal Injection flow.

1 POINT

Question 8

Unit 1 initial conditions:

- Reactor power = 100%

Current conditions:

- 1RC-1 (PZR Spray) and 1RC-3 (PZR Spray Block) fail OPEN

Based on the above conditions, which ONE of the following describes the expected plant response and how RCS pressure will be ultimately controlled?

A. The reactor will NOT trip and the PZR heaters will cycle to control RCS pressure.

B. The reactor will NOT trip and PZR level will be increased to control RCS pressure.

C. The reactor will trip and ES Channels 1 and 2 will actuate. EOP Rule 6 (HPI) will be used to throttle HPI to control RCS pressure with a solid PZR.

D. The reactor will trip and ES Channels 1 and 2 will actuate. EOP Rule 6 (HPI) will be used to control PZR level < 400 inches.

Question 8
T1/G1 – gcw New KA

027AK3.03, Pressurizer Pressure Control System Malfunction / 3
Knowledge of the reasons for the following responses as they apply to the Pressurizer Pressure Control Malfunctions: Actions contained in EOP for PZR PCS malfunction (3.7/4.1)

K/A MATCH ANALYSIS
Question requires knowledge of how the EOP will mitigate a failed open PZR spray valve.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect, PZR heaters cannot overcome PZR spray and the reactor will trip.

B. Incorrect, PZR heaters cannot overcome PZR spray and the reactor will trip. Increasing PZR level could be used to increase or slow the decrease in RCS pressure.

C. Correct, the reactor will trip and ES Channels 1 and 2 will actuate. EOP Rule 6 (HPI) will be used to throttle HPI to control RCS pressure.

D. Incorrect, first part is correct. EOP Rule 6 will not be used to maintain PZR level < 400 inches. RCS will become solid and HPI will be throttled to control pressure.

Technical Reference(s): **PNS-PZR page 14-16**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-PZR R20**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

1. Upon completion of this lesson, the student will demonstrate an understanding of the components, indications, controls and operation of the Pressurizer. The student will be able to assess the status of the Pressurizer during normal, abnormal and emergency conditions and determine corrective actions for improper system operation. The student will also be able to apply any ITS/SLC Conditions and Required Actions associated with the Pressurizer (T1).

ENABLING OBJECTIVES

1. Explain the design basis of the pressurizer. (R21)
2. Describe pressurizer response during load or RCS temperature changes. (R1)(R2)(R3)
3. Given a set of conditions, calculate the change in pressurizer level for a change in RCS temperature. (R33)
4. Explain what is meant by a "subcooled" pressurizer and how to determine if the pressurizer is in a subcooled condition.(R22)(R27)
5. Explain what is meant by a pressurizer "hard bubble" and describe the adverse effects of a "hard bubble" on plant operation, (R23)
6. Identify the source of pressurizer spray for each unit. (R4)
7. Discuss the automatic setpoints and any interlocks associated with pressurizer instrumentation. (R5)
8. Explain the operation of the ICS RC pressure signal median select function as it relates to RC pressure control including: (R28)
   - 8.1 How median select chooses the controlling signal
   - 8.2 Which pressurizer components receive a median selected RC pressure signal
9. Given a set of conditions, determine which RC pressure signal has been selected for control by the ICS RC pressure signal median select function. (R36)
10. Discuss the reasons for bypass flow around the pressurizer spray valve during normal operation. (R6)
11. Evaluate plant response to a failed open pressurizer spray valve without operator action. (R20)

4. AC motor operated valve, **RC-3**, is used in series with the Spray valve for remote spray line isolation. This **is a throttle valve**, so the switch must be held depressed for full valve travel, and should be held for ~5 seconds after closed indication is received to ensure the valve is fully closed.

5. **(OBJ.R6) RC-2**, (Spray Control Bypass), continuously circulates reactor coolant through the spray loop bypassing RC-1. Since the Pzr is a remotely located component connected to a hot leg, this bypass flow minimizes temperature differentials in the spray and surge lines, prevents thermal shock of the spray nozzle, and minimizes the boron concentration difference between the Pzr and RCS.

6. **(OBJ.R20)**The heat removal capability of Pzr spray exceeds the heat-input capability of the heaters. If the spray valve were to fail open and no operator action was taken, RCS pressure would slowly decrease, the reactor would trip and eventually automatic engineered safeguards actuation would occur due to continually decreasing RCS pressure.

   a) In December 1991, Crystal River Unit 3 and experienced a reactor trip **and** ECCS actuation due to low RCS pressure. In Dec. 2001, Salem Unit 2 experienced the same type of event.

   b) The cause of these events was a failed open spray valve with a concurrent failure of the valve position indication/linkage.

7. Pzr spray is most effective if the RCP that supplies spray is operating. Pzr spray experiences a decrease in effectiveness if the RCP that supplies spray is secured.

   a) At a Combustion Engineering plant (Millstone 2), a transient initiated by the loss of a DC bus resulted in the plant being at hot shutdown with only two RCPs operating. The two RCPs that were operating provided no significant spray flow. The operators, however, did not associate the ineffectiveness of spray with an incorrect RCP combination, and incorrectly diagnosed that a "hard bubble" had resulted from collection of non-condensable gases.

   b) As a result, about 2 hours into the transient, RCS pressure had increased to the point where the PORV cycled to control pressure. Subsequently, it was recognized that inadequate spray flow was the cause and auxiliary spray was aligned to depressurize and control RCS pressure.

   c) From this we can see that without spray flow the Pzr behaves much like it would if it were filled with non-condensable gases. Prompt recognition of reduced spray flow due to ineffective RCP combinations can preclude challenging the PORV by either establishing the most effective RCP combination or initiating auxiliary spray.

Instructor Note: OE {3}

On December 31, 2001, a Pzr spray valve failed open at Salem Unit 2, resulting in an automatic reactor scram and a safety injection. Procedure weaknesses challenged the control room crew as it attempted to regain control of reactor coolant system pressure and terminate safety injection flow. Crew diagnostic and teamwork skills prevented the reactor coolant system from reaching a water-solid condition, which could have resulted in lifting the power-operated relief valves and a loss of reactor coolant inventory. The spray valve failed open when the valve positioner feedback linkage broke.

This event revealed weaknesses in the AP for a Pzr pressure control malfunction and, specifically, what reactor coolant pump configuration is needed to minimize flow through a stuck open spray valve. As the event progressed, the crew had to shut down three reactor coolant pumps before the reactor coolant system stopped depressurizing. (See PIP #02-706 for further details)

The Salem operators discovered that spray flow didn't just go away when the "spray" pump was secured. Although diminished, there was still enough spray flow from the other RCPs to decrease RCS pressure. Expected ONS spray flow for various pump combinations is shown in the table below.

Caution: These values are calculated or estimated, not measured.

ONS Spray Flow vs. RCP Combinations

RCP Combination U1-A/B, U2&3-B/A	% Spray Flow (Calculated or estimated)
2/2	100
2/1	91
2/0	78
1*/2	68 (est.)
1/2	65 (est.)
1*/1	43
1/1	39
1*/0	28
1/0	22
0/2	0
0/1	0

* indicates RCP in operation is the "Spray" pump (1A1, 2B1 or 3B1)

Source: Calculations of spray flows from FTI RCS flow modeling data from for 30 EFPY RV analysis.

The ARGs for 1SA2/*D3*, RC Pressure High/ Low, and 1SA2/*D4*, RC Pressure Emerg High, both contain guidance for verifying that the spray valve and/or the spray block valve is closed.

8. The spray flow provided by the reactor coolant pumps accomplishes reduction of pressure during a Reactor Coolant System cooldown.
9. Just prior to securing the last RCP, auxiliary spray is lined up to the Pzr. This alignment supplies a flowpath from the discharge of the HPIPs, to the Pzr spray line, to provide for further RCS pressure reduction.
   a) Auxiliary spray flow is controlled via HP-355, a pneumatic control valve located in the east penetration room.
   b) A controller for HP-355 is located on UB1 in the control room.
10. Below a system temperature of approximately 250°F, the LPI system is used for system heat removal and the steam generators and reactor coolant pumps are removed from service

B. **Pressurizer Heaters** (OP-PNS-PZR-7, 8, 9, 10)

1. **(OBJ.R7)** Heaters:
   a) replace heat lost during normal steady state operation
   b) raise the pressure to normal operating pressure during Reactor Coolant System heatup from the cooled down condition
   c) restore system pressure following transients.
2. Eleven Groups (A thru K) of electric heaters, divided into four banks (BANK 1, 2, 3, & 4), are assembled into three removable horizontal heater assemblies.
   a) ICS median selected narrow range (NR) RCS pressure signal controls these four banks of heaters.
3. Bank 1- (Group A; 126 kW) heaters utilizes SCR proportional control and will normally operate at an adjustable voltage capacity to replace heat lost, thus maintaining pressure at set point.
   a) Spray valve leakage, bypass flow, and insulation losses effect actual heating requirements
   b) Group K, part of Bank 2, stays on continuously (for bypass flow) and is generally associated with Bank 1 controls (ON/OFF Sw).
4. Banks 2, 3, and 4 – use Auto/On/Off control; Auto – cycles at setpoints
5. A recent analysis has determined that a minimum of ~400 kilowatts of heaters should be available from an emergency power source within two hours after loss of off-site power (LOOP) in order to establish and maintain natural circulation in MODE 3.

   Instructors Note: *During LOOP events, no Spray will be present therefore the heating requirements are reduced.*

1 POINT

Question 9

Unit 1 initial plant conditions:

- Time = 0900
- Reactor Power = 100%

Current plant conditions:

- Time = 0915
- Both Main FDW pumps trip
- Reactor Power = 47% and decreasing
- Rule 1 (ATWS) is in progress.
- RCS temperature = 585 °F and increasing
- EFDW flow has been throttled to each SGs at ~990 gpm per header.
- OTSGs indicate 12" XSUR and constant.

Based on the current plant conditions, which ONE of the following actions will occur if Stat Alarms 1SA1/E6 (CRD ELECTRONIC TRIP E) and 1SA1/E7 (CRD ELECTRONIC TRIP F) alarm?

ASSUME NO OPERATOR ACTION

A. Regulating Rods (GP 1-7) will trip and reduce Power Range NIs to below 1%

B. 1FDW-315/316 will automatically throttle closed as OTSG levels reach 30" XSUR

C. TBVs will throttle open to maintain THP pressure at the THP setpoint.

D. Main Turbine will trip to prevent overcooling of the RCS.

Question 9
T1/G1 - kds

029EK2.06, ATWS / 1
Knowledge of the interrelations between the and the following an ATWS: Breakers, relays, and disconnects (2.9*/3.1*)

K/A MATCH ANALYSIS
Tests knowledge of the interrelationship of the relationship of RPS breakers and the E&F relays (DSS Trip) to ICS & DSS components during an ATWS

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct: When electronic trip E&F (DSS) occur, CR gps 1-7 insert. In the old CRI system, contracts E&F would only cause CR groups 5-7 to trip.**

B. Incorrect: FDW 315 and 316 had to have been taken to manual to throttle to less than 1000 gpm per header. They are still in manual. Plausible because if they were in Auto, they would maintain at 30" XSUR.

C. Incorrect: TBVs will maintain at THP setpoint + 125 psi. Plausible because until the trip confirm signal is in, the TBVs will maintain at THP setpoint.

D. Incorrect: the turbine is already tripped. When the Main FDW pumps tripped, AMSAC tripped the Main Turbine.

Technical Reference(s): **IC-CRI**

Proposed references to be provided to applicants during examination: **None**

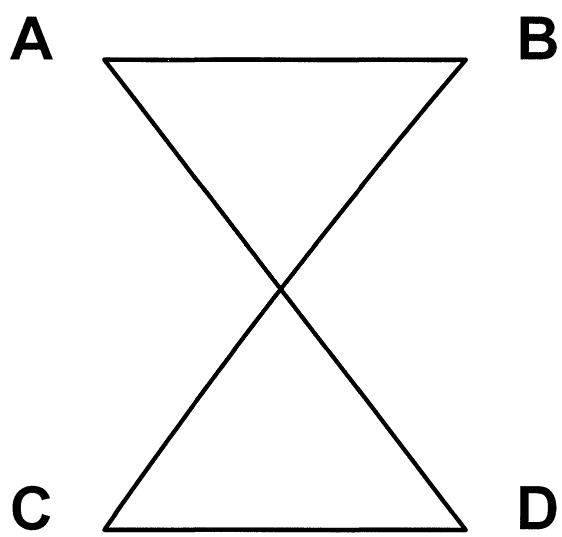
Learning Objective: **IC-CRI R26**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

2.6 **(Obj. R26)** Control Rod Trips



Breakers

A and ***B***

OR

A and ***D***

OR

B and ***C***

OR

C and ***D***

Electronic Trips

DSS 1 and 2

Actuates **BOTH**

'E' and 'F' Electronic Trips

De-energizing Groups 1-7

SCRs

A. Two series trip methods are provided for the removal of power from the CRD mechanisms.

1. First, a trip is initiated when Reactor Protective System logic interrupts power to the under voltage (UV) coil of the 4 main AC feeder breakers.
   a) The AC breakers are actuated also with a shunt trip device to ensure breaker operation by providing a diverse means of opening.
2. Secondly, a trip is initiated when the Silicon Control Rectifier gating power is interrupted by the DSS circuit.
3. As parallel power feeds are provided on **both** gating and 'SRPS' power. Interruption of both feeds is required for trip action to occur for either trip method.
4. Each undervoltage trip coil is operated from the Reactor Protective System. Breakers “A”, “B”, “C”, and "D" can be tripped by the Reactor Protection System (RPS) logic, Manual Trip Switch, or locally at each breaker.

B. **(Obj R26)** “E” & “F” DSS Electronic Trips are tripped by having an actuation signal from **both** DSS 1 & 2 @ 2450 psig RCS pressure. Control Rod Groups 1-7 are de-energized on a DSS trip. DSS trip is reset by depressing the "Trip Reset" button on the OCP/Diamond.

OBJECTIVES

TERMINAL OBJECTIVE

Describe the operation of the Digital Control Rod Drive Instrumentation System including Control Room Diamond Panel, PI Panel, and associated power supplies. Evaluate proper system operation in accordance with station procedures.

ENABLING OBJECTIVES (OP-OC-IC-CRI)

1. Describe the purpose of the following rod groups associated with the Digital Control Rod Drive System: (R1)
   1.1 Safety Groups 1 through 4.
   1.2 Regulating Groups 5 through 7.
   1.3 Axial Power Shaping Rods Group 8.
2. Describe basically how the sequential energizing of the six phases of a CRD stator results in movement of the control rod into or out of the reactor core. (R3)
3. Describe the DCRDCS system power path from the 600 volt Load Centers including: (R25)
   3.1 Source Interruption (SID) protection feature and setpoints
   3.2 SRPS modules and on-line replacement feature
   3.3 SCR Pulse Generator (PG/M) gating source
   3.4 Breaker configuration for each individual CRDM phase
4. Explain the reason for a CRD to automatically step back from three stator coils energized to two stator coils energized if a CRD stops with three stators energized. (R5)
5. State the CRD breaker configurations that initiate an RPS system trip confirm and the signal combination that will initiate an Electronic Trip (DSS). (R26)
   5.1 State which control rod groups are inserted on a DSS 1 & 2 signal.
6. Describe the following indications including how the signal is derived and used by DCRDCS: (R29)
   6.1 API select
   6.2 RPI
   6.3 API-RPI Mismatch

1 POINT

Question 10

Unit 1 plant initial conditions:

- 1A SGTR in progress

Current conditions:

- RCS cool down in progress
- 3 RCPs operating
- 1A SG isolated
- CETCs = 475ºF

Based on current conditions, which ONE of the following is correct?

SEE ATTACHMENT

RCS pressure should be ______ psig.

A. 2155

B. 750

C. 578

D. 525

Question 10
T1/G1 - gcw

038EA2.15, Steam Generator Tube Rupture / 3 **Ability to determine or interpret the following as they apply to a SGTR: Pressure at which to maintain RCS during S/G cool down** (4.2/4.4)

K/A MATCH ANALYSIS
RO must control RCS pressure during the Cooldown to reduce SCM (this will reduce the leak rate).

ANSWER CHOICE ANALYSIS
SGTR Tab Step 36 Note states "If normal pzr spray is available, efforts should be made to minimize core SCM ≤ 15ºF." The expectation is to maintain SCM from 5 – 15ºF. RCS press must be above the NPSH limit for the RCPs.

Answer: B

A. Incorrect, normal RCS pressure. Also the press you would maintain if in FCD tab performing a NC cooldown.

B. Correct, SCM should be as low as possible but still above RCP NPSH curve.

C. Incorrect, saturation pressure for 485ºF. This is10 degrees subcooled, which would be correct except it is below the RCP NPSH curve.

D. Incorrect, saturation pressure for 475ºF.

Technical Reference(s): **EOP SGTR Tab Step 35**

Proposed references to be provided to applicants during examination: **EOP Enclosure 5.18 (P/T Curves)**

Learning Objective: **EAP-SGTR; R6**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

Describe the use of the SGTR tab of the Emergency Operating Procedure in order to perform the required actions during an event involving a primary to secondary leak greater than 25 gpm. Be able to discuss the SGTR procedure steps and their bases in an oral or written format. Discuss in an overview format how SGTR tab mitigates a SGTR event and places the plant into MODE 5 with the affected SG(s) isolated and heat removal via LPI. (T1)

ENABLING OBJECTIVES

1. Using an overview format describe the intent of this procedure including the 4 main strategies of SGTR mitigation. (R1)
2. During a SGTL shutdown explain the importance of maintaining PZR levels ≥ 220, 140 - 180, and 100" at different times during the reactor shutdown and cooldown to 532°F. (R4)
3. Explain the reason for starting the Outside Air Booster Fans for all three units (R18)
4. Given a set of conditions, be able to identify and quantify OTSG tube leakage. (R2)
5. Explain the reason for opening the TB Sump breakers during a SGTR event. (R19)
6. Understand that normal shutdown procedures are not used during a SGTR and the unit shutdown is performed via Enclosure 5.19, Control of Plant Equipment During Shutdown. (R20)
7. Explain the correct method of control for TBVs when the reactor is tripped at 5% power. (R3)
8. Explain why; when HP-24 and 25 are opened per guidance from the SGTR tab the valves should remain open during the unit cooldown. (R22)
9. Describe the three criteria contained in the SGTR tab that allow the operator to procedurally bypass ES actuation. (R23)
10. Explain how and why subcooled margin should be maintained as close as possible to 0°F during the cooldown. (R6)

    10.1 Understand if RCPs are operating SCM may be required to be increased during the depressurization to maintain RCP NPSH.

11. Given a set of conditions determine if the PZR can be sprayed by HPI Auxiliary Spray per Enclosure 5.20, Aux. Spray (R24)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

If normal pzr spray is available, efforts should be made to minimize core SCM ≤ 15°F. Otherwise, minimize core SCM as low as safely achievable.

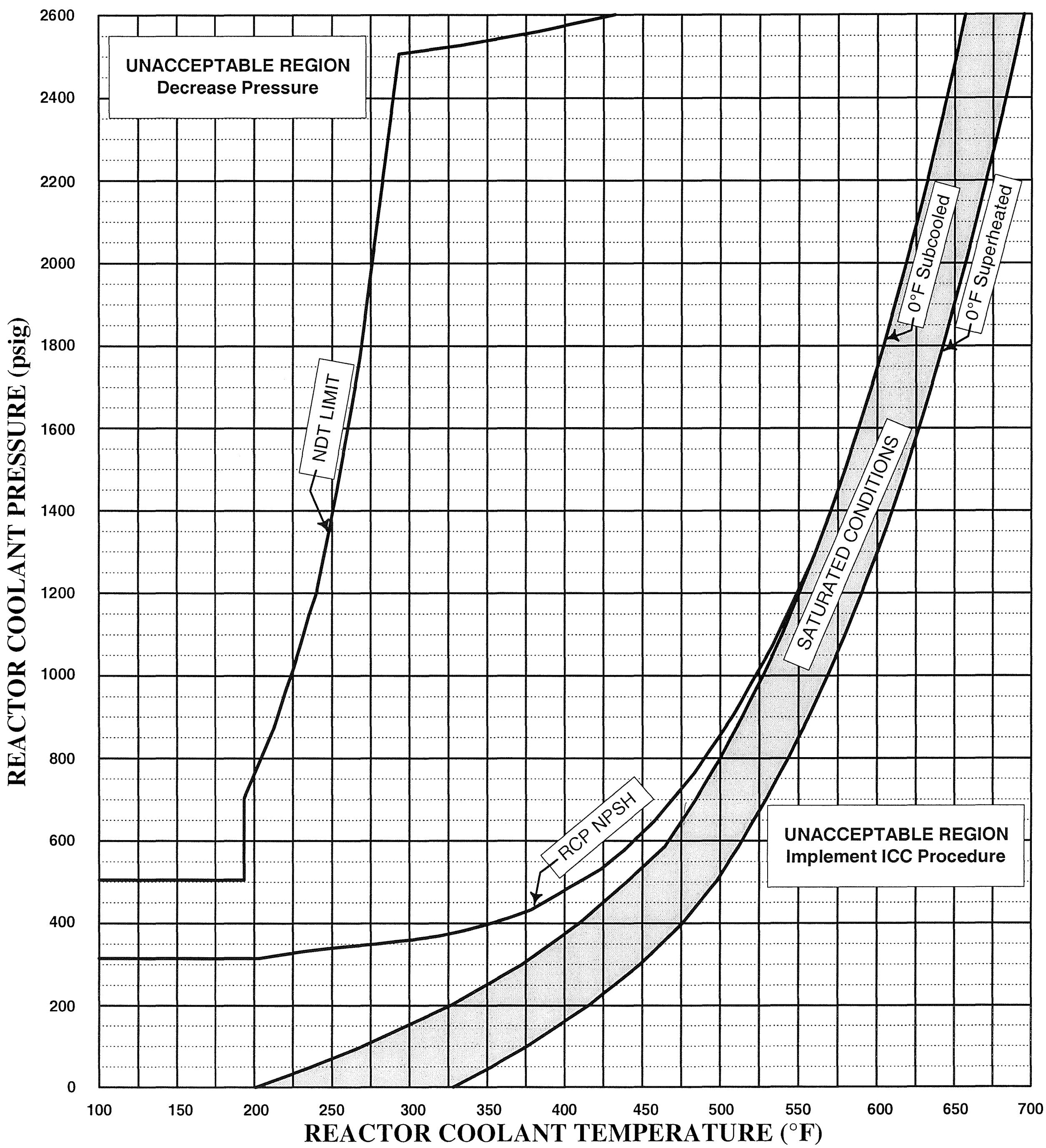
ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
33. Minimize core SCM using the following methods: __ De-energize all Pzr heaters __ Use Pzr spray __ Maintain Pzr level 140″ - 180″ [175″ - 215″ acc]	
34. __ Verify any RCP operating.	__ **GO TO** Step 36.
35. __ Maintain RCP NPSH. • OAC • Encl 5.18 (P/T Curves)	
36. __ **IAAT** RCS de-pressurization methods are inadequate in minimizing core SCM, **THEN** perform Step 37 - 39.	__ **GO TO** Step 40.

NOTE

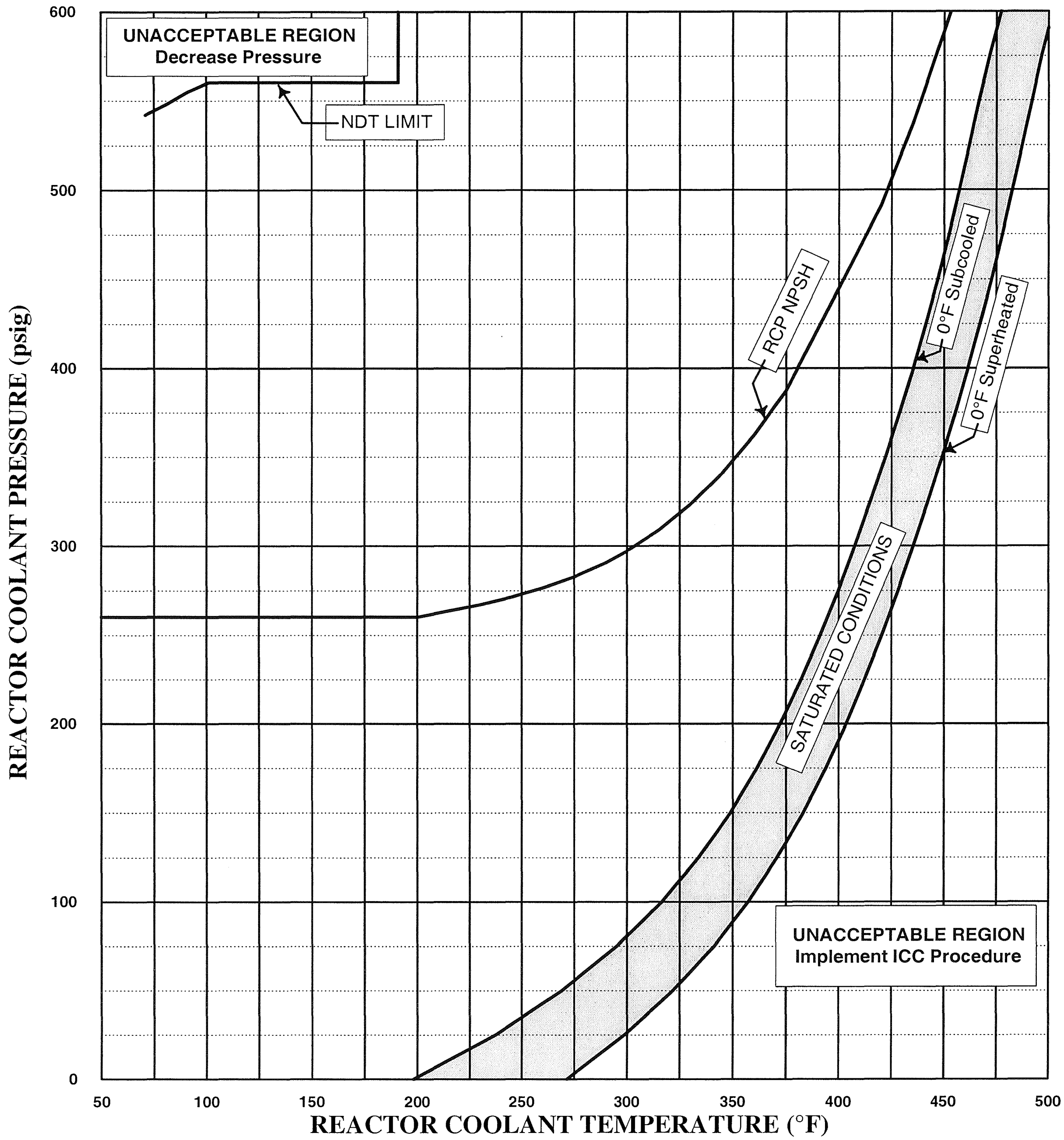
BWST temperature should be used in determining Pzr spray nozzle ΔT. Computer point O1P3367 provides Pzr spray nozzle ΔT information.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
37. __ Verify Pzr spray nozzle ΔT ≥ 410°F.	__ Initiate Encl 5.20 (Aux Pzr Spray).
38. Close the following: __ 1LWD-1 __ 1LWD-2	
39. __ Cycle PORV as necessary.	
40. Verify at least one of the following open: __ 1MS-24 __ 1MS-33	__ **GO TO** Step 44.
41. __ Verify any SG available and unaffected.	__ **GO TO** Step 44.

Normal Containment (P_{RB} < 3 psig): Use OAC or ICCM.
Abnormal Containment (P_{RB} > 3 psig): Use ICCM only.



Normal Containment (P_{RB} < 3 psig): Use OAC or ICCM.
Abnormal Containment (P_{RB} > 3 psig): Use ICCM only.



1 POINT

Question 11

Unit 1 initial conditions:

- Rule 5 (Main Steam Line Break) in progress
- ES Channels 1 and 2 initiated

Current conditions:

- RCS pressure = 1820 psig increasing
- Rule 5 is complete
- EHT tab is complete

Based on the above conditions, which ONE of the following states whether ES Channels 1 and 2 may be reset and the lowest level of permission required prior to resetting the channels?

A. yes / Control Room SRO

B. yes / Operations Shift Manager

C. no / Control Room SRO

D. no / Operations Shift Manager

Question 11
T1/G1 - kds

040AA2.05, Steam Line Rupture - Excessive Heat Transfer / 4 **Ability to determine and interpret the following as they apply to the Steam Line Rupture: When ESFAS systems may be secured** (4.1/4.5)

K/A MATCH ANALYSIS
Question requires knowledge of when ES can be reset and what permission is required.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect: first part is correct. Second part is incorrect. Plausible because directions usually cone from the CRSRO.

B. Correct: the initiating condition is clear and the OSM permission is required to reset ES.

C. Incorrect: first part is incorrect. Plausible because if RCS pressure were above 1600 psig it would be correct. Second part is incorrect. Plausible because directions usually cone from the CRSRO.

D. Incorrect: first part is incorrect. Plausible because if RCS pressure were above 1600 psig it would be correct. Second part is correct.

Technical Reference(s): **EOP Enclosure 5.1, ES Actuation**
Enclosure 5.41, ES Recovery

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-ESA R20**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

12. Discuss the actions in Encl.5.1 to establish LPI flow capability in both trains of LPI with 1 or 2 LPI pumps available.(R17)
    12.1 Explain why these actions are TIME CRITICAL
13. Recognize that starting the CR Outside Air Booster fans is a TIME CRITICAL task and must be performed within 30 minutes of the event. (R19)
14. Recognize that the RB Hydrogen Analyzer is required to be in service within 90 minutes following a LOCA. (R4)
15. Differentiate between plant conditions that allow the operator to exit Encl.5.1 and those conditions that will require Encl.5.1 to remain in the "OPEN" status.(R18)
16. Summarize the guidance provided in Enclosure 5.41, ES Recovery, for resetting ES and restoring the associated systems following a valid ES signal (R20)
    16.1 Recognize that Enclosure 5.41 will be entered from Enclosure 5.1, ES Actuation
    16.2 Recognize that TS 3.3.7 entry is required when any ES component in placed in manual following ES actuation.
    16.3 Recognize that Enclosure 5.41 does not reposition every component associated with ES.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
111.__ Verify Unit 2 turbine tripped.	__ **GO TO** Step 114.
112.__ Close 2LPSW-139.	
113.__ Verify total LPSW flow to UNIT 2 LPI coolers ≤ 6000 gpm.	__ Reduce LPSW to UNIT 2 LPI coolers to obtain total LPSW flow ≤ 6000 gpm.
114.__ Close 1LPSW-139.	
115. Place the following in FAIL OPEN: __ 1LPSW-251 FAIL SWITCH __ 1LPSW-252 FAIL SWITCH	
116. Verify either of the following: __ Three LPSW pumps operating __ Two LPSW pumps operating when Tech Specs only requires two to be operable	__ **GO TO** Step 118.
117. Open the following: __ 1LPSW-4 __ 1LPSW-5	
118.__ Dispatch an operator to perform Encl 5.2 (Placing RB Hydrogen Analyzers In Service). (**PS**)	
119.__ Notify U2 CR SRO that SSF is inoperable due to OTS1-1 open.	
120.__ **IAAT** conditions causing ES actuation have cleared, **THEN** initiate Encl 5.41 (ES Recovery).	
121.__ **WHEN** CR SRO approves, **THEN EXIT** this enclosure.	

• • • END • • •

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE
Technical Specification 3.3.7 and 3.3.6 entry is required when any ES component is in Manual while ES signal is present. These conditions are exited when all digital channels are reset.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. __ **WHEN** all the following exist: __ ES Channels have actuated __ Condition causing ES Channel actuation has cleared __ ES Channel reset is desired __ OSM concurs **THEN** continue.	
2. Reset desired tripped bistables for the following: __ ES Analog Channel A __ ES Analog Channel B __ ES Analog Channel C	
3. __ Verify reset of ES Channels 1 & 2 is desired.	__ **GO TO** Step 31.
4. Verify the following Stat Alarms have cleared: __ 1SA-7/A-1 (ES HP INJECTION CHANNEL A TRIP) __ 1SA-7/B-1 (ES HP INJECTION CHANNEL B TRIP) __ 1SA-7/C-1 (ES HP INJECTION CHANNEL C TRIP) __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP)	1.__ Ensure analog channel bistables are reset. 2.__ **IF** required, **THEN** notify SPOC for assistance. 3.__ **WHEN** the following have cleared, __ 1SA-7/A-1 (ES HP INJECTION CHANNEL A TRIP) __ 1SA-7/B-1 (ES HP INJECTION CHANNEL B TRIP) __ 1SA-7/C-1 (ES HP INJECTION CHANNEL C TRIP) __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP) **THEN** continue.

1 POINT

Question 12

Unit 1 initial conditions:

- Time = 1000
- Reactor power = 100%

Current conditions:

- Time = 1001
- RCS Temperature = 545 ºF decreasing
- RCS pressure = 1700 psig decreasing
- A OTSG pressure = 400 psig decreasing
- A OTSG level = 40% OR decreasing
- B OTSG pressure = 1000 psig decreasing
- B OTSG level = 30% OR decreasing

Based on the above conditions, which ONE of the following correctly states the event that has occurred and the status of the Main FDW pumps?

ASSUME NO OPERATOR ACTIONS

A. 1A Main Feedwater flow input to ICS fails LOW / tripped

B. 1A Main Feedwater flow input to ICS fails LOW / NOT tripped

C. 1A Main Feedwater line break / tripped

D. 1A Main Feedwater line break / NOT tripped

Question 12
T1/G1 - kds

054AK1.01, Loss of Main Feedwater / 4
Knowledge of the operational implications of the following concepts as they apply to Loss of Main Feedwater (MFW): MFW line break depressurizes the S/G (similar to a steam line break) (4.1/4.3)

K/A MATCH ANALYSIS
Knowledge of how a MFW line break will affect plant parameters similar to a steam line break and its effect on main feedwater pumps.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: Overfeeding would not cause SG pressure to decrease to 400 psig. ICS SG high level would remove the faulty signal when SG level reached 86%. Plausible because the ICS failure would cause an overfeed condition on the A SG. AFIS will actuate @ 400 psig on the A SG causing both MFDWPs to trip.

B. Incorrect: Overfeeding would not cause SG pressure to decrease to 400 psig. ICS SG high level would remove the faulty signal when SG level reached 86%. Plausible because the ICS failure would cause an overfeed condition on the A SG. Second part is incorrect.

C. Correct: With a break in the A MFW line, SG pressure will decrease rapidly as level decreases and cause AFIS initiation to occur, isolating the A SG. Steam pressure will decrease as will OTSG levels. AFIS will actuate @ 400 psig on the A SG causing both SGs to trip.

D. Incorrect: first part is correct. Second part is incorrect.

Technical Reference(s): **CF-FDW**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **CF-FDW R43**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

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14. State the setpoints and automatic actions that occur based on FDWP discharge pressure and FDWPT hydraulic oil pressure. (R29)

15. Given a set of conditions, determine proper operation of the FDWP Seal Injection System. (R30, R31)

16. Describe the purpose of the Automatic Feedwater Isolation system. (R34)

17. Describe the instrumentation, statalarms and computer points associated with the AFIS modification. (R42)

18. Given a set of conditions, verify proper operation of AFIS. (R43)

19. Discuss when AFIS is placed in and out of service. (R44)

20. Given a copy of ITS / SLC's, analyze a given set of plant conditions for applicable TS / SLC LCO's. (R11)

21. Apply all ITS / SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R39)

22. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS / SLC's. (R40)

23. Given a set of conditions, analyze FDW System operation to determine system status and any required actions / corrective actions. (R37)

24. Draw a basic one-line diagram of the Feedwater System including all major components and valves. (R36)

a) Provide for a 2/4 logic per steam generator for actuation circuitry.

b) Provide for header specific isolation for the main and emergency feedwater system for a faulted OTSG.

c) Monitors for both steam generator depressurization and rate of depressurization.

1) Rate of depressurization enables AFIS to differentiate between a MSLB and a SBLOCA or ATWS (to avoid tripping the MDEFDWP during a SBLOCA or an ATWS).

2) During a SBLOCA, the operator will have to bypass AFIS.

d) The analog channels of AFIS are powered from:

1) Analog Channel 1- KVIA

2) Analog Channel 2- KVIB

3) Analog Channel 3- KVIC

4) Analog Channel 4- KVID

3. The digital channels of AFIS are powered from:

a) Digital channel 1 is powered from KVIC and DIC.

b) Digital channel 2 is powered from KVID and DID.

c) The Digital channels are designed to energize to trip. **Therefore a loss of power to the digital channel will <u>not</u> cause inadvertent feedwater isolation.**

D. (**Obj. R43**) AFIS Operation (FDW-07)

1. Isolation of Main Feedwater and Tripping of the TDEFDWP

a) A low steam generator pressure of 550 psig for 2 seconds on at least two out of four steam generator specific pressure transmitters will:

1) Trip both MFDWP's.

2) Close MS-93 trip the TDEFDWP (if it is running) or prevent it from starting automatically. Also closes TO-145 to redundantly trip the pump by closing MS-95.

3) Close the main and startup feedwater block valves on the affected steam generator.

4) After five seconds, close the main and startup feedwater control valves on the affected steam generator. (Water Hammer concern).

5) If later during the event it becomes necessary to use any main or startup valves to feed a steam generator, AFIS will have to be reset prior to using the valves by taking the ENABLE/OFF switch to the OFF position.

NOTE: Due to potential spurious actuation problems with AFIS a trip confirm is required prior to the actual actuation of AFIS. This requires a STAR and a Trip Confirm STAR module of a digital channel to trip prior to actual actuation of the circuit. This now requires a 2 out of four times 2 logic to trip AFIS.

b) A QA-1 solenoid valve (TO-145) was added into the hydraulic oil supply to MS-95. (AFIS6.vsd)

   1) This will provide redundancy for MS-93.

   2) If a MSLB were to occur in either SG the solenoid valve will energize and block the hydraulic oil supply to MS-95.

   3) A limit switch from TO-145 will provide input to the controller for MS-87, which will prevent lifting of the relief valve following actuation of the MS-95 trip.

   4) Power for the solenoid will be from KVIC, which is diverse from the MS-93 power supply.

   5) A coil monitor relay will alarm on the OAC to indicate electrical problems. A local test switch will be installed to allow testing of TO-145.

c) The TDEFWP control switch has been modified to add the AFIS override interlock for TO-145. This allows the operator to restart the TDEFWP as necessary to feed Steam Generators without resetting the AFIS signal.

d) The limit switch for MS-93 was replaced with a position transmitter. This will provide the intermediate position signal to the controller for MS-87. Both the lights for MS-93 will be modified to illuminate in the intermediate position.

e) A bottled nitrogen backup was installed for MS-93 to ensure that the valve will close without assistance from the plant instrument air system.

   1) Bottles were installed near MS-93 with check valves and regulators. There are four bottles stored in the rack with connections for two.

E. Tripping of the Motor Driven Emergency Feedwater Pumps

1. A low steam generator pressure of 550 psig for 2 seconds on at least two out of four steam generator specific pressure transmitters coincidence with a high depressurization rate on the specific OTSG of 3 psi/sec will trip the MDEFDWP on the affected steam generator.

   a) These setpoints will be indicative of a faulted steam generator and not the initial symptoms of a SBLOCA.

   b) The depressurization rate will be enabled below 800 psig to avoid arming the logic during non-MSLB transients such as a unit trip or a turbine transient, which could cause actuation of the rate of depressurization circuit.

2. Auto trip signals are provided to the MDEFDWP via redundant trip coils to trip the MDEFDWP.

   a) Digital channel 1 Header "A" provides a trip signal to Trip coil #2 TD (Trip 2) for MDEFWP A.

   b) Digital channel 2 Header "A" provides a trip signal to Trip coil #1TD (Trip 1) for MDEFWP A.

   c) Digital channel 1 Header "B" provides a trip signal to Trip coil #1 TE (Trip 1) for MDEFWP B.

   d) Digital channel 2 Header "B" provides a trip signal to Trip coil #2 TE (Trip 2) for MDEFWP B.

   e) Manual control of the MDEFDWPs' will override AFIS when the pump control switch is placed in the RUN position.

F. Control Room Functions and indications

1. **AFIS Header A, AFIS Header B ENABLE/OFF Pushbuttons**

   a) Since there are two digital channels associated with each header there is a Digital Channel 1 ENABLE/OFF and a Digital Channel 2 ENABLE/OFF switch for each header.

   b) If AFIS has automatically actuated and the signals are clear, the OFF pushbutton is depressed to reset AFIS and the ENABLE pushbutton will rearm AFIS.

2. **AFIS Header A, AFIS Header B INITIATE/NORMAL P/B**

   a) When Train A INITIATE or the Train B INITIATE pushbutton is depressed, full AFIS actuation will occur on that **specific** steam generator.

   b) When the NORMAL pushbutton is depressed, the manual initiate pushbutton unlatches.

3. The MSLB Test Panels have been removed by this modification.

G. The following information is available in the control room to determine the status of AFIS and its actuation devices:

1. Statalarms SA-2-8 or SA2-20 alarm when the digital channels are in test, OFF, or have a failed PT input or failed STAR module.
2. Statalarm SA2-32 alarms when AFIS actuates on Header A.
   a) Response: Verify Header A isolated.
3. Statalarm SA2-44 alarms when AFIS actuates on Header B.
   a) Response: Verify Header B isolated.
4. Statalarm SA2-47 alarms when a single AFIS analog input is in the tripped state (1 of 4 logic).
   a) Response: Have I&E investigate.
5. Analog Channel 4 transmitter signals are on OAC points O_E2200 and O_E2201.
6. All FDW and MS valves have open/close indicating lights on the control boards. The lights for MS-93 were changed to illuminate both lights in the intermediate position.
7. TO-145 coil failure will alarm on O_D2773.
8. Nitrogen Low-pressure alarms (O_A1858 and O_A1859) are received at ≈ 1034 psig.
   a) Response: Have SPOC change the bottle and valve in the standby bottle prior to reaching the Lo-Lo pressure alarm setpoint.
9. Nitrogen Lo-Lo alarms (O_A1858 and O_A1859) will be received at ≈ 430 psig.
   a) Response: 1) verify or place the spare bottle in service, 2) If the in-service bottle reaches 320 psig declare MS-93 isolation function for AFIS inoperable.
10. The MDEFDWP red indicating lights were changed to extinguish when either switchgear trip coil fails. There was inadequate room on the control board to add the second light so the lights are located on the switchgear.

1 POINT

Question 13

Unit 1 plant conditions:

- EOP Blackout tab has been in progress for three hours

Which ONE of the following describes why the Blackout tab directs the crew to FAIL 1CC-8 closed?

A. 1CC-8 will fail open if IA pressure decreases to < 35 psig.

B. Prevents auto restart of CC pumps once AC power is restored.

C. CC will not be needed in the Reactor Building during the shutdown following the blackout.

D. 1CC-8 will fail open once there is NO DC power available to the solenoid.

Question 13
T1/G1 - gcw

055EK3.02, Loss of Offsite and Onsite Power - Station Blackout / 6 **Knowledge of the reasons for the following responses as the apply to the Station Blackout: Actions contained in EOP for loss of offsite and onsite power** (4.3/4.6)

K/A MATCH ANALYSIS
Question requires knowledge of bases for a step in the BO tab of the EOP.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: 1CC-8 fails closed on loss of IA.

B. Incorrect: Although the statement is true as the pumps will auto start. But, this is not the reason/bases for the step. "D" is the actual reason/bases behind failing the valve closed.

C. Incorrect: CC would still be needed if available during the shutdown for letdown coolers, etc.

D. Correct: Ensures positive control over containment since the valve will fail open on loss of DC to the solenoid.

Technical Reference(s): **EAP-BO; Page 21 of 32**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-BO; R10**

Question Source: **Bank EAP221001**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

OBJECTIVES

Terminal Objective

1. Demonstrate the ability to utilize the Blackout section of the EOP to mitigate a loss of all AC power.
2. Be able to explain the bases behind or reasons for steps performed in the Blackout Section of the EOP.

Enabling Objectives

1. Identify plant conditions that would require entry into the Blackout section of the EOP. (R1)
2. List the five major functions provided by the Blackout section of the EOP. (R2)
3. Analyze station conditions to determine the preferred source of cooling water for the Steam Generators. (R3)
4. Analyze station conditions to determine the preferred source of AC power utilized by Enclosure 5.38, Restoration of Power to attempt to energize ES Switchgear. (R6)
5. Describe actions expected for steps directing the operator to "Initiate feeding and steaming available SG's as necessary to stabilize RCS P/T". (R4)
6. Discuss the reason a natural circulation cooldown is not performed during blackout conditions. (R5)
7. Discuss the operational significance behind energizing Standby Bus #1 once it has been determined that power can not be restored to any ES Switchgear. (R7)
8. Discuss the operational significance behind operating the Station ASW pump during a blackout even if the Station ASW pump is not utilized for SG cooling. (R13)
9. Discuss the operational significance behind shutting down the KI, KU, KX, & KOAC Inverters during a station blackout. (R8)
10. Discuss the operational significance behind shutting down the MFWP and Main Turbine EBOP's once they are no longer needed during a station blackout. (R9)
11. Explain why CC-8 is failed closed during a station blackout. (R10)
12. Identify instrumentation in the Control Room that would be utilized to determine the availability of the BWST as a suction source for an HPI Pump during blackout conditions. (R11)
13. List the possible HPIP suction sources that can be utilized during a Blackout. (R14)
14. Recognize that once an HPIP is aligned to the ASW switchgear, no amp or breaker indications will be available in the Control Room. (R12)

2.48 **IAAT** blackout exists on Units 2 and 3,
AND <u>any</u> of the following conditions exists:

- Power has **NOT** been restored within three hours
- 1CA bus voltage to is ≈ 105 VDC

THEN notify SPOC to perform Encl 5.30 (Fail Closed 1CC-8).

A. ***(Obj R10)*** *CC-8 is a solenoid powered pneumatic Containment Isolation valve. The valve will fail closed on a loss of Air, but on loss of power to the solenoid, the valve will fail open.* ***If all 3 units are in a blackout, then as battery power is drained, it is possible for the valve to fail open. This is undesirable since it is a containment isolation valve.***

INSTRUCTOR NOTE: This enclosure is a 3-step enclosure utilized by SPOC to isolate and bleed off IA to CC-8 to ensure it is failed closed.

2.49 **IAAT** EWST level is ≤ 60,000 gal,
THEN notify TSC to perform Encl 5.31 (Temporarily Charging the HPSW System) to make up to the EWST.

A. *As EWST level decreases, makeup to the EWST can not automatically occur since there is a blackout in progress. Making up to the EWST is important to maintain availability of HPSW.*

INSTRUCTOR NOTE: Refer to Attachment 4 (Enclosure 5.31, Temporarily Charging the HPSW system

2.50 **IAAT** HPI is operating with the BWST providing suction, then initiate Encl. 5.39 (Makeup to the BWST During Blackout).

2.51 **WHEN** power is restored to <u>any</u> 4160V switchgear (1TC, 1TD, 1TE)
THEN GO TO Subsequent Actions tab.

• • • END • • •

<u>Unit Status</u>

SG feed is being provided by EFDW or SSF-ASW

2.52 **IAAT** all 4160V SWGR (1TC, 1TD, 1TE) are de-energized for 1.5 hours,

THEN dispatch an operator to perform Encl. 5.17 (Generator Emergency Hydrogen Purge).

A. *This step provides a method to depressurize and purge the generator during a station blackout prior to a loss of Seal Oil that would occur at the 4 hour mark.*

2.53 Place the following control switches to OFF:

- 1A HPI Pump
- 1B HPI Pump

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
48. __ **IAAT** blackout exists on Units 2 and 3, **AND** <u>any</u> of the following conditions exists: __ Power has **NOT** been restored within three hours __ 1CA bus voltage is ≈ 105 VDC **THEN** notify SPOC to perform Encl 5.30 (Fail Closed 1CC-8) (OSC x-2173 or x-2780).	
49. __ **IAAT** EWST level is ≤ 60,000 gal, **THEN** notify TSC to perform Encl 5.31 (Temporarily Charging the HPSW System) to make up to the EWST (TSC x-3715).	
50. __ **IAAT** HPI is operating with the BWST providing suction, **THEN** initiate Encl 5.39 (Makeup to the BWST During Blackout).	
51. __ **WHEN** power is restored to <u>any</u> 4160V switchgear (1TC, 1TD, 1TE), **THEN GO TO** Subsequent Actions.	

• • • END • • •

EAP221001

Unit 1 Plant Conditions:

- EOP Blackout tab has been in progress for three hours

Which ONE of the following describes why the crew should provide direction to FAIL 1CC-8 closed? (.25)

A. 1CC-8 will fail open if IA pressure decreases to < 35 psig.

B. Prevents auto restart of CC pumps once AC power is restored.

C. CC will not be needed in the Reactor Building during the shutdown following the blackout.

D. 1CC-8 is a containment isolation valve and will have failed open once there is NO DC power available to the solenoid.

D

A. Incorrect: 1CC-8 fails closed on loss of IA.

B. Incorrect: Although the statement is true as the pumps will auto start. But, this is not the reason/bases for the step. "D" is the actual reason/bases behind failing the valve closed.

C. Incorrect: CC would still be needed if available during the shutdown for letdown coolers, etc.

D. Correct: Ensures positive control over containment since the valve will fail open on loss of DC to the solenoid.

1 POINT

Question 14

Oconee initial plant conditions:
- Time = 07:00:00
- Oconee Unit 1 reactor power = 100%
- Oconee Unit 2 reactor power = 100%
- Keowee Unit 1 output = 73 MWe
- ACB-4 is closed
- PCB-8 is FAILED closed
- 230 KV Switchyard Yellow Bus voltage = 225.1 KV

Current conditions:
- Time = 07:00:30
- Oconee Unit 2 RCS pressure decreases to 1436 psig
- 230 KV Switchyard Yellow Bus voltage = 226.2 KV

Based on the above conditions, which ONE of the following describes the status of each Keowee unit and from where will Oconee Units 1 and 2 receive power?

ASSUME NO OPERATOR ACTIONS

A. Keowee Unit 1 supplies Oconee Unit 1 via the Overhead Power Path
Keowee Unit 2 supplies Oconee Unit 2 via the Standby Busses and CT-4.

B. Keowee Unit 1 operates at rated speed but not tied to the Overhead Power Path
Keowee Unit 2 supplies Oconee Unit 1 and 2 via the Standby Buses and CT-4.

C. Keowee Unit 1 supplies the Standby Buses and CT-4.
Keowee Unit 2 operates at rated speed but not tied to the Overhead Power Path
Oconee Unit 1 is supplied from 1T and Oconee Unit 2 is supplied from CT-2.

D. Keowee Unit 1 operates at rated speed but not tied to the Overhead Power Path
Keowee Unit 2 supplies the Standby Buses and CT-4.
Oconee Unit 1 is supplied from 1T and Oconee Unit 2 is supplied from CT-2.

Question 14
T1/G1 - gcw

056AA2.14, Loss of Offsite power
Ability to determine and interpret the following as they apply to the Loss of Offsite Power: Operational status of ED/Gs (A and B) (4.4/4.6)

K/A MATCH ANALYSIS
Oconee does not use emergency diesels generators for emergency power. The Keowee Hydro units are used for emergency power at Oconee. Question requires knowledge of the status of the Keowee units following a loss of offsite power (switchyard isolation) for the conditions given.

ANSWER CHOICE ANALYSIS
Due to low Yellow Bus voltage and ES 1 or 2 signal a switchyard isolation occurs. Both Oconee Unit 1 and 2 will trip on high RCS pressure because of the SWYD isolation. Normally the non-LOCA unit would receive power from the overhead and the LOCA unit via the underground and CT-4. Due to PCB-8 being failed closed a switchyard isolation complete signal will not be generated and Keowee Unit 1 will not tie into the overhead path. Both units will receive power from the underground.

Answer: B

A. Incorrect, this answer would be correct if PCB-8 was not failed closed.

B. Correct, Keowee Unit 1 will not tie into the overhead and both Oconee units will be supplied via CT-4 and the STBY bus.

C. Incorrect, this answer would be correct is SWYD yellow bus voltage was not low, caused a SWYD isolation and the candidate was confused about which Keowee unit was tied to the underground.

D. Incorrect, this answer would be correct is SWYD yellow bus voltage was not low and caused a SWYD isolation.

Technical Reference(s):

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EL-KHG R11**

Question Source: **Bank EL041101**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

1. Demonstrate an understanding of the basic operation of the Keowee Hydro units during both normal and emergency operation. (T1)

2. Assess the operation of the Keowee Hydro units during normal and emergency operations. (T2)

ENABLING OBJECTIVES

1. State the purpose of the Keowee Hydro Generators. (R1)

2. Explain the basic operation of the Keowee Waterwheel Turbine. (R2)

3. Describe the basic operation of the Keowee CO2 Fire Protection System. (R3)

4. Given a set of conditions, determine when the Keowee CO2 Fire Protection System will automatically actuate and when manual operation is required. (R17)

5. Describe the purpose and function of Oconee control board switches associated with Keowee Hydro unit. (R7)

6. Determine the response of the Keowee Hydro Units from operation of the KHU switches located in the ONS control room. (R19)

7. Describe the purpose and function of all panel board indications in the control room associated with Keowee Hydro Generators. (R8)

8. Given indications from available ONS control room instrumentation, assess the status of the KHUs. (R20)

9. Determine the sequencing of actions required to regain normal control of the Keowee Hydro unit following an emergency start signal. (R9)

10. Verify proper operation of ACB 1-4 during all modes of operation. (R11)

11. Evaluate the intent of any given limits and precautions associated with OP/0/A/1106/19, Keowee Hydro at Oconee. (R12)

12. For an emergency lockout (ELO) or normal lockout (NLO) of a KHU: (R10)

    12.1Describe automatic actions that occur.

    12.2Determine events that that will cause an ELO or NLO.

EL041101

The following conditions exist:

- Keowee Hydro Unit (KHU) 1 is generating to the grid
- ACB-4 is closed
- ES 1 and 2 occur on Oconee Unit 2
- Switchyard phase voltages (KV) are:
  - YELLOW BUS X = 140, Y = 156, Z = 230
  - RED BUS X = 155, Y = 159, Z = 232
- PCB-8 fails closed

Which ONE of the following describes the emergency power lineup, following these events? (.25)

KHU 1....... / KHU 2.........

A) ____ operates at rated speed and supplies the Yellow Bus via the Overhead Power Path and PCB-9 ____ emergency starts and immediately supplies the Standby Busses via the Underground Power Path and CT-4.

B) ____ operates at rated speed but not tied to the Overhead Power Path, ____ emergency starts and immediately supplies the Standby Buses via the Underground Power Path and CT-4.

C) ____ trips due to overspeed, ____ emergency starts and supplies the Yellow Bus via the Overhead Power Path and PCB-9.

D) ____ trips due to the fault on PCB-8. ____ automatically starts and immediately supplies the Standby Buses via the Underground Power Path and CT-4.

B
A: Incorrect - KHU-1 will not supply the Yellow bus due to an incomplete SYI
B. Correct
C. Incorrect - KHU-1 will not trip. KHU-2 will not supply the Yellow Bus.
D. Incorrect - KHU-1 will not trip.

1 POINT

Question 15

Unit 1 plant conditions:

- 1DCB bus has been inadvertently de-energized.

Based on the above conditions, which ONE of the following correctly describes the status of 1DIC panelboard?

The 1DIC panelboard will…

A. de-energize with power having to be manually aligned from the alternate power supply.

B. remain energized with power coming from the same unit via isolating diodes.

C. de-energize with power having to be manually aligned from the Standby Battery Charger.

D. remain energized with power coming from the alternate unit via isolating diodes.

Question 15
T1/G1-kds

058AA1.03, Loss of DC Power / 6
Ability to operate and / or monitor the following as they apply to the Loss of DC Power: Vital and battery bus components (3.1/3.3)

K/A MATCH ANALYSIS
Monitor "Vital and Battery Bus Components" (DIC Panelboard) as they apply to a loss of DC power (Loss of Bus DCB).

ANSWER CHOICE ANALYSIS
Upon de-energizing 125 VDC bus DCB (loss of DCB), the Vital Bus DIC will receive power via the alternate unit isolating diodes. The Essential Bus inverters will receive power from the DCA bus on the same unit.

Answer: D

A. Incorrect, will not de-energize. Plausible because if power is lost to the DIC inverter, the Vital Panel Board KVIC would de-energize and have to be manually aligned to its alternate power supply.

B. Incorrect, automatically supplied from an alternate unit via isolating diodes. Plausible because the Essential powered components are backed by the same unit isolating diodes.

C. Incorrect, will not de-energize. Plausible because if the normal battery charger to DCB bus was at fault, the standby charger would be line up to energize the bus.

D. Correct, automatically supplied from an alternate unit via isolating diodes.

Technical Reference(s): **EL-DCD**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EL-DCD R4**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

2.3 The purpose of the Kirk-key interlock feature on the standby charger output breakers.

2.4 The order of closing the battery charger AC Input and DC Output breakers when placing a charger in service.

2.5 Battery charger output over-voltage protection.

3. Briefly describe Isolating Diode Assemblies operation including: (R3)

3.1 Their purpose.

3.2 The three functions accomplished by isolating diode assemblies.

3.3 The sources of DC power auctioneered for each DC system using isolating diode assemblies.

3.4 How the operator is made aware that a bad diode has been detected.

3.5 Why a "bad" diode can be tolerated without affecting the operability of an assembly.

3.6 How control power for the monitoring and indicating circuits is supplied.

3.7 Briefly, describe what the Peak Inverse Voltage (PIV) test is and who performs this test.

3.8 What the "monitor test" push buttons are used for.

4. Explain why ground detection is important to ungrounded DC systems. (R14) **{1}**

4.1 Recognize that grounds on vital DC systems can render the entire system inoperable.

4.2 Recognize that NSD 311, Nuclear Safety-Related DC Systems Ground Response, sets the standard for responses to grounds.

5. Briefly discuss the Vital DC Instrument and Control System operation including: (R4)

5.1 Purpose of the System

5.2 Six typical loads

5.3 The way power is normally supplied to the buses

5.4 How power is supplied in the event of a charger failure.

5.5 How power may be supplied from another unit.

5.6 Reason for tying DCA and DCB buses together before removing a battery from service

5.7 The power supplies to Vital I&C Battery Chargers.

5.8 How to perform a battery ground test.

5.9 Separating buses between units for ground location.

5.10Location of the batteries, battery chargers, distribution centers, DC panelboards and Isolating Diode Assemblies.

6. Briefly describe the Essential DC Power System operation including: (R6)

    6.1 The normal source of power to the system.

    6.2 Two alternate sources of power to each bus.

    6.3 The loads supplied by the system.

    6.4 Location of the Isolating Diode Assemblies

7. Briefly discuss the Power Battery System Operation including: (R7)

    7.1 Purpose of the system

    7.2 Battery bank and distribution network

    7.3 How 250 VDC is achieved on the system.

    7.4 Ten loads supplied from the system.

    7.5 The location of the battery banks and chargers

    7.6 Taking a power battery bank out of service, and the considerations involved.

8. Briefly describe the 230 KV Switchyard DC Power System, including: (R8)

    8.1 Purpose of the system

    8.2 Batteries, chargers and distribution network

    8.3 How redundant power feeds to the common closing coils for the PCBs are provided.

    8.4 Isolating a battery from the bus and the considerations involved.

    8.5 The power supplies to the battery chargers.

9. Briefly describe the 525 KV Switchyard DC Power System, including: (R9)

    9.1 Purpose of the System.

    9.2 Batteries, chargers and distribution network

    9.3 Isolating a battery from the bus

    9.4 The power supplies to the battery chargers.

1) The risk significance of continuing refueling activities with known ground conditions is not well known among operations, maintenance, and engineering personnel. Contributing to this condition is an unawareness of both past site and industry experience.

2) The methodical approach to isolating the ground may not have been thoroughly thought out. Methods used were not consistently applied and well documented. The focus was on past experience with grounds during a previous washdown and some existing problems versus actual test data.

3) A responsible lead was not designated with clear goals. Three hand-offs occurred (SPOC-Maint.-Ops). As a result, information received was not considered in the aggregate.

4) Insufficient interaction between electrical maintenance and engineering personnel contributed to some delay in diagnosing the ground condition. Communication was not timely and thorough.

5) Pre-job briefing weaknesses noted are as follows:

   (a) Insufficient use of plant and industry OE.

   (b) Not all reference material fully analyzed or considered.

   (c) Contingency plans not fully considered.

6) The shutdown protection plan does not specifically require an independent risk review for changes in operational conditions that last for significant periods of time. For example, the existence of a long-standing ground, changing weather conditions, or other unplanned conditional change.

7) Washdown practices are resulting in water intrusion to electrical equipment that has a potential to degrade plant materiel conditions. Interviews indicated that significant water intrusion into electrical conduit and trays has resulted in water accumulation in light fixtures and other electrical components.

8) Some alarm and abnormal procedures lack information that would allow control room personnel to respond to a loss of DC event and facilitate recovery in a more timely manner.

2.3 (Obj. R4) Vital DC Instrumentation and Control Power Supply (EL-DCD-4)

A. Purpose

1. The Vital DC Power System provides a source of reliable, continuous power for control and instrumentation for normal operation and orderly shutdown for each unit.

B. General Description

1. For each unit, two independent and physically separate 125 volt DC batteries and DC distribution center are provided for the Vital Instrumentation and Control Power System.
    a) These same DC distribution centers supply DC power to the Essential power panel boards through their associated isolating diodes from the same unit (there is no backup from another unit for Essential power).
2. The DC buses are two-conductor, metal-clad distribution center assemblies.
3. Three battery chargers are also supplied, with two serving as normal supplies to the bus sections (through independent breakers).
4. The batteries supply the load without interruption, should the chargers or AC source fail (through independent breakers).
5. One of these three battery chargers serves as a standby, and is used for servicing and for backing up the normal supply chargers.
6. A bus tie, with "normally open" breakers, is provided between each pair of DC distribution center (i.e. 1DCA & 1DCB), to back up a battery when it is removed from service.
7. Breaker indication is provided in the Control Room on VB1. **(OC-EL-DCD-5)**
8. Four separate 125 volt DC Instrumentation and Control panelboards are supplied DC power for each unit and are located in the Cable Room.
    a) Each 125 volt DC I&C panelboards receives its DC power through an auctioneering network of two diode assemblies.
    b) One assembly is connected to the unit's 125 volt distribution center and the other assembly is connected to another unit's 125 volt distribution center.

C. Vital DC Loads (typical)

1. DCA Bus
    a) DIA Panelboard
        1) Keowee Emergency Startup Channels
        2) Main Feeder Bus Monitor relay
        3) EHC control
        4) Transformer lockout relays
        5) Load shed relays
        6) CCW, condensate interlocks

7) Mulsifyer systems

8) CRD breaker controls

9) KVIA - Vital AC power panel board through an "inverter"- supplying such loads as: NI, RPS, ES, RCP power monitors etc.

10) CT-1 to 1TA breaker control power

11) 1A1 and 1B1 RCP trip coil receiving UV signal

b) DIB Panelboard

1) Same type DC loads as DIA

2) KVIB - Vital AC power panel board through a "inverter"

2. DCB Bus

a) DIC panelboard

1) Same type DC loads as DIA

2) KVIC - Vital AC power panelboard through a "inverter"

b) DID panelboard

1) Same type DC loads as DIA

2) KVID - Vital AC power panelboard through an "inverter"

D. Vital DC Sources of Power

1. Normal Power supplied by:

a) CA and CB Battery Chargers through their own breakers

1) Receive AC input power from XS1 and XS2 respectively

b) CS Battery Charger is a standby

1) Receives AC input power from XS3

2. Alternate Power supplied by:

a) CA Battery to DCA bus through an independent breaker

b) CB Battery to DCB bus through an independent breaker

3. Backup power supplied from an alternate unit's CA and CB DC buses through isolating diode assemblies.

(3 → 2 → 1 → 3)

a) 3 backs up 2

b) 2 backs up 1

c) 1 backs up 3

E. 125V I&C DC Ground Detection and Test Circuit **(OC-EL-DCD-6)**

1. For the **site** (3 units) 125 VDC I&C DC system there is **one** Ground Detection and Test Circuit.
   a) Ground Detection
      1) The system consists of two redundant ground detector relays; 64P-64N/CA and 64P-64N/CB.
         (a) A single relay is to be in service at a time with the other relay providing a manually switched backup.
         (b) Either relay can detect a ground on any bus on any unit through the isolating diodes.
      2) A set of test resistors are provided for calibrating the setpoint of 10,000 ohms (~18V).
      3) Selector switch 43AB, located on the back of the Unit 1 Electrical Control Board (ECB), is configured with the following functions:
         (a) **OFF** position - opens contacts to disconnect the 64P-N relays from the DC buses and closes contacts to generate alarms (1, 2, 3 SA-4/E-6, 125V DC Ground Trouble) and test the indicators.
         (b) **A** and **B** positions - close contacts to align the respective 64P-N relays to be in service.
      4) If a ground is detected, stat alarms 1, 2, 3 SA-4/E-6, 125Vdc Ground Trouble, will actuate and the P-leg light or the N-leg light (also located on the back of the ECB) will indicate "bright".
      5) When the units are separated, by opening the respective isolating diode breakers**, the ground detector will be monitoring unit 1 only**.
         (a) The circuit is physically connected to the unit 1 DC buses.
         (b) However, if a ground occurs on unit 1, the ground detection circuit will actuate the **125 VDC Ground Trouble** stat alarm on **all 3 units**.
      6) Two OAC analog points are provided to indicate and trend ground voltage on the bus selected by the 43AB switch.
         (a) O1A1856 Control Battery Ground Voltage P-Leg
         (b) O1A1857 Control Battery Ground Voltage N-Leg
         (c) These points are accessible from Unit 1 OAC only.
   b) Test Circuit

1) Use the Ground Test switch located in the back of the Unit 1 Electrical Control Board (ECB).

2) The test is performed using OP/1/A/1700/010, Operation of the Batteries and Battery Chargers, 125 VDC Ground Detector System Operation enclosure.

   (a) The Test switch is positioned to either the "N-Leg" or "P-Leg." position.

      (1) The P-Leg and N-Leg positions provide a momentary closed contact to connect the ground relay through a 10,000 ohm test resistor to the respective buses to test the alarms.

      (2) The applicable light should go bright.

      (3) Statalarm SA-4/E-6, 125V DC Ground Trouble, in **each** Control Room will be received.

3) The voltmeters over the switch indicate battery bus voltage.

F. Operator Actions During Ground Isolation

1. Should a ground develop and I&C determine that separation of the units is required, the operator will isolate each unit's DC power panelboard (DIA, B, C, and D) from its backup supply from the alternate unit by opening the appropriate Isolating Diode input and output breakers.

   a) Prior to removal and/or return to service of an isolating diode for ground isolation I&E performs a breaker test to verify that the alternate source diode breakers have not failed (are closed as expected).

   b) This process narrows the ground to the affected unit so that a work request can be written in order that repairs can be made expeditiously.

2. The procedure for operating units for ground isolation is very tedious and lengthy, requiring verification and operation of multiple breakers with similar nomenclatures. Good self-checking techniques are of utmost importance.

3. It is important to return the DC system to normal lineup after the grounded system has been located. Tech Specs allows each unit (separated at the 'Vital' isolating diode monitor panels) to be separated from its backup unit for no longer than 24 hours.

G. Vital Power Components Locations

1. CA and CB Batteries

a) Located in a room that is at the top of a stairwell across from each Reactor Building personnel hatch on the 3rd/ground floor in the Auxiliary Building.

b) Both batteries are located in the same room on opposite walls.

2. Battery Chargers are located in the respective unit's Equipment Room.

3. DCA, DCB buses Distribution Centers are located in the respective unit's Equipment Room.

4. ADA (1 and 2), ADB (1 and 2), ADC (1 and 2), ADD (1 and 2) Isolating Diode Assemblies are located in the respective unit's Equipment Room.

5. DIA, DIB, DIC, and DID power panelboards are located in the respective unit's Cable Room.

H. **(Obj. R15, 16, 17)** Technical Specifications

1. Applicable Specs

a) Tech Spec 3.8.3, DC Sources - Operating

b) Tech Spec 3.8.4, DC Sources - Shutdown

c) Tech Spec 3.8.8, Distribution Systems - Operating

d) Tech Spec 3.8.9, Distribution Systems - Shutdown

2. TS 3.8.3 Major LCOs and Actions

a) TS 3.8.3.a lists the I&C power sources required to be operable (3 of 4) per unit; if the unit is in Mode 1, 2, 3, or 4.

1) Each power source shall be aligned to at least one panelboard provided that a power source is not the only source for two or more of the Unit's panelboards

b) TS 3.8.3.b requires two additional power sources when any other unit is in Mode 1, 2, 3, or 4.

1) This will require 5 of the 6 sources (1CA, 1CB, 2CA, 2CB, 3CA, 3CB)

c) TS 3.8.3.c requires one additional power source beyond those required in 3.8.3.a if the other two units are in Mode 5 or 6.

1) This power source **shall not** be a power source that is available to meet the 3 of 4 requirement of 3.8.3.a

d) TS 3.8.3 is modified by a note that applies to Unit 2&3 only. The note indicates that no single 125 VDC source shall be the only source for panelboards 1DIC and 1DID.

1 POINT

Question 16

Unit 1 initial conditions:

- Reactor power = 100%

Current conditions:

- A, B and C LPSW pumps tripped
- AP/24, Loss of LPSW in progress

Based on the above conditions, which ONE of the following statements is a required action per AP/24?

A. If the TDEFDWP is operating satisfactorily; stop the MDEFDWPs immediately

B. If the TDEFDWP is operating satisfactorily; stop the MDEFDWPs when directed by Station Management

C. If HPIP motor bearings ≥ 195ºF; align and start SSF-ASW to cool the HPI pump motors

D. If HPIP motor bearings ≥ 195ºF; ensure HPSW operating properly and aligned to the HPI pump motor coolers

Question 16
T1/G1 - kds

062AA1.02, Loss of Nuclear Service Water **Ability to operate and / or monitor the following as they apply to the Loss of Nuclear Service Water (SWS): Loads on the SWS in the control room** (3.2/3.3)

K/A MATCH ANALYSIS
Ability to operate or monitor (Recognize temperatures and operating conditions to remove equipment from operation [MD EFDW]) during a loss of LPSW.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct. On a loss of LPSW, AP-24 directs the operator to secure the MD EFDWPs if the TD EFDWP is operating properly.**

B. Incorrect: Per AP-24, IAAT the TD EFDWP is operating properly the MDEFDWps should be stopped. Station Management's permission is not required.

C. Incorrect: Per AP-24, if HPI pump motor bearing temps ≥ 195 ºF, Encl 5.3 (Station ASW to HPI Pump Motor Coolers) is initiated. Plausible because in most applications at ONS where ASW is used as a cooling source (feed to SGs), SSF ASW is the preferred source.

D. Incorrect: HPSW is the normal backup to the HPIP motors when LPSW is lost. If temps ≥ 195 ºF then station ASW is aligned to the pumps motors.

Technical Reference(s): **AP/24 (Loss of LPSW) Step 4.21**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-APG R9**

Question Source: **Bank EAP212401**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

G. Locate and identify the answers to specific questions on applicable limits, cautions, notes, etc., within the procedures

3.5 In addition, become familiar with the content of each so as to be able to answer questions relating to general systems alignments, available operator controls and instrumentation, and the bases for specific actions.

4. Given a copy of AP/*/A/1700/05, 06, 08, 10, 11, 13, 14, 16, 19, 22, 23, 24, 25, 27, 31, and 2000/02, walkthrough steps, locate equipment, instrumentation and controls outside the Control Room referred to in the AP. Especially address those devices, which require manual operation. (R5)

5. Explain the basis for limits, cautions, notes and major steps in the AP. (R6)

6. Given a set of parameters, determine if immediate Rx trip criteria is met for applicable AP's and OMP guidance. (R7)

7. Discuss major mitigation strategy associated with each AP. (R8)

8. Without the use of reference, when an AP is required to be utilized by the operator be able to demonstrate the following: (R9)

   8.1 State the Entry Conditions and Immediate Manual Actions in the AP.

   8.2 Explain the basis for limits, cautions, notes and major steps in the AP.

   8.3 Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.

   8.4 Utilizing available operator controls and instrumentation both inside and outside the control room interpret the indications and take proper actions per the AP that should mitigate the abnormal condition.

   8.5 Provide proper directions to operators and supporting groups performing actions of the AP outside the control room.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.17 __ **IAAT** <u>any</u> Main Turbine journal bearing vibration (bearings 1-10) > 12 mils, **OR** Alterex bearing vibration (bearings 11 or 12) > 8 mils, {2} **THEN** perform the following: A. __ Trip Rx. B. __ Trip the Turbine Generator.	
4.18 __ Consider reducing LPSW System loads per Encl 5.2 (LPSW System Loads).	
4.19 __ Verify using SGs for heat removal.	__ Initiate AP/26 (Loss of Decay Heat Removal).
4.20 __ **IAAT** LPSW pump motor stator temperatures ≥ 260°F (Computer points O1A1339, O1A1344, O1A1348), **THEN** reduce LPSW System loads per Encl 5.2 (LPSW System Loads) at the discretion of Station Management.	
4.21 __ **IAAT** the TDEFDWP is operating satisfactorily, **THEN** stop MDEFDWPs.	
4.22 __ **IAAT** the MDEFDWPs motor stator temperatures exceed 311°F (Computer points O1A1262, O1A1630), **THEN** perform Step 4.23.	__ **GO TO** Step 4.24.
4.23 __ Start TDEFDWP.	__ Notify Station Management.

1 POINT

Question 17

Unit 2 initial conditions:

- Reactor Power = 70%
- Switchyard isolation occurs.
- IMAs performed
- Symptom check performed

Current conditions:

- MFBs have just re-energized
- AP/11 (Recovery From Loss of Power) is initiated

Based on the current plant conditions, which ONE of the following actions are required to prevent exceeding system limitations?

A. Reduce 2HP-120 setpoint to ≥ 100 inches to prevent HPI suction swap to BWST.

B. Throttle EFDW using 2FDW-315 & 2FDW-316 to prevent excessive EFDW header flow.

C. Swap air ejector steam from Main Steam to Aux Steam to prevent excessive cooldown.

D. Restore the condensate system within one hour to prevent steam induced water hammer.

Question 17
T1/G1-kds

BE02EG2.1.32, Reactor Trip - Stabilization - Recovery / 1 **Ability to explain and apply all system limits and precautions.** (3.4/3.8)

K/A MATCH ANALYSIS
Question requires knowledge of EFDW system limits (system limits/precautions) as it applies during a reactor trip with no RCPs.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect: HPI suction from the BWST is not an operational limit. Plausible because direction is given to maintain Pressurizer level at 120-140".

B. Correct: Upon switchyard isolation, RCPs will trip which will establish the OTSG setpoint at 240". 2FDW 315 & 316 will open fully to establish levels. With these valves fully open and the TD EFDWP as well as both MD EFDWPs operating, flow in each EFDW header will exceed the header limit (1000 gpm) per Rule 7 and have to be throttled.

C. Incorrect: Swapping SJAE to the aux steam system is no longer in Subsequent actions. Plausible because this step used to be in Subsequent Actions.

D. Incorrect: EOP enclosure 5.9 has a note to restore the condensate system within 25 minutes to prevent water hammer.

Technical Reference(s): **EAP-LOHT**
EOP Rule 7

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-LOHT R27**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

13. **Explain why the RCS high point vents must be opened if HPI cooling is not effective. (R19)**

    13.1 **Recognize that degraded HPI cooling may require feeding the SGs with lake water from either the SSF-ASWP of the Station ASWP.**

14. **Given plant conditions, determine appropriate actions based on Enclosure 5.8 (Feeding SGs with Station ASW). (R31)**

15. Recognize that if there are NO HPIPs **AND** NO FDW available (from any source) that the PORV must be manually cycled (to conserve RCS inventory), and RCPs secured to have 1 RCP/loop (to reduce RCS heat input). Efforts must continue to restore HPIPs or the ability to feed the SG(s). (R20)

16. Given plant conditions, determine appropriate actions based on Rule 7 (SG Feed Control). (R27)

17. **Given plant conditions, determine appropriate actions based on "Loss of Heat Transfer" tab of the EOP. (R22)**

18. **Explain how a single MDEFDWP is aligned to both SGs. (R42)**

19. Explain why operation of the condensate system is preferred during extended EFDW operation. (R43)

20. **Describe actions taken per enclosure 5.9, Extended EFDW Operation to maintain UST inventory. (R44)**

21. **Explain the actions required to establish suction source to the EFDW pumps from the Hotwell. (R45)**

Table 1 **Maximum Feed Rates When <u>All</u> SCMs are > 0°F**		
SG Condition	**Flow Instrument**	**Maximum Feed Rate**
Dry SG w/o Heat Transfer	EFDW flow indicator	100 gpm to <u>affected</u> SG
	S/U FDW flow indicator	0.05 x 10^6 lbm/hr to <u>affected</u> SG
	SSF ASW flow indicator	100 gpm <u>total</u> to Unit 1
Non-dry SG **<u>OR</u>** Dry SG with Heat Transfer	EFDW flow indicator	1000 gpm per header
	S/U FDW flow indicator	0.5 x 10^6 lbm/hr per header
	SSF ASW flow indicator	500 gpm <u>total</u> to Unit 1

Table 2
Feed Rates To Be Established When <u>Any</u> SCM is = 0°F and Rapid Cooldown NOT in Progress

<u>NOTE</u>

After initial feed rates are established, flow should be throttled to maintain cooldown rate within Tech Spec limits but SG levels must continue to increase until LOSCM setpoint is reached.

FDW source	**Flow Instrument**	**Initial Feed Rates**	
Emergency FDW	EFDW total flow indicator	1 SG	450 gpm
		2 SGs	300 gpm each
	S/U FDW flow indicator	1 SG	0.23 x 10^6 lbm/hr
		2 SGs	0.15 x 10^6 lbm/hr each
Main FDW	S/U FDW flow indicator	1 SG	0.33 x 10^6 lbm/hr
		2 SGs	0.22 x 10^6 lbm/hr each
SSF ASW **AND NO** SSF Event *	SSF ASW flow indicator	400 gpm <u>total</u> to Unit 1	
SSF ASW **AND SSF** Event *	SSF ASW flow indicator	AP/25 controls feed rate	

*SSF activated per AP/25 with <u>both</u> SSF RC Makeup <u>and</u> SSF Aux Service Water systems required. {31}

Table 3
Emergency FDW Pump and Header Maximum Flow Limits

		EFDW flow indicator	S/U FDW flow indicator
MDEFDWP	**(suction from HW)**	440 gpm/pump	0.22×10^6 lbm/hr
	(suction from UST)	600 gpm/pump	0.30×10^6 lbm/hr
TDEFDWP (any suction source)		950 gpm	0.45×10^6 lbm/hr
Emergency FDW Header Flow		1000 gpm	0.5×10^6 lbm/hr

Table 4
SG Level Control Points

NOTE
Flow may be throttled as necessary to maintain cooldown rate within Tech Spec limits during the approach to the SG Level Control Point.

Plant Condition	Main FDW Pump	EFDW Pump	SSF ASW Pump
All SCMs > 0°F **AND** any RCP on	25″ [55″ acc] S/U level	30″ [60″ acc] XSUR (use MFDW setpoint if feeding via S/U CVs)	30″ [60″ acc] XSUR
All SCMs > 0°F **AND** all RCPs off	50% [50% acc] Operating Range	240″ [270″ acc] XSUR (use MFDW setpoint if feeding via S/U CVs)	240″ [270″ acc] XSUR
Any SCM = 0°F **AND NO** SSF Event *	95% [95% acc] Operating Range	LOSCM setpoint (Turn-on code "EFW" or Per Table 5)	LOSCM setpoint (Turn-on code "EFW" or Per Table 5)
Any SCM = 0°F **AND** SSF Event *	N/A	N/A	Per AP/25
Superheated with CETCs ≤ 1200°F	95% [95% acc] Operating Range	LOSCM setpoint (Turn-on code "EFW" or Per Table 5)	LOSCM setpoint (Turn-on code "EFW" or Per Table 5)
Superheated with CETCs > 1200°F	Per Encl 5.15 (ICC Full Range SG Level)	Per Encl 5.15 (ICC Full Range SG Level)	Per Encl 5.15 (ICC Full Range SG Level)

* SSF activated per AP/25 with both SSF RC Makeup and SSF Aux Service Water systems required. {31}

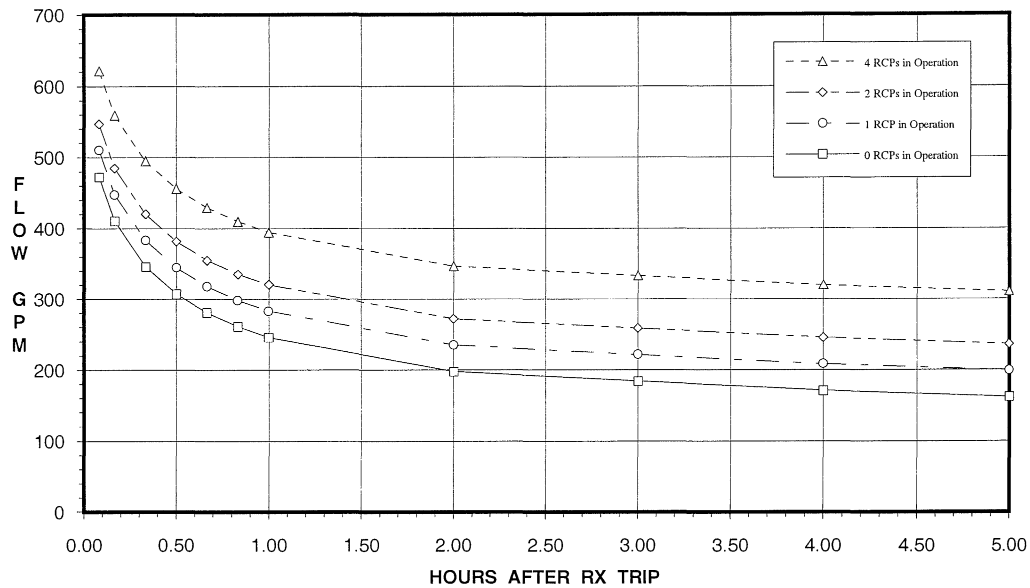
NOTE

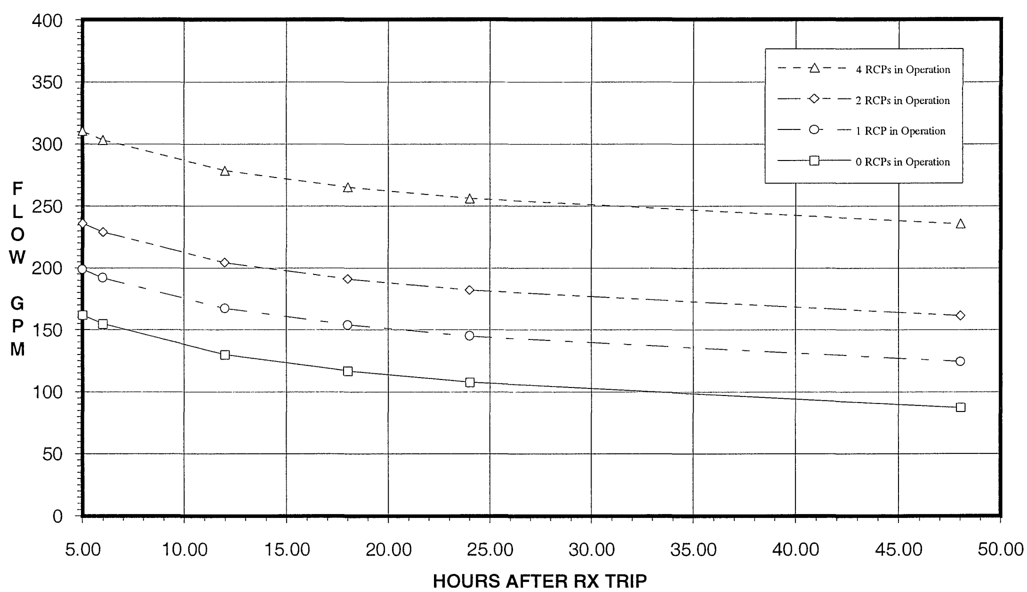
If RB Temperature indication is unavailable, utilize RB pressure on the bottom row to calculate LOSCM setpoint.

Table 5
Desired Indicated XSUR Level (inches) To Establish For LOSCM

	RB Press < 3 psig	**RB Press ≥ 3 psig**					
SG Press (psig) ↓ / RB Temp (°F) →	N/A	> 100 to 150	> 150 to 200	> 200 to 250	> 250 to 300	> 300 to 350	> 350
0 to < 50	360	370	375	385	388	388	388
50 to < 100	345	355	360	370	380	388	388
100 to < 150	340	345	350	360	370	380	388
150 to < 200	330	340	345	355	365	375	385
200 to < 300	325	335	340	350	360	370	380
300 to < 400	320	325	335	340	350	360	375
400 to < 500	310	320	325	335	345	355	365
500 to < 600	305	310	320	325	335	350	360
600 to < 700	300	305	315	320	330	345	355
700 to < 800	295	300	310	315	325	335	350
800 to < 900	290	295	305	310	320	330	345
900 to < 1000	285	290	300	305	315	325	340
1000 to < 1100	280	285	295	300	310	325	335
≥ 1100	275	280	290	295	305	320	330
SG Press (psig) ↑ / RB Press (psig) →	< 3.0	3.0 to 5.0	> 5.0 to 15.0	> 15.0 to 35.0	> 35.0 to 72.5	> 72.5 to 140.0	> 140.0

TOTAL FLOW REQUIRED TO MATCH NSSS HEAT*





*** NSSS HEAT - core decay heat and RCP(s) heat load**

1 POINT

Question 18

Which ONE of following describes the purpose of Condensate Booster Pump feed?

Provide sufficient feed to the steam generators to:

A. Maintain RCS pressure less than PORV relief setpoint.

B. Reduce RCS temperature and pressure to DHR entry conditions.

C. Stabilize RCS temperature and pressure at current values.

D. Stabilize RCS temperature and pressure at normal post-trip values.

Question 18
T1/G1-kds

BE04EG2.1.27, Inadequate Heat Transfer-Loss of Secondary Heat Sink **Knowledge of system purpose and/or function** (2.8/2.9)

K/A MATCH ANALYSIS
Loss of Main and Emergency Feedwater requires CBP feed. Question requires knowledge of the purpose of CBP feed.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: while CBP feed should maintain RCS pressure below PORV setpoint, it is not the purpose.

B. Incorrect: CBP feed is not used to cooldown.

C. Correct: CBP feed should be used to stabilize RCS temperature and pressure at current values.

D. Incorrect, CBP feed should be used to stabilize RCS temperature and pressure at current values.

Technical Reference(s): **EOP Rule 3**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP LOHT R26**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

1. Describe the use of Loss of Heat Transfer tab of the Emergency Operating Procedure in order to perform the required actions of a Control Room operating crew in an event involving a loss of heat transfer. (T1)

ENABLING OBJECTIVES

1. **Describe the conditions that would require entry into LHT. (R23)**
2. **Discuss the overall mitigation strategy of LHT. (R24)**
3. **Explain the basis for cautions, notes and major steps in LHT. (R25)**
4. Given plant conditions, determine appropriate actions based on Rule 3 (Loss of Main or EFDW). (R26)
5. **Given plant conditions, determine appropriate actions based on Enclosure 5.27 (Alternate Methods For Controlling EFDW Flow). (R30)**
6. Given plant conditions, determine appropriate actions based on Enclosure 5.26 (Manual Start of the TDEFDWPT). (R29)
7. **Describe, in general, the correct method for establishing SG feed supplied by the CBPs in order to maintain system temperatures until EFDW can be restored. (R6)**
8. **Explain why an excessive RCS cooldown would result when feeding SGs with the CBPs if a level were established. (R7)**
9. **State when <u>and</u> how HPI forced cooling should be initiated following a loss of all sources of feedwater. (R1)**
10. **Given plant conditions, determine appropriate actions based on Rule 4 (Initiation of HPI Forced Cooling). (R28)**
11. Recognize that limiting the number of running RCPs to one per loop can reduce heat input to the RCS. (R2)
12. Describe the basis for securing all but one RCP when in the HPI forced cooling mode. (R10)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

This rule is **NOT** applicable if loss of Main FDW is due to Turbine Building flooding.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. __ **IAAT NO** SGs can be fed with FDW (Main/CBP/Emergency), **AND** any of the following exist: __ RCS pressure reaches 2300 psig **OR** NDT limit __ Pzr level reaches 375″ [340″ acc] **THEN PERFORM** Rule 4 (Initiation of HPI Forced Cooling).	
2. __ Start EFDW pumps to feed all intact SGs.	
3. __ Verify any EFDW pump operating.	__ **GO TO** Step 5.
4. __ **GO TO** Step 31.	
5. Place the following in MANUAL and close: __ 1FDW-315 __ 1FDW-316	__ Notify CR SRO of failure.
6. Verify both of the following: __ Any CBP operating __ TBVs available on an intact SG	__ **GO TO** Step 14.
7. __ Select OFF for both digital channels on AFIS HEADER A.	
8. __ Select OFF for both digital channels on AFIS HEADER B.	
9. Place Startup Block valve control switch for all intact SGs in OPEN:	
10. Simultaneously position Startup Control valves 10 - 20% open on all intact SGs:	

Step 9 table:

✓	1A SG	✓	1B SG
	1FDW-33		1FDW-42

Step 10 table:

✓	1A SG	✓	1B SG
	1FDW-35		1FDW-44

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. Perform the following: __ Place 1FDW-31 switch in CLOSE. __ Place 1FDW-40 switch in CLOSE. __ Close 1FDW-32. __ Close 1FDW-41.	
12. __ Verify Rule 4 (Initiation of HPI Forced Cooling) in progress.	**CAUTION** Until SGs are dry, lower SG pressure slowly to prevent overcooling. 1. __ Lower SG pressure in <u>available</u> SGs to ≈ 500 psig. 2. __ Control FDW flow to stabilize RCS P/T by throttling the following as necessary: • Startup Control valves • TBVs 3. __ Notify CR SRO that CBP feed is in progress.{22} 4. Place the following switches to OPEN: __ 1FDW-38 __ 1FDW-47 5. Place the following switches to CLOSE: __ 1FDW-36 __ 1FDW-45 6. __ **GO TO** Step 14.
13. Close the following: __ 1FDW-35 __ 1FDW-44	1. __ **IF** 1FDW-35 fails open, **THEN** place 1FDW-33 control switch to CLOSE. 2. __ **IF** 1FDW-44 fails open, **THEN** place 1FDW-42 control switch to CLOSE.
14. __ Verify 1 TD EFDW PUMP is available for manual start.	__ **GO TO** Step 16.
15. __ Dispatch an operator to perform Encl 5.26 (Manual Start of TDEFDWP). (**PS**)	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
16. __ Verify cross-tie with Unit 2 is desired.	1. Dispatch an operator to open the following: __ 3FDW-313 (3A EFDW LINE DISCH TO 3A S/G X-CONN) __ 3FDW-314 (3B EFDW LINE DISCH TO 3B S/G X-CONN) 2. __ **GO TO** Step 18.
17. Dispatch an operator to open the following: __ 2FDW-313 (2A EFDW LINE DISCH TO 2A S/G X-CONN) __ 2FDW-314 (2B EFDW LINE DISCH TO 2B S/G X-CONN)	
18. __ Dispatch an operator to 1FDW-313 <u>and</u> have them notify the CR when in position.	
19. Notify alternate unit to perform the following: A. __ Place <u>both</u> EFDW control valves in manual and closed. B. __ Start their TD EFDW PUMP.	Notify alternate unit to perform the following: A. __ Place <u>both</u> EFDW control valves in manual and closed. B. __ Start <u>both</u> MD EFDW pumps.
20. __ **WHEN** <u>either</u> of the following exists: __ Operator is in position at 1FDW-313 __ Unit 1 TD EFDW PUMP has been manually started **THEN** continue.	
21. __ **IAAT** an operator is in position at 1FDW-313, **AND** Unit 1 TD EFDW PUMP is **NOT** operating, **THEN** notify the operator to open the following: __ 1FDW-313 (1A EFDW LINE DISCH TO 1A S/G X-CONN) __ 1FDW-314 (1B EFDW LINE DISCH TO 1B S/G X-CONN)	__ **GO TO** Step 22.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
22. Verify either of the following exists: __ HPI Forced Cooling is maintaining core cooling __ CBP feed providing SG feed	1. __ Establish 100 gpm to an available intact SG. 2. __ **WHEN** heat transfer is observed, **THEN** feed and steam SG to stabilize T_c. 3. __ **IF** second SG is intact and available to feed, **THEN** perform the following: A. __ Establish 100 gpm to second SG. B. __ **WHEN** heat transfer is observed, **THEN** feed and steam both SGs to stabilize T_c. 4. __ **IF** $T_c > 550°F$, **THEN** initiate cool down to ≤ 550°F by feeding and steaming intact SGs at a rate that prevents RCS saturation using either of the following: __ TBVs __ ADVs 5. Notify CR SRO of the following: __ SG feed status. __ Rule 3 actions are continuing. 6. __ **GO TO** Step 24.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
23. Notify CR SRO of the following: A. EFDW is available from one of the following: __ Unit 1 TD EFDW PUMP __ SG feed is aligned from an alternate unit. {22} B. __ Rule 3 actions are continuing.	
24. __ **IAAT** both of the following exist: __ An EFDW control valve will **NOT** control in AUTO __ The same EFDW control valve will **NOT** respond in MANUAL **THEN** perform Steps 25 and 26.	__ **GO TO** Step 27.
25. __ Notify CR SRO that Encl 5.27 (Alternate Methods for Controlling EFDW Flow) is being initiated. {22}	
26. __ Initiate Encl 5.27 (Alternate Methods for Controlling EFDW Flow).	
27. __ Verify any SCM ≤ 0°F.	__ **IF** overcooling, **OR** exceeding limits in Rule 7 (SG Feed Control), **THEN** throttle EFDW, as necessary.
28. Notify the alternate unit to perform the following: __ Monitor EFDWP parameters. __ Maintain UST level > 7.5'. __ Enter appropriate TS/SLC for EFDW valves closed in manual.	
29. __ **IAAT** Unit 1 EFDW is in operation, **THEN** initiate Encl 5.9 (Extended EFDW Operation).	
30. __ **WHEN** directed by CR SRO, **THEN EXIT** this rule.	

• • • END • • •

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
31. __ **IAAT** <u>both</u> of the following exist: __ An EFDW control valve will **NOT** control in AUTO __ The same EFDW control valve will **NOT** respond in MANUAL **THEN** perform Steps 32 and 33.	__ **GO TO** Step 34.
32. __ Notify CR SRO that Encl 5.27 (Alternate Methods for Controlling EFDW Flow) is being initiated. {22}	
33. __ Initiate Encl 5.27 (Alternate Methods for Controlling EFDW Flow).	
34. __ Verify <u>any</u> SCM ≤ 0°F.	**<u>CAUTION</u>** ATWS events may initially require throttling to prevent exceeding pump limits and additional throttling once the Rx is shutdown to prevent overcooling. __ **IF** overcooling, **OR** exceeding limits in Rule 7 (SG Feed Control), **THEN** throttle EFDW, as necessary.
35. __ **IAAT** Unit 1 EFDW is in operation, **THEN** initiate Encl 5.9 (Extended EFDW Operation).	
36. __ **WHEN** directed by CR SRO, **THEN EXIT** this rule.	

• • • END • • •

1 POINT

Question 19

Unit 1 plant conditions:

- Reactor power = 48%
- Group 6 Rod 6 is stuck
- AP/15 (Dropped or Misaligned Control Rods) in progress
- OP/1/A/1105/019 (Control Rod Drive System) in progress

Based on the above conditions and the Limits and Precautions of OP/1/A/1105/019, which ONE of the following correctly describes the speed at which the stuck control rod is operated and why?

The control rod should be operated in _____ speed to prevent damaging the CRD ____.

A. JOG / spider

B. JOG / motor

C. RUN / spider

D. RUN / motor

Question 19
T1/G2 - gcw

005AA2.02, Inoperable / Stuck Control Rod **Difference between jog and run rod speeds, effect on CRDM of stuck rod** (2.5*/3.0*)

K/A MATCH ANALYSIS
The question requires knowledge of JOG and RUN speeds when operating a stuck rod.

ANSWER CHOICE ANALYSIS
OP/1/A/1105/019 L&P 2.10 states:

> *If partially withdrawn or fully withdrawn control rod is stuck or jammed, do* ***NOT*** *operate control rod in JOG speed. Operate in RUN speed only. Possibility of overloading spider exists if CRD is operated in JOG speed when CRD is* ***NOT*** *free running. If fully inserted control rod is stuck or jammed, control rod may be operated in JOG speed only for purpose of latching CRDM to lead screw.*

Answer: C

A. Incorrect; first part is incorrect. Second part is correct.

B. Incorrect; both parts are incorrect.

C. Correct; per L&P a stuck control rod should not be operated in JOG to prevent overloading the spider.

D. Incorrect; first part is correct. Second part is incorrect

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Technical Reference(s): **OP/1/A/1105/019, Control Rod Drive System Limits and Precautions**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **IC-CRI; R16**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

14.5Manual Transfer/Sync and Transfer Confirm Pushbutton/Indicator

14.6Sequence/Sequence Override Pushbutton Indicator

14.7Group/Auxiliary Pushbutton/Indicator

14.8Auto/Manual Pushbutton/Indicator.

14.9Clamp/Clamp-Release Pushbutton/Indicator

14.10 Speed Selector Switch (Jog/Run)

14.11 Manual Command Switch (Insert/Withdraw)

14.12 Single Select Switch (Off, 1-12, ALL)

14.13 Group Select Switch (Off, 1-8)

15. Describe how the operator resets the Control Rod Drive Trip breakers from the Diamond Control panel. (R19)

16. Explain the purpose for the Clamping Contactors associated with the CRD power supplies. (R14)

17. Explain the CRD Patch Panel including the associated S.L.C. requirement. (R15)

18. Given a Limit and Precaution from OP/*/A/1105/019, Control Rod Drive System, explain the basis of the limit or precaution. (R16)

19. Given the procedure, describe the bases of the steps involved in the following CRD system evolutions: (R17)

    19.1 Transferring between D.C. Hold, Auxiliary and Group power supplies for the C CRDs.

    19.2 Latch and PI alignment of a safety group or any individual rod.

20. Describe the process and required controls to accomplish group 8, APSR movement.(R24)

21. Describe the process for verifying the "A" and "CC" phases of Groups 1-4 stators operable. (R18)

22. Discuss the following concerning the Diverse Scram System (DSS): (R20)

    22.1 Operation and bases of DSS

    22.2 Signal inputs

    22.3 Actuation setpoints

    22.4 System reset

    22.5 Operability verification by the operator

Control Rod Drive System

1. Purpose

To describe operation of Control Rod Drive System.

2. Limits And Precautions

2.1 Use of this procedure can affect core reactivity management due to changes in the following: (R.M.)

- CTP
- Control Rod position
- RCS Boron
- Steam flow with ICS in manual
- FDW flow
- ICS operation

2.2 Other R.M. related Limits and Precautions:

2.2.1 Criticality should be anticipated anytime Control Rods are being withdrawn. (R.M.)

2.2.2 Prior to dropped or asymmetric rod recovery, contact Duty Reactor Engineer to evaluate effects of local power distribution and possible necessity for special maneuvering limits. (R.M.)

2.2.3 Pulling any individual control rod with Group 1 withdrawn to 50% is unanalyzed condition. With reactor shut down, ensure all rods are inserted prior to withdrawing individual control rod. (R.M.)

NOTE: When Group 8 is selected, controlling group (normally Group 7) CONTROL ON lights will also be ON.

2.2.4 Ensure desired PI panel CONTROL ON lights are only ON for CRD group/rod to be operated. (R.M.) {11}

2.2.5 Ensure TBVs to manual prior to reset of CRDs. (R.M.) {8 : Plant Sign}

2.2.6 When Reactor trip occurs, any FDW ICS control station in "HAND" may automatically transfer to "AUTO" resulting in FDW transient. (R.M.) {4}

2.3 If any of these limits are exceeded, center CRDM shall be checked for accumulation of undissolved gases:

2.3.1 If Reactor Coolant System temperature/pressure is reduced below or to right of curve on Enclosure 4.8 "Dissolved Gas Concentration Curve."

2.3.2 Loss of level in Pressurizer below 0 inches if nitrogen is in Pressurizer.

2.3.3 Loss of RC System pressure indication during which it **CANNOT** be shown that pressure did **NOT** drop below curve on Enclosure 4.8 "Dissolved Gas Concentration Curve."

2.3.4 Loss of level in either Core Flood Tank below 0 inches if RC pressure is below Core Flood Tank pressure.

2.4 If Control Rods are withdrawn during event that requires venting, drive (do **NOT** trip) rods to In Limits unless trip is imminent or required by safety considerations.

2.5 When safety groups are withdrawn, maintain "Withdraw" command until CRD TRAVEL "Out" indication is OFF.

2.6 When safety groups are inserted, maintain "Insert" command until CRD TRAVEL "In" indication is OFF.

2.7 During testing, limits for rate and frequency of cycling CRD Breakers shall be observed:

2.7.1 There must be 15 second interval after opening before reclosing breaker.

2.7.2 Frequency of operation must **NOT** exceed 20 in 10 minutes or 30 per hour.

2.8 Operating limits have been established to assure that control rod drop is prohibited under conditions which would defeat hydraulic snubbing action of control rod drive mechanism. Two major concerns are gases in CRDM "Torque-Taker Tube" and fluid vaporization above "Torque-Taker" when rod is dropped. Limits established for control rod operation are listed below:

2.8.1 Control rod operation is allowed when RCS pressure is above and to left of curve shown on Enclosure 4.8 "Dissolved Gas Concentration Curve."

2.8.2 If control rods must be operated during RCS cooldown when pressure is < 350 psig, maintain RCS temperature constant for 1/2 hour prior to going below 350 psig to allow CRDM temperatures to stabilize.

2.9 If Pressurizer level decreases to less than 184 inches with RCS depressurized, all CRDs must be vented.

2.10 If partially withdrawn or fully withdrawn control rod is stuck or jammed, do **NOT** operate control rod in JOG speed. Operate in RUN speed only. Possibility of overloading spider exists if CRD is operated in JOG speed when CRD is **NOT** free running. If fully inserted control rod is stuck or jammed, control rod may be operated in JOG speed only for purpose of latching CRDM to lead screw.

2.11 When operating switches on Diamond, maintain switch depressed until light indication changes state.

2.12 If CRD system is in SEQUENCE when API/RPI mismatch alarm is received & API/RPI reset is desired, SEQUENCE OR must be selected in order to be able to select the group and rod that needs to be reset. If system is in SEQUENCE, the group select and rod select switches are ignored. {23}

3. Procedure

3.1 Perform applicable enclosures.

1 POINT

Question 20

Unit 2 initial conditions:

- Time = 0900
- Reactor Startup in progress
- NI 1 & 2 = 70 cps
- NI 3 & 4 = 0 cps (out of service)
- ALL WRs = ~ 2.7 E-4%

Current conditions:

- Time = 0901
- NI 1 & 2 are inoperable

Based on the current conditions, which ONE of the following list all actions required per TS 3.3.9 (Source Range Neutron Flux) and why?

A. Insert Control Rods to Gp 1 = 50% immediately and verify SDM within 1 Hour. This is to ensure the reactor is sufficiently shutdown in a condition where power is not able to be determined accurately.

B. Suspend operations involving positive reactivity changes and insert all control rods immediately. Open control rod drive trip breakers and verify SDM within 1 Hour. This is because the source range provides the only reliable direct indication of power in this condition.

C. Maintain present power level and restore inoperable channels to operable status prior to increasing Thermal Power. This prevents power increases in the range where the operators rely solely on the source range instrumentation for power indication.

D. Initiate action to restore affected channels to operable status within 1 Hour to ensure the future ability to accurately monitor reactivity changes in low power conditions. Further operation is justified because the instrumentation does not provide a safety function during this range of power.

Question 20
T1/G2 - kds

032AK3.01, Loss of Source Range Nuclear Instrumentation
Knowledge of the reasons for the following responses as they apply to the Loss of Source Range Nuclear Instrumentation: Startup termination on source-range loss (3.2/3.6)

K/A MATCH ANALYSIS
The question requires knowledge of 1 hour TS and presents conditions that warrant startup termination and requires the knowledge of the reasoning for stopping the startup.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect: All control rods are required to be inserted completely. Plausible because the startup procedure OP/1/A/1101/001 and reactivity balance procedure PT/1/A/1103/015 state that if shutdown required during approach to criticality or ECP window missed, shutdown to Gp 1 = 50% and sample RCS boron.

B. Correct: Per TS 3.3.9: Suspend operations involving positive reactivity changes (immediately), initiate action to insert all control rods (immediately), open control rod drive trip breakers ($\leq$ 1Hr) and verify SDM ($\leq$ 1Hr). TS 3.3.9 (Bases) This is because the source range provides the only reliable direct indication of power in this condition

C. Incorrect: Does not list all actions per TS 3.3.9. Plausible because for one required Source Range NI being out of service, it is correct.

D. Incorrect: Incorrect actions for current power level. Plausible because if power is > 4E-4% on WR channels, this answer is correct.

Technical Reference(s): **TS 3.3.9 & Bases**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **ADM-TSS R4**

Question Source: **New**

Question History: Last NRC Exam ___________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVES

1. Analyze a given set of plant conditions for applicable LCO's and commitments; apply rules to determine applicable Conditions and Required Actions for the given plant conditions and compute the maximum Completion Time allowed for each Required Action to ensure compliance with Tech Spec's and SLC's.

ENABLING OBJECTIVES

1. Analyze plant conditions to determine any applicable TS or SLC Conditions, Actions, and/or Completion Times. (R1)

2. Apply the rules of Section 3.0 of Technical Specification to determine appropriate actions for a given set of plant conditions. (R2)

3. Know Tech Spec and SLC Action Statements with Completion Times $\leq$ 1 hour. (R4)

4. Know the bases in Tech Spec's and SLC's for all Limiting Conditions for Operations and Safety Limits as discussed in this lesson plan. (R5)

5. Given a set of conditions, evaluate system, train, or component operability as defined in Tech Spec's and SLC's. (R6)

3.3 INSTRUMENTATION

3.3.9 Source Range Neutron Flux

LCO 3.3.9 Two source range neutron flux channels shall be OPERABLE.

APPLICABILITY: MODES 2, 3, 4, and 5.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One required source range neutron flux channel inoperable with THERMAL POWER level ≤ 4E-4% RTP on the wide range neutron flux channels.	A.1	Restore channel to OPERABLE status.	Prior to increasing THERMAL POWER
B. Two required source range neutron flux channels inoperable with THERMAL POWER level ≤ 4E-4% RTP on the wide range neutron flux channels.	B.1	Suspend operations involving positive reactivity changes.	Immediately
	AND		
	B.2	Initiate action to insert all CONTROL RODS.	Immediately
	AND		
	B.3	Open CONTROL ROD drive trip breakers.	1 hour
	AND		
			(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.4 Verify SDM to be within the limit specified in the COLR.	1 hour AND Once per 12 hours thereafter
C. One or more required source range neutron flux channel(s) inoperable with THERMAL POWER level > 4E-4% RTP on the wide range neutron flux channels.	C.1 Initiate action to restore affected channel(s) to OPERABLE status.	1 hour

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.9.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.9.2	--------------------------NOTE-------------------------- Neutron detectors are excluded from CHANNEL CALIBRATION. -- Perform CHANNEL CALIBRATION.	18 months

B 3.3 INSTRUMENTATION

B 3.3.9 Source Range Neutron Flux

BASES

BACKGROUND

The source range neutron flux channels provide the operator with an indication of the approach to criticality at lower power levels than can be seen on the wide range neutron flux instrumentation. These channels also provide the operator with a flux indication that reveals changes in reactivity and helps to verify that SDM is being maintained.

The source range instrumentation has four redundant count rate channels originating in four fission chambers. Four source range detectors are externally located symmetrically around the core. These channels are used over a counting range of 0.1 cps to 1E5 cps and are displayed on the operator's control console in terms of log count rate. The channels also measure the rate of change of the neutron flux level, which is displayed for the operator in terms of startup rate from -0.1 decades to +7 decades per minute. An interlock provides a control rod withdraw "inhibit" on a high startup rate of +2 decades per minute in either channel.

APPLICABLE SAFETY ANALYSES

The source range neutron flux channels are necessary to monitor core reactivity changes. They are the primary means for detecting reactivity changes and triggering operator actions to respond to reactivity transients initiated from conditions in which the Reactor Protection System (RPS) is not required to be OPERABLE. They also trigger operator actions to anticipate RPS actuation in the event of reactivity transients starting from shutdown or low power conditions.

The source range neutron flux channels satisfy Criterion 2 of 10 CFR 50.36 (Ref. 1).

LCO

Two source range neutron flux channels shall be OPERABLE to provide the operator with redundant source range neutron instrumentation. The source range instrumentation provides the primary power indication at low power levels < 4E-4% RTP on wide range instrumentation and must remain OPERABLE for the operator to continue increasing power.

BASES (continued)

APPLICABILITY

Two source range neutron flux channels shall be OPERABLE in MODE 2 to provide redundant indication during an approach to criticality. Neutron flux level is sufficient for monitoring on the wide range and on the power range instrumentation prior to entering MODE 1; therefore, source range instrumentation is not required in MODE 1.

In MODES 3, 4, and 5, source range neutron flux instrumentation shall be OPERABLE to provide the operator with a means of monitoring neutron flux and to provide an early indication of reactivity changes.

The requirements for source range neutron flux instrumentation during MODE 6 refueling operations are addressed in LCO 3.9.2, "Nuclear Instrumentation."

ACTIONS

A.1

The Required Action for one required channel of the source range neutron flux indication inoperable with THERMAL POWER ≤ 4E-4% RTP on the wide range neutron flux instrumentation is to delay increasing reactor power until the channel is repaired and restored to OPERABLE status. This limits power increases in the range where the operators rely solely on the source range instrumentation for power indication. The Completion Time ensures the source range is available prior to further power increases. Furthermore, it ensures that power remains below the point where the wide range channels provide primary protection.

B.1, B.2, B.3, and B.4

With both required source range neutron flux channels inoperable with THERMAL POWER ≤ 4E-4% RTP on the wide range neutron flux instrumentation, the operators must take actions to limit the possibilities for adding positive reactivity. This is done by immediately suspending positive reactivity additions, initiating action to insert all CONTROL RODS, and opening the control rod drive trip breakers within 1 hour. Periodic SDM verification is then required to provide a means for detecting the slow reactivity changes that could be caused by mechanisms other than CONTROL ROD withdrawal or operations involving positive reactivity changes. Since the source range instrumentation provides the only reliable direct indication of power in this condition, the operators must continue to verify the SDM every 12 hours until at least one channel of the source range instrumentation is returned to OPERABLE status. Required

BASES

ACTIONS

B.1, B.2, B.3, and B.4 (continued)

Action B.1, Required Action B.2, and Required Action B.3 preclude rapid positive reactivity additions. The 1 hour Completion Time for Required Action B.3 and Required Action B.4 provides sufficient time for operators to accomplish the actions. The 12 hour Frequency for performing the SDM verification provides reasonable assurance that the reactivity changes possible with CONTROL RODS inserted are detected before SDM limits are challenged.

C.1

With reactor power > 4E-4% RTP in MODE 2, 3, 4, or 5 on the wide range neutron flux instrumentation, continued operation is allowed with one or more required source range neutron flux channels inoperable. The ability to continue operation is justified because the instrumentation does not provide a safety function during high power operation. However, actions are initiated within 1 hour to restore the channel(s) to OPERABLE status for future availability. The Completion Time of 1 hour is sufficient to initiate the action. The action must continue until channels are restored to OPERABLE status.

SURVEILLANCE REQUIREMENTS

SR 3.3.9.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined, based on a combination of the channel instrument uncertainties, including isolation, indication, and readability. If a channel is outside the criteria, it may be an indication that the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE. If

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.9.1 (continued)

the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction.

The Frequency, equivalent to every shift, is based on operating experience that demonstrates channel failure is rare. Since the probability of two random failures in redundant channels in any 12 hour period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but potentially more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO's required channels. When operating in Required Action A.1, CHANNEL CHECK is still required. However, in this condition, a redundant source range may not be available for comparison. CHANNEL CHECK may still be performed via comparison with wide range detectors, if available, and verification that the OPERABLE source range channel is energized and indicating a value consistent with current unit status.

SR 3.3.9.2

For source range neutron flux channels, CHANNEL CALIBRATION is a complete check and readjustment of the channels from the preamplifier input to the indicators. This test verifies the channel responds to measured parameters within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift to ensure that the instrument channel remains operational between successive tests.

The SR is modified by a Note excluding neutron detectors from CHANNEL CALIBRATION. It is not necessary to test the detectors because generating a meaningful test signal is difficult. The detectors are of simple construction, and any failures in the detectors will be apparent as change in channel output.

The Frequency of 18 months is based on demonstrated instrument CHANNEL CALIBRATION reliability over an 18 month interval, such that the instrument is not adversely affected by drift.

REFERENCES

1. 10 CFR 50.36.

Question 21
T1/G2 – New KA - gcw

061AK1.01, Area Radiation Monitoring
Knowledge of the operational implications of the following concepts as they apply to Area Radiation Monitoring System Alarms: Detector limitations
(2.5*/2.9?)

K/A MATCH ANALYSIS
Question requires knowledge of limitations on when certain RIAs may be used for SG leak identification.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct: RIAs-59 and 60 are inaccurate below 20% power and, in addition, are not allowed to be used below 40% by procedure. Also, 1RIA-40 cannot discern between SGs. SGTR tab only uses RIAs-16 & 17 when < 40% power.**

B. Incorrect: 1RIA-40 cannot discern between SGs

C. Incorrect: RIAs-59 and 60 are inaccurate below 20% power and, in addition, are not allowed to be used below 40% by procedure

D. Incorrect: RIAs-59 and 60 are inaccurate below 20% power and, in addition, are not allowed to be used below 40% by procedure. Also, 1RIA-40 cannot discern between SGs.

Technical Reference(s): **RAD-RIA**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **RAD-RIA R15**

Question Source: **Bank RAD011502**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

14. Without the use of reference, when AP/1700/018, (Abnormal Release of Radioactivity), is required to be utilized by the operator be able to demonstrate the following: (R16)
    - State the Entry Conditions and Immediate Manual Actions in the AP.
    - Explain the basis for limits, cautions, notes and major steps in the AP
    - Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.
    - Utilizing available operator controls and instrumentation both inside and outside the control room interpret the indications and take proper actions per the AP that should mitigate the abnormal condition.
    - Provide proper directions to operators and supporting groups performing actions of the AP outside the control room
15. Evaluate an inoperable monitor to determine if any required actions are necessary per TS & SLC. (R9)
16. Utilize Area and Process Radiation Monitor indications to analyze plant conditions and determine the proper course of action required to prevent the potential inadvertent release of radioactive effluent to the environment. (R15)

3. The high range detector "keep alive" source replaces the check source function, with a constant indication of proper channel functioning. RIAs-37 & 38 have a continuous check source. In the event the detector's sensitivity should drop, a fault statalarm would alarm and the radiation monitor display terminal would show a fault.
4. Both detectors are located in a detector shield assembly consisting of a 4" schedule 40 process pipe with 4" of lead shield.
5. (**Obj. R3**) The RIA 37&38 monitor package has an IA purge connection just upstream of the monitor to remove lingering waste gas from the line following a waste gas tank release. Plant personnel can perform maintenance on the monitor without being exposed to the waste gas and monitor readings will not be upscale during normal operation.
6. Interlock terminates gaseous release by closing GWD-4, 5, 6, 7, 206, 207 & 215 and actuates statalarm "RM GWD DISCH Radiation Inhibit". If reading drops below setpoint, valves will not reopen and release will not begin again. (also stops Waste Gas Exhauster)
7. Located on the 4th floor of the auxiliary building in penetration room (Unit 1); 6th floor purge exhaust room (Unit #3)
8. An RM-80 microprocessor controls operation and output of the monitor.

E. 1, 3RIA-39 Control Room Gas - (Pβ) (CPM)

1. The control room gas monitor pulls a continuous air sample from the return air duct of the Control Room Ventilation system into a shielded gas detection chamber with a beta scintillation detector to monitor for the presence of radioactivity.
2. The monitor alarms on a high radiation signal and alerts the operator to energize the outside air booster fans and filter system to minimize unfiltered air entering the Control Room.
3. The skid is located on the 6th floor of the Auxiliary Building behind the Emergency Air Booster Fans.
4. Skid includes a RM-80 microprocessor which performs data acquisition and control functions, provides alarm relays, analog outputs, and digital communications.
5. There is also a flow meter and sample tubing installed on the monitor skid.

F. 1, 2, 3RIA-40 - Monitors air ejector off gas - (Pβ)(CPM)

1. The air ejector vent monitor is a single-detector monitor system used to monitor the off-gas of the main condenser air ejectors to detect activity resulting from SG tube leakage.
2. Monitor is an off-line monitoring system which has a pump pulling a sample flow from the combined CSAE vent line through the monitor and discharging back into the combined vent line.

3. This type of system allows for better internal shielding and enhances sensitivity.
4. The monitor is located on the 6th floor purge equipment room.
5. The inlet line to the monitor has a self contained air dryer installed to collect moisture prior to entering the monitor skid. The moisture is drained via a tygon tube to the Vent Stack. Condensation of the moist CSAE discharge in the RIA-40 sample system has been a problem. It typically occurs during startup.
6. Monitor activity readings are correlated to SG leak rates to aid Operators in determining the magnitude of primary to secondary leakage. Leak rates are calculated manually and by the OAC.
7. Sample flow, ~3 scfm, enters the monitor through a sample inlet. The sample passes through the sample pump and into a shielded stainless steel canister where it is viewed by a beta scintillator detector mounted inside the shielded assembly. Exit flow from the monitor returns to the condenser steam air exhauster line.
8. The gas monitor operation is monitored by a dedicated RM-80 microprocessor.
9. The RM-80 is programmed to monitor the operation and output of the detector and check source as well as the sample pump and other instrumentation on the skid.

G. 1, 3RIA-41 Spent Fuel Pool Building Gas - (Pβ)(CPM)

1. The Monitor pulls a continuous air sample from the exhaust duct from the SFP and Fuel Loading areas to detect the presence of radioactive gases.
2. The monitor is a gas monitor of the same design as the monitor for RIA-39.
3. The monitor is located in the Purge Equipment Room on the 6th floor of the Auxiliary Building for Unit 3 and in the Air Handling Room on the 6th floor of the Auxiliary Building on Unit 1.
4. RIA-41 has no local alarm in the SFP. Notification of personnel in the SFP area should be made as soon as possible.

H. 1, 3RIA-42 - Monitors RCW return from aux building - (NaI)(CPM)

1. Located in TB basement behind backwash pumps
2. A pump on the skid ensures sufficient sample flow.
3. RIA-42 is basically the same as RIAs-31, 35 and 50 except that they have slightly different pumps.
4. Detects potential leaks in SF coolers, primary sample coolers and seal return coolers.

H. 1RIA-8 Primary Chemistry Lab Monitor - (mR/hr)

1. Alerts personnel to an increase in radiation levels in the primary chemistry lab
2. Local audible (horn) alarm provided.

I. 1, 2, 3RIA-10 Primary Sample Hood Monitor - (mR/hr)

1. Alerts personnel to an increase in radiation levels in the primary sample hood area
2. Local audible (horn) alarm provided.

J. 1, 3RIA-11 Auxiliary Building Corridor 3rd Floor - (mR/hr)

1. Alerts personnel to an increase in radiation levels in the vicinity of the change rooms on the third floor of the auxiliary building
2. Local audible (horn) alarm provided.

K. 1, 3RIA-12 Chemical Addition Area Monitor - (mR/hr)

1. Alerts personnel to an increase in radiation levels in the vicinity of the chemical addition mix tank on the second floor of the auxiliary building
2. Local audible (horn) alarm provided.

L. 1, 3RIA-13 Waste Disposal Control Area Monitor - (mR/hr)

1. Alerts personnel to an increase in radiation levels in the vicinity of the waste disposal tank on the first floor of the auxiliary building
2. Local audible (horn) alarm provided.

M. 1, 3RIA-15 High Pressure Injection Pump Room Monitor - (mR/hr)

1. Alerts personnel to an increase in radiation levels in the HPIP room
2. Also uses a Ion Chamber detector to extent its range
3. Local audible (horn) alarm provided.

N. 1, 2, 3RIA-16 & 17 "A" & "B" Main Steam Line Monitors - (mR/hr)

1. Alerts control room personnel of a SG tube leak in the A or B SG.
2. Also uses a Ion Chamber detector to extent their range
3. No local alarm provided.
4. Used to determine activity released to the atmosphere when MSRVs lift following a SG tube leak. This allows for determination of offsite dose.

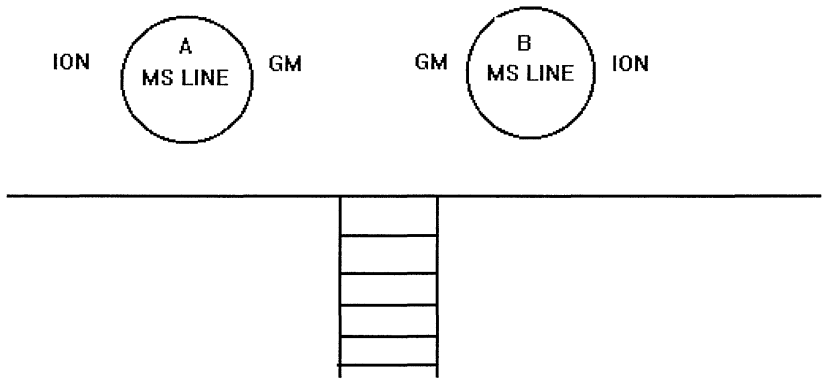


FIGURE 1.

5. A GM detector is positioned on one side of each steam line. An ION chamber is positioned on the other side of the steam lines. The GM and ION input from each steam line outputs to RIAs-16 and 17, respectively. The ION chamber provides additional range for these monitors. Refer to Figure 1 above.

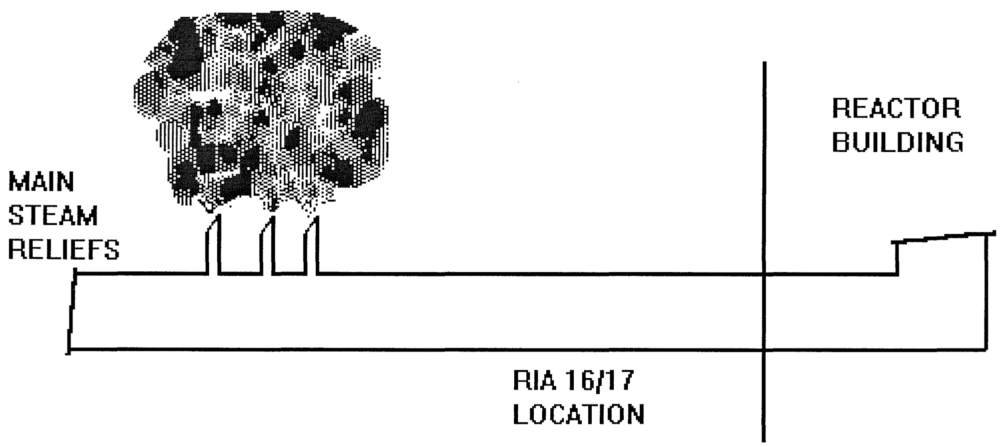


Figure 2.

6. The detectors are located between the MSRVs and the Reactor Building. This allows for determination of the amount of curies released in case of a SG tube rupture followed by a MSRV lifting. Refer to Figure 2 above.
7. The GM and Ion Chamber detectors associated with RIA-16 and RIA-17 are sensitive to gamma radiation emitted by all isotopes, which would be present in the steam following a tube leak or tube rupture. Although RIA-16 and RIA-17 detectors would exhibit some sensitivity to N-16 gammas, they are not considered "N-16 detectors."

O. 1, 2, 3RIA-56 High Range Stack Monitor - (R/hr)

1. Gross gamma unit vent monitor./ Ion Chamber detector
2. Allows control room personnel to monitor vent stack releases with radiation levels, which may over range the normal vent stack process monitors.
3. Reg Guide 1.97 monitor

P. 1, 2, 3RIA-57 & 58 High Range Containment Monitors - (R/hr)

1. Allows control room personnel to monitor post LOCA containment atmosphere radiation levels per Reg Guide 1.97.
2. Ion Chamber detectors
3. Used by control room or radiation protection personnel for detection of a breach in a fission product barrier and determination of the magnitude of the resulting release
4. Detectors are accessed from the east and west penetration rooms. Each detector is located inside a 3" diameter stainless steel housing, which protrudes into Containment. The SS housing is welded to a 12" diameter flange bolted to the Containment. The wall thickness of the reactor building end piece is thin enough to minimize gamma radiation attenuation, yet thick enough to meet containment pressure boundary code requirements.
5. RIA-57 & 58 output directly to dedicated control room display units (RM-23), as well as the Transient Monitor System Computer and the OAC. There is a recorder for RIA-58. This is a requirement of Reg Guide 1.97.
6. The detectors, cables, connectors and associated electronics are environmentally and seismically qualified for their location.

Q. 1RIA-59/60 Main Steam Line N-16 detectors (GPD & GPM)

1. Overview
   a) NSM ON-13113 installed 1RIA-59/60 (Main Steam Line N-16 detectors) to provide diverse/redundant indication of a SG tube leak/rupture.
   b) 1RIA-59/60 manufactured by MGP Instruments.
   c) Each RIA consists of a detector and a Local Processor Display Unit (LPDU).
   d) Powered from an uninterruptible power source supplied by lighting panel;
      1) Unit 1- OFL4 breaker #15 for 1RIA-59 & breaker # 17 for 1RIA-60
   e) Not Safety Grade equipment.

3. Local Processor Display Unit (LPDU) (Turbine Building 5th floor)
   a) The LPDU performs the following functions:
      1) Pulse height spectrum analysis
      2) Discriminates pulse output from the detector (count rate) to only pass signal from N-16 gamma interaction.
   b) Tube leak size determination
      1) The LPDU uses several algorithms to processes the N-16 count rate & Reactor power, adjust for variables (i.e. pipe geometry, distance of detector from SG) and determine leak rate. (GPD & GPM)
      2) Reactor power indication is provided from the median select of ICS Star module RXC (A or B).
   c) Output signal to Statalarms, RIA View Node screen and OAC

   NOTE: A function of the LPDU (not used by OPS) is to use different algorithms that vary the time from leak to detector to determine the location of the leak within the SG.

   d) LPDU has a local display screen and input point (IO port for a laptop) for system testing and alarm setpoint adjustment.
4. Accuracy
   a) 1RIA-59/60 rely on N-16 Gamma interactions to determine SG tube leak size, below 20% there are insufficient N-16 interactions for the RIAs to be considered accurate.
   b) Each 1RIA-59/60 LPDU has a reactor power input signal. Below 20% power the 1RIA-50/60 LPDU output signal sent to the OAC and RIA display view node will be magenta (Bad Quality).
      1) **Caution** a RIA detector fault can change the output to magenta, also. A fault is expected to activate both the RIA Fault Statalarm and the associated OAC point.
   c) At and above 20% reactor power 1RIA-59/60 LPDU will provide an accurate/valid indication of SG Tube leak/rupture.

RAD011502

Unit 1 Plant Conditions:

- SGTL in progress
- Rx power = ~32% decreasing
- Maximum Runback is in progress

Which ONE of the following correctly lists all of the RIAs that are allowed to be used to identify the specific SG with the tube leak? (.25)

Unit 1 RIA(s): ____________.

A) 16 and 17

B) 16, 17, and 40

C) 16, 17, 59, and 60

D) 16, 17, 40, 59, and 60

A. Correct: RIAs-59 and 60 are inaccurate below 20% power and, in addition, are not allowed to be used below 40% by procedure. Also, 1RIA-40 cannot discern between SGs. SGTR tab only uses RIAs-16 & 17 when < 40% power.

B. Incorrect: 1RIA-40 cannot discern between SGs

C. Incorrect: RIAs-59 and 60 are inaccurate below 20% power and, in addition, are not allowed to be used below 40% by procedure

D. Incorrect: RIAs-59 and 60 are inaccurate below 20% power and, in addition, are not allowed to be used below 40% by procedure. Also, 1RIA-40 cannot discern between SGs.

1 POINT

Question 22

Plant initial conditions:

- Unit 1 in MODE 6
  - ➢ De-fuel in progress
- Unit 2 in MODE 5
- 1RIA-3 (Fuel Transfer Canal Wall) = 1.4 mr/hr
- 1RIA-6 (Spent Fuel Pool) = 0.72 mr/hr

Current conditions:

- 1RIA-3 (Fuel Transfer Canal Wall) = 1.3 mr/hr
- 1RIA-6 (Spent Fuel Pool) = 12.38 mr/hr
  - ➢ Local evacuation alarm sounds

Based on the above conditions, which ONE of the following describes REQUIRED operator actions?

A. Stop Unit 1 RB Purge Fan and start a SFP Filtered exhaust fan.

B. Stop Unit 1 RB Purge Fan and stop all GWRs in progress.

C. Stop Unit 2 RB Purge Fan and start a SFP Filtered exhaust fan

D. Stop Unit 2 RB Purge Fan and stop all GWRs in progress.

Question 22
T1/G2 - gcw

036AA1.02, Fuel Handling Accident **Ability to operate and / or monitor the following as they apply to the Fuel Handling Incidents: ARM system** (3.1/3.5)

K/A MATCH ANALYSIS
Question requires that the candidate determine where the fuel handling accident occurred by monitoring RIA indications and what actions are required to mitigate it.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect, first part is incorrect. The SFP Filtered Exhaust Fan is associated with Unit 2's RB Purge. Second part is correct.

B. Incorrect, first part is incorrect. The SFP Filtered Exhaust Fan is associated with Unit 2's RB Purge. Second part is incorrect. Would be correct for Vent Gas RIAs.

C. Correct, Local evacuation alarm on 1RIA-6 indicates that spent fuel damage may have occurred in the Unit 1 & 2 SFP. AP/9 (Spent Fuel Damage) should be entered. AP/9 directs that the Unit 2 RB purge fan should be secured and a SFP Filtered Exhaust fan should be started.

D. Incorrect, first part is correct. Second part would be correct for Vent Gas RIAs.

Technical Reference(s): **AP/9, Spent Fuel Damage**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **FH-FHS R47, R31**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

14. Without the use of reference, when an AP is required to be utilized by the operator be able to demonstrate the following: (R47)
    - State the Entry Conditions and Immediate Manual Actions in the AP.
    - Explain the basis for limits, cautions, notes and major steps in the AP
    - Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.
    - Utilizing available operator controls and instrumentation both inside and outside the control room interpret the indications and take proper actions per the AP that should mitigate the abnormal condition.
    - Provide proper directions to operators and supporting groups performing actions of the AP outside the control room.
15. List the three- (3) actions that should be taken by bridge operators and spotters when an unexplained decrease in the Fuel Transfer Canal level occurs. (R7)
16. List the actions that the Refueling SRO should take if an unexplained decrease in fuel transfer canal occurs. (R19)
17. List the necessary actions for an accident involving spent fuel damage in the Spent Fuel Pool. (R-31)
18. State the required number of operable flux monitors when core geometry is being changed and what action should be taken if it is determined this limit is not satisfied. (R20)
19. State the time limit associated with temporarily having all LPI pumps secured during fuel handling. (R21)
20. Describe how it is determined if the Unit 1 & 2 spent fuel pool is an acceptable suction source for an operating unit's SSF RC Makeup system and be able to correctly evaluate whether those requirements are met. (R22)
21. Explain what actions must be performed prior to releasing a fuel assembly after it has been inserted into the core. (R23)
22. When given a situation regarding the operation of the RB Polar Crane, determine what actions must be taken to ensure all rules of fuel handling are met. (R25)
23. Describe the rules stated in procedures that govern personnel getting on or off of a fuel handling bridge when it is in motion. (R18)
24. Describe the actions which must be taken while the fuel receiving roll up door is open. (R17)

1. Entry Conditions

Suspected spent fuel damage has occurred in the Unit 1 RB or Units 1 and 2 SFP.

2. Automatic Systems Actions

2.1 The following occurs upon high alarm on 1RIA-49 (Reac Bldg Gas Low) or 1RIA-49A (Reac Bldg Gas High):

- RB evacuation alarm sounds
- 1LWD-2 (RB Normal Sump Isolation) closes

2.2 Local evacuation alarm sounds upon high alarm on 1RIA-3 (Fuel Transfer Canal Wall).

2.3 Local evacuation alarm sounds upon high alarm on 1RIA-6 (Spent Fuel Pool).

3. Immediate Manual Actions

3.1 None

4. Subsequent Actions

	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1	__ Verify affected area is Units 1 and 2 SFP.	__ **GO TO** Step 4.14.
4.2	__ Announce Plant conditions using PA System including areas requiring evacuation.	
4.3	__ Notify the OSM to reference the following: • Emergency Plan • NSD-202 (Reportability)	
4.4	__ Verify Units 1&2 SFP level decreasing.	__ **GO TO** Step 4.6.
4.5	__ Initiate AP/1&2/35 (Loss of SFP Cooling and/or Level).	
4.6	__ Stop Unit 2 RB Purge Fan.	
4.7	Close the following: __ 2PR-1 __ 2PR-2 __ 2PR-3 __ 2PR-4 __ 2PR-5 __ 2PR-6	
4.8	__ Dispatch an operator to start Fan 1 <u>or</u> Fan 2 on 1/2 Spent Fuel Filtered Exhaust Control Panel (Unit 2 A-6 entry into 1&2 SFP).	
4.9	Start the following: {1} __ A Outside Air Booster Fan __ B Outside Air Booster Fan	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.10 Notify Unit 3 to start the following: {1} __ 3A Outside Air Booster Fan __ 3B Outside Air Booster Fan	
4.11 __ Notify RP to obtain and evaluate airborne particulate and gaseous samples from the U1 & 2 SFP.	
4.12 __ Monitor the following Rad Monitors for an increase in radiation levels in the U1 & 2 SFP: • 1RIA-6 (SFP) • 1RIA-41 (SFP Gas)	
4.13 __ **WHEN** conditions permit, **THEN EXIT** this procedure.	

• • • END • • •

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.14 __ Place REACTOR BUILDING EVACUATION switch to TEST.	

NOTE

Due to relaxed refueling Tech Spec requirements, penetration openings are allowed during fuel movement of fuel that has been sub critical for > 72 hrs. Any open penetrations must be isolated within 30 minutes of fuel damage.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.15 __ Notify Containment Closure Coordinator to ensure containment isolated per OP/1/A/1502/009 (Containment Closure Control). {2}	
4.16 __ Announce Plant conditions using PA System including areas requiring evacuation.	
4.17 __ Notify the OSM to reference the following: • Emergency Plan • NSD-202 (Reportability)	
4.18 Start the following: {1} __ A Outside Air Booster Fan __ B Outside Air Booster Fan	
4.19 Notify Unit 3 to start the following: {1} __ 3A Outside Air Booster Fan __ 3B Outside Air Booster Fan	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

Stopping the RB purge may cause increase of SFP level if compressed air is open in the RB.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.20 __ Stop Unit 1 RB Purge Fan.	
4.21 Close the following: __ 1PR-1 __ 1PR-2 __ 1PR-3 __ 1PR-4 __ 1PR-5 __ 1PR-6	
4.22 __ Notify RP to obtain and evaluate airborne particulate and gaseous samples from the U1 RB atmosphere.	
4.23 __ Monitor the following Rad Monitors for an increase in radiation levels in the affected area: • 1RIA-3 (Fuel Transfer Canal Wall) • 1RIA-4 (Reac Bldg Personnel Hatch) • 1RIA-47 (Reac Bldg Particulate) • 1RIA-48 (Reac Bldg Iodine) • 1RIA-49 (Reac Bldg Gas Low) • 1RIA-49A (Reac Bldg Gas High)	
4.24 __ **WHEN** conditions permit, **THEN EXIT** this procedure.	

• • • END • • •

1 POINT

Question 23

Unit 1 initial plant conditions:
- Time = 0400
- Reactor power = 100%
- Generator output = 902 MWe
- Group 7 CR position = 90%
- Condenser vacuum = 27.8" Hg
- Turbine Master in HAND

Current conditions:
- Time = 0405
- Condenser vacuum = 22.3" Hg and stable

Which one of the following correctly describes the change in generator output and control rod position that would result from the above conditions?

A. Generator output will decrease due to the reduction in ICS front end demand
Group 7 Control Rods will withdraw due to positive neutron error

B. Generator output will decrease due to the reduction in ICS front end demand
Group 7 Control Rods will insert due to tracking MWe

C. Generator output will decrease due to reduced turbine efficiency
Group 7 Control Rods will withdraw due to positive neutron error

D. Generator output will decrease due to reduced turbine efficiency
Group 7 Control Rods will insert due to tracking MWe

Question 23
T1/G2 - kds

051AA1.04, Loss of Condenser Vacuum
Ability to operate and / or monitor the following as they apply to the Loss of Condenser Vacuum: Rod position (2.5*/2.5*)

K/A MATCH ANALYSIS
Question requires knowledge of ICS operation and how condenser vacuum affects ICS control signals including Control Rod Position.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: Generator output will decrease because of the decrease in turbine efficiency. Plausible because the front end demand is reducing but its reducing because of the reduction in MWe. Control Rods would withdraw with a positive neutron error.

B. Incorrect: Generator output will decrease because of the decrease in turbine efficiency. Plausible because the front end demand is reducing but its reducing because of the reduction in MWe

C. Incorrect: CRs will not withdraw. Plausible because with a positive neutron error Control Rods will insert.

D. Correct: With ICS tracking MWe due to the Turbine Master in HAND, ICS front end demand is overridden by "Track" signal which in this case is MWe. As condenser vacuum decreases, turbine efficiency will decrease causing MWe to decrease. Since ICS is tracking MWe, the track signal (which overrides front end demand) will reduce demand to the rest of ICS to match MWe.

Technical Reference(s):

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SAE-L008 R8**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

LESSON SPECIFIC OBJECTIVES

Terminal Objectives

When generated megawatts begin to decrease, correctly diagnose that a condenser vacuum leak exists.

Following receipt of statalarm 1SA-3/A-6, Condenser Vacuum Low, refer to the Alarm Response Manual and AP/1/A/1700/027, Loss Of Condenser Vacuum, for the necessary corrective action.

After the condenser vacuum leak has been isolated, restore condenser vacuum to 28" Hg and unit load to 100%.

Use proper communications practices and team skills during control room operations.

Enabling Objectives

1. Based on control room indication, correctly diagnose that condenser vacuum is decreasing: (R8)
    - 1.1 Generated megawatts decreasing
    - 1.2 Indicated condenser vacuum decreasing
2. Following receipt of statalarm 1SA-3/A-6, Condenser Vacuum Low, refer to the associated alarm response guide and AP/1/A/1700/027, Loss Of Condenser Vacuum. (R9)

3. EXERCISE PRESENTATION

Instructor Note:	If this exercise is to be run in an unannounced format, GO TO STEP 3.3 on page 20.)

3.1 Vacuum Leak Demonstration

A. Review the training objectives with the students.

B. Assign positions and allow students to review control boards and assume plant.

INITIATE A CONDENSER VACUUM LEAK

> **<u>TIMER</u>#1:**
>
> **Enter and activate Malfunction MSS200, 12 Condenser Vacuum Leak at 12% degradation.**
>
> **Condenser vacuum will decrease at a rate of approximately 0.5" Hg. per minute.**
>
> **Decreasing condenser vacuum can be monitored via Updater.**

C. When the students have identified a decrease in generated megawatts, FREEZE the simulator.

D. Discuss the immediate indications of a decrease in unit efficiency with the team.

1. Generated megawatts will begin to slowly decrease, due to increased back pressure.
2. ICS compares CTP Set to CTP Best and is unaffected by the decrease in vacuum, when operating in automatic.

3.2 Discuss the potential causes of a decrease in unit efficiency with the team:

A. Condenser vacuum leak.

1. A condenser vacuum leak allows noncondensible gases (i.e., air) to be drawn into the condenser. These noncondensible gases tend to migrate to the area of the lowest pressure; around the condenser tubes.
2. The noncondensible gases accumulate around the tubes and form an insulating barrier which impedes the transfer of heat energy from the steam to the CCW flowing through the tubes.
3. This inhibition of heat transfer prevents the turbine exhaust steam from being condensed at the rate necessary for the given power level, resulting in a increase in turbine backpressure.

4. Increasing condenser backpressure prevents the turbine from extracting as much energy from the steam, resulting in decreased efficiency, i.e.:

   a) $Wk_{turbine} = m(h_{in} - h_{out})$; as condenser backpressure increases h_{out} increases, resulting in a smaller Δ h and less work by the turbine.

5. A condenser leak will be indicated by decreasing vacuum on the OAC and control board gauge (1UB2).

B. Degraded CCW flow

1. A reduction in CCW flow will have a similar effect on condenser vacuum as a vacuum leak.
2. The reduction in CCW flow will result in a decrease in heat transfer from the turbine exhaust steam which will again result in an increase in condenser backpressure.
3. In addition to decreasing condenser vacuum, the operators may observe indications of a tripped CCWP(s), fluctuating or low CCWP amps, and/or actuation of the CCWP Pump Bay Level Low statalarm (1SA-9/A-10), indicating that a CCWP intake screen has become clogged (assuming that it is a pump related problem and not a failed closed valve or breach in a CCW header).

C. Increasing CCW (lake) temperature

1. Increasing CCW temperature would also result in a reduction of condenser heat transfer.
2. However, this is a gradual, seasonal effect that would not result in immediate or rapid changes in unit efficiency.

D. Steam leak

1. A steam leak results in a decrease in mass flow rate to the turbine and, therefore, a decrease in generated megawatts.
2. With the two main steam lines tied together at the turbine steam chest, a small steam leak will be difficult to diagnose from the control room.
3. Not only can a steam leak be due to a breach in a main steam header or one of it's auxiliary headers, but the steam could also be leaking through a relief valve, turbine bypass valve, etc.
4. However, a steam leak will not result in a decrease in condenser vacuum.

E. Turbine header pressure control malfunction

1. A gradual or partial failure of the controlling turbine header pressure instrument can result in symptoms that immediately resemble a decrease in unit efficiency.

2. As indicated turbine header pressure decreases, the turbine control valves will ramp close in an effort to restore turbine header pressure to setpoint and generated megawatts will decrease.
3. Again, the indicated low THP will generate a THP error signal in ICS. This error signal is fed forward to the feedwater and reactor ICS subsystems in order to increase power and restore generated megawatts.
4. Control rods will continue to withdraw until either all of the control rods are fully withdrawn or until reactor demand reaches 101% power, at which time the ICS reactor demand high limit prevents further rod withdrawal (indicated by the white 'load limit by reactor' light on the ULD.
5. Depending upon the magnitude of the failure, the operator may observe an increase in steam generator outlet pressure and/or an OAC SASS THP mismatch alarm.
6. However, as with a steam leak, there will not be a decrease in condenser vacuum associated with a THP instrument failure.

Take the simulator to RUN and allow condenser vacuum to decrease until statalarm 1SA-3/A-6, Condenser Vacuum Low, actuates (at 25″Hg.) and then FREEZE the simulator. As vacuum decreases, point out the affect it has on generated megawatts

F. Discuss the guidance provided in the alarm response guide (ARG) for 1SA-3/A-6 with the students:

1. Explain to the students that they are not required to wait until receipt of this statalarm prior to taking corrective action.
2. Also point out to the students that, even though there are no automatic actions associated with this statalarm, the main turbine and FDWP turbines may trip shortly after receipt of this alarm (at 21.75" Hg and 19" Hg respectively).
3. Graphic Display "1COND01" on the OAC provides an indication of condenser vacuum and absolute backpressure for each of the three condenser sections.

- Note: Simulator OAC does not model all condenser points.
  a) Depending upon the location and magnitude of the vacuum leak, the affected condenser section can be identified based on its higher OAC backpressure reading and the vacuum system OFDs can be referenced to aid in diagnosing the general location of the leak.

4. The ARG directs the operator to refer to AP/1/A/1700/027.
   a) It is important to notify the dispatcher any time a load change is anticipated or required, so that additional generating capacity can be brought on-line as necessary.

G. A NEO should be directed to align the main vacuum pumps to the affected unit.
   1. This should be accomplished per Enclosure 5.1, Main Vacuum Pump Alignment, of AP/1/A/1700/027. This procedure is pre-staged.
   2. Main vacuum pumps are started from the CR per this AP.
   3. Point out that once the vacuum leak has been identified and isolated, the main vacuum pumps should be isolated and secured when condenser vacuum reaches 26" Hg. The main vacuum pumps are only capable of achieving ~ 26" Hg in the condenser and must be isolated to allow the CSAE's to return condenser vacuum to normal (~ 28" Hg).

H. While the main vacuum pumps are being aligned, the AP directs the operators to verify that the steam seal header pressure is > 1.5 psig.
   1. The steam seal system seals the main turbine and FDWP turbine shafts to prevent air in-leakage (and steam out-leakage on the HP turbine).
      a) Steam seal header pressure can be monitored on the steam seal header pressure gauge on 1AB1.
      b) Statalarm 1SA-6/B-10, Steam Seal Header Pressure Low, will actuate on 1.5 psig decreasing.
      c) Corrective actions for low steam seal header pressure can be found in the alarm response guide for 1SA-6/B-10 and in OP/1/A/1106/13, Steam Seal System.

I. Verify CSAE's operating properly.
   1. The condenser steam air ejectors continuously remove noncondensible gases from each condenser section during normal operation, preventing the gases from accumulating around the condenser tubes and inhibiting heat transfer.
   2. Steam to each of the CSAE's can be monitored on the 1AB1 control board gauges.
   3. In addition, statalarm 1SA-5/E-12, Air Ejector Steam Pressure Low, will actuate if the steam pressure to any of the CSAE's decreases to $\leq$ 255 psig.

4. Guidance for valving in additional sections of CSAE's and for draining water from CSAE suction lines is provided in OP/1&2/A/1106/16.

J. Ensure ALL available CCW pumps are operating.

1. The operators should verify that no previously operating CCW pump has tripped, and that the operating CCW pumps have normal, stable amps indicated.

a) The operators can monitor CCW total flow on the OAC. Total flow for 3 CCW pump operation is ~ 745,000 gpm.

b) They should also verify, via the OAC, that no CCW condenser discharge valve(s) has inadvertently gone shut.

c) If an additional CCW pump is required, the operators should start it in accordance with Encl. 4.1, CCW Pump Startup of OP/1/A/1104/012A, CCW Pump Operation.

K. A NEO(s) should be dispatched to determine the source of the vacuum leak. Again, the OAC indication and the OFDs may aid in determining the general location of the leak.

L. Discuss plant response to a condenser vacuum leak without operator action.

1. As discussed previously, generated megawatts will begin to decrease due to the decrease in turbine efficiency.

2. Reactor power will remain constant.

3. At 21.75" Hg decreasing, the main turbine will trip and the reactor will trip on an RPS anticipatory trip signal.

4. At 19" Hg decreasing, the main FDWPs will trip and the EFDW System will actuate.

5. At 7" Hg decreasing, the Turbine Bypass Valves will fail closed to prevent the condensers from being over pressurized. The unit will stabilize at hot shutdown conditions with feedwater being provided from the EFDW System and steam being relieved out of the main steam relief valves.

M. At the conclusion of the demonstration, run the exercise in an announced format.

1 POINT

Question 24

Unit 3 plant conditions:

- A Challenging Active Fire has been determined by the control room crew
- The fire location is:
  - ➢ inside the Unit 3 Turbine Building 3rd floor
  - ➢ Column C-55
- 7 minutes have elapsed

Which ONE of the following is correct at this time?

The Unit MS lines ___________ be isolated and the SSF breaker transfer will be performed by the ____________.

A. will / units BOP

B. will not / units BOP

C. will / units AP/EOP NEO

D. will not / units AP/EOP NEO

Question 24
T1/G2 - gcw

067AG2.1.2, Plant Fire On-site
Knowledge of operator responsibilities during all modes of plant operation
(3.0/4.0)

K/A MATCH ANALYSIS
This question requires knowledge of the fire response process including NEO and RO actions.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect - MS lines **will not** be isolated until a challenging active fire inside an SSF risk area has been determined. The AP/EOP NEO will transfer the breakers during a fire event in the TB/AB not the BOP.

B. Incorrect - First portion is correct the MS lines **will not** be isolated and the SSF Breakers will not be transferred by the BOP within 10 minutes per AP/25 during a station fire event. This answer would be correct during an event other than a fire (blackout) that requires the SSF to be activated.

C. Incorrect - MS lines **will not** be isolated. The second portion is correct for the fire event as the AP/EOP NEO will transfer the SSF breakers within 10 minutes. This would be correct if the fire was in the Unit 3 TBB.

D. Correct - During a Challenging Active Fire that is outside of the SSF risk area the MS lines will not be isolated. The AP/EOP NEO will transfer the SSF breakers within 10 minutes per the Fire Alarm ARG.

Technical Reference(s): **1SA-3/B-6 (Fire Alarm)**

Proposed references to be provided to applicants during examination: **1SA-3/B-6 Attachment 1**

Learning Objective: **AP/25 Changes R4**

Question Source: **Bank; RQ Exam A Shift Q 9**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVES

1. Given AP/0/A/1700/025 and a set of conditions, determine the actions required to mitigate an event in accordance with AP/25. (T1)

ENABLING OBJECTIVES

1. State the revised entry conditions for AP/25. (R1)
2. Define a "confirmed active fire." (R2)
3. Explain the reason for activation of the SSF for a confirmed fire. (R3)
4. Summarize the required actions to be taken in AP/25 following a report of a confirmed active fire. (R4)
5. Summarize the required actions to be taken in accordance with AP/25 to restore an affected unit's SSF systems to normal operation following an SSF event. (R5)

FIRE ALARM {3} {4}

1. Alarm Setpoint

None

2. Automatic Action

None

3. Manual Action

3.1 Monitor fire alarm cabinet in rear of control room to determine cause of alarm.

- Refer to Section 5 for list of alarm points.

3.2 Push ACKNOWLEDGE Switch at fire alarm cabinet to silence audible alarm.

3.3 **IF** more than one alarm or trouble condition exists, press PREVIOUS/NEXT Switch to scroll through all alarms on display unit to determine affected areas or detectors.

3.4 **IF** one or more detectors are in alarm condition, dispatch a fire brigade qualified operator(s) to affected area(s) to determine validity of alarm(s).

3.5 Notify an AP/EOP NEO to report to the CR.

NOTE:	
	• CONFIRMED ACTIVE FIRE is a locally observed fire with smoke and either radiant heat or visible flame.
	• SSF RISK AREA: Control Rooms, Cable Rooms, Equipment Rooms, Cross-Hatched portions of TB (see attachment 1), U1&2 Blockhouse, U3 Blockhouse.
	• LOCALIZED ACTIVE FIRE is an ACTIVE FIRE that is a locally verified fire where you can observe a combination of flame, smoke or heat in a small localized area or affecting only a single component (pump bearing failed, single breaker cubicle smoking etc.).
	• CHALLENGING ACTIVE FIRE is an Active Fire that is spreading <u>and</u> is burning cables (bundles/ trays which have the potential to affect additional equipment) <u>outside</u> of load center, switchgear, control board, termination cabinet, or other piece of equipment.

3.6 **<u>IF</u>** alarm is valid,
<u>THEN</u> perform the following:

3.6.1 Have another RO perform Attachment 2 (Fire Brigade Activation).

3.6.2 Determine from dispatched operator if fire is a LOCALIZED ACTIVE FIRE or a CHALLENGING ACTIVE FIRE.

3.6.3 Determine from dispatched operator if fire is in SSF RISK AREA by using table below:

SSF Risk Area	**Affected Units**
Unit 1 & 2 Control Room	Units 1, 2
Unit 3 Control Room	Unit 3
Unit 1 Cable Room	Units 1, 2, 3
Unit 2 Cable Room	Units 1, 2, 3
Unit 3 Cable Room	Unit 3
Unit 1 Equipment Room	Unit 1
Unit 2 Equipment Room	Unit 2
Unit 3 Equipment Room	Unit 3
Units 1& 2 Blockhouse	Units 1, 2, 3
Unit 3 Blockhouse	Unit 3
Cross-Hatched Areas in TB (refer Attachment 1)	Refer to Attachment 1

3.6.4 **IF** there is a CHALLENGING ACTIVE FIRE in an SSF Risk Area **THEN** perform the following for affected Unit:

A. Notify SROs on affected Units, per table in step 3.6.3, to enter AP/0/A/1700/25 (Standby Shutdown Facility Emergency Operating Procedure) for their Unit(s).

NOTE:	If available, use Control Room personnel on unaffected Unit, as needed.

B. Notify OSM to perform the following:

- Refer to RP/0/B/1000/001 (Emergency Classification)
- As resources allow, implement RP/0/B/1000/029 (Fire Brigade Response)

NOTE:	• To determine affected Unit(s) that need SSF Breaker Transfers use table in step 3.6.3. • If fire is outside of SSF RISK AREAs per table in step 3.6.3, then the Unit that has the fire is the only Unit that needs SSF Breaker Transfers.

3.6.5 **IF** there is a LOCALIZED ACTIVE FIRE in any area of the AB / TB or a AB / TB CHALLENGING ACTIVE FIRE that is outside of the SSF RISK AREAs
THEN perform the following:

A. Dispatch one AP/EOP NEO to perform pre-staged Encl (SSF Breaker Transfer) of AP/0/A/1700/025 (Standby Shutdown Facility Emergency Operating Procedure) for all affected Unit(s).

B. Refer to RP/0/B/1000/029 (Fire Brigade Response)

C. Refer to Fire Plan

D. Refer RP/0/B/1000/001 (Emergency Classification)

3.6.6 **IF** a fire exists inside RB,
THEN perform the following:

A. Refer to RP/0/B/1000/029 (Fire Brigade Response)

B. Refer to Fire Plan

C. Refer RP/0/B/1000/001 (Emergency Classification)

D. Shutdown reactor **IF** it is necessary to gain access to an area that is off limits during reactor operation.

E. For oil fires involving stainless steel, use only CO_2 Fire Extinguishers.

F. For oil fires generated by RCS surface temperatures, the RCS should be cooled down below the flash point (425°F) **IF** oil leak and/or fire **CANNOT** be secured.

3.7 **IF** alarm(s) is **NOT** valid, push RESET Switch to clear alarm.

3.8 **IF** one or more detectors are in the trouble condition, **OR** an invalid alarm condition **CANNOT** be reset, notify I&E to investigate and repair cause of alarm(s).

3.9 **IF** I&E **CANNOT** immediately repair cause of alarm(s), perform the following actions:

3.9.1 Declare affected detector(s) inoperable and record in accordance with OMP 1-02 (Rules Of Practice).

3.9.2 Verify requirements of Selected Licensee Commitment 16.9.6, Fire Detection Instrumentation, are met.

3.9.3 Have I&E lockout affected detectors.

4. Alarm Sources and References

4.1 Any detector alarm condition.

4.2 Any detector trouble condition.

4.3 Reflash Module in Fire Alarm Cabinet.

4.4 Drawing O-756-M and O-756-N Fire Detection System Tabulation.

Question 9

Unit 3 plant conditions:

- A Challenging Active Fire has been determined by the control room crew
- The fire location is:
  - inside the Unit 3 Turbine Building 3rd floor
  - Column C-55
- 7 minutes have elapsed

Which ONE of the following is correct at this time? (.25)

The Unit MS lines __________ be isolated and the SSF breaker transfer will be performed by the ___________.

A. will / units BOP

B. will not / units BOP

C. will / units AP/EOP NEO

D. will not / units AP/EOP NEO

Question 9 ANSWER

==

D

A. Incorrect - MS lines **will not** be isolated until a challenging active fire inside an SSF risk area has been determined. The AP/EOP NEO will transfer the breakers during a fire event in the TB/AB not the BOP.

B. Incorrect - First portion is correct the MS lines **will not** be isolated and the SSF Breakers will not be transferred by the BOP within 10 minutes per AP/25 during a station fire event. This answer would be correct during an event other than a fire (blackout) that requires the SSF to be activated.

C. Incorrect - MS lines **will not** be isolated. The second portion is correct for the fire event as the AP/EOP NEO will transfer the SSF breakers within 10 minutes. This would be correct if the fire was in the Unit 3 TBB.

D. Correct - During a Challenging Active Fire that is outside of the SSF risk area the MS lines **will not** be isolated. The AP/EOP NEO will transfer the SSF breakers within 10 minutes per the Fire Alarm ARG.

New question - AP/25 Changes A

AP/25 changes (11-06) (p7) Obj's - With the use of AP/25 describe the operator actions required to stabilize and control the plant from the SSF. (R6) Summarize the actions to be taken in the Fire Alarm ARG for the following events: Confirmed active fire outside an SSF risk area, Challenging active fire in an SSF risk area (R3)

Recognize that the SSF breakers must be transferred within 10 minutes of the time that a fire has been <u>confirmed</u> to be a LOCALIZED or CHALLENGING ACTIVE fire inside <u>or</u> outside an SSF risk area. (R4)

Reference: AP/25 and FIRE ALARM ARG

1 POINT

Question 25

Unit 1 initial plant conditions:

- Reactor power = 2%

Current conditions:

- ICS AUTO power and ICS HAND power lost

Based on the above conditions, which ONE of the following describes the level at which SGs will be maintained and how decay heat removal from the core is controlled?

ASSUME NO OPERATOR ACTIONS

A. 25 inches SUR / manual operation of the ADVs.

B. 30 inches XSUR / manual operation of the ADVs.

C. 25 inches SUR / manual operation of the TBVs.

D. 30 inches XSUR / manual operation of the TBVs.

Question 25
T1/G2 - gcw

BA02AK2.2, Loss of NNI-X/Y / 7
Knowledge of the interrelations between the (Loss of NNI-X) and the following: Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility. (3.8/3.8)

K/A MATCH ANALYSIS
This question requires knowledge of the plant response to a loss of KI and KU (NNI-X and NNI-Y).

ANSWER CHOICE ANALYSIS
With a loss of ICS Hand and Auto power the MFDW pump and the reactor will trip. EFDW will control SG levels at 30 inches XSUR. The TBVs will fail closed requiring the use of the ADVs to control decay heat removal.

Answer: B

A. Incorrect, the MFDW pumps will trip resulting in EFDW controlling SG levels at 30 inches XSUR. Second part is correct.

B. Correct, the MFDW pumps will trip resulting in EFDW controlling SG levels at 30 inches XSUR. The TBVs will fail closed requiring the use of the ADVs to control decay heat removal.

C. Incorrect, the MFDW pumps will trip resulting in EFDW controlling SG levels at 30 inches XSUR.

D. Incorrect, first part is correct. With a loss of ICS Hand and Auto power the TBVs fail closed.

Technical Reference(s): **AP/23, Loss of ICS Power**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **STG-ICS R33**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

32. Given a control or indication utilized in the ICS, assess the affect of the following power failures: (R33)

    32.1 Loss of Auto Power (KI)

    32.2 Loss of Hand Power (KU)

    32.3 Loss of Auto and Hand Power

    32.4 STAR Module Failure

33. Draw the ICS logic from memory. (R35)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. Ensure plant conditions are stabilized using available indications as follows: __ Monitor PAM instrumentation. __ Maintain LDST level > 60″ per LDST level gauges. {3} __ Use CR indications as listed in Encl 5.4 (Available Control Room Indications).	
2. __ Ensure SG pressure and RCS temperature controlled with ADVs per Encl 5.24 (Operation of the ADVs) of EP/1 (EOP). **(PS)**	
3. __ Verify essential inverters have been de-energized due to a station blackout.	__ **GO TO** Step 5.
4. __ **WHEN** electrical power has been restored, **THEN** continue this procedure.	
5. __ Dispatch an operator to perform Encl 5.1 (Bypass of 1KI and 1KU Inverters).	
6. __ **IAAT** ICS AUTO power has been restored as indicated by 1SA-2/B-11 (ICS AUTO POWER FAILURE) off, **THEN** perform Steps 7 - 13.	__ **GO TO** Step 14.

NOTE

Some of the following steps may not be necessary based on plant conditions when power is restored.

7. __ Ensure TBVs properly controlling SG pressure and RCS temperature.	__ **GO TO** Step 9.
8. __ Notify operator at ADVs to secure use of ADVs.	
9. __ Ensure Pzr level setpoint set as desired.	
10. __ Ensure 1HP-120 in AUTO.	

1 POINT

Question 26

Unit 1 initial conditions:

- LOCA CD tab in progress
- Core SCM = 85 ºF
- All HPIPs operating
- All LPIPs operating

Based on the above plant conditions, what criterion is required to throttle HPI per Rule 6 and when are the HPIPs directed to be secured per the LOCA CD tab?

A. CETCs decreasing / As soon as LPI flow rates are ≥ 3400 gpm total flow or ≥ 2900 gpm flow in one header.

B. CETCs decreasing / As soon as the ECCS Suction Swap to RBES (Encl. 5.12) is complete.

C. Pzr level increasing / As soon as the ECCS Suction Swap to RBES (Encl. 5.12) is complete

D. Pzr level increasing / As soon as LPI flow rates are ≥ 3400 gpm total flow or ≥ 2900 gpm flow in one header.

Question 26
T1/G2 - kds

BE08EK1.1, LOCA Cooldown **Knowledge of the operational implications of the following concepts as they apply to the (LOCA Cooldown): Components, capacity, and function of emergency systems.** (3.5/3.8)

K/A MATCH ANALYSIS
Question requires knowledge of emergency systems (HPI) function and how they are used during a Large Break LOCA (when throttled and secured).

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: CETCs are not required to be decreasing to throttle HPI if not in HPI Forced Cooling. Plausible because this is the criteria if in HPI Forced Cooling. LPI flow criteria is not a requirement to secure HPI. Plausible because it is criteria to be the LOCA CD tab.

B. Incorrect: CETCs are not required to be decreasing to throttle HPI if not in HPI Forced Cooling. Plausible because this is the criteria if in HPI Forced Cooling.

C. **Correct: The LOCA CD tab is entered from other locations in the EOP if LPI flow is > 3400 gpm total or > 2900 gpm in an individual header. In the LOCA CD tab, it specifies that when the ECCS suction swap to the RBES is complete (Encl 5.12 in this case), secure HPIPs. In Rule 6 with HPI Forced Cooling not in progress, All WR NIs must be < 1%, AND Core SCM > 0 ºF, AND Pzr level must be increasing to throttle HPI.**

D. Incorrect: LPI flow criteria is not a requirement to secure HPI. Plausible because it is the criteria used to be in the LOCA CD tab.

Technical Reference(s): **EOP Rule 6; LOCA CD Tab**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-UNPP R12**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

8. Explain why the operator should control feedwater to match Rx power production during an UNPP event until RCS temperature stabilizes, i.e. no heatup or overcooling. (R7)

9. State when an UNPP event is considered to be terminated. (R9)

10. Explain what section of the EOP is transferred to following a successful completion of the UNPP section and what this transfer is based on. (R13)

11. Given plant conditions, determine appropriate actions based on UNPP section of the EOP. (R10)

12. Explain the basis for cautions, notes and major steps in UNPP and Rule 1 (ATWS/UNPP). (R8)

13. Given plant conditions, determine if HPI throttling requirements are met per Rule 6 (Throttling HPI). (R12)

    13.1 Understand the configuration of HPI that constitutes “emergency boration” per Rule 1.

    13.2 Understand the termination criteria for emergency boration per the UNPP tab and Rule 6.

HPI Pump Throttling Limits

- HPI must be throttled to prevent violating the RV-P/T limit.
- HPI pump operation must be limited to two HPIPs when only one BWST suction valve (1HP-24 or 1HP-25) is open.
- HPI must be throttled ≤ 475 gpm/pump (including seal injection for A header) when only one HPI pump is operating in a header.
- Total HPI flow must be throttled ≤ 950 gpm including seal injection when 1A and 1B HPI pumps are operating with 1HP-409 open.
- Total HPI flow must be throttled < 750 gpm when all the following exist:

  - LPI suction is from the RBES
  - piggyback is aligned
  - either of the following exist:
    - only one piggyback valve is open (1LP-15 or 1LP-16)
    - only one LPI pump operating
- HPI may be throttled under the following conditions:

HPI Forced Cooling in Progress:	HPI Forced Cooling NOT in Progress:

All the following conditions must exist:
• Core SCM > 0
• CETCs decreasing
	All the following conditions must exist:
	• All WR NIs ≤ 1%
	• Core SCM > 0
	• Pzr level
	  • With PTS - Pzr level increasing
	  • With **NO** PTS- Pzr level > 100″ [180″ acc]
	• SRO concurrence required if throttling following emergency boration

HPI Pump Minimum Flow Limit

- Maintain ≥ 170 gpm indicated/pump.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. __ **IAAT** BWST level is ≤ 19', **THEN** initiate Encl 5.12 (ECCS Suction Swap to RBES).	
2. __ Verify ES actuated.	__ **GO TO** Step 4.
3. __ **GO TO** Step 7.	
4. __ Verify two LPI pumps operating.	__ **IF** <u>any</u> HPI pump is operating, **AND** LPI/HPI piggyback is aligned, **THEN** maximize <u>total</u> LPI flow < 3100 gpm by throttling HPI flow.
5. Notify Unit 3 to start the following: __ 3A Outside Air Booster Fan __ 3B Outside Air Booster Fan	
6. Start the following: __ A Outside Air Booster Fan __ B Outside Air Booster Fan	
7. Perform the following: __ Ensure <u>all</u> RBCUs in low speed. __ Open 1LPSW-18. __ Open 1LPSW-21. __ Open 1LPSW-24.	
8. __ Initiate Encl 5.35 (Containment Isolation).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. __ Start all RB Aux fans.	
10. __ **IAAT** either of the following exists: __ LPI FLOW TRAIN A plus LPI FLOW TRAIN B ≥ 3400 gpm __ Only one LPI header in operation with header flow ≥ 2900 gpm **THEN GO TO** Step 11.	__ **GO TO** Step 42.
11. __ Stop all RCPs.	
12. Dispatch an operator to remove white tags and close the following (Unit 1 Equip Rm): __ 1XO-F5C (1CF-1 BKR (1A CFT OUTLET)) __ 1XP-F5C (1CF-2 BKR (1B CFT OUTLET)) __ 1XS2-F3D (1LP-104 BKR (POST LOCA BORON DILUTE))	
13. __ **IAAT** breakers for 1CF-1, **AND** 1CF-2 are closed, **THEN** close the following: __ 1CF-1 __ 1CF-2	
14. __ Dispatch an operator to perform Encl 5.28 (Local SG Isolation) to isolate both SGs.	
15. Verify both of the following are closed: __ 1MS-24 __ 1MS-33	__ Initiate Encl 5.33 (Swapping Aux Steam Header to Another Unit).
16. __ Initiate Encl 5.25 (SG Isolation) to isolate both SGs.	
17. __ Initiate Encl 5.36 (Equipment Alignment For Plant Shutdown).	
18. __ Verify core SCM ≤ 0°F.	__ **GO TO** Step 35.
19. __ **WHEN** CETCs are ≤ 400°F, **THEN** continue in this procedure.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
20. Dispatch an operator to SSF to perform the following: A. __ Remove white tag and close breaker 1XSF-F6D (1LP-103 (LOCA BORON DILUTION VALVE)). B. __ Stand by in SSF Control Room for operating 1LP-103.	
21. __ **WHEN** breaker for 1LP-104 is closed, **THEN** open 1LP-104. {24}	
22. __ Notify operator at SSF to open 1LP-103 (POST LOCA BORON DILUTE). {24}	
23. __ Verify 1LP-103 (POST LOCA BORON DILUTE) is open.	1. __ Notify the TSC to provide guidance on use of the Alternate Post LOCA Boron Dilution flow path. 2. __ **GO TO** Step 25.
24. __ Verify flow through Post LOCA Boron Dilution valves by checking flow switch indication.	__ Notify the TSC to provide guidance on use of the Alternate Post LOCA Boron Dilution flow path.
25. __ **IAAT** Alternate Post LOCA Boron Dilution flow path is needed, **AND** TSC guidance has been provided, **THEN** perform Steps 26 - 27.	__ **GO TO** Step 28.
26. Dispatch an operator to the Equipment Room to perform the following: __ Close 1XS1-F5D (1LP-105 BKR (POST LOCA BORON DILUTE TO LPI SUCT)). __ Remove white tag and close 1XS1-F5C (1LP-2 BKR (RC RETURN BLK)). __ Remove white tag and close 1XS1-F4D (1LP-1 BKR (RCS LPI ISOL VLV)).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
27. __ **WHEN** breakers for the following are closed: __ 1LP-105 __ 1LP-2 __ 1LP-1 **THEN** open the following: A. __ 1LP-105 B. __ 1LP-2 C. __ 1LP-1 {24}	
28. __ **IAAT** all the following exist: __ Any RBS pump operating __ RB pressure < 3 psig __ < 24 hours into event **THEN** stop all RBS pumps.	
29. __ **WHEN** ECCS suction swap to the RBES is complete, **THEN** stop all HPI pumps.	
30. __ Verify 2LPSW-139 is closed.	__ **GO TO** Step 33.
31. Start the following: __ AHU-15 (1AB3) __ AHU-16 (2AB3)	1. __ Ensure at least two LPSW pumps operating. 2. __ **IF** at least two LPSW pumps operating, **THEN** perform the following: A. __ Locally close 2LPSW-45 (Unit 2 MT Oil Coolers Supply) (T-1/J-34). B. __ Open 2LPSW-139. 3. __ **GO TO** Step 33.
32. Ensure at least one of the following are operating: __ AUX BLDG EXH FAN 19 (1AB3) __ AUX BLDG EXH FAN 21 (1AB3) __ AUX BLDG EXH FAN 20 (2AB3)	1. __ Ensure at least two LPSW pumps operating. 2. __ **IF** at least two LPSW pumps operating, **THEN** perform the following: A. __ Locally close 2LPSW-45 (Unit 2 MT Oil Coolers Supply) (T-1/J-34). B. __ Open 2LPSW-139.

1 POINT

Question 27

Unit 1 conditions;

- Forced Cooldown tab in progress
- Decision is made to perform a Natural Circulation Cooldown
- CETC = 530 ºF stable
- RCS pressure = 2130 psig stable

Based on plant conditions, how does the Reactor Operator initially control RCS pressure as the cooldown begins and why?

A. Establish and maintain RCS pressure to achieve SCM > 150 ºF to promote flow through the RV Head Vents thereby cooling the surrounding area.

B. Establish and maintain RCS pressure to achieve SCM > 150 ºF to ensure any potential voids have been collapsed.

C. Establish and maintain RCS pressure ~ 2155 psig to promote flow through the RV Head Vents thereby cooling the surrounding area.

D. Establish and maintain RCS pressure ~ 2155 psig to ensure any potential voids have been collapsed.

Question 27
T1/G2 - kds

BE09EK3.4, Natural Circulation Cooldown **Knowledge of the reasons for the following responses as they apply to the (Natural Circulation Cooldown): RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.** (3.8/3.8)

K/A MATCH ANALYSIS
Question requires knowledge of procedure (and procedure limits) for natural circ cooldown and reasons for these steps.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: > 450 ºF, RCS Pressure of 2155 psig is established. Plausible because it would be correct if CETC < 450 ºF.

B. Incorrect: > 450 ºF, RCS Pressure of 2155 psig is established. Plausible because 150 ºF SCM is established if < 450 ºF. Also in FCD tab, it collapses voids by increasing RCS pressure.

C. **Correct: In the Forced Cooldown tab of the EOP, when an natural circ cooldown is commenced, if CETCs are > 450 ºF, RCS pressure of 2155 is established and maintained so that as the cooldown begins, SCM will increase to between 150 – 200 ºF. This is to promote flow through the reactor vessel head for cooling (head vents are open). If CETCs are < 450 ºF, then a SCM of > 150 ºF is established for the same reason.**

D. Incorrect: Establishing pressure of 2155 psig is to promote flow through the vessel head. Plausible because in FCD tab, it directs the collapsing of voids by increasing RCS pressure.

Technical Reference(s): **EOP FCD Tab**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-FCD R5**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

OBJECTIVES

Terminal Objective

1. Demonstrate the ability to utilize the Forced Cooldown section of the EOP to establish a pressurizer bubble.
2. Demonstrate the ability to utilize the Forced Cooldown section of the EOP to perform a cooldown.
3. Be able to explain the bases behind or reasons for steps performed in the Forced Cooldown Section of the EOP.

Enabling Objectives

1. List the five major functions performed by the Forced Cooldown (FCD) section of the EOP. (R1)
2. Recognize that during solid plant conditions, manual control of HPI, PZR heaters, and heat transfer may be required to maintain RCS pressure constant. (R2)
3. Explain the significance of stabilizing RCS temperature with a "water solid" RCS prior to establishing a bubble in the pressurizer. (R3)
4. Explain why a plant cooldown using natural circulation cooling should be avoided if possible. (R4)
5. Explain the bases for the following actions associated with a natural circulation cooldown: (R5)
   - 5.1 maintaining RCS pressure at 2155 psig when $T_h > 450°F$
   - 5.2 maintaining subcooled margin > 150° when $T_h < 450°$ F
6. Explain how opening the RV Head Vents can help prevent void formation in the RV Head during a natural circulation cooldown. (R6)
7. List two methods that may be used to eliminate a void in the RCS outside of the PZR, other than ambient cooling. (R7)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
41. __ **WHEN** both hot leg levels are ≥ 573″, **AND** Rx vessel head level is ≥ 163″, **THEN** close all hot leg vents: __ 1RC-155 __ 1RC-156 __ 1RC-157 __ 1RC-158	
42. __ Verify Nat Circ cooldown in progress.	1. Close the following: __ 1RC-159 __ 1RC-160 2. __ **GO TO** Step 45.
43. Verify either of the following: __ T_{hot} ≤ 450°F __ CETCs are ≤ 450°F	__ **GO TO** Step 45.
44. __ Maintain loop SCMs > 150°F.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

Unit Status

A Nat Circ cooldown is desired.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
111.__ Notify Chemistry to sample RCS boron hourly, or as often as possible, until MODE 5.	
112. Initiate determination of minimum required boron concentration for MODE 5 using either of the following: __ Reactor Engineer __ PT/1/A/1103/015 (Reactivity Balance Procedure)	
113.__ **IAAT** required boron concentration for MODE 5 is determined, **THEN** initiate Encl 5.11 (RCS Boration).	

NOTE

LDST temperature should be used for calculating Pzr spray nozzle ΔT if LDST is supplying HPI pump suction. BWST temperature should be used if BWST is supplying HPI pump suction. Computer point O1P3367 provides Pzr spray nozzle ΔT information based on which source is supplying HPI pump suction.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
114.__ **IAAT** Pzr spray nozzle ΔT is < 410°F, **THEN PERFORM** Encl 5.20 (Aux Pzr Spray).	
115. Close the following: __ 1LWD-1 __ 1LWD-2 __ 1GWD-12 __ 1GWD-13	
116.__ Verify T_{hot} and CETCs > 450°F.	1.__ Establish and maintain loop SCMs > 150°F. 2.__ **GO TO** Step 118.
117.__ Establish and maintain RCS pressure at 2155 psig.	
118.__ Locally close breaker 1SKL-08 (1RC-159/1RC-160) (Unit 1 Cable Rm).	

1 POINT

Question 28

Unit 2 plant conditions

- Reactor power = 100%
- Green "OFF" lights are illuminated on BOTH CC pumps
- 2SA9-C1 (CC Component Cooling Return Flow Low) actuated
- 2HP-120 (RC Volume Control) in HAND

Based on the above conditions, which ONE of the following is the expected plant response within the next 3 minutes?

Assume no operator action AND the reactor does NOT trip

Pressurizer level will ____ and LDST level will ______.

A. increase / decrease

B. increase / remain constant

C. remain constant / decrease

D. remain constant / remain constant

Question 28
T2/G1 - gcw

004K1.18, Chemical and Volume Control **Knowledge of the physical connections and/or cause-effect relationships between the CVCS and the following systems: CCWS** (2.9/3.2)

K/A MATCH ANALYSIS
Question requires knowledge of the affect on the HPI system on a loss of CC flow and the resulting plant response.

ANSWER CHOICE ANALYSIS
Answer: A

A. Correct - 2HP-5 will close on high L/D temperature. LDST level will decrease and Pzr level will increase with 2HP-120 in hand.

B. Incorrect - LDST level will not remain constant with 2HP-5 closed.

C. Incorrect - Pzr level will not remain constant with 2HP-120 in hand.

D. Incorrect - Neither LDST level of Pzr level will remain constant.

Technical Reference(s): **PNS-CC**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-CC R17**

Question Source: **Bank; PNS021703**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

10. Describe the sequence and precautions necessary while valving in the spare CC cooler. (R10)

11. Explain the reason for draining the CRD service structure prior to pulling the reactor vessel head prior to refueling. (R11)

12. Describe the method of draining the CRD service structure. (R12)

13. Explain how CC-8 failing closed at power affects plant operation. (R13)

14. Describe briefly the steps involved in reopening CC-8 after the valve has failed closed because of a loss of Instrument Air. (R14)

15. Describe the six (6) interlocks and/or automatic actions associated with the CC System. (R15)

16. Explain why the CC System must be in operation: (R16)

    16.1 Before letdown is established if RCS temperature is > 120° F

    16.2 If RCS temperature is > 190° F

17. Given a set of plant conditions, diagnose the cause of a CC System problem and/or determine the required corrective action. (R17)

18. Evaluate the overall affect on other plant systems based on the normal and/or abnormal operation of the CC system. (R18, R19)

19. When AP/1700/20, Loss of CC, is required to be utilized by the operator be able to demonstrate the following: (R20)

    - State the Entry Conditions, Immediate Manual Actions, and Contingency Actions in the AP.
    - Explain the basis for limits, cautions, notes and major steps in the AP
    - Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.
    - Describe general system alignments, available operator controls and instrumentation both inside and outside the control room.
    - Provide proper directions to operators and supporting groups performing actions of the AP outside the control room.

20. Given a copy of TS/SLCs, analyze a given set of conditions for applicable TS/SLC LCOs. (R21)

21. Apply all TS/SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R22)

22. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS/SLCs. (R23)

E. High Letdown temperature effects on the RCS

1. As letdown temperature increases, the demineralizer in service will tend to release boron into the system. This will add negative reactivity to the core, resulting in an RCS temperature decrease and/or outward rod motion to maintain the same reactor power level.

2. If temperature reaches 135°F, HP-5, Letdown Isolation will automatically close to protect the downstream demineralizers.

   a) When HP-5 closes and letdown isolates, pressurizer level will begin to increase. This causes the RCS volume control valve (HP-120) to close to maintain RCS level.

   b) Although letdown and makeup are now essentially stopped, there will remain a net increase in RCS volume (pzr increases) due to the continued flow of seal injection into the RCS.

   c) Unit 1 will see an RCS volume increase of ~26 gpm (6.5 gpm/pump of seal flow enters RCS) while Units 2&3 will be ~ 34 gpm (8.5gpm/pump enters RCS).

   d) The operator will utilize AP/*/1700/32, Loss of Letdown, to re-establish proper makeup flow. If this cannot be accomplished, guidance will be given to shutdown.

2.6 **(OBJ R15)** Interlocks Associated With the CC System

A. If in AUTO, the standby CC Pump starts at 575 GPM flow.

B. If de-energized, the CRDs cannot be energized if CC flow is less than 138 GPM to the CRDs.

C. A reactor coolant pump cannot be started if CC flow is less than 575 GPM. Low CC flow will not affect a running RCP.

D. Letdown cooler CC inlet valve CC-1 (CC-2) must be open before letdown cooler inlet valve HP-1 (HP-2) will open.

E. CC-7 and 8 close on actuation of ES Channels 5 and 6 (respectively)

F. If CC-7 or CC-8 goes closed, the CC pumps will trip and automatically restart when CC-7 and CC-8 are reopened.

G. Up on receiving a MFBMP (both MFB's de-energized for ≥ 20 seconds); both CC pumps will receive a start signal.

PNS021703

Unit 2 plant conditions

- Reactor power = 100%
- Green "OFF" lights are illuminated on **BOTH** CC pumps
- 2SA9-C1 (CC Component Cooling Return Flow Low) statalarm has actuated
- 2HP-120 (RC Volume Control) in HAND

Assuming no operator action AND the reactor does NOT trip, which ONE of the following is correct plant response within the next 3 minutes? (.25)

Pressurizer level will ____ and LDST level will ______.

A) increase / decrease

B) increase / remain constant

C) remain constant / decrease

D) remain constant / remain constant

A

A. Correct - 2HP-5 will close on high L/D temperature. LDST level will decrease and Pzr level will increase with 2HP-120 in hand.

B. Incorrect - LDST level will not remain constant with 2HP-5 closed.

C. Incorrect - Pzr level will not remain constant with 2HP-120 in hand.

D. Incorrect - Neither LDST level of Pzr level will remain constant.

1 POINT

Question 29

Unit 1 initial conditions:

- MODE 5
- RCS intact
- LPI in normal decay heat removal
- LPI in purification

Current conditions:

- ALL source range NI increasing

Based on the above conditions, which ONE of the following describes required actions of AP/3 (Boron Dilution)?

A. Secure LPI purification and initiate boration from the BWST.

B. Secure LPI purification and initiate boration from the CBAST.

C. Align letdown to 1A BHUT and initiate boration from the BWST.

D. Align letdown to 1A BHUT and initiate boration from the CBAST.

Question 29
T2/G1 - gcw New KA

005K5.09, Residual Heat Removal System
Knowledge of the operational implications of the following concepts as they apply the RHRS: Dilution and boration considerations (3.2/3.4)

K/A MATCH ANALYSIS
Question requires knowledge of the mitigation strategies for a dilution event.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect, first part is correct. Second part is incorrect, plausible because for other cases in the AP boration is from the BWST.

B. Correct, AP/3 directs, securing of LPI purification and the initiate of boration from the CBAST.

C. Incorrect, first part is incorrect. Plausible because at power letdown is aligned to 1A BHUT. Second part is incorrect. Plausible because for other cases in the AP boration is from the BWST.

D. Incorrect, first part is incorrect. Plausible because at power letdown is aligned to 1A BHUT. Second part is correct.

Technical Reference(s): **AP/3 (Boron Dilution) Step 4.92, 4.98**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-APG R9**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

G. Locate and identify the answers to specific questions on applicable limits, cautions, notes, etc., within the procedures

3.5 In addition, become familiar with the content of each so as to be able to answer questions relating to general systems alignments, available operator controls and instrumentation, and the bases for specific actions.

4. <u>Given a copy of</u> AP/*/A/1700/05, 06, 08, 10, 11, 13, 14, 16, 19, 22, 23, 24, 25, 27, 31, and 2000/02, walkthrough steps, locate equipment, instrumentation and controls outside the Control Room referred to in the AP. Especially address those devices, which require manual operation. (R5)

5. Explain the basis for limits, cautions, notes and major steps in the AP. (R6)

6. Given a set of parameters, determine if immediate Rx trip criteria is met for applicable AP's and OMP guidance. (R7)

7. Discuss major mitigation strategy associated with each AP. (R8)

8. <u>Without the use of reference</u>, when an AP is required to be utilized by the operator be able to demonstrate the following: (R9)

   8.1 State the Entry Conditions and Immediate Manual Actions in the AP.

   8.2 Explain the basis for limits, cautions, notes and major steps in the AP.

   8.3 Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.

   8.4 Utilizing available operator controls and instrumentation both inside and outside the control room interpret the indications and take proper actions per the AP that should mitigate the abnormal condition.

   8.5 Provide proper directions to operators and supporting groups performing actions of the AP outside the control room.

1. Entry Conditions

Actual or suspected reduction of RCS boron concentration as indicated by <u>any</u> of the following:

- Unexplained neutron level increase (resulting in change in Neutron Error and control rod insertion if at power)
- Unexplained RCS P/T increase
- Unexplained RCS level increase
- Unexplained LDST level increase
- Chemical analysis

2. Automatic Systems Actions

2.1 Possible RB evacuation alarm

2.2 Possible control rod insertion

2.3 Possible Rx trip

3. Immediate Manual Actions

None

4. Subsequent Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1 Verify one of the following: __ All control rods inserted __ RV head removed.	1. __ **IF** ICS is in Auto, **THEN** ensure control rods responding as necessary. 2. __ **IF** ICS is in Manual, **AND** the Rx is sub-critical, **THEN** trip Rx. 3. __ **IF** ICS is in Manual, **AND** the Rx is critical, **THEN** adjust control rods as required to maintain power level defined by CR SRO.
4.2 Make the following notifications: __ PA announcement of the event including required RB evacuation __ Notify OSM to reference the following: • RP/0/B/1000/001 (Emergency Classification) • NSD-202 (Reportability) • OMP 1-14 (Notifications)	
4.3 __ Verify LPI in operation.	__ **GO TO** Step 4.5.
4.4 __ **GO TO** Step 4.87.	
4.5 __ Verify Rx at power.	__ **GO TO** Step 4.56.
4.6 __ Notify Chemistry to sample the following for boron concentration: • RCS • LDST	
4.7 __ Verify both RC bleed transfer pumps stopped.	1. __ Stop 1A BLEED TRANSFER PUMP. 2. __ Stop 1B BLEED TRANSFER PUMP. 3. __ Close 1CS-46. 4. __ Close 1CS-56.
4.8 __ Place 1HP-14 in NORMAL.	
4.9 __ Close 1HP-16.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.87 __ Verify RCS is intact.	__ **GO TO** Step 4.105.
4.88 __ Notify Chemistry to sample the RCS for boron concentration.	
4.89 __ Verify RCS cooldown has been terminated.	__ Stop RCS cooldown.
4.90 __ Verify <u>both</u> RC bleed transfer pumps stopped.	1.__ Stop 1A BLEED TRANSFER PUMP. 2.__ Stop 1B BLEED TRANSFER PUMP. 3.__ Close 1CS-46. 4.__ Close 1CS-56.
4.91 __ Maintain PZR level and RCS pressure within limits for current plant conditions while restoring boron concentration.	
4.92 __ Initiate Encl 5.1 (RCS Boration from CBAST via LPI).	
4.93 __ Verify LPI purification is in operation.	__ **GO TO** Step 4.99.
4.94 __ Close 1LP-14.	
4.95 Throttle the following as required: __ 1LPSW-251 __ 1LPSW-252	
4.96 __ Monitor RCS and Decay Heat Cooler Outlet Temperature for desired response.	
4.97 __ Dispatch an operator to close 1LP-96 (LP SUPPLY TO PURIFICATION IX BLOCK). (A-2, U1 SS Filter Rm 208)	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.98 __ Verify all demineralizers out of service.	1. __ **IF** any purification IX is in service, **THEN** perform the following: A. __ Open 1HP-13. B. __ Close 1HP-8. C. __ Close 1HP-9 & 11. 2. __ **IF** any deborating IX is in service, **THEN** perform the following: A. __ Close 1CS-27. B. __ Close 1CS-32 & 37. C. __ Open 1CS-26.
4.99 __ Verify RCS pressure > LPSW pressure.	__ Isolate LPI coolers one at a time to attempt to identify potential leakage into the RCS.
4.100 __ Determine and isolate potential sources of unborated water including any unusual valve lineups.	
4.101 __ Recalculate shutdown margin.	

Question 30
T2/G1 - kds

006A2.08, Emergency Core Cooling **Ability to (a) predict the impacts of the following malfunctions or operations on the ECCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:** **Effect of electric power loss on valve position (3.0/3.3)**

K/A MATCH ANALYSIS
Question requires knowledge of how a power loss to an ECCS valve (HP-26) will have on the design purpose of the system during an event requiring ECCS and how the procedure compensates for the failed component.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: 1HP-410 is not throttled; it is directed to be opened. Plausible because Rule 2 does direct checking flow in figure 1 when flow is passing through 1HP-26.

B. Incorrect: There will still be flow through 1HP-120 into the header. Plausible because there no automatic action to compensate for the valve failure.

C. Incorrect: There will still be flow through 1HP-120 into the header. Plausible because there no automatic action to compensate for the valve failure.

D. Correct: HP-26 (The A HPI header injection valve) should position to Full Open upon receiving an ES signal. While this will not allow full injection flow as designed for ES, 1HP-120 will be full open due to Pzr level decreasing which will allow ~ 160 gpm to the header. Rule 2 will direct opening 1HP-410 fully which will bypass around the failed valve.

Technical Reference(s): **EOP Rule 2**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-LOSCM R4**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

TERMINAL OBJECTIVE:

1. Explain the use of the EOP-Loss of Subcooling Margin (LOSCM) section and applicable enclosures to perform the required actions for a loss of subcooling. (T1)
2. Using EOP Enclosure 5.12 (ECCS Suction Swap to the RBES), correctly align the LPI system and successfully make the transfer from the BWST to the RBES. (T2)

ENABLING OBJECTIVES:

Objs. R: 2, 3, 4, 14, 6, 7, 15, 9, 8, 13, 24 Covered in Rule 2, 6, & 7 Training – Attmt #1

1. Describe/demonstrate the use of Rule #2, Loss of SCM:

1.1 State the conditions which require the operator to manually trip RCPs. **(R2)**

1.2 Explain the two reasons for tripping RCPs when Subcooling margin is lost due to a SBLOCA. **(R3)**

- A. Describe operator actions if RCPs remain on > 2 minutes after SCM = 0°F, or if the time since SCM loss is unknown.

1.3 Describe the procedure for manual initiation of FULL HPI upon a loss of subcooling. **(R4)**

1.4 Verify HPI flow using Figure 1, Required HPI Flow Per Header in Rule #2. **(R14)**

1.5 Explain why SG levels should be raised to the Loss of SCM (LOSCM) Setpoint. **(R6)**

- A. Briefly explain the methods to determine the LOSCM setpoint

1.6 Recognize that S/G de-pressurization and RCS overcooling may result from raising SG(s) level(s) to the Loss of SCM Setpoint. **(R7)**

- A. Recognize that once initial feed rates have been established, SG feed may be throttled to prevent overcooling but feeding with main and/or EFDW must continue until the Loss of SCM Setpoint is reached.

1.7 Determine proper steam generator level setpoints for all LOSCM scenarios **(R15)**

- A. Recognize that if MFDW is available and EFDW is unavailable, that SG levels should be raised to 95% on the OR. **(R9)**

1.8 Explain why the EFDW flow rate must be continuously monitored in order to prevent exceeding pump run-out limits when filling SGs to the Loss of SCM Setpoint. **(R8)**

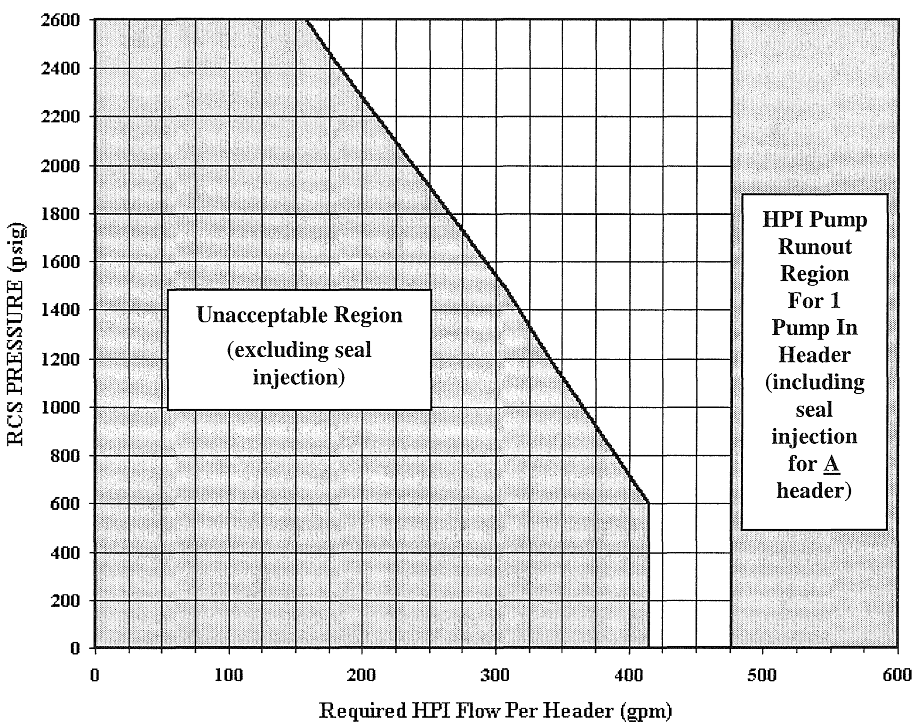
1.9 Recognize that during a SB LOCA, initiating feed of at least one SG to the LOSCM setpoint is required within 20 minutes of a reactor trip in order to meet the time critical task. **(R13)**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. __ **IAAT** all the following exist: __ Any SCM ≤ 0°F __ Rx power ≤ 1% **AND** either of the following exists: __ ≤ 2 minutes elapsed since loss of SCM __ RCP motor amps stable **AND** ≈ normal **THEN** perform Steps 2 and 3. {9}	1. __ Notify CR SRO of RCP status. {9, 22} 2. __ **GO TO** Step 4.
2. __ Stop all RCPs.	1. __ Place 1TA AUTO/MAN switch in MAN. 2. __ Place 1TB AUTO/MAN switch in MAN. 3. __ Open 1TA SU 6.9 KV FDR. 4. __ Open 1TB SU 6.9 KV FDR.
3. __ Notify CR SRO of RCP status. {22}	
4. __ Verify Blackout exists.	__ **GO TO** Step 6.
5. __ **WHEN** power has been restored, **THEN** continue.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. Open the following: __ 1HP-24 __ 1HP-25	1. __ **IF** both BWST suction valves (1HP-24 and 1HP-25) are closed, **THEN** perform the following: A. __ Start 1A LPI PUMP. B. __ Start 1B LPI PUMP. C. Open the following: __ 1LP-15 __ 1LP-16 __ 1LP-9 __ 1LP-10 __ 1LP-6 __ 1LP-7 D. __ **IF** two LPI Pumps are running only to provide HPI pump suction, **THEN** secure one LPI pump. E. __ Dispatch an operator to open 1HP-363 (LETDOWN LINE TO LPI PUMP SUCTION BLOCK) (A-1-119, U1 LPI Hatch Rm, N end). F. __ **GO TO** Step 7. 2. __ **IF** only one BWST suction valve (1HP-24 or 1HP-25) is open, **THEN** perform the following: A. __ **IF** three HPI pumps are operating, **THEN** secure 1B HPI PUMP. B. __ **IF** < 2 HPI pumps operating, **THEN** start HPI pumps to obtain two HPI pump operation, preferably in opposite headers. C. __ **GO TO** Step 8.
7. __ Start all available HPI pumps.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. Open the following: __ 1HP-26 __ 1HP-27	
9. __ Verify <u>at least two</u> HPI pumps are operating using two diverse indications.	__ **GO TO** Step 18.
10. __ **IAAT** ≥ 2 HPI pumps operating, **AND** HPI flow in <u>any</u> header is in the Unacceptable Region of Figure 1 **THEN** perform Steps 11 - 13.	__ **GO TO** Step 12.
11. __ Open the following in the <u>affected</u> header: ✓ | **1A Header** | ✓ | **1B Header** | 1HP-410 | | 1HP-409	1.__ Notify CR SRO to consider manual operation of the failed valve. 2.__ **IF** HPI flow exists in <u>only one</u> header, **THEN GO TO** Step 18.

Figure 1
Required HPI Flow Per Header



ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. __ **IAAT** the following limits are exceeded, **Pump Operation** — **Limit** 1 HPI pump/hdr — 475 gpm (incl. seal injection for A hdr) 1A & 1B HPI pumps operating with 1HP-409 open — Total flow of 950 gpm (incl. seal injection) **THEN** throttle HPI to maximize flow ≤ flow limit.	
13. __ Notify CR SRO of HPI status. {22}	
14. __ **IAAT** either of the following exists: __ LPI FLOW TRAIN A plus LPI FLOW TRAIN B ≥ 3400 gpm __ Only one LPI header in operation with header flow ≥ 2900 gpm **THEN GO TO** Step 15.	__ **GO TO** Step 25.
15. Perform the following: __ Place 1FDW-315 in MANUAL and close. __ Place 1FDW-316 in MANUAL and close.	1.__ **IF** 1FDW-315 will **NOT** close, **THEN** stop 1A MD EFDWP. 2.__ **IF** 1FDW-316 will **NOT** close, **THEN** stop 1B MD EFDWP. 3.__ Place 1 TD EFDW PUMP in PULL TO LOCK.
16. __ Notify crew that performance of Rule 3 is **NOT** required due to LB LOCA.	
17. __ **WHEN** directed by CR SRO, **THEN EXIT** this rule.	

Step 12 limits:

Pump Operation	Limit
1 HPI pump/hdr	475 gpm (incl. seal injection for A hdr)
1A & 1B HPI pumps operating with 1HP-409 open	Total flow of 950 gpm (incl. seal injection)

• • • END • • •

1 POINT

Question 31

Unit 1 initial conditions:

- RCS temperature = 500ºF
- RCS pressure = 885 psig

Current conditions:

- RCS pressure decreasing
- Pressurizer level decreasing
- PZR relief valve tailpipe temperature = 300ºF
- Quench tank level increasing
- Quench tank pressure = 10 psig increasing

Which ONE of the following would cause of the current conditions?

A. 1B2 RCP Upper, Middle, and Lower seals have failed

B. 1RC-159 and 1RC-160 (RXV Head vents) are leaking

C. Low range RCS pressure has failed HIGH

D. 1RC-66 (PORV) is leaking

Question 31
T2/G1 – gcw New KA

007A4.10, Pressurizer Relief Tank/Quench Tank System **Ability to manually operate and/or monitor in the control room: Recognition of leaking PORV/code safety (3.6/3.8)**

K/A MATCH ANALYSIS
Question requires recognizing the symptoms of an open PORV.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect, failure of all a RCPs seals would cause seal leakage to increase and thus QT level. A LOCA would also result which would cause RCS pressure to decrease. PZR level would decrease, however this would not cause the QT to pressurize or relief line temperature to increase.

B. Incorrect, 1RC-159 and 1RC-160 (RXV Head vents) discharge to the RBCUs discharge. Plausible because the manual vents on the hot legs go to the QT.

C. Incorrect, It is isolated above 600 psig. If Low range cooldown pressure were in service and LOW selected on the PORV this failure would cause the PORV to open.

D. Correct, 1RC-66 (PORV) failing OPEN would cause these indications.

Technical Reference(s): **PNS-PZR Page 34 - 35**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-PZR R19**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

30. Given a copy of Technical Specifications, and associated Bases, analyze a given set of Pressurizer conditions for applicable TS/SLCs. (R25)

31. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TC/SLCs associated with the Pressurizer. (R38)

32. Identify actions to be taken if RCS pressure approaches the PORV setpoint and the reactor building is open for personnel entry. (R26)

33. Given a set of plant conditions, diagnose the cause of a pressurizer problem and/or determine the required corrective action. (R19)

- RCS could Saturate before ES 1/2:
  - Voids occur in RV Head or Loops, HT ↓, RCS Heats up, RCS Expands, Pzr Insurges, and level rises quickly
  - If Pzr level rises above the steam leak location, the RCS (P) decrease may be reduced or stopped. Otherwise the Pzr could possibly fill completely.

- ES 1/2 Actuate Prior to a loss of subcooling margin (No Saturation:
  - o A similar response will occur. HPI injection will cause Pzr level to increase, which will, in turn, compress the existing bubble. Eventually, RCS (P) will reach the PORV setpoint. Ultimately, the Pzr will fill completely.

2. System Response to a Pressurizer Water Space Leak

Instructor Note: This is a generic description. Actual plant response may vary due to plant conditions. The magnitude of plant response will be dictated by the size of the steam leak. System response description also assumes no operator action.

System response will be similar to a RCS leak anywhere on the RCS.

a) Makeup flow will increase (and LDST level will decrease) in response to the loss of RCS inventory.

b) Pressurizer level: Small leak ↔, Large leak ↓; depends upon the magnitude of the leak

c) RCS (P): dependent upon leak size. For small leaks, RCS pressure will remain constant. As Pzr level drops, the steam bubble will expand to fill the space causing RC pressure to decrease. Pzr heaters will energize as pressure continues to drop.

d) If leak is of such a magnitude that RCS makeup flow cannot maintain level, RCS pressure will continue to drop until the reactor trips and ES actuates. HPI will then fill the Pzr solid.

3. Identifying an Open or Leaking Pressurizer Relief Valve

a) **(OBJ.R13)** Pzr Relief Valve Flow Monitor will alert the operator to an open relief valve via alarm/indication.

b) RC-66 valve indication

c) Pzr boron concentration increasing relative to RCS

d) **(OBJ.R34)** Pzr relief valve tailpipe temperature

1) Pzr relief valve tailpipe temperature is a function of Pzr temperature (or pressure since saturated) and Quench Tank pressure.

2) Since flow through a relief valve is a constant enthalpy throttling process, the temperature downstream of a relief valve can be found by:

   (a) Finding the point where the temperature (or *absolute* pressure) of the Pzr intersects the saturation curve on the Mollier diagram.

INSTRUCTORS NOTE: Work a couple of examples with the students using the Mollier Diagram. See handout #1 & #2

   (b) Cross the horizontal constant enthalpy line from this intersection point to the point where the constant enthalpy line intersects the *absolute* pressure of the Quench Tank.

   (c) Follow the *absolute* Quench Tank pressure line up to the intersection of the saturation curve.

   (d) The constant temperature line that intersects this same point on the saturation curve is the temperature of the steam downstream of the relief valve.

3) Quench tank level, temperature, and pressure

   (a) Steam flow past a leaking relief valve will enter the quench tank below water level.

   (b) The contents of the quench tank will condense the steam.

   (c) The condensed steam will increase quench tank level, temperature, and pressure.

   (d) The same process occurs for an open relief valve except that the effluent rapidly heats the contents of the quench tank to saturated conditions, a steam bubble forms in the quench tank and the quench tank rupture disk ruptures.

4. Emergency Operating Procedure (EOP) Evolutions using the Pzr

   a) SGTL: During a shutdown due to a steam generator tube leak/rupture which requires entry into the EOP, the heaters are manually secured and spray (or the PORV if spray is unavailable) is manually initiated. This allows the operator to purposely lower RCS pressure to minimize the subcooling margin (SCM). This minimizes the differential pressure between the RCS and the steam generator, thus decreasing the tube leak rate.

1 POINT

Question 32

Unit 1 plant conditions:

- Mode 5
- CC system in operation
- OP/1/A/1104/008 (Component Cooling System) Enclosure. 4.5 (Letdown Cooler Flow Balance Setup) in progress
- It is determined that CRD outlet header flow is too low

As the Letdown Cooler outlet valves are adjusted to correct the CRD header flow, which ONE of the following describes an expected change in control room indications?

A. Total CC flow increases

B. Neutron count rate increases

C. RCP CC return flow decreases

D. CC pump discharge pressure increases

Question 32
T2/G1 - kds

008A4.06, Component Cooling Water System **Ability to manually operate and/or monitor in the control room: Remote operation of hand-operated throttle valves to regulate CCW flow rate (**2.5*/2.5)

K/A MATCH ANALYSIS
Question requires knowledge of how to adjust CC throttle valves and their impact on the system parameters observed in the control room.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: Total CC flow will decrease. Plausible because the purpose of the procedure in to increase CRD flow which is included in Total Flow.

B. Incorrect: Neutron count rate will decrease. Plausible because if flow were to increase to the Letdown IX, then B would be correct.

C. Incorrect: RCP CC flow will increase. Plausible because total CC flow will decrease without touching the RCP throttle valves.

D. Correct: As the letdown cooler outlet valve is throttled closed, the flow decreases through the letdown coolers and increases through the rest of the system components. Overall the total flow will decrease because you have throttled the discharge valve to a centrifugal pump.

Technical Reference(s):

Proposed references to be provided to applicants during examination: **None**

Learning Objective**: PNS-CC Obj R7, R8**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

Upon completion of this lesson, the student will be able to describe the purpose, operation, and response of the Component Cooling System during normal and abnormal plant conditions

ENABLING OBJECTIVES

1. Draw the Component Cooling System, showing the pumps, coolers, and major valves. (R1)
2. List the (4) major components cooled by the CC system. (R2)
3. State the cooling medium for the CC coolers. (R3)
4. Explain how the CC System acts as a barrier to prevent the release of radioactive liquid to the environment. (R4)
5. Explain how repositioning of system valves can adversely affect CC system performance once the system has been set up for proper operation. (R7)
6. List the purpose(s) of the following CC System components: (R5)
   - 6.1 Coolers
   - 6.2 Pumps
   - 6.3 Surge Tank
   - 6.4 Control Rod Drive Filters
   - 6.5 Return Penetration Block Valves, CC-7 and CC-8.
   - 6.6 Drain Tank and Pump
   - 6.7 RIA-50
7. Describe the corrosion inhibitor used in the CC System, how it protects the system, and its associated hazard to personnel. (R6)
8. List the CC System controls and indications available to the operator in the control room. (R8)
9. Describe briefly the steps involved in startup of the CC System. (R9)

1 POINT

Question 33

Unit 1 initial conditions:

- Time = 0400
- Reactor power = 75%
- Plant transient

Current conditions:

- Time = 0402
- Plant stable
- Reactor power = 70%
- RCS pressure = 2209 psig
- PZR temperature = 644ºF
- Tave = 584ºF

Which ONE of the following correctly describes the effect of the above transient on the PZR and status of the PZR Control System?

A. A PZR insurge will occur, PZR heater Bank 2 Group B and D are energized and 1RC-1 (PZR SPRAY) is OPEN.

B. A PZR insurge will occur, ALL PZR heaters are de-energized and 1RC-1 (PZR SPRAY) is OPEN.

C. A PZR outsurge will occur, PZR heater Bank 2 Group B and D are energized and 1RC-1 (PZR SPRAY) is CLOSED.

D. A PZR outsurge will occur, ALL PZR heaters are de-energized and 1RC-1 (PZR SPRAY) is CLOSED.

Question 33
T2/G1 - kds

010K1.03, Pressurizer Pressure Control **Knowledge of the physical connections and/or cause-effect relationships between the PZR PCS and the following systems: RCS** (3.6/3.7)

K/A MATCH ANALYSIS
Question requires knowledge of the effect of changes on the RCS (Tave Change) to the effect on Pressurizer pressure control.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct: The transient has caused RCS temperature to increase which has resulted in an insurge in the PZR. This has caused the PZR to become subcooled and also due to the PZR level increase RCS pressure has increased. When the PZR is 20 psig subcooled the "Pressurizer Water Space Saturation Recovery Circuit" will energize Heater Bank #2 (Groups B & D). PZR spray opens at 2205 psig increasing and closes at 2155 psig decreasing.**

B. Incorrect: first part is correct. ALL heaters will not be off because the PZR is subcooled. Plausible because normally all heater will be off by 2175 psig. Spray would be open.

C. Incorrect: first part is incorrect. Second part is correct. Spray would be open.

D. Incorrect: first part is incorrect. ALL heaters will not be off because the PZR is subcooled. Plausible because normally all heater will be off by 2175 psig Spray would be open.

Technical Reference(s): **PNS-PZR Pages 13, 17, 18, 36**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-PZR R5, R29**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

1. Upon completion of this lesson, the student will demonstrate an understanding of the components, indications, controls and operation of the Pressurizer. The student will be able to assess the status of the Pressurizer during normal, abnormal and emergency conditions and determine corrective actions for improper system operation. The student will also be able to apply any ITS/SLC Conditions and Required Actions associated with the Pressurizer (T1).

ENABLING OBJECTIVES

1. Explain the design basis of the pressurizer. (R21)
2. Describe pressurizer response during load or RCS temperature changes. (R1)(R2)(R3)
3. Given a set of conditions, calculate the change in pressurizer level for a change in RCS temperature. (R33)
4. Explain what is meant by a “subcooled” pressurizer and how to determine if the pressurizer is in a subcooled condition.(R22)(R27)
5. Explain what is meant by a pressurizer “hard bubble” and describe the adverse effects of a “hard bubble” on plant operation, (R23)
6. Identify the source of pressurizer spray for each unit. (R4)
7. Discuss the automatic setpoints and any interlocks associated with pressurizer instrumentation. (R5)
8. Explain the operation of the ICS RC pressure signal median select function as it relates to RC pressure control including: (R28)
   - 8.1 How median select chooses the controlling signal
   - 8.2 Which pressurizer components receive a median selected RC pressure signal
9. Given a set of conditions, determine which RC pressure signal has been selected for control by the ICS RC pressure signal median select function. (R36)
10. Discuss the reasons for bypass flow around the pressurizer spray valve during normal operation. (R6)
11. Evaluate plant response to a failed open pressurizer spray valve without operator action. (R20)

12. Explain the operation of the Pressurizer Water Space Saturation Recovery Circuit. (R29)

13. Discuss the operation of the pressurizer heaters including: (R7)

    13.1 Three purposes

    13.2 Level interlock: purpose and setpoints (normal and SSF)

14. Describe the physical operation of the PORV including what causes the Pilot Valve to operate and how this causes the PORV to open or close. (R8)

15. Explain the purpose of the two opening setpoints associated with the PORV. (R9)

16. Explain how to manually operate the PORV. (R37)

17. Given a set of conditions, determine operability of the PORV following a loss of power. (R30)

18. Discuss the reason for the pressurizer safeties and their setpoint. (R12)

19. Given a set of plant conditions, determine the response of Pressurizer level. (R14)(R15)

20. Explain the operation of SASS as it relates to pressurizer level control. (R31)

21. Given a set of conditions, determine how pressurizer level control/indication is affected by a loss of SASS and/or ICCM. (R35)

22. Discuss the use of Pressurizer Saturation Pressure Indication by the operator. (R16)

23. Discuss the forming of a pressurizer steam bubble including any precautions to be taken during the evolution. (R17)

24. Given a completed copy of PT/0/A/201/04 _RC66 Stroke Test apply compare data taken to acceptance criteria to determine PORV operability. (R10)(R11)

25. Differentiate between a pressurizer steam space leak and a water space leak. (R32)

26. Given a set of plant conditions, determine the position of the PORV. (R13)

27. Given a set of conditions, calculate the expected PORV discharge temperature. (R34)

28. Given a copy of a Limit and Precaution from OP/A/1103/05, Pressurizer Operation, be able to state the reason for that limit and precaution. (R18)

29. Apply TS/SLC rules to determine applicable Conditions and Required actions for a given set of Pressurizer conditions. (R24)

a) TS use the analytical value of 285". 25" instrument error is the worse case error. 260" allows us to use whatever instrument is available.

E. Since all sources of heat in the system, i.e., core, heaters, and reactor coolant pumps, are interconnected by the reactor coolant piping with no intervening isolation valves, system pressure relief protection is provided on top of the Pzr. Overpressure protection consists of two code safety valves and one electromatic relief valve

2.4 Component Description

(Instructor Note: The non-nuclear instruments (NNI) inputs that are used in the control of Pzr level, temperature and pressure are also inputs to the digital Integrated Control System (ICS). NNI inputs to Pzr level, temperature and pressure control may be modified by ICS. As such, Pzr level, temperature, and pressure control can be considered to be a sub-function of ICS. Operation of NNI is addressed in the Reactor Coolant Instrumentation (RCI) lesson plan and operation of the ICS is addressed in the Integrated Control System lesson plan.)

A. **Pressurizer Spray** (PNS-PZR-1, 3, 4 & 15)

1. **(OBJ.R4)**The Pzr Spray Line originates at the discharge of the A1 RCP for Unit 1, and B1 RCP on Units 2 & 3.
2. Spray flow is caused by the dp between RCP discharge and vessel outlet due to head losses as the coolant flows through the vessel.
3. Pzr Spray flow is controlled by a DC solenoid operated valve, RC-1, which responds to a manual open/close signal from the operator or automatically from the opening and closing pressure set points.

a) **(OBJ.R5)**RC-1 opens at **2205** psig increasing and closes at **2155** psig decreasing.

b) **(OBJ.R28)**RC-1 is controlled by the ICS median selected *narrow range (NR)* RCS pressure signal.

1) The inputs to the ICS NR RC pressure signal median select function are:

a. RC pressure #1 on RCS loop A (input to RPS chan. A)

b. RC pressure #2 on RCS loop B (input to RPS chan. E)

c. RC pressure #3 on RCS loop A (input to RPS chan. B)

2) Median select refers to the mathematical technique of selecting the middle of three signals as an output.

3) **(OBJ.R36)**This process adds a degree of redundancy and reliability to the system. For example, if RC pressure #1 was the controlling signal and it failed high or low, it would no longer be the median or controlling signal.

a) Although some of the heater groups are load shed, all heaters will be available within one minute.

6. **Heater Bank 2 – Groups B and D**-can be controlled from each unit's **Aux Shutdown Panel**

   a) OFF / NORMAL / ON – switch positions are selected; in NORMAL control can only be from the Control Room

7. **Heater Bank 2- Group B and C**- can be controlled from the **SSF**.

   a) Group B is normally powered from MCC 1, 2, 3XSF, which is normally fed from load center 1, 2, 3X8.

   b) However, when powered from the SSF diesel, Group B can only be operated from the SSF unit control board.

   c) **Group C heaters** are **only powered from the SSF** and can **only be operated from the SSF control board.**

      - Power is supplied from OTS1 thru PXSF transformer to PXSF MCC (located in the D/G room).
      - Separate breaker for each unit's Group C heaters on PXSF MCC.
      - We do NOT take credit for Group C to satisfy TS 3.4.9.
      - Separate ON-OFF switches for the Group C heaters for each unit in the SSF control room (separate from the Group B ON-OFF switch).

   d) Low level heater cutoff **-85" SSF Pzr level-uncompensated**

8. The heaters for each unit are normally supplied from non-safety related motor control centers (MCCs) XH, XI, XJ, and XK. They are divided among the three 4160 volt ES buses such that the loss of one entire 4160 volt bus will not preclude the capability to supply sufficient heaters to maintain natural circulation in MODE 3.

9. **(Obj. R29) Pressurizer Water Space Saturation Recovery Circuit**

   In addition to being controlled by the ICS median selected narrow range (NR) RCS pressure signal, **Heater Bank #2** (**Groups B & D**) also receives a controlling signal from the Pressurizer Water Space Saturation Recovery Circuit.

   a) The purpose of this circuit is to automatically detect subcooled conditions and energize a limited number of heater assemblies in order to reestablish saturated conditions.

   b) Pzr temperature-RTD 'C' is applied to a function generator that calculates the corresponding Psat.

c) If the calculated Psat for the current Pzr temperature is significantly below the actual RCS pressure (NR Med-selected RCS pressure), Heater Bank 2 is in AUTO, and control is from the control room, the circuit will energize Bank #2 in order to reestablish saturated conditions.

d) To minimize cycling the calculated Psat must be 20 psig below actual RCS pressure before Bank 2 will energize and will not de-energize until Psat and RCS pressure are within 15 psig (5 psig dead band).

10. **Pzr Low Level Heater Cutoff - 80" (compensated Pzr level)** interlock de-energizes the heaters to prevent damage while they are uncovered.

11. Uncovered Pressurizer Heater Incidents {4}

a) A B&W Customer Service Bulletin, VIL B&W/91-01, describes the detrimental effects of heaters staying energized without any level.

b) The bulletin discusses several events and has analyzed those dealing with B&W plants to assure continued operation of those particular plants is safe. Rancho Seco in November 1986, Arkansas Nuclear One-Unit 2 in June 1981, Waterford 3 in March 1983, and an unnamed foreign reactor in July 1976 are events discussed in this report.

c) Pzr heaters have a low-level cutoff to prevent uncovered heater operation. In almost every case this low-level cutoff was defeated by false indication from the level circuitry usually due to faulty reference leg levels causing false higher than actual levels.

d) Uncovered energized heaters could result in the following:

1) Heater resistive element failure rendering the heater inoperative

2) Heater element failure

3) Damage to the heater sheath given sufficient time

4) Rupture of the heater sheath, allowing water to enter the heater element.

5) Pzr shell damage given sufficient time

e) The general assumption that the heaters will just burnout is not entirely correct. At the unnamed foreign reactor, a LBLOCA occurred due to uncovered heaters remaining energized for enough time to damage the Pzr shell. The B&W analysis of the Rancho Seco event concluded that uncovered energized heaters could reach 2200° F and that the radiant heat, especially along with refill of the Pzr, could cause tensile stresses in excess of the material yield stress. Higher initial pressures will add to the tensile stresses.

f) Basically, when dealing with uncovered energized heaters there are no guarantees. If the heaters do not readily burnout, the Pzr is operating in an unanalyzed situation and anything up to a LBLOCA can occur.

b) LOHT: Following a loss of all feedwater event where no sources of feedwater are available and RCS pressure is approaching 2300 psig, HPI is utilized. Flow is established in each injection header through HP-26 and HP-27 and the PORV manually opened to provide a flowpath for cooling water from the BWST, through the core, to the basement of the reactor building. This is called “HPI Forced Cooling”.

2.8 **System Interlocks/Automatic Actions (OBJ.R5...)**

A. In automatic, HP-120 maintains pressurizer level at setpoint (normally **220 inches**) under normal conditions.

B. In automatic, the Pzr heater banks cycle as necessary to maintain RCS pressure as follows:

1. **Bank #1**- maintains RCS pressure **at setpoint** (normally 2155 psig) using SCR proportional control.
2. **Bank #2**- energizes at **2140 psig** decreasing and de-energizes at **2150** psig increasing.
3. **Bank #3**- energizes at **2145 psig** decreasing and de-energizes at **2175** psig increasing. Bank #3 normally remains energized with Heater Bank #1 cycling on and off to maintain RCS pressure at setpoint
4. **Bank #4**- energizes at **2130 psig** decreasing and de-energizes at **2145** psig increasing.
   a) “NR RCS Pressure LO / LOLO”; OAC alarms at 2135# and 2125# respectively
   b) Warns operators of approaching the last bank of heaters or exceeding the DNB parameter for low RCS pressure

C. An **80-inch** (**85” SSF**) low pressurizer level interlock prevents the heaters from being energized while they are uncovered.

D. In automatic, **RC-1 Spray Valve** opens at **2205 psig** increasing RCS pressure and closes at **2155 psig** decreasing.

E. In automatic and selected to HIGH, **RC-66 PORV** opens at approximately **2450 psig** and will reseat at approximately **2400 psi** (**530 and 480 psig** when selected to LOW.)

F. At **2500 psig Pzr Code Safety Relief Valves** lift; not guaranteed to reseat.

2.9 **Procedural Limits and Precautions**

A. **(OBJ.R18)**The maximum allowable heatup and cooldown rate for the pressurizer is **<u>90°F per hour</u>**

This is within the TS limit of 100°F per hour, which protects the system components from exceeding <u>design thermal stresses</u>.

1 POINT

Question 34

Which ONE following correctly completes the statement?

The actual RPS high flux trip setpoint is set at ___% when in shutdown bypass and this limit is imposed to...

A. 5

prevent any significant power production with a portion of the RPS bypassed.

B. 5

ensure Emergency FDW has sufficient capacity to remove decay heat.

C. 4

ensure Emergency FDW has sufficient capacity to remove decay heat.

D. 4

prevent any significant power production with a portion of the RPS bypassed.

Question 34
T2/G1 - kds

012K4.02, Reactor Protection System **Knowledge of RPS design feature(s) and/or interlock(s) which provide for the following: Automatic reactor trip when RPS setpoints are exceeded for each RPS function; basis for each** (4.0/4.5)

K/A MATCH ANALYSIS
Question asks design feature/interlock (4% setpoint when in S/D Bypass) and the basis for the setpoint.

ANSWER CHOICE ANALYSIS

Answer: D

A. Incorrect: Incorrect setpoint. Plausible because 5% is the Tech Spec setpoint.

B. Incorrect: Incorrect setpoint and reason. Plausible because 5% is the definition for Mode 1 (Power Range Operation).

C. Incorrect: Incorrect reason. Plausible because keeping power below 5% will prevent Mode 1 (Power Range Operation).

D. Correct: See By administrative procedure, the high flux trip set points are manually reset to approximately 4% when in S/D bypass. 4% is below the Tech Spec requirement of less than or equal to 5% when shutdown thus, preventing significant power production when performing zero power physics testing.

Technical Reference(s): **PNS-RPS Pages 18, 19**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-RPS R5**

Question Source: **IC080**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

5. Explain the following concerning the Shutdown Bypass function in RPS: (R5)
    5.1 The three plant operations for which the SD Bypass function provides the capability to perform.
    5.2 The four normal tripping parameters in RPS that are bypassed when SD Bypass is active.
    5.3 The new tripping parameter that is automatically inserted into RPS when SD Bypass is active, the trip set point, and the basis for the new trip variable.
    5.4 What administratively controlled action is required when SD Bypass is selected, and the basis for that action.
    5.5 The basic operation required to place each RPS channel in SD Bypass, and the indications that alert the operator that a channel is in SD Bypass.
    5.6 The consequence of selecting SD Bypass during full power operation.
6. Explain the following concerning the Manual Bypass (channel trip bypass) function in RPS: (R6)
    6.1 The effect on an RPS channel of placing that channel in Manual Bypass.
    6.2 The meaning of two-out-of four and two-out-of three logic in RPS.
    6.3 When Manual Bypass is used.
    6.4 The basic operation required to place an RPS channel in Manual Bypass, and the indications that alert the operator that a channel is in Manual Bypass.
    6.5 What administrative limit is imposed on the use of Manual Bypass, and what safeguards are used to insure compliance with this limit.
7. Explain the following relative to a bistable: (R7)
    7.1 Basic electronic operation
    7.2 Two basic functions bistables serve in RPS
    7.3 Function and/or operation of each operator-related indication and control on a bistable module
8. Explain the following relative to a STAR Module (R29)
    8.1 Inputs
    8.2 Outputs
    8.3 Normal operation
    8.4 Trip conditions; indications when tripped and methods used to manually trip.

NOTE: PIP O-00-003607 was written on the setpoint for the main turbine ETS oil pressure trip. Tech. Specs. Requires the setpoint to be ≥800 psig. We were setting the trip at 800 psig ±24. This allowed the trip to be set <800 psig. The new setpoint for the trip has been changed to 850 ±24 psig.

11. Manual Trip pushbutton
    a) Provides the operator ability to manually trip the reactor if necessary (TS 3.3.2)

B. Protective Functions Bypasses

1. **(OBJ R5)** Shutdown Bypass
    a) Certain segments of the RPS protective functions for a channel can be bypassed with a key-switch located in that channel's RPS cabinet (A2, B2, C2, or D2). **(OC-IC-RPS-8)**
    b) **(OBJ R5.1)** Bypass function is to provide capability to perform CRD testing, zero power physics testing, and startup procedures. It provides the capability to reset the CRD breakers when the plant is shut down. (Pull Group 1 to 50%).
    c) **(OBJ R5.2)** During startup the RCS pressure is low and only one or two RCPs, at times, are operating. This would keep RPS tripped.
    d) **(OBJ R5.2)** Positioning S/D Bypass Key switch to "Bypass" bypasses the Low Pressure Trip, the variable low pressure trip, the flux/flow – imbalance trip, and the power/RCPs trip normally associated with the RPS.
    e) **(OBJ R5.3)** In addition to bypassing the four trip parameters above, the "Bypass" position automatically inserts a high RCS pressure trip set point of ≤1720 psig, so that the plant cannot be operated normally with portions of the RPS in S/D Bypass.
        1) While the normal high pressure trip of ≤2355 psig is not electrically bypassed it is basically nonfunctional because RPS will trip before the setpoint can be reached.
    f) The setpoint of ≤1720 psig is selected for the new high pressure trip so that the plant must first be shutdown, using normal procedures, before S/D Bypass can be initiated; 1720 psig is below the normal low pressure trip of 1800 psig, so that the plant must first be maneuvered past the normal low pressure trip point before going to S/D bypass. 1710 psig is the actual setpoint used for conservatism.
    g) **(OBJ 5.4)** By administrative procedure, the high flux trip set points are manually reset to approximately 4% when in S/D bypass. 4% is below the Tech Spec requirement of less than or equal to 5% when shutdown thus, preventing significant power production when performing zero power physics testing.

1) Sufficient natural circulation flow would be available to remove up to 5% of rated power if no RCPs were operating

2) While the normal high flux trip of ≤105.5% power is not electrically bypassed it is basically nonfunctional because RPS will trip before the setpoint can be reached.

h) Resetting the high flux trip to this value prevents any significant power from being produced when performing zero power physics testing. Sufficient natural circulation flow would be available to remove up to 5% of rated power if no RCPs were operating.

i) **(OBJ 5.5)** A Shutdown Bypass key switch is located in each RPS channel Cabinet (A2, B2, C2, and D2). The channel key switch is located to the left of the Reactor Trip Module and Manual Bypass key switch.

1) When the operator selects the Shutdown Bypass position the following occurs:

- Statalarm on panel SA-5 alarms indicating the specific channel is in Shutdown Bypass

j) **(OBJ 5.6)** Selecting S/D Bypass at full power will result in a trip of the associated RPS channel on high RCS pressure.

2. **(OBJ R6)** Manual Bypass (Channel Trip Bypass)

a) **(OBJ R6.1)** A Manual Bypass key switch located in each RPS channel Cabinet (A2, B2, C2, and D2) on the Reactor Trip Module, bypasses all automatic trip functions associated with that channel. **(OC-IC-RPS-9)**

b) **(OBJ R6.2)** As will be discussed in a later section of this lesson plan, the RPS will initiate a reactor trip if two of the four RPS channels trip; this constitutes a two-out-of four logic. If the automatic trip functions of one channel are bypassed, two RPS channels are still required to actuate a reactor trip, but only three channels are left available. The trip logic with one channel in Manual Bypass becomes two-out-of three.

c) **(OBJ R6.3)** Manual Bypass is used, normally, for testing individual RPS channels while the plant is operating (so that the likelihood of inadvertent reactor trip is reduced); but it <u>may</u> also be used to bypass an inoperable channel due to a component failure in that channel.

IC080

A high flux trip setpoint ≤ 5% is the administrative Tech. Spec. limit imposed on reactor power when in shutdown bypass. This limit is imposed: (.25)

A) to prevent any significant power production with a portion of the RPS trips bypassed.

B) because sufficient natural circulation would be available to remove up to 10% of rated power, if no RCP's were operating.

C) to ensure at least 1% shutdown margin will be maintained.

D) to ensure no power operations can occur with part of the RPS bypassed.

A

1 POINT

Question 35

Unit 1 plant conditions:

- Reactor power = 100%
- "B" ES analog channel WR RCS pressure test module is in "TEST-OPERATE"
- 1KVIC power panelboard is de-energized

Based on the above conditions, which ONE of the following describes the ES channels that will actuate?

A. All ES digital channels 1 through 6

B. All ES digital channels 1 through 4

C. Only ODD ES digital channels 1 and 3

D. Only EVEN ES digital channels 2 and 4

Question 35
T2/G1 - kds

013K5.02, Engineered Safety Features Actuation System **Knowledge of the operational implications of the following concepts as they apply to the ESFAS: Safety system logic and reliability** (2.9/3.3)

K/A MATCH ANALYSIS
Question asks Operational implications (inadvertent initiation of ES) of placing switch to "Test" with system logic (2/3 ES channels satisfied) and reliability (De-energized channel – trip).

ANSWER CHOICE ANALYSIS
KVIC bkr 2 feeds analog channel 3 and when it is de-energized, it sends a trip signal. Taking the B channel to "Test-Operate" provides an additional analog channel trip signal providing the necessary 2/3 for initiation. WR RCS pressure provides an initiation signal for ES associated with RCS pressure (ES 1-4). This provides ES initiation Ch 1-4.

Answer: B

A. Incorrect: There are no trip signals going to channel 5 &6. Plausible because ES 5&6 come off of WR Building Pressure.

B. Correct: With Channel "B" in Test-Operate the channel is in a trip state. When KVIC is de-energized, 2 of 3 analog channels have a trip signal and actuate ES digital channels 1-4

C. Incorrect: There are two trip signals going to ES digital channels 1-4. Plausible because Odd ICS channels are powered by KVIB (placed in Test-Operate) assuming that even channels will not because they are in test.

D. Incorrect: There are two trip signals going to ES digital channels 1-4. Plausible because Odd ICS channels are powered by KVIB (placed in Test-Operate) assuming that odd channels will not because the even channels are in test.

Technical Reference(s): **IC-ES Page 22**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **IC-ES R12**

Question Source: **Bank IC030801**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

12. Predict the response of ES analog and digital channels following a loss of power to: (R12)

    12.1 Analog channels

    12.2 Digital channels

    12.3 Analog and Digital channels simultaneously

13. Explain the actions necessary to manually trip and/or reset an analog or digital ESG channel. (R13)

14. Predict the emergency operation of the ESG analog and digital channels in response to a LOCA that results in RCS pressure gradually decreasing to ≈100 psig accompanied by a gradual increase in Reactor Building pressure to ≈15 psig. (R14)

15. Discuss the proper operation of all RZ Module controls and indications located on a unit's vertical control board in the Control Room. (R15)

16. Discuss and properly apply the guidance associated with repositioning ES equipment following an ES actuation. (R16)

17. Describe the actions necessary to properly return HPI pumps, Reactor Building Cooling Units and Keowee Hydro Units to normal operation following ES actuation. (R17)

2) Limit pressurization transient

3) Insure cooling water restored to necessary components - RCPs, CRDMs

4) Limit chemical spray hazard to RB equipment

c) Operator must determine cause and correct problem with ESG system insuring required Tech Specs are met.

d) Possible causes of inadvertent actuation of ESG include:

1) Pressure Instrument failure while testing another Analog channel could result in ES actuation. (Example: while testing Channel 'A' Analog, RCS WR to Channel B fails low.)

2) Loss of power on (or from) vital busses **(OBJ. R12)**

Refer to OC-IC-ES-2

(a) Loss of power to an analog channel results in a trip signal being sent from that channel. (Only the outputs supplied from bistables - HPI, LPI and NR RB pressures; therefore, RBS will not actuate as a result of a vital power failure.)

(b) Digital channels must have power to actuate their associated safeguards action.

(c) KVIA Bkr #2 feeds Analog Ch A & Odd Dig Chnls

KVIB Bkr #2 feeds Analog Ch B & Even Dig Chnls

KVIC Bkr #2 feeds Analog Ch C

(d) Loss of KVIA and KVIC - Analog channels A & C send trip signal to digital channels 1-6. Only even channels 2, 4, and 6 actuate (KVIB powered) channels 7 and 8 do not receive a trip signal on a loss of analog channel power.

(e) Loss of KVIB and KVIC - Analog channels B and C send trip signal to digital channels 1-6. Only odd channels 1, 3, and 5 actuate (KVIA powered).

(f) Loss of KVIA and KVIB - Analog channels A and B send trip signal but no power available for digital channels - no actuation.

3. Manual Trip and Reset of ES Channels **(OBJ. R13)**

a) Analog channels

IC030801

Unit 1 plant conditions:

- Reactor Power = 10%
- "B" ES analog channel WR RCS pressure test module is in "TEST-OPERATE"
- 1KVIC power panelboard is de-energized

Which ONE of the following is correct? (.25)

A) All ES digital channels 1 through 6 actuate.

B) All ES digital channels 1 through 4 actuate.

C) Only ODD ES digital channels 1 and 3 actuate.

D) Only EVEN ES digitial channels 2 and 4 actuate.

B

A. There are no trip signals going to channel 5 &6.

B. Correct - With Channel "B" in Test-Operate the channel is in a trip state. When KVIC is deenergized, 2 of 3 analog channels have a trip signal and actuate ES digital channels 1-4

C. There are two trip signals going to ES digital channels 1-4.

D. SEE above

1 POINT

Question 36

Unit 1initial conditions:

- Steam leak inside containment
- Reactor Trip
- Rule 5 complete
- ES 1-6 initiated

Current conditions:

- RB pressure 0.5 psig stable
- EOP Enclosure 5.41 (ES Recovery) in progress

Which ONE of the following correctly states the sequence to place the Reactor Building Cooling Units in their normal configuration in accordance with Encl. 5.41?

1 - Reset Analog Bistables
2 - Place RBCUs on RZ module to MANUAL
3 - Reset Digital Channels 5 & 6
4 - Depress the PUSH TO RET TO NORMAL AFT ES RESET pushbuttons
5 - Initiate OP/1/A/1104/015 (RBCUs)
6 - Position the RBCU switches in LOW

A. 2 / 1 / 3 / 4 / 6 / 5

B. 1 / 3 / 4 / 6 / 5

C. 2 / 6 / 4 / 5

D. 1 / 3 / 6 / 4 / 5

Question 36
T2/G1 - kds

022GG2.1.23, Containment Cooling System **Ability to perform specific system and integrated plant procedures during all modes of plant operation.** (3.9/4.0)

K/A MATCH ANALYSIS
Question requires knowledge of integrated plant procedures (Encl 5.41 of EOP) in resetting the RBCUs (Containment Cooling).

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: Encl 5.41 does not place RZ module in MANUAL as part of the restoration process. Plausible because it will allow the RBCUs to be in their normal alignment.

B. Incorrect: Resets the logic before repositioning RBCU switches (one RBCU will turn off and the other two will shift to HIGH speed. Plausible because it will return the RBCUs in the lineup that they were in before the ES signal.

C. Incorrect: Encl 5.41 does not place RZ module in MANUAL as part of the restoration process. Plausible because it will allow the RBCUs to be in their normal alignment.

D. Correct: To Reset the RBCUs per Encl 5.41: The analog channels in the ES cabinets are reset, The digital channels on UB1 are reset, The RBCU switches are placed in LOW, The RESET switches are reset, The RBCU operating procedure is initiated to restore LPSW lineup.

Technical Reference(s): **EP/1/A/1800/001 Encl 5.41**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-RBC R10**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

11. Given a copy of PT/0160/002, RBCU Air Flow Test, and a set of data, evaluate if acceptance criteria is met. (R17)

12. Explain how to return the RBCUs to normal operation following ES actuation. (R10)

13. Explain the potential results of a valid cooler rupture in a RBCU and the importance of taking prompt action. (R12)

14. Describe two conditions that will activate a RBCU "Cooler Rupture" alarm. (R13)

15. Given a set of conditions, determine the proper operation / alignment of the RBC System, including the RB Aux Cooling units, and the basis for that specific operation / alignment. (R5, R7, R9)

16. Given a set of plant conditions, analyze RBC System operation and determine system status and any required actions / corrective actions. (R14, R15)

17. Given a copy of TS / SLC's, analyze a given set of plant conditions for applicable TS / SLC LCO's. (R11)

18. Apply all TS / SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R18)

19. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS / SLC's. (R19)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
NOTE Technical Specification 3.3.7 and 3.3.6 entry is required when any ES component is in Manual while ES signal is present. These conditions are exited when all digital channels are reset.	
1. __ **WHEN** <u>all</u> the following exist: __ ES Channels have actuated __ Condition causing ES Channel actuation has cleared __ ES Channel reset is desired __ OSM concurs **THEN** continue.	
2. Reset desired tripped bistables for the following: __ ES Analog Channel A __ ES Analog Channel B __ ES Analog Channel C	
3. __ Verify reset of ES Channels 1 & 2 is desired.	__ **GO TO** Step 31.
4. Verify the following Stat Alarms have cleared: __ 1SA-7/A-1 (ES HP INJECTION CHANNEL A TRIP) __ 1SA-7/B-1 (ES HP INJECTION CHANNEL B TRIP) __ 1SA-7/C-1 (ES HP INJECTION CHANNEL C TRIP) __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP)	1. __ Ensure analog channel bistables are reset. 2. __ **IF** required, **THEN** notify SPOC for assistance. 3. __ **WHEN** the following have cleared, __ 1SA-7/A-1 (ES HP INJECTION CHANNEL A TRIP) __ 1SA-7/B-1 (ES HP INJECTION CHANNEL B TRIP) __ 1SA-7/C-1 (ES HP INJECTION CHANNEL C TRIP) __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP) **THEN** continue.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. Depress digital channel RESET pushbuttons for the following: (1UB1) __ Ch 1 __ Ch 2	
6. Verify the following digital channel TRIPPED lights clear: (1UB1) __ Ch 1 __ Ch 2	1.__ Notify SPOC for assistance. 2.__ **WHEN** the ES digital channels 1 & 2 are reset, **THEN** continue.
7. __ Dispatch an operator to perform Encl (SSF Restoration) of AP/1/A/1700/042 (Inadvertent ES Actuation). {34}	
8. Verify both the following exist: __ Keowee Hydro shutdown is desired. __ OSM concurs	__ **GO TO** Step 20.
9. Verify Keowee Hydro supplying any Unit Main Feeder Bus: __ Unit 1 __ Unit 2 __ Unit 3	__ **GO TO** Step 11.
10. __ **GO TO** Step 20.	
11. Verify any of the following are closed: __ SK1 CT4 STBY BUS 1 FEEDER __ SK2 CT4 STBY BUS 2 FEEDER	__ **GO TO** Step 17.
12. __ Enter T.S.3.8.1 Condition D for the underground power path.	
13. Place the following transfer switches in MAN: __ CT4 BUS 1 AUTO/MAN __ CT4 BUS 2 AUTO/MAN	
14. Open the following breakers: __ SK1 CT4 STBY BUS 1 FEEDER __ SK2 CT4 STBY BUS 2 FEEDER	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15. Place the following transfer switches in AUTO: __ CT4 BUS 1 AUTO/MAN __ CT4 BUS 2 AUTO/MAN	
16. __ Exit T.S.3.8.1 Condition D for the underground power path.	

NOTE

- Keowee Units that do **NOT** have Normal Lockout will parallel to the grid when the ES signal is removed.
- Keowee Units that have Normal Lockout will trip when the ES signal is removed.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
17. Inform Keowee Hydro operator of the following: __ Resetting ES start signal to KHUs. __ Expected response based on NOTE.	
18. Depress the following on Unit 1: (1UB1) __ CH 1 KEOWEE LOGIC RESET (PUSH TO RET TO NORMAL AFT ES RESET) __ CH 2 KEOWEE LOGIC RESET (PUSH TO RET TO NORMAL AFT ES RESET)	
19. __ Notify Keowee Hydro operator to shutdown <u>both</u> KHUs per OP/0/A/2000/041 (Keowee Modes of Operations). {35}	
20. __ Stop the 1C HPI Pump.	
21. __ Open 1HP-27.	
22. __ Close 1HP-409.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE
The following steps will reset HPI pump ES logic.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
23. __ Ensure only one HPI pump operating.	
24. __ Ensure standby HPI pump in AUTO.	
25. __ Verify 1A HPI PUMP operating with switch in ON position.	1.__ Place 1A HPI PUMP switch to OFF. 2.__ Place 1A HPI PUMP switch to AUTO. 3.__ **GO TO** Step 27.
26. Perform the following: A. __ Place 1A HPI PUMP switch to AUTO. B. __ Place 1A HPI PUMP switch to ON.	
27. __ Verify 1B HPI PUMP operating with switch in ON position.	1.__ Place 1B HPI PUMP switch to OFF. 2.__ Place 1B HPI PUMP switch to AUTO. 3.__ **GO TO** Step 29.
28. Perform the following: A. __ Place 1B HPI PUMP switch to AUTO. B. __ Place 1B HPI PUMP switch to ON.	
29. Verify both of the following breakers open: __ SL-1 CT5 STBY BUS 1 FEEDER __ SL-2 CT5 STBY BUS 2 FEEDER	__ **IF** in-progress procedures require one HPI pump to be in the OFF position, **THEN** position the standby HPI pump switch to OFF.
30. Perform the following: A. Open the following to restore RB RIAs: ES Channel 1 __ 1PR-7 __ 1PR-9 ES Channel 2 __ 1PR-8 __ 1PR-10 B. __ Start the RB RIA sample pump from the ENABLE CONTROLS screen on the RIA View Node.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
31. __ Verify reset of ES Channels 3 & 4 is desired.	__ **GO TO** Step 36.
32. Verify the following Stat Alarms have cleared: __ 1SA-7/A-2 (ES LP INJECTION CHANNEL A TRIP) __ 1SA-7/B-2 (ES LP INJECTION CHANNEL B TRIP) __ 1SA-7/C-2 (ES LP INJECTION CHANNEL C TRIP) __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP)	1. __ Ensure analog channel bistables are reset. 2. __ **IF** required, **THEN** notify SPOC for assistance. 3. __ **WHEN** the following have cleared, __ 1SA-7/A-2 (ES LP INJECTION CHANNEL A TRIP) __ 1SA-7/B-2 (ES LP INJECTION CHANNEL B TRIP) __ 1SA-7/C-2 (ES LP INJECTION CHANNEL C TRIP) __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP) **THEN** continue.
33. Depress digital channel RESET pushbuttons for the following: (1UB1) __ Ch 3 __ Ch 4	
34. Verify the following digital channel TRIPPED lights clear: (1UB1) __ Ch 3 __ Ch 4	1. __ Notify SPOC for assistance. 2. __ **WHEN** the ES digital channels 3 & 4 are reset, **THEN** continue.
35. Close the following: __ 1LP-17 __ 1LP-18	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
36. __ Verify reset of ES Channels 5 & 6 is desired.	__ **GO TO** Step 47.
37. Verify the following Stat Alarms have cleared: __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP)	1. __ Ensure analog channel bistables are reset. 2. __ **IF** required, **THEN** notify SPOC for assistance. 3. __ **WHEN** the following have cleared, __ 1SA-7/A-3 (ES RB ISOLATION CHANNEL A TRIP) __ 1SA-7/B-3 (ES RB ISOLATION CHANNEL B TRIP) __ 1SA-7/C-3 (ES RB ISOLATION CHANNEL C TRIP) **THEN** continue.
38. Depress digital channel RESET pushbuttons for the following: (1UB1) __ Ch 5 __ Ch 6	
39. Verify the following digital channel TRIPPED lights clear: (1UB1) __ Ch 5 __ Ch 6	1. __ Notify SPOC for assistance. 2. __ **WHEN** the ES digital channels 5 & 6 are reset, **THEN** continue.
40. __ Verify <u>any</u> CC pump operating.	__ **GO TO** Step 42.
41. Perform the following: A. __ Ensure <u>one</u> CC pump in ON. B. __ Ensure <u>one</u> CC pump off <u>and</u> in AUTO.	
42. Position the following switches to LOW: __ 1A RBCU __ 1B RBCU __ 1C RBCU	
43. Depress the following PUSH TO RET TO NORMAL AFT ES RESET pushbuttons: __ 1A RBCU ES RESET __ 1B RBCU ES RESET __ 1C RBCU ES RESET	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

The Turnover Checklist may be used to determine condition of the RBCUs before ES actuation.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
44. Initiate OP/1/A/1104/015 (Reactor Building Cooling System) to place the following in normal alignment: {36} __ RBCUs __ 1LPSW-18 __ 1LPSW-21 __ 1LPSW-24	
45. __ Initiate OP/1/A/1104/010 (Low Pressure Service Water) to restore RB Auxiliary Fan Coolers to service using "Startup of RB Aux Coolers" portion of Encl (LPSW Shutdown and Return to Service of RB Aux Coolers). {37}	
46. Secure the Penetration Room Ventilation fans from RZ Module: __ PR FAN-1A __ PR FAN-1B	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
47. __ Verify reset of ES Channels 7 & 8 is desired.	__ **GO TO** Step 53.
48. Verify the following Stat Alarms have cleared: __ 1SA-7/A-4 (ES RB SPRAY CHANNEL A TRIP) __ 1SA-7/B-4 (ES RB SPRAY CHANNEL B TRIP) __ 1SA-7/C-4 (ES RB SPRAY CHANNEL C TRIP)	1.__ **IF** required, **THEN** notify SPOC for assistance. 2.__ **WHEN** the following have cleared, __ 1SA-7/A-4 (ES RB SPRAY CHANNEL A TRIP) __ 1SA-7/B-4 (ES RB SPRAY CHANNEL B TRIP) __ 1SA-7/C-4 (ES RB SPRAY CHANNEL C TRIP) **THEN** continue.
49. Depress digital channel RESET pushbuttons for the following: (1UB1) __ Ch 7 __ Ch 8	
50. Verify the following digital channel TRIPPED lights clear: (1UB1) __ Ch 7 __ Ch 8	1.__ Notify SPOC for assistance. 2.__ **WHEN** the ES digital channels 7 & 8 are reset, **THEN** continue.
51. Stop the following: __ 1A RBS Pump __ 1B RBS Pump	
52. Close the following: __ 1BS-1 __ 1BS-2	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

TS/SLCs below are included as a reference. This list may **NOT** be complete based on the specific situation. Reference TS/SLC manuals.

Any ES Channel

- TS 3.3.7 (ESPS Digital Automatic Actuation Logic Channels) due to the digital actuation logic being blocked if any ES component in MANUAL. Cleared when all digital channels are reset.
- TS 3.3.6 (ESPS Manual Instrumentation) due to the manual actuation initiation being blocked if any ES component in Manual. Cleared when all digital channels are reset.
- TS 3.5.4 (BWST) BWST level

ES Channel 1 or 2

- TS 3.4.15 (RCS Leakage Detection Instrumentation) due to Rx Bldg RIAs being out of service
- TS 3.10 (Standby Shutdown Facility) for SSF inoperability due to the SSF power loss (ES Channel 1 only)
- TS 3.4.9 if PZR level is > 260″

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
53. __ Initiate logging TS/SLC entry/exit, as applicable.	
54. Close the following: __ 1LPSW-4 __ 1LPSW-5	
55. __ Ensure ≤ two LPSW pumps operating, as required.	
56. __ Verify Unit 2 on decay heat removal.	__ **GO TO** Step 58.
57. __ Notify Unit 2 to control LPI cooler outlet temperature, as required.	
58. Place the following in NORMAL: __ 1LPSW-251 FAIL SWITCH __ 1LPSW-252 FAIL SWITCH	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
59. Perform the following: A. __ Depress 1LPSW-251 HIGH FLOW CLOSURE RESET. B. __ Place 1LPSW-251 in auto. C. __ Adjust 1LPSW-251 setpoint to desired flowrate. D. __ Depress 1LPSW-252 HIGH FLOW CLOSURE RESET. E. __ Place 1LPSW-252 in auto. F. __ Adjust 1LPSW-252 setpoint to desired flowrate.	
60. __ Place 1LPSW-51 in MANUAL.	
61. __ Close 1LPSW-51.	
62. __ Open 1LPSW-139.	
63. Maintain MTOT temperature 90 - 100°F using one of the following: __ Throttle 1LPSW-51 in MANUAL. __ Place 1LPSW-51 in AUTO and adjust setpoint.	
64. __ Verify 2LPSW-139 was closed by Encl 5.1 (ES Actuation).	__ **GO TO** Step 69.
65. __ Place 2LPSW-51 in HAND.	
66. __ Close 2LPSW-51.	
67. __ Open 2LPSW-139.	
68. Maintain MTOT temperature 90 - 100°F using one of the following: __ Throttle 2LPSW-51 in HAND. __ Place 2LPSW-51 in AUTO and adjust setpoint.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
69. __ Verify SGTR or LOCA in progress on any unit.	1. Stop the following: __ A OUTSIDE AIR BOOSTER FAN __ B OUTSIDE AIR BOOSTER FAN 2. Notify Unit 3 to stop the following: __ 3A OUTSIDE AIR BOOSTER FAN __ 3B OUTSIDE AIR BOOSTER FAN
70. __ Dispatch an operator to place both RB Hydrogen Analyzer trains in Standby Mode per OP/1/A/1102/022 (RB Hydrogen Analyzer System). {38}	
71. __ Verify LPI in operation.	__ Select DECAY HEAT LOW FLOW ALARM SELECT switch to BLOCK.
72. __ **EXIT** this enclosure.	

• • • **END** • • •

1 POINT

Question 37

Unit 2 plant conditions:

- SBLOCA
- Enclosure 5.12 (ECCS Suction Swap to RBES) is complete

Which ONE of the following design features of the Reactor Building Spray (BS) system ensures that it performs its designed purpose?

A. Flow orifices in each Building Spray header eliminate the need to throttle BS after initiation to prevent pump motor over current.

B. Screens cover the RBES to filter particles and prevent blockage of flow through the spray nozzles.

C. 50% of the spray nozzles are plugged to eliminate the need to throttle BS after initiation to prevent pump motor over current.

D. Screens cover the RBES to filter particles and prevent loss of suction to the Reactor Building Spray pumps.

Question 37
T2/G1 - kds

026K4.05, Containment Spray System
Knowledge of CSS design feature(s) and/or interlock(s) which provide for the following: Prevention of material from clogging nozzles during recirculation
(2.8/3.3)

K/A MATCH ANALYSIS
Question matches design feature of the RBS system (Sump Screens) to prevent material from clogging nozzles during recirculation mode.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect: Flow orifices were added for NPSH concern, not motor over-current. Plausible because reducing header flow will reduce possibility of runnout and motor over-current condition.

B. Correct: RBES sump screens were added to prevent debris from clogging the spray nozzles during recirc mode. While flow orifices and blocking 50% of the spray nozzles was a system modification, it was intended to ensure there was adequate NPSH for the BS pumps by limiting flow through the system. In addition to increasing BS pump NPSH, it will reduce flow which will in turn, will reduce operating current. But this is not the reason for the system modification.

C. Incorrect: Flow Nozzles were plugged for NPSH concern, not motor over-current. Plausible because reducing header flow will reduce possibility of runnout and motor over-current condition.

D. Incorrect: Screens are to prevent clogging the spray nozzles. NPSH is not their designed function. Plausible because they could actually prevent blockage at the suction of the pump.

Technical Reference(s): **PNS-BS Page 11**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-BS T1**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVES

1. Describe the purpose, location and modes of operation for the RBS System. The student should also recognize important power supplies associated with the system. (T1)

2. Assess the status of the RBS system during various system conditions to verify proper operation and determine any required corrective actions. T2)

ENABLING OBJECTIVES

1. State the two (2) purposes of the RBS System. (R1)

2. Given a set of conditions, determine if the RBS System will be available to perform its Safety Function. (R16)

3. List the power supplies for the RBS Pumps (R3)

4. List the following flow values for the RBS pumps. (R2, R7)

   4.1 Minimum flow requirement

   4.2 Normal ES flow when taking suction from BWST

   4.3 Normal flow when taking suction from RB Emergency Sump (RBES)

5. Draw the RBS System labeling all major components and valves. Include the following: (R5, R10)

   5.1 BWST

   5.2 RBES

   5.3 Recirc flowpath to BWST (for testing)

6. State the setpoint, statalarms armed, and equipment actuated by ES Channels 7 and 8. (R6)

7. For PT/0204/007, RBS Pump Test, describe: (R12)

   7.1 The purpose

   7.2 How the test is performed

8. Given a copy of PT/0204/007, RBS Pump Test, and a set of data, determine if the acceptance criteria is met. (R13)

9. Describe the purpose and the basic method to perform the RBS System Leakage Test. (R9)

B. Recirculation from the Reactor Building Emergency Sump (RBES)

1. Recirculation Mode from the RBES

   a) When the predetermined RB and BWST levels designated in the Emergency Operating Procedure (EOP) are reached, LPI pump suction is swapped to the RB emergency sump. (OP-OC-BS-2A)

      1) LP-19 and LP-20 are opened

      2) LP-21 and LP-22 are closed

2. Screens covering the RBES filter particles > ≈1/8" in diameter (opening ≈0.12" x0.12) to prevent blockage of flow through the spray nozzles.

3. During extended operation of the RBS System, the generation of hydrogen gas in the RB is a concern.

4. Passive Caustic Addition System {1}

   a) The generation of hydrogen is a result of a zinc-boric acid reaction. Zinc is contained in galvanized metals in the RB and boric acid is contained in the RB spray water.

   b) NSM ON-13104 has been implemented on all three Oconee units and is part of the Alternate Source Term Licensing Project. This modification will correct the design deficiencies and licensing vulnerabilities of the caustic addition function of the Chemical Addition System. Manual operator actions will be eliminated and Control Room doses during certain accidents will be substantially reduced. The modifications will also improve the reliability of the system.

   c) The control of pH in re-circulated coolant after a LOCA is important to minimize the re-evolution of radioactive iodine isotopes that are dissolved in the coolant in the RB basement and emergency sump. Maintaining the radioiodine in solution reduces radioactive material releases to the environment.

   d) The TSP (Trisodium Phosphate Dodecahydrate) Addition System performs this function during a LOCA. It has no function during normal operation. TSP is stored in wire mesh baskets in the reactor building basement. Following an accident, the TSP will be dissolved by the containment fluid. This will raise the pH of the water in the containment following a BDA (Design Basis Accident). The quantity of TSP stored in the baskets is sufficient to raise the containment sump fluid pH to at least 7.0 at STP following a DBA.

1 POINT

Question 38

Unit 3 plant conditions:

- Reactor power = 100%
- 3MS-112 & 3MS-173 (SSRH 3A/3B Controls) are in MANUAL
- 3MS-77, 78, 80, 81 (MS to SSRH's) are in AUTO

Which ONE of the following is correct if a turbine trip were to occur with the given conditions?

A. 3MS-112 & 3MS-173 valve demand will throttle back with load.

B. 3MS-112 & 3MS-173 valve demand will remain full open but the air will be ported off, causing the valves to close.

C. 3MS-77, 78, 80, and 81 will close when the air is dumped off of the valves

D. 3MS-77, 78, 80, and 81 will close as SSRH inlet pressure decreases

Question 38
T2/G1 - kds

039A3.02, Main and Reheat Steam System **Ability to monitor automatic operation of the MRSS, including: Isolation of the MRSS** (3.1/3.5*)

K/A MATCH ANALYSIS
Question requires knowledge of automatic actions (Isolation) of the MSRs.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect - 3MS-112 & 173 will close in manual when the Main Turbine trips. Plausible because they will throttle back in a "runback condition".

B. Incorrect – The signal from the Moore Controllers will direct the valves to close. Plausible because this and the air being bled off of the valves causes them to close.

C. Incorrect - 3MS-77, 78, 80 and 81 are Motor Operated Valves. Plausible because they close in this situation.

D. Correct – Upon receipt of a Turbine Trip signal, and a decrease in SSRH inlet pressure, MS-77, 78, 80 and 81 will close regardless of the switch positions in the Control Room and on the Heater Panel unless power is not available.

Technical Reference(s): **STG-MSR Page 15**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **STG-MSR R18**

Question Source: **Bank STG113**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

Relate the operation of the MSRH and MSRH Drain Systems to the operation of the Main Turbine and Secondary Side Systems during all operating modes.

ENABLING OBJECTIVES

1. State two (2) positive effects on the Low Pressure Turbines of using Moisture Separator Reheaters. (R1)
2. Describe how moisture is removed in the MSRH's. (R2)
3. Identify the steam supply source to the First Stage Reheaters. (R3)
4. Explain why the non-condensable gases are vented from the reheaters during operation. (R12)
5. Describe the function of the Extraction Bypass Drain System. (R4)
6. Explain why the FSRH Steam supply can be left in service over the full range of turbine load considering thermal stresses on MSRH's and Turbines. (R5)
7. Explain why the Second Stage Reheater steam supply is activated/deactivated gradually as turbine load is increased/decreased. (R6)
8. State the maximum limit on side to side differential temperature for the LP Turbines and how we ensure this limit is not exceeded. (R9)
9. Describe the effects of SSRH steam supplies during power operation with a loss of power event. (R17)
10. Describe the purpose and operation of MS-112 and MS-173 over the full range of plant operation. (R20)
11. State the purpose and operation of MS-77, 78, 80, and 81 (MS to SSRH's) and the load range of the turbine when these valves are normally opened or closed. (R7)
12. Describe the response of MS-112 and MS-173 HD-37 and HD-52 when power is lost and then regained to the associated Moore Controllers. (R21)
13. Predict the response of the SSRH control system during a Load Rejection and during a Turbine Trip with the controls in Auto and Manual on the pneumatic valves (MS-112/173) and Automatic, Manual Open and Manual Close on the electric valves (MS-77,78,80 & 81). (R18)

(e) As turbine load continues to increase, HP Turbine Exhaust will proportionally continue to increase. Eventually, the setpoint pressure will be greater than the pressure required to keep the tubes at the temperature setpoint. Once the pressure control circuitry provides a valve demand signal to MS-112/173 which is greater than the temperature control circuitry, the controller switches from temperature control to pressure control. Again, as turbine load continues to increase, pressure in the tubes will be in accordance to the characterized curve as determined by HP Turbine Exhaust.

b) MANUAL - allows for operator control in either the pre-warm phase or for manual ramping of SSRH tube pressure.

c) **(Obj. R18) Turbine Trip effect on MS-112,173 (SSRH Control)**:

(a) The declining EHC pressure will reposition the 'Extraction Relay Dump Valve' to remove all air from MS112, 173 (SSRH Control) and the extraction relays causing them to go closed.

(b) On a turbine trip an 'EHC' electrical trip signal will be sent to the Moore controllers to close these valves.

(c) **(Obj. R18)** Note: If a **Load Rejection** occurs without a Turbine trip, MS-112/173 will automatically throttle back with load.

2) **(Obj. R19) MS 112/173 Moore Controller Indications**:

(a) **'P'** - Indicates the process being controlled in this case it will show SSRH tube supply pressure.

(b) **'S'** - Indicates the internally processed setpoint in the pressure or ramp control mode only. This signal is developed from cold reheat pressure.

(c) **'V'** - Indicates the actual valve position requested by the Moore controller to the valve. The same indication as read on the horizontal bar graph on the bottom of the controller in a digital format

(d) **'X'** - High pressure Turbine exhaust pressure.

(e) **'Y'** - Indicates the highest of the two SSRH tube outlet temperatures as input to the Moore controller for the pre-warm mode.

(f) **'S' bar** - Indicates the setpoint as generated internally by the Moore controller based on calculated value using cold reheat pressure. It is activated once turbine load is $\geq$ 1%.

STG113

Unit 3 plant conditions:

- Reactor power = 100%
- 3MS-112 & 3MS-173 (SSRH 3A/3B Controls) are in MANUAL.
- 3MS-77, 78, 80, 81 (MS to SSRH's) are in AUTO.

Which ONE of the following is correct if a turbine trip were to occur with the given conditions? (.25)

A) 3MS-112 & 3MS-173 valve demand will decrease to 50%.

B) 3MS-112 & 3MS-173 valve demand will remain full open.

C) 3MS-77, 78, 80, and 81 will remain full open.

D) 3MS-77, 78, 80, and 81 will close.

Answer D

A. Incorrect - 3MS-112 & 173 will close in manual when the Main Turbine trips
B. Incorrect - same as the reason for "A".
C. Incorrect - 3MS-77, 78, 80 and 81 will not operate automatically if 3MS-112 & 173 are in manual.
D. Correct - After 3MS-112 & 173 close, 3MS-77, 78, 80 & 81 will go closed if they are in auto due to Turbine load being < 1%.

1 POINT

Question 39

Unit 1 initial conditions:

- Reactor power = 50%
- 1A and 1B SG levels ≈30% Operating Range

Current conditions:

- 1A1 and 1B1 RCP's trip

Based on the above conditions, which ONE of the following states where SG levels will be controlled?

Assume no operator actions

A. 240 inches on the Extended Startup Range.

B. 30 inches on the Extended Startup Range.

C. 25 inches on the Startup Range.

D. 50% on the Operating Range.

Question 39
T2/G1 - gcw

059A3.02, Main Feedwater **Ability to monitor automatic operation of the MFW, including: Programmed levels of the S/G** (2.9/3.1)

K/A MATCH ANALYSIS
Knowledge of plant response and automatic SG level control on a loss of 2 RCPS.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect. Still have at least one RCP available. MFDW also available. EFDW should not start.

B. Incorrect. EFDW is not be required.

C. Correct. MFDW is still available. SG level should be maintained at 25" on SUR via Startup Control Valves.

D. Incorrect. Will still have at least one RCP on.

Technical Reference(s): **CF-FDW Page 22**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **CF-FDW R37, R28**

Question Source: **Bank; CF033701**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

14. State the setpoints and automatic actions that occur based on FDWP discharge pressure and FDWPT hydraulic oil pressure. (R29)

15. Given a set of conditions, determine proper operation of the FDWP Seal Injection System. (R30, R31)

16. Describe the purpose of the Automatic Feedwater Isolation system. (R34)

17. Describe the instrumentation, statalarms and computer points associated with the AFIS modification. (R42)

18. Given a set of conditions, verify proper operation of AFIS. (R43)

19. Discuss when AFIS is placed in and out of service. (R44)

20. Given a copy of ITS / SLC's, analyze a given set of plant conditions for applicable TS / SLC LCO's. (R11)

21. Apply all ITS / SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R39)

22. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS / SLC's. (R40)

23. Given a set of conditions, analyze FDW System operation to determine system status and any required actions / corrective actions. (R37)

24. Draw a basic one-line diagram of the Feedwater System including all major components and valves. (R36)

recovered. Both MDEFWPs auto started and 2FDW-316 opened to feed up to 30 inches in the 2B SG. EFW response was as expected.

This was identified by the CARB to be a Human Performance event. The primary root causes were:

1. Inappropriate emphasis on procedural step information to use TBVs to control cooldown rate. (**Procedure guidance not clear, Latent Organizational Weakness**)
2. Failure to properly monitor Feedwater/TBVs during transient. (**QV&V**)
3. Inadequate SRO Oversight during the event (**Clear Accountability by Supervisor**)

The CARB recommended the need to establish "a clear standard of conduct for the operator when the plant and/or system is in manual operations." This standard will include responsibilities and observable behaviors for the operator when in manual operations.

3. (**Obj. R28**) Startup FDW Control Valves (FDW-35 and 44)
   a) Interlock with Main FDW Block valves already discussed.
   b) Controlled by ICS Bailey Station on UB1.
   c) In AUTO, and at low unit load, the SU CV's control SG levels a minimum level of 25" SUR (Startup Range) to prevent the SG's from boiling dry.
   d) As unit load increases during startup, the SG's come off of level control, as the amount of FDW to them increases; the SU CV's begin to ramp open under command of the ICS.
   e) Another level control circuit associated with the SU CV's is SG level control on a loss of all RCP's. In this condition, in order to establish natural circulation cooling through the SG's, the SU CV's, if in AUTO, will establish and maintain SG levels at 50% on the OR. The Operator can take manual control of the valves during the fill if necessary to prevent overcooling.
4. Main FDW Control Valves (FDW-32 and 41)
   a) Controlled by ICS Bailey Station on UB1:
   b) With the Main CV's in AUTO, the ICS controls their position to regulate FDW flow to match demand for the unit.
5. Startup Line Isolations (FDW-36 and 45) and SG EFDW Header Isolations (FDW-38 and 47)
   a) Motor operated from Control Room.
   b) CLOSE, AUTO, OPEN.
   c) Normally in AUTO.

CF033701

Unit 1 conditions:

INITIAL CONDITIONS:

- Reactor power = 50%
- 1A and 1B SG levels ≈30% Operating Range

.

CURRENT CONDITIONS

- 1A1 and 1B1 RCP's trip

.

Which ONE of the following is correct? (.25)

Assume no operator actions

SG levels will be controlled at...

A. 240 inches on the Extended Startup Range.

B. 30 inches on the Extended Startup Range.

C. 25 inches on the Startup Range.

D. 50% on the Operating Range.

C

A. Incorrect. Still have at least one RCP available. MFDW also available. EFDW should not start.
B. Incorrect. EFDW would not be required.
C. Correct. MFDW is still available. SG level should be maintained at 25" on SUR via Startup Control Valves.
D. Incorrect. Will still have at least one RCP on.

1 POINT

Question 40

Unit 1 initial conditions:

- Reactor power = 50%
- Loss of main feedwater

Current plant conditions:

- RCS temperature 546 ºF decreasing
- PZR Level 45" decreasing
- RCS pressure 2015 psig decreasing
- A SG pressures = 995 psig decreasing
- B SG pressures = 1010 psig stable

Which ONE of the following malfunctions will result in the above conditions?

ASSUME NO OPERATOR ACTIONS

A. Turbine Control Valve #1 failed OPEN

B. CSAE steam supply relief valve failed OPEN

C. SG SUR level indication fails LOW

D. 1FDW-315 failed OPEN

Question 40
T2/G1-kds

061K3.01, Auxiliary / Emergency Feedwater (AFW) System **Knowledge of the effect that a loss or malfunction of the AFW will have on the following: RCS** (4.4/4.6)

K/A MATCH ANALYSIS
Question describes how a malfunction of the EFDW control valve (1FDW-315) will affect RCS parameters (RCS temp & pzr level).

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: the control valve leak would be isolated upon the Rx/Turbine Trip. RCS temperature would not still be decreasing. Plausible because RCS temperature would be decreasing if the control valve was still leaking.

B. Incorrect: CSAE steam supply relief valve failed OPEN would not cause this plant response. The steam supply comes off the "B" Main Steam line.

C. Incorrect: SUR indication failing low would cause the SU Control Valves to fully open but would not cause an overfeed condition because the MFPs have tripped. Plausible because if a MFP were still operating, it would cause an overfeed condition.

D. Correct: 1FDW 315 failing open will cause overfeeding of the 1A SG which will cause the RCS to cool to below setpoint (~ 555 ºF).

Technical Reference(s):

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SAEL019 R3**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

1.0 OBJECTIVES:

Terminal:

1.1 Upon successful completion of this exercise, the student will be able to correctly identify and diagnose a Loss of Main & Emergency FDW. Additionally, using proper communications, team skills, and human performance techniques, the student will be able to perform the respective RO/SRO actions to respond to and mitigate the effects of the plant transient associated with this event in accordance with Abnormal and Emergency Operating Procedures. (T1)

Enabling:

1.2 Analyze unit status and utilize board indications to diagnose a loss of Main Feedwater. (R1)

A. If the reactor has not tripped already, manually trip the reactor.

B. Stabilize the RCS temperature and pressure to prevent any further re-pressurization or temperature increase due to the loss of a portion of the heat sink.

1.3 Perform IMAs and a symptoms check following the reactor trip. (R2)

1.4 Analyze unit status and utilize board indications to diagnose a failure of 1FDW-316 in the fully open position: (R3)

A. Refer to Rule 3 to feed the "1B" SG through the Main FDW Startup control valve.

B. Control EFDW flows to prevent pump runout and exceeding flow limits as per Rule 7.

1.5 Determine that the MDEFDWPs have failed and lineup to feed OTSGs with the CBPs per Rule 3, Loss of Main or Emergency FDW. (R4)

A. Direct NLO(s) to cross-connect EFDW to Unit 3.

B. After EFDW is made available from an alternate source, recover from CBP cooling by establishing EFDW flow to the OTSGs.

C. Demonstrate the ability to properly restore FDW flow, Heat Transfer and OTSG level to dry, intact OTSG(s).

1 POINT

Question 41

Unit 1 initial conditions:

- Reactor power = 100%
- 1DCA Bus Voltage = 125 VDC
- 1DCB Bus Voltage = 126 VDC
- 2DCA Bus Voltage = 127 VDC
- 2DCB Bus Voltage = 127 VDC

Current conditions:

- 1XS1 incoming feeder breaker trips

Based on the above conditions, which ONE of the following is correct regarding the DC power systems?

A. 1DCA will be powered from 2DCA

B. 1KX Inverter will be powered from 1DCB

C. 1DCB loads will be powered from Battery 1CB

D. 1DIC Inverter will be powered from 1DCB

Question 41
T2/G1 - kds

062K1.03, A.C. Electrical Distribution
Knowledge of the physical connections and/or cause effect relationships between the ac distribution system and the following systems: DC distribution (3.5/4.0)

K/A MATCH ANALYSIS
Question requires knowledge relationship between the AC Electrical distribution system (1XS1 supply power to Battery Charger 1CA) and its relationship with the DC distribution system (DCA).

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect: Bus DCA does not have an isolating diode setup. Plausible because DC Buses DIA-DIC do have isolating diodes.

B. Correct: Upon a loss of 1XS1, Battery Charger 1CA de-energizes. Battery 1CA automatically picks up DC bus DCA. Essential Inverters (KX, KI and KU) are powered from DCA or DCB (whichever has the higher potential). Vital DC Buses (DIA, DIB, DIC, DID) are powered from their unit or the alternate unit (whichever has the higher potential).

C. Incorrect: DCB is not powered from 1XS1. The Battery Charger will be supplying DCB and the battery. Plausible because if 1XS2 were de-energized, C would be correct.

D. Incorrect: 1DIC is supplied from the alternate unit (higher potential). Plausible because 1DIC would be supplied from 1DCB if it had the higher potential.

Technical Reference(s): **EL-DCD Pages 27 - 29**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EL-DCD R4**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

2.3 The purpose of the Kirk-key interlock feature on the standby charger output breakers.

2.4 The order of closing the battery charger AC Input and DC Output breakers when placing a charger in service.

2.5 Battery charger output over-voltage protection.

3. Briefly describe Isolating Diode Assemblies operation including: (R3)

3.1 Their purpose.

3.2 The three functions accomplished by isolating diode assemblies.

3.3 The sources of DC power auctioneered for each DC system using isolating diode assemblies.

3.4 How the operator is made aware that a bad diode has been detected.

3.5 Why a "bad" diode can be tolerated without affecting the operability of an assembly.

3.6 How control power for the monitoring and indicating circuits is supplied.

3.7 Briefly, describe what the Peak Inverse Voltage (PIV) test is and who performs this test.

3.8 What the "monitor test" push buttons are used for.

4. Explain why ground detection is important to ungrounded DC systems. (R14) **{1}**

4.1 Recognize that grounds on vital DC systems can render the entire system inoperable.

4.2 Recognize that NSD 311, Nuclear Safety-Related DC Systems Ground Response, sets the standard for responses to grounds.

5. Briefly discuss the Vital DC Instrument and Control System operation including: (R4)

5.1 Purpose of the System

5.2 Six typical loads

5.3 The way power is normally supplied to the buses

5.4 How power is supplied in the event of a charger failure.

5.5 How power may be supplied from another unit.

5.6 Reason for tying DCA and DCB buses together before removing a battery from service

5.7 The power supplies to Vital I&C Battery Chargers.

5.8 How to perform a battery ground test.

5.9 Separating buses between units for ground location.

5.10 Location of the batteries, battery chargers, distribution centers, DC panelboards and Isolating Diode Assemblies.

6. Briefly describe the Essential DC Power System operation including: (R6)

6.1 The normal source of power to the system.

6.2 Two alternate sources of power to each bus.

6.3 The loads supplied by the system.

6.4 Location of the Isolating Diode Assemblies

7. Briefly discuss the Power Battery System Operation including: (R7)

7.1 Purpose of the system

7.2 Battery bank and distribution network

7.3 How 250 VDC is achieved on the system.

7.4 Ten loads supplied from the system.

7.5 The location of the battery banks and chargers

7.6 Taking a power battery bank out of service, and the considerations involved.

8. Briefly describe the 230 KV Switchyard DC Power System, including: (R8)

8.1 Purpose of the system

8.2 Batteries, chargers and distribution network

8.3 How redundant power feeds to the common closing coils for the PCBs are provided.

8.4 Isolating a battery from the bus and the considerations involved.

8.5 The power supplies to the battery chargers.

9. Briefly describe the 525 KV Switchyard DC Power System, including: (R9)

9.1 Purpose of the System.

9.2 Batteries, chargers and distribution network

9.3 Isolating a battery from the bus

9.4 The power supplies to the battery chargers.

1) The risk significance of continuing refueling activities with known ground conditions is not well known among operations, maintenance, and engineering personnel. Contributing to this condition is an unawareness of both past site and industry experience.

2) The methodical approach to isolating the ground may not have been thoroughly thought out. Methods used were not consistently applied and well documented. The focus was on past experience with grounds during a previous washdown and some existing problems versus actual test data.

3) A responsible lead was not designated with clear goals. Three hand-offs occurred (SPOC-Maint.-Ops). As a result, information received was not considered in the aggregate.

4) Insufficient interaction between electrical maintenance and engineering personnel contributed to some delay in diagnosing the ground condition. Communication was not timely and thorough.

5) Pre-job briefing weaknesses noted are as follows:

   (a) Insufficient use of plant and industry OE.

   (b) Not all reference material fully analyzed or considered.

   (c) Contingency plans not fully considered.

6) The shutdown protection plan does not specifically require an independent risk review for changes in operational conditions that last for significant periods of time. For example, the existence of a long-standing ground, changing weather conditions, or other unplanned conditional change.

7) Washdown practices are resulting in water intrusion to electrical equipment that has a potential to degrade plant materiel conditions. Interviews indicated that significant water intrusion into electrical conduit and trays has resulted in water accumulation in light fixtures and other electrical components.

8) Some alarm and abnormal procedures lack information that would allow control room personnel to respond to a loss of DC event and facilitate recovery in a more timely manner.

2.3 (Obj. R4) Vital DC Instrumentation and Control Power Supply (EL-DCD-4)

A. Purpose

1. The Vital DC Power System provides a source of reliable, continuous power for control and instrumentation for normal operation and orderly shutdown for each unit.

B. General Description

1. For each unit, two independent and physically separate 125 volt DC batteries and DC distribution center are provided for the Vital Instrumentation and Control Power System.
    a) These same DC distribution centers supply DC power to the Essential power panel boards through their associated isolating diodes from the same unit (there is no backup from another unit for Essential power).
2. The DC buses are two-conductor, metal-clad distribution center assemblies.
3. Three battery chargers are also supplied, with two serving as normal supplies to the bus sections (through independent breakers).
4. The batteries supply the load without interruption, should the chargers or AC source fail (through independent breakers).
5. One of these three battery chargers serves as a standby, and is used for servicing and for backing up the normal supply chargers.
6. A bus tie, with "normally open" breakers, is provided between each pair of DC distribution center (i.e. 1DCA & 1DCB), to back up a battery when it is removed from service.
7. Breaker indication is provided in the Control Room on VB1. **(OC-EL-DCD-5)**
8. Four separate 125 volt DC Instrumentation and Control panelboards are supplied DC power for each unit and are located in the Cable Room.
    a) Each 125 volt DC I&C panelboards receives its DC power through an auctioneering network of two diode assemblies.
    b) One assembly is connected to the unit's 125 volt distribution center and the other assembly is connected to another unit's 125 volt distribution center.

C. Vital DC Loads (typical)

1. DCA Bus
    a) DIA Panelboard
        1) Keowee Emergency Startup Channels
        2) Main Feeder Bus Monitor relay
        3) EHC control
        4) Transformer lockout relays
        5) Load shed relays
        6) CCW, condensate interlocks

7) Mulsifyer systems

8) CRD breaker controls

9) KVIA - Vital AC power panel board through an "inverter"-supplying such loads as: NI, RPS, ES, RCP power monitors etc.

10) CT-1 to 1TA breaker control power

11) 1A1 and 1B1 RCP trip coil receiving UV signal

b) DIB Panelboard

1) Same type DC loads as DIA

2) KVIB - Vital AC power panel board through a "inverter"

2. DCB Bus

a) DIC panelboard

1) Same type DC loads as DIA

2) KVIC - Vital AC power panelboard through a "inverter"

b) DID panelboard

1) Same type DC loads as DIA

2) KVID - Vital AC power panelboard through an "inverter"

D. Vital DC Sources of Power

1. <u>Normal Power</u> supplied by:

a) CA and CB Battery Chargers through their own breakers

1) Receive AC input power from XS1 and XS2 respectively

b) CS Battery Charger is a standby

1) Receives AC input power from XS3

2. <u>Alternate Power</u> supplied by:

a) CA Battery to DCA bus through an independent breaker

b) CB Battery to DCB bus through an independent breaker

3. <u>Backup power</u> supplied from an alternate unit's CA and CB DC buses through isolating diode assemblies.

$(3 \rightarrow 2 \rightarrow 1 \rightarrow 3)$

a) 3 backs up 2

b) 2 backs up 1

c) 1 backs up 3

E. 125V I&C DC Ground Detection and Test Circuit **(OC-EL-DCD-6)**

1 POINT

Question 42

Which ONE of the following is a load of the Power Batteries?

A. PCB-9 control power

B. Main FWPT Auxiliary Oil Pump

C. Main Turbine Turning Gear Oil pump

D. CCW-8 (CCW Emergency Discharge to the tailrace)

Question 42
T2/G1-gcw
063K2.01, D.C. Electrical Distribution

Knowledge of the physical connections and/or cause-effect relationships between the DC electrical system and the following systems: Major DC loads (2.9*/3.1*)

K/A MATCH ANALYSIS
Question requires knowledge of major DC loads.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect, PCB-9 control power comes from the switchyard batteries.

B. Incorrect, Main FWPT Auxiliary Oil Pump is an AC pump. Plausible because the TDEFDWP Aux oil pimp is powered from the power batteries.

C. Incorrect: Main Turbine Turning Gear Oil pump is an AC pump. Plausible because the Emergency bearing oil pimp is powered from the power batteries.

D. Correct, CCW-8 is powered from the power batteries.

Technical Reference(s): **EL-DCD Page 36**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EL-DCD R7**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

5.9 Separating buses between units for ground location.

5.10 Location of the batteries, battery chargers, distribution centers, DC panelboards and Isolating Diode Assemblies.

6. Briefly describe the Essential DC Power System operation including: (R6)

   6.1 The normal source of power to the system.

   6.2 Two alternate sources of power to each bus.

   6.3 The loads supplied by the system.

   6.4 Location of the Isolating Diode Assemblies

7. Briefly discuss the Power Battery System Operation including: (R7)

   7.1 Purpose of the system

   7.2 Battery bank and distribution network

   7.3 How 250 VDC is achieved on the system.

   7.4 Ten loads supplied from the system.

   7.5 The location of the battery banks and chargers

   7.6 Taking a power battery bank out of service, and the considerations involved.

8. Briefly describe the 230 KV Switchyard DC Power System, including: (R8)

   8.1 Purpose of the system

   8.2 Batteries, chargers and distribution network

   8.3 How redundant power feeds to the common closing coils for the PCBs are provided.

   8.4 Isolating a battery from the bus and the considerations involved.

   8.5 The power supplies to the battery chargers.

9. Briefly describe the 525 KV Switchyard DC Power System, including: (R9)

   9.1 Purpose of the System.

   9.2 Batteries, chargers and distribution network

   9.3 Isolating a battery from the bus

   9.4 The power supplies to the battery chargers.

7. Notice that a Power Battery cannot be isolated from the bus without also isolating the respective Battery Charger from the bus.
8. FWPT Control Power is the only 125 volt DC load on the system.
9. When starting large DC motors that are powered from the power batteries sufficient voltage drop may occur to cause PA/PA charger Trouble alarms due to the momentary low voltage on motor start.

C. Power Battery Loads - 250 VDC
   1. RCP DC oil lift pump
   2. Main Turbine Emergency Bearing Oil Pump
   3. Emergency Seal Oil Pump
   4. Emergency Bearing Oil Pump
   5. EFWPT Auxiliary Oil Pump
   6. CCW-8 - to tailrace
   7. 1CCW-1 through 6
   8. 2CCW-7
   9. 3CCW-93
   10. FDW-36 & 45 - to normal header
   11. FDW-38 & 47 - to aux. header
   12. DC Lighting
   13. KOAC Inverter

D. Battery Charger Power Supply
   1. XO for PA Battery Charger
   2. XP for PB Battery Charger
   3. XP for PS Battery Charger

E. Locations
   1. Power Batteries and Chargers for Unit 1 and 2 are located in the Turbine Building on the third floor near the west wall across from the stairwell to the fifth floor north entrance to Unit 1 & 2 Control Room.
   2. Power Batteries for Unit 3 are located on the Turbine Building fifth floor outside the Unit 3 south entrance elevator lobby.
   3. Power Battery Chargers for Unit 3 are located on the third floor of the Turbine Building at the elevator lobby entrance.

F. Degraded Operation

1 POINT

Question 43

Initial plant conditions:
- Oconee Unit 1 and 2 at 100% power
- Keowee Unit 1 output = 88 MWe
- ACB-3 closed

Current conditions:
- Switchyard Isolation occurs

Based on the current conditions, which ONE of the following describes which ACB will close to energize Oconee Unit 1's Main Feeder Bus and what is a requirement that must be satisfied before the ACB can close?

A. ACB-1
Keowee output voltage and frequency must be within 5% of normal

B. ACB-1
Keowee output voltage and frequency must be within 10% of normal

C. ACB-2
Keowee output voltage and frequency must be within 5% of normal

D. ACB-2
Keowee output voltage and frequency must be within 10% of normal

Question 43
T2 /G1 – gcw New KA

064A1.03, Emergency Diesel Generator
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ED/G system controls including: Operating voltages, currents, and temperatures (3.1/3.4)

K/A MATCH ANALYSIS
This question tests knowledge of the "Out of Tolerance Circuit" on the Keowee units. This circuit monitors voltage and frequency of the unit and prevents supplying power to ES equipment if frequency and voltage are not at appropriate values.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect, first part is incorrect. Plausible because if ACB-4 were closed this would be correct. Second part is incorrect. Plausible because 5% is where the Statalarm for voltage and frequency actuates.

B. Incorrect, first part is incorrect. Plausible because if ACB-4 were closed this would be correct. Second part is correct.

C. Incorrect, first part is correct. Second part is incorrect. Plausible because 5% is where the Statalarm for voltage and frequency actuates.

D. Correct, on a non-LOCA Switchyard Isolation power will be restored to the MFBs via the overhead power path. This will be from the Keowee unit not tied to the Underground. ACB-3 is the underground feeder for Keowee Unit 1. So Keowee Unit 2 (output is ACB-2) will supply the MFBs. The "Out of Tolerance Circuit" requires that Keowee output voltage and frequency must be within 10% of normal values before the associated breaker can close.

Technical Reference(s): **EL-KHG Page 19**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EL-KHG R11**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

1. Demonstrate an understanding of the basic operation of the Keowee Hydro units during both normal and emergency operation. (T1)
2. Assess the operation of the Keowee Hydro units during normal and emergency operations. (T2)

ENABLING OBJECTIVES

1. State the purpose of the Keowee Hydro Generators. (R1)
2. Explain the basic operation of the Keowee Waterwheel Turbine. (R2)
3. Describe the basic operation of the Keowee CO2 Fire Protection System. (R3)
4. Given a set of conditions, determine when the Keowee CO2 Fire Protection System will automatically actuate and when manual operation is required. (R17)
5. Describe the purpose and function of Oconee control board switches associated with Keowee Hydro unit. (R7)
6. Determine the response of the Keowee Hydro Units from operation of the KHU switches located in the ONS control room. (R19)
7. Describe the purpose and function of all panel board indications in the control room associated with Keowee Hydro Generators. (R8)
8. Given indications from available ONS control room instrumentation, assess the status of the KHUs. (R20)
9. Determine the sequencing of actions required to regain normal control of the Keowee Hydro unit following an emergency start signal. (R9)
10. Verify proper operation of ACB 1-4 during all modes of operation. (R11)
11. Evaluate the intent of any given limits and precautions associated with OP/0/A/1106/19, Keowee Hydro at Oconee. (R12)
12. For an emergency lockout (ELO) or normal lockout (NLO) of a KHU: (R10)

    12.1Describe automatic actions that occur.

    12.2Determine events that that will cause an ELO or NLO.

2) Close - Note that frequency must be ≤ 66 cycles to close.
   (a) Manually
   (b) Automatic Startup
   (c) Emergency Start if a Switchyard Isolation is completed and 11 second timer associated with the Out Of Tolerance circuitry has timed out.
      (1) 11 second timer is to ensure the speed/frequency of the unit is correct following an emergency start signal.
   (d) Interlocked so that the Overhead ACB associated with Keowee unit tied to underground will not automatically close in following an emergency start

B. Out of Tolerance Circuit

1. This circuit addresses problems that may arise from the KHU supplying power to ONS at a lower or higher voltage and/or frequency than is desired. Note that this circuitry is associated with an Emergency Start signal ONLY.
2. During an emergency start, this circuitry will not allow ACB-1/2 or SK-1/2 to close until ~ 90% increasing or ~ 110% decreasing voltage and/or frequency.
3. During emergency starts, an 11 second timer does not allow ACB -1/2, and SK -1/2 to close till the timer times out. This should provide enough time to ensure the frequency/voltage is within the required range, even if the unit was supplying the grid when the emergency start was received. When the timer times out the OOT circuit becomes active.
4. Statalarm at Keowee will actuate when this circuit senses a +- 5% delta from the normal voltage/frequency. Oconee will receive 2SA-17/A-05, Keowee Statalarm Panal Alarm.
5. If the required voltage and frequency (NORMAL +- 10%) is not maintained, then after ~ 5 seconds this logic will send a trip signal to open ACB 1/2 and SK1/2. They will not reclose automatically.
6. There is a Defeat Interlock Switch located at KHS to bypass this protection. If the switch is placed in the DEFEAT position, the KHU is considered OOS, but ACB 1/2, SK 1/2 may be operated.

C. Instrumentation - **(OBJ.R8, 20)**

1. Field DC Volts
2. Field DC Amps
3. Xformer 1/2X AC Volts - Low side reading on the 1/2X transformer

1 POINT

Question 44

Unit 1 plant conditions:
- Reactor Building Purge in progress
- HIGH alarm received on 1RIA-45 (Unit Vent Gas Lo Range)

Based on the above conditions, which ONE of the following describes the plant response?

A. 1LWD-2 closes

B. 1PR 2-5 close and the Main Purge Fan trips

C. RB Evacuation Alarm actuates

D. 1PR 1-6 close and the Main Purge Fan trips

Question 44
T2 /G1 - KDS

073A1.01, Process Radiation Monitoring
Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PRM system controls including: Radiation levels (3.2/3.5)

K/A MATCH ANALYSIS
Question requires knowledge of plant response to a HIGH process radiation alarm.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect- 1RIA-49 will close 1LWD-2 on a HIGH alarm.

B. Correct- A high radiation alarm on 1RIA-45 will close PR-2 through PR-5 and trip the Main Purge Fan.

C. Incorrect-.1RIA-49 will actuate the RB Evacuation Alarm on a HIGH alarm.

D. Incorrect- PR-1 and PR-6 do not receive close signals on the high radiation monitor alarm. Plausible because upon receiving ES 1&2, PR 1-6 will close.

Technical Reference(s): **RAD-RIA**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-RBP R2**

Question Source: **Bank PNS160501**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

5. Describe the basic function of each applicable monitor. (R2)
   5.1 State the purpose of each monitor.
   5.2 State where each monitor is located\
   5.3 List the interlocks and automatic actions associated with each applicable monitor.
   5.4 When given the monitor title, be able to state which system(s) the monitor checks.
6. List seven (7) functions which can be performed at the RIA Control Room CRT. (R8)
7. Describe the basic procedure to check/set High and Alert alarm setpoints. (R5)
8. Describe the operational relationship between the following components associated with the Sorrento Radiation Monitoring System: (R10)
   8.1 RM-80 Microprocessor Unit
   8.2 Transient Monitor System Computer
   8.3 View Node
9. For the following situations, state whether or not the associated Radiation Monitor is operational and explain why for each case: (R11)
   9.1 The RM-80 out of service
   9.2 Transient Monitor System Computer out of service
   9.3 The View Node out of service
10. Describe a situation which would require the Operator to monitor the status of a Radiation Monitor locally from the skid. (R12)
11. Describe the basic procedure to be used to purge RIAs-37 & 38 and state two (2) reasons why this purge operation is performed. (R3)
12. Other than going to the skid, explain how RIA status can be monitored after the Control Room View Node is lost. (R13)
13. Describe the required actions of the Operator in case of a High Radiation Alarm with the associated Transient Monitor System Computer out of service. (R14)

I. 1, 2, 3RIA-43, 44, 45, 46 - Unit Vent Monitors (CPM)

1. Particulate (RIA-43), Iodine (RIA-44), Normal gas (RIA-45), High Gas (RIA-46) "PIGG"
2. RIAs-43 & 45 are plastic beta scintillation detectors.
3. RIA-44 is a NaI detector.
4. RIA-46 is a Cadmium Telluride solid state detector.
5. Located on 6th floor Auxiliary Building in the Purge Equipment room close to the Unit Vent Stack
6. On HIGH alarm, RIA-45 will do the following:
   a) Close PR-2 through PR-5
   b) Trip the main and mini purges
   c) Actuates statalarm "RM Reactor BLDG Purge Disch RAD Inhibit"
7. When RIA-46 reaches the "switchover acceptance range setpoint", the following occurs:
   a) RIA-45 will read zero
   b) RIA-46 will now perform the same interlock functions that RIA-45 performed
   c) This provides a backup function so that in case of a failure of RIA-45 HIGH alarm, then RIA-46 HIGH alarm will actuate the required interlock functions. Normally RIA-45 HIGH alarm setpoint will be reached prior to RIA-46 reaching the "switchover acceptance range setpoint".
8. RIA Swapovers
   a) Under normal operating circumstances, when RIA 45/46 (and RIA 49/49A) are both in service, the RIA 45 (49) readings would increase to the high alarm setpoint and actuate the interlock. RIA 46 (49A) would continue to read zero on the RIA view screens while all this occurs. At this point, the interlock is NOT actuated by RIA 46 (49A). RIA 46 (49A) could actually be seeing some value (less than the 'switchover acceptance range setpoint'). Only when the 'switchover acceptance range setpoint' is reached will the RIA indicate a value.
   b) If RIA 45 (49) is out of service, but RIA 46 (49A) is in service and the accepted range setpoint is left where it currently is, the activity in the Vent (Reactor Building) would increase with RIA 46 (49A) reading zero until the 'switchover accepted range setpoint' is met. At this point the interlock would be actuated because the 'switchover acceptance range setpoint' is currently set above the high setpoint.

PNS160501

Unit 1 plant conditions:

- Reactor Building Purge in progress
- High alarm received on 1RIA-45

Which ONE of the following correctly describes the response of the RB Purge isolation valves? (.25)

PR-___________ close

A) 1 / 2 / 3 / 4

B) 2 / 3 / 4 / 5

C) 3 / 4 / 5 / 6

D) 1 / 2 / 5 / 6

B

A. Incorrect- PR-1 does not receive a close signal on the high radiation monitor alarm.
B. Correct- A high radiation alarm on 1RIA-45 will close PR-2 through PR-5.
C. Incorrect- PR-6 does not receive a close signal on the high radiation monitor alarm.
D. Incorrect- PR-1 and PR-6 do not receive close signals on the high radiation monitor alarm.

1 POINT

Question 45

Plant conditions:

- Unit 1 = 100%
- Unit 2 = de-fueled
- Unit 3 = 100%
- ALL Unit 1 & 2 LPSW pumps have just tripped
- AP-24 (Loss of LPSW) initiated

Based on the current plant conditions, which ONE of the following actions will be taken first per AP/24?

A. Trip the reactor due to CRDM temperatures exceeding operational limits.

B. Cross-connect Unit 1 / 2 LPSW with HPSW.

C. Trip the reactor due to RCP component temperatures exceeding operational limits.

D. Refer to AP/29 (Rapid Unit Shutdown) and commence a Unit 1 shutdown.

Question 45
T2 /G1 - kds

076A1.02, Service Water System **Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SWS controls including: Reactor and turbine building closed cooling water temperatures** (2.6*/2.6*)

K/A MATCH ANALYSIS
The question requires knowledge of the effect of a total loss of LPSW (changes in parameters) will have on CC temperatures (RB CC water) and the effect CC temperature will have on CRDM temperatures including time to exceed operational limits.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct: Upon a loss of ALL LPSW pumps, CC temperatures will increase quickly causing a loss of letdown and within several minutes CRDM temperatures exceeding limits. It will take much longer (10-15 minutes) to exceed RCP temperature limits.**

B. Incorrect: AP-24 directs cross connecting with Unit 3 if no LPSW pumps are operating. Plausible because x-connecting with the HPSW system used to be an option.

C. Incorrect: Plausible because unless LPSW is restored, the RCPs will likely have to be secured but the reactor will already have been tripped (these actions are on the same IAAT step).

D. Incorrect: Plausible because with no LPSW letdown will isolate which would require the shutdown of the unit using AP/29 if letdown was not restored.

Technical Reference(s): **AP/24 (Loss of LPSW), AP/20 (Loss of Component Cooling)**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SSS-LPW R15, 16**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

11. Concerning Engineered Safeguards operation of the LPSW system: (R14)

    11.1State the Engineered Safeguards signals that affect the LPSW system.

    11.2Describe how each Engineered Safeguards signal affects operation of the LPSW system.

12. Analyze a given set of plant conditions for applicable TS/SLC LCOs. (R18)

13. Apply all TS/SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R19)

14. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS/SLCs. (R20)

15. Concerning abnormal operation of the LPSW system:

    15.1Describe the method used to supply LPSW in the event LPSW flow is lost on Unit 1&2 or Unit 3. (R15)

    15.2Describe how degraded conditions of the LPSW system could impact accident mitigation. (R16)

    15.3Describe how degraded conditions of the LPSW system could result from HPSW pump configuration. (R17)

16. Given a completed copy of PT/*/A/0251/001, Low Pressure Service Water Pump Test, evaluate the data and compare to acceptance criteria to determine component operability. (R21)

17. Given a completed copy of PT/*/A/0251/022, LPSW-251 and 252 Travel Stop Verification, evaluate the data and compare to acceptance criteria to determine component operability. (R22)

4. Subsequent Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

Unit 1 normally handles LPSW System operation unless otherwise directed by the CR SRO.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1 __ Verify Unit 1 is going to handle LPSW system operations.	__ **GO TO** Step 4.40.
4.2 Open all LPSW pump suction valves: __ LPSW-2 __ LPSW-3 __ LPSW-1	1. __ **IF** any LPSW pump is operating with a closed suction valve, **THEN** perform the following: {4} A. __ Place the Unit 1/2 STANDBY LPSW PUMP AUTO START CIRCUIT in DISABLE. B. __ Stop the affected LPSW pump. 2. __ Dispatch an operator to locally open the affected suction valve.

NOTE

Indications of LPSW pump cavitation may vary depending on the length of time since the event occurred. Indications of cavitation may be any of the following: {4}

- Pump amps erratic
- Pump amps below normal
- LPSW header pressure fluctuating

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.3 __ Verify any LPSW pump is cavitating.	__ **GO TO** Step 4.6.
4.4 __ Place the Unit 1/2 STANDBY LPSW PUMP AUTO START CIRCUIT in DISABLE.	
4.5 Stop the affected pumps: __ A LPSW PUMP __ B LPSW PUMP __ C LPSW PUMP	
4.6 __ Start all available (**NOT** previously cavitating) LPSW pumps.	
4.7 __ Verify normal LPSW System operation is restored.	__ **GO TO** Step 4.11.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

1LPSW-1054, 1055, 1061, and 1062 will close to isolate RB Auxiliary Fan Coolers on low LPSW pressure.

4.8 __ Verify that RB Auxiliary Fan Coolers have isolated.	__ **GO TO** Step 4.10.
4.9 __ Restore RB Auxiliary Fan Coolers to service using "Startup of RB Aux Coolers" portion of "LPSW Shutdown and Return to Service of RB Aux Coolers" Encl of OP/1/A/1104/010 (Low Pressure Service Water). {3}	
4.10 __ **EXIT** this procedure.	

• • • END • • •

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.11 __ Dispatch an operator to perform Encl 5.1 (Local Operator Actions).	
4.12 __ **IAAT** conditions permit for a secured pump to be re-started, **THEN** start the LPSW pump(s) that were previously secured.	
4.13 __ **IAAT NO** Unit 1 & 2 LPSW pumps are available, **AND** Unit 3 LPSW system is available, **THEN** perform the following: A. __ Direct Unit 3 to start an additional LPSW pump, as required. B. __ Notify the operator performing Encl 5.1 (Local Operator Actions) to cross-tie Unit 1&2 LPSW to Unit 3.	
4.14 __ Verify CC related alarms.	__ **GO TO** Step 4.16.
4.15 __ Initiate AP/20 (Loss of Component Cooling).	
4.16 __ **IAAT** any RCP temperature limit is exceeded: {1}	

✓	Temperature	Limit
	Motor thrust bearing	190°F
	Motor upper guide bearing	190°F
	Motor lower guide bearing	190°F
	RCP motor stator	295°F
	RCP seal return	260°F
	RCP radial bearing	225°F

THEN perform the following:

A. __ Trip Rx.

B. __ Stop all RCPs.

1. Entry Conditions

- Loss of CC inventory
- Degraded or loss of CC flow

2. Automatic Systems Actions

2.1 Standby CC pump starts at 575 gpm CC total flow decreasing.

2.2 1HP-5 closes at letdown temperature ≥ 135°F.

2.3 All RCP seal return valves close upon loss of both RCP seal injection (≤ 22 gpm) and total CC flow (≤ 575 gpm) with RCS pressure ≥ 400 psig.

3. Immediate Manual Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3.1 __ **IAAT** both of the following are lost: • CC to RCPs • RCP seal injection **THEN** perform the following: A. __ Trip Rx. B. __ Stop all RCPs. C. __ Initiate AP/25 (SSF EOP).	

NOTE

If CRD stator cooling is lost, stator temperatures will reach 180°F in ≈ 4 minutes.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3.2 __ **IAAT** ≥ two CRD stator temperatures ≥ 180°F, **THEN** trip Rx.	

1 POINT

Question 46

Plant conditions:

- ALL off-site power sources have been lost (100KV, 230 KV and 525 KV transmission lines)
- Keowee has energized the MFB via the overhead power path
- IA pressure = 85 psig and decreasing
- ALL Diesel air compressors are OFF

Based on the above conditions, which ONE of the following describes which air compressors will be operating?

ASSUME NO OPERATOR ACTIONS

A. ONLY the Back-up Instrument Air compressors will be operating

B. ONLY the Auxiliary Instrument Air compressors will be operating

C. ALL Auxiliary Instrument Air compressors and All Back-up Instrument Air compressors will be operating

D. ALL Auxiliary Instrument Air compressors and the Primary Instrument Air compressor will be operating

Question 46
T2 /G1 - gcw

078K2.01, Instrument Air **Knowledge of bus power supplies to the following: Instrument air compressor** (2.7/2.9)

K/A MATCH ANALYSIS
Question requires knowledge of where the different air compressors are powered. Also required to know which air compressors are powered from load shed busses and/or a unit's Main Feeder Busses.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect, the Back-up Instrument Air Compressors will not be operating because they are powered from a load shed power supply.

B. Correct, Auxiliary Instrument Air compressors will be operating because they are power from a non-load shed source.

C. Incorrect, first part is correct. Second part is incorrect.

D. Incorrect, the Primary Instrument Air Compressors will not be operating because it is fed from the 230 KV or 525 KV switchyard.

Technical Reference(s): **SSS-IA**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SSS-IA; R35 and R37**

Question Source: **ONS 2005 RO Q 54**

Question History: Last NRC Exam: **ONS 2005 Q 54**

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

TERMINAL OBJECTIVES

1. Determine proper operation of the Instrument Air and Service Air systems based on the status of related in plant instrumentation and controls. (T1)

2. Perform required actions per the Compressed Air System operating procedure, the Auxiliary Instrument Air System operating procedure and the Loss of Instrument Air abnormal operating procedure as directed by the Control Room Operators during normal and abnormal operation of the Instrument Air system. (T2)

3. Determine the operating status of the Instrument Air and Service Air systems based on instrumentation and alarms available in the Control Room. (T3)

4. Perform required actions per the Compressed Air system operating procedure, the Auxiliary Instrument Air system operating procedure and the Loss of Instrument Air abnormal operating procedure in the Control Room during normal and abnormal operation. (T4)

5. Appraise the operation of the Instrument Air Systems by Reactor Operators and Non-Licensed Operators to ensure the system is operated properly during normal and abnormal operating situations. (T5)

ENABLING OBJECTIVES

1. Explain the purpose of the Instrument Air System. (R1)

2. Explain the reasoning behind the selection of the power supply to the Primary Instrument Air Compressor. (R35)

3. Identify auto trips for the Primary IA Compressor. (R33)

4. Explain the three reasons oil is injected into the compressor unit of the Primary IA Compressor. (R34)

5. Based on the relative positions of the Primary IA Compressor inlet butterfly valve, spiral control valve, and blowdown valve determine if the compressor is loading or unloading (R32)

6. Describe how oil is removed from the air in the Primary IA Compressor. (R36)

7. Describe the operation of the Primary IA Compressor cooling water system. (R31)

8. Describe the operation of the Primary/Backup IA Compressor Air Dryers. (R29)

9. Describe how to determine the cause of an auto trip of the Primary IA Compressor. (R30)

10. For PT/0/B/0170/012 Primary Instrument Air System Air Quality Test, describe: (R49)
    - 10.1 Test purpose
    - 10.2 Test performance
11. Given a copy of PT/0/B/0170/012 PIA System Air Quality Test, and a set of data, determine if acceptance criteria is met. (R50)
12. When given the position of the Unloading Valves and Discharge Feather Valves determine whether a Worthington Backup IA compressor is running loaded or unloaded. (R2)
13. Describe the normal and alternate cooling water supplies to the Backup IA Compressors. (R3)
14. Explain the purpose of the Backup IA aftercoolers in the IA System. (R4)
15. Identify the cooling water supply to the Backup IA Compressor aftercoolers. (R5)
16. Explain the purpose of the air receiver tanks in the IA System, and why it is important to periodically blow down the receiver tanks. (R6)
17. Explain the purpose of the air dryers in the IA System. (R7)
18. Discuss the Backup IA Compressor operation for the following switch positions: (R8)
    - 18.1 BASE
    - 18.2 OFF
    - 18.3 STANDBY-1
    - 18.4 STANDBY-2
19. Locate the three alarms on the Backup IA Compressor Control Panel, and explain, what each means. (R9)
20. Describe the two functions of the reset button on the Backup IA Compressor Control Panel. (R10)
21. Explain the function of the transfer switch on the Backup IA Compressor Control Panel. (R11)
22. Discuss any precautions that must be exercised when IA is valved into the Reactor Building, if containment integrity is required. (R14)
23. Explain the purpose for the Auxiliary Instrument Air System. (R37)
24. Explain how the AIA system is protected against leaks, which may occur on the original IA system. (R38)

G. Operation

1. During normal operation, the AIA system is a backup to the IA system. The compressor is in the automatic mode ready to respond to a loss of AC power or a loss of IA pressure.

   NOTE: When the compressor is placed in the automatic mode the sequence is to place the compressor in automatic and then depress the start button to arm the start circuit to allow the compressor to start when desired.

2. Emergency Operation

   a) Loss of AC Power

      1) There is a contact in the auto start circuit for the compressors that is an energize-to-open and de-energize to close contact. When the system is operating normally, the contact is open and the compressors are off. When power is lost, the contact closes and completes the start circuit for the compressors. The compressors won't start because there is no AC power. When power is regained, a timer associated with the contact keeps it closed for another five seconds to give the compressors time to start before the contact re-opens.

      2) After this start, the compressors will provide 246 SCFM (100 SCFM per compressor minus the 54 scfm blowdown from the 3 AIA dryers)) of compressed air at 100 PSIG to the AIA system components. They will automatically load and unload themselves to maintain the receiver pressure at 100 PSIG.

      3) If the IA system depressurizes because of loss of compressors (the Primary IA compressor should be running), the check valves at the tie-ins and at each component will close to prevent the AIA system from depressurizing.

      4) If for some reason, the compressors are not able to regulate system pressure at 100 PSIG, they will automatically shut themselves down at 135 PSIG and then restart at 88 PSIG.

   b) Loss of IA Pressure

      1) Line break in the IA system.

         (a) When the line breaks both the IA and the AIA systems will begin losing pressure.

         (b) At 88 PSIG, AIA system pressure, the three AIA compressors will start if in automatic and control system pressure at 100 PSIG.

         (c) At 85 PSIG, statalarm SA4/C5 **AUX BUILD. COMPR. AIR HEADER PRESSURE LOW** will actuate.

2. PRESENTATION

2.1 Instrument Air System

A. Components and Description

1. The Instrument Air system consists of one primary IA compressor with two filter/dryer trains and three backup IA compressors with two filter/dryer trains and four distribution headers and the component supply lines.

a) The four distribution headers run the full length of the Turbine Building. Three of these headers are interconnected and supply the Turbine Building. These headers are located at elevation 783 ft. and are located along columns D, H and M.

b) The fourth header is located along column M at elevation 796 and supplies components in the Auxiliary Building via three Auxiliary Building headers, one for each unit. Each Auxiliary Building header connects to a receiver, one per unit, and branches out to supply the components. The Auxiliary Building IA supply headers are interconnected between units.

B. Primary Instrument Air Compressor (OC-SSS-IA-2,3, & 4)

a) General Description

1) Two (2) stage, Sullair rotary screw-type, positive displacement compressor.

2) Rated at 2200 SCFM

(a) The Primary IA Compressor is normally powered from B3T- 4.

(1) **(Obj. R35)** The reasoning for the selection of this power supply is that if the 230 kV switchyard is lost, B3T will continue to provide power to the Primary IA compressor via the 5T autotransformer from the 525 kV switchyard.

(b) The control panel is powered from 3DID Bkr. #11. The compressor will trip if control power is lost.

54. 078K2.01 1

Plant conditions:
- ALL off-site power sources have been lost (230 KV and 525 KV transmission lines)
- Keowee has energized the MFB via the overhead power path
- IA pressure = 85 psig and decreasing
- ALL Diesel air compressors are OFF
- No operator actions have been taken

Which ONE of the following is correct?

A. ONLY the Back-up Instrument Air compressors will be operating

B. ONLY the Auxiliary Instrument Air compressors will be operating

C. ALL Auxiliary Instrument Air compressors and All Back-up Instrument Air compressors will be operating

D. ALL Auxiliary Instrument Air compressors and the Primary Instrument Air compressor will be operating

<u>Replaced original question with new one accepted.</u>

Oconee Lesson Plan OP-OC-SSS-IA objective # 35 and 37, and pages 14 and 37

A. Incorrect, the Back-up Instrument Air Compressors will not be operating because they are powered from a load shed power supply.

B. Correct, Auxiliary Instrument Air compressors will be operating because they are power from a non-load shed source.

C. Correct, first part correct. Second part incorrect.

D. Incorrect, the Primary Instrument Air Compressors will not be operating because it is fed from the 230 KV or 525 KV switchyard.

K/A: 078K2.01 Knowledge of the electrical power supplies to the following: Instrument Air Compressor (2.7/2.9).

Answer: B

1 POINT

Question 47

Unit 1 initial conditions:

- Time = 0500
- Reactor power = 100%

Current conditions:

- Time = 0505
- 1A MSLB in containment
- Core SCM = 16ºF decreasing slowly
- RB Pressure = 7.8 psig increasing slowly
- Enclosure 5.1 (ES Actuation) in progress

Based on the above conditions, which ONE of the following describes a correct action per Enclosure 5.1 (ES Actuation) and why?

A. Take 1HP-3 and 4 to manual and OPEN to re-establish letdown.

B. Take 1HP-20 and 21 to manual and OPEN to re-establish RCP seal return.

C. Take 1CC-7 and 8 to manual and OPEN to provide cooling to the RCP motors.

D. Take 1LPSW-6 and 15 to manual and OPEN to provide cooling to the RCP seal package.

Question 47
T2 /G1 - gcw

103A4.04, Containment System **Ability to manually operate and/or monitor in the control room: Phase A and phase B resets** (3.5*/3.5*)

K/A MATCH ANALYSIS
Question requires knowledge of when to restore RB isolation valves after an ES actuation.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect, LD will not be re-established at this time.

B. Correct, with the RCP operating seal return will be reestablished.

C. Incorrect, first part is correct. However CC does not cool the RCP motors. It does however cool the RCP seal package.

D. Incorrect, first part is correct. However LPSW does not cool the seal package. It does however cool the RCP RCP motors.

Technical Reference(s): **EAP-ES Page 26**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-ES R5**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

Describe the use of Encl.5.1 (ES Actuation) of the Emergency Operating Procedure in order to perform the required actions for an Engineered Safeguards System actuation.

ENABLING OBJECTIVES

1. Distinguish between a MSLB, SBLOCA, or LBLOCA as the cause of the ES actuation.(R14)
2. State when Encl.5.1of the EOP should be performed, and by whom it should be performed. (R1)
3. Recognize that if Encl.5.1has been performed and AC power is lost and then regained, Encl.5.1should be performed again. (R8)
4. State the bases for the "Sequencing" of the major steps in Encl.5.1. (R13)
5. Explain how proper ES actuation is verified following automatic initiation of an ES channel. (R2)
6. Describe the required action(s) if it is discovered that an ES channel failed to properly actuate when the actuation setpoint was reached. (R9)
7. Identify when RCP support systems are re-established following ES actuation. (R5)
8. Compare the difference in operator actions if ES channels 1 & 2 have actuated and the following conditions exist: (R10)

- Both (HP-24 & 25 HPI BWST Suction) fail to open.
- Only one of (HP-24 & HP-25 HPI BWST Suction) fails to open.

9. Recognize that HPI flow (including RCP seal injection) must be added to the indicated LPI flow when aligned in piggyback to determine actual LPI flow. (R11)
10. Demonstrate the proper use of the "Required HPI Flow per Header" curve. (R3)
11. Recognize that SRO discretion is applied prior to securing LPI pumps following ES actuation, and that the crew should be notified of this action. (R12)

2.66 **(OBJ R5)** Verify any RCP operating.

RNO:

GO TO Step 68.

A. *If a RCP is operating, continuing to the next step will re-align the seal return flowpath.*

2.67 Ensure the following are open:

- 1HP-20
- 1HP-21

2.68 **(OBJ R5) IAAT** any RCP is operating,

AND ES Channels 5 and 6 actuate,

THEN perform Steps 69 and 70.

RNO:

GO TO Step 71.

A. *If NO RCP is operating, RCP supports will* ***not*** *be re-aligned to ensure containment integrity is maintained.*

2.69 Open the following:

- 1CC-7
- 1CC-8
- 1LPSW-15
- 1LPSW-6

A. *Aligns Component Cooling to RCP thermal barriers (1), and external coolers (2&3).*

B. *Aligns LPSW to motor stators for cooling*

C. *Re-establishing RCP supports to a running RCP is done to prevent pump damage.*

1. *This step must be performed in a timely manner to prevent RCP or RCP motor damage.*
2. *Damage from operating without cooling could occur as soon as 3 to 4 minutes.*

1 POINT

Question 48

Unit 1 plant condition:

- Date/Time = 06-22-07 / 1200
- Reactor power = 100%
- ES channel 1 inadvertently actuates

Based on the above conditions, which ONE of the following describes the effect on RCP operation?

A. RCP seal return flow is isolated and RCPs may continue operating until 06-26-07 / 1600 unless otherwise directed.

B. RCP seal return flow is isolated and RCPs may continue operating indefinitely unless immediate trip criteria are exceeded.

C. RCP motor stator cooling is isolated and RCPs may continue operating until 06-26-07 / 1600 unless otherwise directed.

D. RCP motor stator cooling is isolated and RCPs may continue operating indefinitely unless immediate trip criteria are exceeded.

Question 48
T2 /G1 - gcw

003K6.04, Reactor Coolant Pump System **Knowledge of the effect of a loss or malfunction on the following will have on the RCPS: Containment isolation valves affecting RCP operation** (2.8/3.1)

K/A MATCH ANALYSIS
Question requires knowledge of the effect on RCP operation when containment isolation valves are closed (seal return valves).

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct, per a note in the "Loss of RCP seal Return" section of AP/16 (Abnormal RCP Operation) RCP operation should be limited to less than 100 hours with no seal return flow.**

B. Incorrect, operation is limited to 100 hours.

C. Incorrect, LPSW flow to the RCP motors would be isolated if ES channel 5 or 6 actuated. The limit on operation is based on stator temperature.

D. Incorrect, this would be correct if ES channel 5 or 6 actuated.

Technical Reference(s): **AP/16, Abnormal RCP Operation**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-APG R9**

Question Source: **New**

Question History: Last NRC Exam: **ONS 2006**

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

Operation of RCPs without seal return flow should be limited to 100 hours unless otherwise directed by OSM or the RCP Component Engineer.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. __ Request direction from OSM and the RCP Component Engineer for continued operation of RCPs without seal return.	
9. __ Verify RCP seal injection flow is between 6 and 12 gpm/RCP.	__ Initiate AP/14 (Loss of Normal HPI Makeup and/or RCP Seal Injection).
10. __ **IAAT** an RCP has been shutdown for ≥ 30 minutes, **THEN** close the associated RCP motor cooler inlet/outlet valve: __ 1LPSW-7&8 (1A1 RCP) __ 1LPSW-9&10 (1B1 RCP) __ 1LPSW-13&14 (1A2 RCP) __ 1LPSW-11&12 (1B2 RCP)	
11. __ **WHEN** seal return flow can be established to affected RCPs, **THEN** open the following: __ 1HP-20 __ 1HP-21	
12. Open the following for the affected RCPs: (see table below)	
13. __ **WHEN** conditions permit, **THEN EXIT** this procedure.	

✓	Seal Return Stop	RCP
	1HP-228	1A1
	1HP-226	1A2
	1HP-232	1B1
	1HP-230	1B2

• • • END • • •

1 POINT

Question 49

The Unit 2 Auxiliary Instrument Air System compressor is powered from which ONE of the following load centers?

A. 2XD

B. 2XF

C. 2XP

D. 2XS1

Question 49
T2 /G1 - gcw

078K2.02, Instrument Air **Knowledge of bus power supplies to the following: Emergency air compressor** (3.3*/3.5*)

K/A MATCH ANALYSIS
Requires knowledge of the power supply for the AIA compressors.

ANSWER CHOICE ANALYSIS
Auxiliary Instrument Air System compressors are power from non-load shed power supplies 1,2,3XP.

Answer: C

A. Incorrect, plausible because 1XD supplies the "A" Worthington compressor (Backup IA Compressor).

B. Incorrect, plausible because 2XF supplies the "C" Worthington compressor (Backup IA Compressor).

C. Correct, Auxiliary Instrument Air System compressors are power from non-load shed power supplies 2XP

D. Incorrect, plausible because this is a ES safety related bus.

Technical Reference(s): **SSS-IA**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **None**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

c) When valving in IA to RB, valve in slowly to prevent causing a sudden drop in Aux. Bldg. IA pressure.

2.2 Auxiliary Instrument Air (AIA) System

A. **(Obj. R37)** The AIA system provides a reliable source of instrument air to selected components during a loss of IA. The components selected are based on maintaining operations, which minimize operator burden and Unit transients while reaching, and maintaining a safe shutdown.

a) This system was designed to maintain a supply of instrument air to components during two basic failure modes involving the IA System: (OC-SSS-IA-8)

1) Line breaks with demands which exceed the IA System capacity, and

2) Load shedding of IA System equipment's electrical power supplies.

B. Load Shed (Protection from loss of AC power)

1. The compressors are powered from non-load shed power supplies:

a) Unit 1 compressor from 1XP

b) Unit 2 compressor from 2XP

c) Unit 3 compressor from 3XP

2. The air dryers are also powered from non-load shed sources:

a) Unit 1 from 1KC

b) Unit 2 from 2KC

c) Unit 3 from 3KC

C. **(Obj. R38)** Line Break (Protection against leaks)

1. The existing Instrument Air system, including the Primary Instrument Air Compressor, can handle a 1.5-inch diameter or smaller break. This means that if the break is > 1.5 inches, the system is not capable of maintaining the air pressure high enough to operate components.

a) The AIA system has spring loaded check valves located at junctions of the IA (AIA-2) and AIA systems and at each of the individual components served that will close if the IA system begins to depressurize. (OC-SSS-IA-9)

D. Equipment supplied by AIA system

1. Refer to Enclosure 5.1 of the Loss of Instrument Air APs for the valves and indications supplied by the AIA system

E. Nitrogen Backup to FDW-315, FDW-316, MS-87, MS-126, MS-129

1. The bottles of nitrogen will, initially, be left in place. They may be removed in the future but for now they are the backup of last resort.

1 POINT

Question 50

Unit 1 initial conditions:

- Reactor power = 100%

Current conditions:

- CRD Outlet HDR Flow = 150 gpm
- CC Total Flow = 525 gpm

Based on the above conditions, which ONE of the following describes which Statalarm will actuate, the expected automatic action (if any) and the required operator actions?

A. 1SA-9/B-1 (CRD RETURN FLOW LOW)
Standby CC pump starts
If standby CC pump is NOT operating, verify CC surge tank level > 18" and start the standby CC pump

B. 1SA-9/B-1 (CRD RETURN FLOW LOW)
NO automatic actions
Verify CC surge tank level > 18" and start the standby CC pump

C. 1SA-9/C-1 (COMPONENT COOLING RETURN FLOW LOW)
Standby CC pump starts
If standby CC pump is NOT operating, verify CC surge tank level > 18" and start the standby CC pump

D. 1SA-9/C-1 (COMPONENT COOLING RETURN FLOW LOW)
NO automatic actions
Verify CC surge tank level > 18" and start the standby CC pump

Question 50
T2 /G1 - gcw

008GG2.4.50, Component Cooling Water System **Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.** (3.3/3.3)

K/A MATCH ANALYSIS

Question requires knowledge CC system alarm setpoints operation of components identified in the ARG.

ANSWER CHOICE ANALYSIS

1SA-9/C-1 (COMPONENT COOLING RETURN FLOW LOW) states:

Alarm Setpoint
- 575 gpm

Automatic Action
- **IF** in AUTO, Standby CC pump starts.

Manual Action
- **IF** low flow is due to CC Pump failure **AND** Standby CC Pump did **NOT** start perform the following:
  - ➢ Verify CC Surge Tank level > 18".
  - ➢ Start Standby CC Pump

Answer: C

A. Incorrect, plausible because of the interlock on low CC return flow.

B. Incorrect, plausible because this answer would be correct if CRD Outlet HDR Flow < 138 gpm. Refer to ARG 1SA-9/B-1 (CRD RETURN FLOW LOW)

C. **Correct, per ARG.**

D. Incorrect, statalarm is correct the actions are for 1SA-9/B-1 (CRD RETURN FLOW LOW)

Technical Reference(s):
1SA-9/C-1 (COMPONENT COOLING RETURN FLOW LOW)
1SA-9/B-1 (CRD RETURN FLOW LOW)

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-CC R15, R17**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

10. Describe the sequence and precautions necessary while valving in the spare CC cooler. (R10)

11. Explain the reason for draining the CRD service structure prior to pulling the reactor vessel head prior to refueling. (R11)

12. Describe the method of draining the CRD service structure. (R12)

13. Explain how CC-8 failing closed at power affects plant operation. (R13)

14. Describe briefly the steps involved in reopening CC-8 after the valve has failed closed because of a loss of Instrument Air. (R14)

15. Describe the six (6) interlocks and/or automatic actions associated with the CC System. (R15)

16. Explain why the CC System must be in operation: (R16)

    16.1 Before letdown is established if RCS temperature is > 120° F

    16.2 If RCS temperature is > 190° F

17. Given a set of plant conditions, diagnose the cause of a CC System problem and/or determine the required corrective action. (R17)

18. Evaluate the overall affect on other plant systems based on the normal and/or abnormal operation of the CC system. (R18, R19)

19. When AP/1700/20, Loss of CC*,* is required to be utilized by the operator be able to demonstrate the following: (R20)

    - State the Entry Conditions, Immediate Manual Actions, and Contingency Actions in the AP.
    - Explain the basis for limits, cautions, notes and major steps in the AP
    - Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.
    - Describe general system alignments, available operator controls and instrumentation both inside and outside the control room.
    - Provide proper directions to operators and supporting groups performing actions of the AP outside the control room.

20. Given a copy of TS/SLCs, analyze a given set of conditions for applicable TS/SLC LCOs. (R21)

21. Apply all TS/SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R22)

22. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS/SLCs. (R23)

C-1

CC

COMPONENT COOLING RETURN FLOW LOW

1. Alarm Setpoint

1.1 575 gpm

2. Automatic Action

2.1 **IF** in AUTO, Standby CC pump starts.

3. Manual Action

3.1 **IF** low flow is due to CC Pump failure **AND** Standby CC Pump did **NOT** start perform the following:

3.1.1 Verify CC Surge Tank level > 18".

3.1.2 Start Standby CC Pump

3.2 Refer to AP/1/A/1700/020 (Loss of Component Cooling)

4. Alarm Sources and References

4.1 1FT-1A

4.2 0-422W-2

B-1

CC

CRD RETURN FLOW LOW

1. Alarm Setpoint

1.1 138 gpm

2. Automatic Action

None

3. Manual Action

3.1 **IF** low flow is due to CC Pump failure **AND** Standby CC Pump did **NOT** start perform the following:

3.1.1 Verify CC Surge Tank level > 18".

3.1.2 Start Standby CC Pump

3.2 Refer to AP/1/A/1700/020 (Loss of Component Cooling).

4. Alarm Sources and References

4.1 1FT-97A

4.2 0-733

4.3 0-422GG-1

1 POINT

Question 51

Unit 3 plant conditions:

- Reactor power = 100%
- ES Analog Channel "C" WR RCS pressure signal fails LOW

Based on the above conditions, which ONE of the following describes the change in ES logic?

A. ES Channels 1-4 are in a 2/2 logic (will require ES channels A and B to initiate ES)

B. ES Channels 1-6 are in a 2/2 logic (will require ES channels A and B to initiate ES)

C. ES channels 1-4 are now in a 1/2 logic (will require ES channels A or B to initiate ES)

D. ES channels 1-6 are now in a 1/2 logic (will require ES channels A or B to initiate ES)

Question 51
T2/G1 - kds

013K6.01, Engineered Safeguards System **Knowledge of the effect of a loss or malfunction on the following will have on the ESFAS: Sensors and detectors** (2.7*/3.1*)

K/A MATCH ANALYSIS
Question requires knowledge of the effect of a failed WR RCS pressure instrument on the ES system.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: would be correct if the instrument failed HIGH.

B. Incorrect: would be correct if the RB pressure instrument failed HIGH.

C. Correct: When the C RCS WR pressure instrument fails low, it sends a trip signal to each analog signal (channels 1-4) making them a 1/2 logic requiring only one of the remaining channels to trip to initiate ES.

D. Incorrect: this would be correct if the failed instrument was RB pressure.

Technical Reference(s): **IC-ES**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **IC-ES R8, R5**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVE

1. Properly describe the operation of all components of the ESG system during normal, inadvertent, and emergency operations. (T1)

ENABLING OBJECTIVES

1. State the purpose of the Engineered Safeguards System. (R1)

2. List the input signals and the sources of power for the Engineered Safeguards analog subsystem. (R2)

3. State the function of the following components located in the ES analog cabinets including any associated setpoints: (R3)

   3.1 RC Pressure Trip Bistable Modules (HPI and LPI)

   3.2 RC Pressure Inhibit Bistable Modules (HPI and LPI)

   3.3 RC Pressure Test Module

   3.4 RB Pressure Trip Bistable Module

   3.5 RB Pressure Test Module

   3.6 High RB Pressure Contact Buffers

1) Individual portions, HPI, LPI and RB pressure (4 psig); can be manually tripped by taking the rotary switch on the associated Pressure Test Module to the "Test Operate" position. There is one test module for WR RC pressure which will trip both the HPI and LPI bistables, and a separate test module for NR RB pressure which will trip the 3 psig RB pressure bistable.

2) Located in each Analog channel are the RC Pressure bistable modules (one for 1600# and one for 550#) and the Reactor building pressure trip bistable module.

   If tripped, these three modules, and thus the channel, can be reset by depressing the "output state" toggle switch (located on each bistable module) for each bistable that has tripped, when RC pressure is > 1600# (HPI), > 550# (LPI), or RB pressure < 3#.

3) As stated earlier, no action is required to reset analog channel outputs feeding channels 7 & 8. When RB pressure is < 10 psig the output signal will clear.

b) Digital channels

1) Can be manually tripped at the manual trip/reset panel in control room.

Refer to OC-IC-ES-10

2) Channels 1-6 can be reset at same location if at least 2 out of 3 analog channels are reset.

3) Channels 7 & 8 can be reset at same location when RB pressure switches have reset (RB pressure < 10 #).

   NOTE: At one time, it was thought that if portions of an ES channel were in manual and in their Non-ES positions, the components could be returned to their ES positions by depressing the manual digital channel reset buttons and then releasing them. This was incorrect. If individual components have been selected to manual, their respective RZ Module "AUTO" pushbuttons must be depressed in order to automatically reposition those components with the ES signal unless the ES signal is completely cleared (analog and digital) and reinitiated.

C. Emergency Operation **(OBJ. R14)**

1. In the case of a serious loss of coolant accident the ESG System would actuate in the following manner:

a) The three wide range RC pressure transmitters will indicate a drop in pressure.

b) At the correct setting the trip bistables trip - 1600 psig (TS ≥ 1590#).

c) From the Analog channel, the trip signal is sent to two redundant Digital logic channels, in this case channels 1 & 2 (HPI, Keowee Hydro Units and Non-Essential RB Isolation).

d) When the digital logic module receives a trip signal from two or more analog channels it generates a signal to the unit control modules which send the ESG signal to each component of that digital channel.

Refer to OC-IC-ES-6 & 7

2. If the HPI channels fail to maintain RC pressure and it continues to decrease:

   a) At 550 psig (TS ≥ 500 #) the LPI/LPSW channels (3 & 4) will be actuated in the same manner as the HPI channels.

Refer to OC-IC-ES-9

3. When Rx. Building pressure increases to 3.0 psig (TS ≤ 4 #), the RB pressure trip bistables trip.

   a) Bistable output is fed to digital channels 5 & 6 and also through an OR gate to digital channels 1, 2, 3 & 4

Refer to OC-IC-ES-2

   b) This logic provides for actuation of RB cooling, PRV and Essential RB Isolation (Channels 5 & 6) as well as LPI & HPI on high RB pressure.

4. If Rx. Building pressure continues to increase to 10 psig (TS ≤ 15 #) the RB spray system will actuate:

   a) Uses 6 pressure switches in a double, 2/3 logic.

   b) Three used with channel 7, and three are used with channel 8.

   c) Each pressure switch is fed to a contact buffer and from there straight to the digital channels.

1 POINT

Question 52

Unit 1 initial conditions:

- Batch addition to LDST in progress
- 1A BHUT addition complete
- Makeup to LDST from 1B BHUT initiated to add 245 gallons of 1B Bleed to the Unit 1 LDST
- LDST level = 78.7 inches

Current conditions:

- 1HP-15 (LDST Makeup Control) Batched out
- 1HP-15 “P” = 245
- LDST level = 84.8 inches

Based on the above conditions, which ONE of the following correctly describes whether an acceptable volume of 1B Bleed was added to the LDST and what action is required?

1HP-15 added...

A. more 1B Bleed than desired / notify an SRO to evaluate the addition and determine actions to take

B. more 1B Bleed than desired / add water from 1A BHUT to the LDST to minimize the reactivity management event

C. less 1B Bleed than desired / notify an SRO to evaluate the addition and determine actions to take

D. less 1B Bleed than desired / add water from 1B BHUT to the LDST to minimize the reactivity management event

Question 52
T2 /G1 –gcw - New KA

004K6.13, Chemical and Volume Control
Knowledge of the effect of a loss or malfunction on the following CVCS components: Purpose and function of the boration/dilution batch controller
(3.1/3.3)

K/A MATCH ANALYSIS

ANSWER CHOICE ANALYSIS
LDST - 31 gal/inch
6.1 inches X 31 gal/inch = 189.1 gals
Per PIP O-05-07623 there can be up to 20 gallon difference in 1HP-15 indication and LDST level change. In this case the level change is larger and not acceptable.

Answer: C

A. Incorrect, per the calculation the volume will less than desired. The second part is correct.

B. Incorrect, per the calculation the volume will less than desired. The second part is incorrect and an SRO should evaluate the effect on reactivity and take actions to minimize reactivity events.

C. Correct, per a NOTE on page 3 of 5 of Enclosure 4.5 of OP/1103/004, if the wrong volume is added and SRO should evaluate the effect on reactivity and take actions to minimize reactivity events.

D. Incorrect, the first part is correct. An SRO should evaluate the effect on reactivity and take actions to minimize reactivity events.

Technical Reference(s): **OP/1/A/1103/004 (Soluble Poison Control) PIP O-05-07623**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **CP016 R12**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

_____ 3.7 Start 1B BLEED TRANSFER PUMP.

NOTE:	If only one Letdown Filter is in service 1HP-15 may require throttling for high ΔP.

_____ 3.8 Open 1CS-56 (1B RC BLEED XFER PUMP DISCH).

_____ 3.9 **IF** increased makeup flow is required, throttle 1CS-58 (1B BHUT Recirc) to establish desired flow **AND** maintain 90-125 psig on 1B Bleed Transfer Pump discharge pressure gauge. (AB-1, U#1-BTP Room)

NOTE:	If abnormal alarms or indications occur, procedure should continue to stop flow. (R.M.) {17}

_____ 3.10 **WHEN** required, stop 1B BLEED TRANSFER PUMP.

_____ _____ 3.11 Close 1CS-56 (1B RC BLEED XFER PUMP DISCH). (R.M.)

NOTE:	• If during RCS makeup the wrong volume is added an SRO should evaluate effect on reactivity and take action to minimize reactivity management events. (R.M.) • 1HP-15 Controller volume will be different from volume based on LDST level change. {22}

_____ 3.12 Perform one of the following: (R.M.)

- ☐ Verify correct volume added

  Or

- ☐ Notify appropriate SRO

_____ 3.13 Reset 1HP-15 Controller for Normal Operation.

_____ 3.14 Close 1HP-16 (LDST MAKEUP ISOLATION).

_____ 3.15 Record RCS batch volume in Auto Log.

_____ 3.16 **IF** desired, request RCS sample for boron. (R.M.)

Appendix

17. PIP # O-04-01877 ensured steps are in place that stops RCS makeup and notifies SRO in case of abnormal indications during makeup.
18. PIP # O-04-00633 added steps to identify volume and concentration of A RC Bleed Storage Header in Component Boron Log for Reactivity Management.
19. PIP # 0-04-00017 changed sequence of operating RC-6 and RC-7 to prevent hammering Pzr sample piping during operation which allows valves to be normal in closed position.
20. PIP # 0-04-04675 made changes in sequence for operation of RC-6 and RC-7 based on engineering recommendations.
21. PIP # O-04-05868 corrected volume. PIP # O-04-5973 / OSC 2729 corrected RCS volumes.
22. PIP # O-05-05195 and O-05-07623 identified that volume added to LDST indicated from HP-15 controller volume and LDST level difference (diverse indications) will be different. See PIP # O-05-07623 CA #1 for actual values.
23. PIP # O-04-05655 added R2/R3 designations to applicable enclosures as described in OMP 1-09 Attachment P.
24. PIP # O-06-02710 added information for CBAST level detector Heat Trace.
25. PIP # O-06-04353 added information about Bleed Transfer pump flow.
26. PIP # O-07-02505 added information that letdown flow should be maintained ≥ 75 gpm.

Signature Type	Indiv	Team	Group	Date
Approved By:	TMD7360	TAL8382	O-RES	11/14/2005

General: Outage: N/A Mode: N/A

Other Tracking Processes
Type Number Text

Actual Corrective Action:
Priority: I3a Actual CAC: B3 Status: Closed Due Date: 05/31/2006
The guidance currently included in OP/_/A/1103/004 is that _HP-15 controller volume will typically be 10 gallons or less different from the volume determined based on LDST level change. This guidance was developed based on a review of batch additions performed per PIP 05-5195 corrective action 1. The larger volume differences of 22.77 gallons and 11.71 gallons identified in this PIP were for batch sizes of 245 gallons and 115 gallons respectively. The vast majority of batch additions that were reviewed per 05-5195 were less than 100 gallons each. Based on the deviations identified in this PIP, a more in-depth review of batch additions was conducted for all three units including larger batch sizes.

A total of 137 additions from 20 gallons to 420 gallons were reviewed for Unit 1, 146 additions from 10 gallons to 787 gallons were reviewed for Unit 2 and 140 additions from 20 gallons to 556 gallons were reviewed for Unit 3 based on operator log data. The volume addition as determined by LDST level change was calculated for each addition based on the 31.3 gallons/inch relationship verified in PIP 05-5195. For additions less than or equal to 100 gallons, the difference in volume added between the controller and as calculated by LDST level change was less than or equal to 10 gallons for approximately 95% of the additions. As identified in PIP 05-5195 the deviations were not directly proportional to the batch size and were not repeatable. For additions greater than 100 gallons, the difference in volume added between the controller and as calculated by LDST level change was bounded by 10 gallons for every 100 gallons of addition for approximately 93% of the additions. The table below documents the findings. This data is applicable to all three units. No significant difference was noted for Unit 1 as compared to Unit 2 or Unit 3.

Batch Size per Controller	Deviation in Batch Size Volume Based on LDST Level
Up to 100 gallons	Less than or equal to 10 gallons
From 100 to 200 gallons	Less than or equal to 20 gallons
From 200 to 300 gallons	Less than or equal to 30 gallons
From 300 to 400 gallons	Less than or equal to 40 gallons

Batch sizes greater than 400 gallons are not included based on the limited number. However, the relationship for those reviewed is consistent with the table above. As was the case for smaller batch sizes, the deviations were not directly proportional to the batch size and were not repeatable.

Based on the above, CNS and MNS were contacted to determine how they are performing this volume comparison. Per I&C Engineering personnel at CNS and MNS, neither station performs a volume comparison between the "blender" flow controller and level changes in the VCT (equivalent to the LDST) for additions to the tank. The primary reason given was inconsistencies in the volume comparisons.

Given the work history on the instrumentation associated with these measurements (Refer to PIP 05-5195 CA#1) coupled with the similarity in volume deviations for all three units, no additional action is justified in terms of instrumentation performance.

Based on the results of this review, corrective action 2 is assigned to Operations to review this PIP and consider the following recommended actions:

A) Revise the guidance (Note in Enclosure 4.4) in OP/_/A/1103/004 to read "the difference in volume between _HP-15 Controller and LDST level change will typically be less than 10 gallons for every 100 gallons in batch size (ie; Up to 100 gallons, deviation less than or equal to +/- 10 gallons, 100 - 200 gallons, deviation less than or equal to +/- 20 gallons, etc.)"

OR

B) Revise OP/_/A/1103/004 to delete performance of the volume comparison.

In either case, it is recommended that verification of unit response be added as a check in the procedure to ensure the desired volume was added resulting in the expected unit response.

Originated By: EMW8382: WELCH JR, EDWARD M Team: TKM5008 Group: RES Date: 05/30/2006

Signature Type	Indiv	Team	Group	Date
Accepted By:	TAL8382	TAL8382	O-RES	11/14/2005

1 POINT

Question 53

Unit 1 initial conditions:

- Reactor power = 100%
- 1RC-1 (PZR Spray) OPEN

Current conditions:

- 1RC-1 (PZR Spray) CLOSED
- RCS Pressure = 2148 psig increasing

Based on the above conditions, which ONE of the following describes the PZR heaters that are energized?

A. ONLY Bank 1

B. ONLY Bank 1 and 3

C. ONLY Bank 1, 2 and 3

D. All Pressurizer heater banks

Question 53
T2 /G1 - kds

010A3.02, Pressurizer Pressure Control
Ability to monitor automatic operation of the PZR PCS, including: PZR pressure
(3.6/3.5)

K/A MATCH ANALYSIS
Question requires knowledge of Pzr Heater Setpoints.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct: For RCS pressure decreasing from 2190 psig all Pzr heater banks should be de-energized. As pressure decreases, Bank 1 should come on ~ 2155 psig, Bank 2 should come on ~ 2140 psig, Bank 3 should come on ~ 2145, Bank 4 should come on ~ 2130 psig**

B. Incorrect- Bank 3 heaters would not be on. Plausible because if pressure was low and increasing at 2148 psig, bank heaters 1-3 would be on.

C. Incorrect- Bank 2 & 3 heaters would not be on. Plausible because if pressure was low and increasing at 2148 psig, it would be correct.

D. Incorrect- Only Bank 1 heaters would be on. Plausible because if pressure was low and increasing at 2148 psig, bank heaters 1-3 would be on

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Technical Reference(s): **PNS-Pzr Page 36**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **PNS-Pzr R5,**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

1. Upon completion of this lesson, the student will demonstrate an understanding of the components, indications, controls and operation of the Pressurizer. The student will be able to assess the status of the Pressurizer during normal, abnormal and emergency conditions and determine corrective actions for improper system operation. The student will also be able to apply any ITS/SLC Conditions and Required Actions associated with the Pressurizer (T1).

ENABLING OBJECTIVES

1. Explain the design basis of the pressurizer. (R21)
2. Describe pressurizer response during load or RCS temperature changes. (R1)(R2)(R3)
3. Given a set of conditions, calculate the change in pressurizer level for a change in RCS temperature. (R33)
4. Explain what is meant by a "subcooled" pressurizer and how to determine if the pressurizer is in a subcooled condition.(R22)(R27)
5. Explain what is meant by a pressurizer "hard bubble" and describe the adverse effects of a "hard bubble" on plant operation, (R23)
6. Identify the source of pressurizer spray for each unit. (R4)
7. Discuss the automatic setpoints and any interlocks associated with pressurizer instrumentation. (R5)
8. Explain the operation of the ICS RC pressure signal median select function as it relates to RC pressure control including: (R28)
   8.1 How median select chooses the controlling signal
   8.2 Which pressurizer components receive a median selected RC pressure signal
9. Given a set of conditions, determine which RC pressure signal has been selected for control by the ICS RC pressure signal median select function. (R36)
10. Discuss the reasons for bypass flow around the pressurizer spray valve during normal operation. (R6)
11. Evaluate plant response to a failed open pressurizer spray valve without operator action. (R20)

b) LOHT: Following a loss of all feedwater event where no sources of feedwater are available and RCS pressure is approaching 2300 psig, HPI is utilized. Flow is established in each injection header through HP-26 and HP-27 and the PORV manually opened to provide a flowpath for cooling water from the BWST, through the core, to the basement of the reactor building. This is called "HPI Forced Cooling".

2.8 **System Interlocks/Automatic Actions (OBJ.R5...)**

A. In automatic, HP-120 maintains pressurizer level at setpoint (normally **220 inches**) under normal conditions.

B. In automatic, the Pzr heater banks cycle as necessary to maintain RCS pressure as follows:

1. **Bank #1**- maintains RCS pressure **at setpoint** (normally 2155 psig) using SCR proportional control.
2. **Bank #2**- energizes at **2140 psig** decreasing and de-energizes at **2150** psig increasing.
3. **Bank #3**- energizes at **2145 psig** decreasing and de-energizes at **2175** psig increasing. Bank #3 normally remains energized with Heater Bank #1 cycling on and off to maintain RCS pressure at setpoint
4. **Bank #4**- energizes at **2130 psig** decreasing and de-energizes at **2145** psig increasing.
   a) "NR RCS Pressure LO / LOLO"; OAC alarms at 2135# and 2125# respectively
   b) Warns operators of approaching the last bank of heaters or exceeding the DNB parameter for low RCS pressure

C. An **80-inch** (**85" SSF**) low pressurizer level interlock prevents the heaters from being energized while they are uncovered.

D. In automatic, **RC-1 Spray Valve** opens at **2205 psig** increasing RCS pressure and closes at **2155 psig** decreasing.

E. In automatic and selected to HIGH, **RC-66 PORV** opens at approximately **2450 psig** and will reseat at approximately **2400 psi** (**530 and 480 psig** when selected to LOW.)

F. At **2500 psig Pzr Code Safety Relief Valves** lift; not guaranteed to reseat.

2.9 **Procedural Limits and Precautions**

A. **(OBJ.R18)**The maximum allowable heatup and cooldown rate for the pressurizer is **<u>90°F per hour</u>**

This is within the TS limit of 100°F per hour, which protects the system components from exceeding <u>design thermal stresses</u>.

1 POINT

Question 54

Unit 1 plant conditions:

- Reactor Power = 100%
- 1SA9/D-4 (MS 1A PEN PRIMARY COOL FAN FAIL) stat alarm received

When will the standby steam line cooling fan start and based on what signal?

A. Immediately / breaker position of the running fan

B. 30 seconds / breaker position of the running fan

C. 30 seconds / pressure switch located in the cooling ductwork

D. Immediately / pressure switch located in the cooling ductwork

Question 54
T2 /G1 - kds

022K4.01, Containment Cooling **Knowledge of CCS design feature(s) and/or interlock(s) which provide for the following: Cooling of containment penetrations** (2.5*/3.0*)

K/A MATCH ANALYSIS
Question requires knowledge of interlock associated with containment penetration cooling fans.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: There is a 30 second time delay associated with standby fan start. Plausible because this type of auto start logic is common.

B. Incorrect: Fan is started based on a pressure switch in the ductwork. Plausible because this type of auto start logic is common.

C. Correct: A pressure switch in the ductwork will actuate under low flow conditions and send a start signal to the standby fan. There is a thirty second time relay that will delay standby fan start to allow initial fan starting.

D. Incorrect: There is a 30 second time delay associated with standby fan start. Plausible because of the importance of this system to maintain cooling to the penetration.

Technical Reference(s): **STG-MS**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **STG-MS R7**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

LESSON OBJECTIVES

TERMINAL OBJECTIVE

1. Describe the basic operation of all specified components of the Main Steam System and list the various loads that are supplied steam.

ENABLING OBJECTIVES

1. State the purpose(s) of the Main Steam System (R1)
2. Concerning the Line Penetration Cooling Fans:
    - 2.1 State the purpose of the Main Steam Line Penetration Cooling fans. (R3)
    - 2.2 List the locations of the East and West fans for each unit. (R6)
    - 2.3 List the condition(s) that will actuate either of the Main Steam Line Penetration Cooling Fan Fail statalarms. (R7)
    - 2.4 Recognize that a failure to maintain MS line cooling can result in a required unit shutdown. (R8)
3. State the purpose(s) of the Main Steam Relief Valves (MSRVs) (R2)
4. Explain the reason that the MSRVs setpoints are staggered. (R9)
5. Describe the condition that MSRVs can remain open by design following a reactor trip. (R22)
6. Explain why work in and around MSRVs during unit power operation should not be permitted. (R10)
7. Identify the conditions that would necessitate use of the Main Steam Atmospheric Dump Valves (ADVs) including operability requirements and basis for operability. (R11)
8. Explain the purpose for performing PT/1/A/251/19, MS Atmospheric Dump Valve Functional Test. (R12)
9. List the three functions of the Turbine Bypass Valves. (R13)
10. State the purpose of the breakdown orifices associated with the Turbine Bypass Valves. (R4)
11. Describe how a properly operating steam trap allows the flow of condensation while preventing excessive steam flow. (R14)

REFER to OC-STG-MS-2

5. The fans are started locally via a 3 position (Fan A/OFF/Fan B) control switch located within the control panel. A local 20 amp breaker switch for each fan motor must also be on.
6. **(OBJ R6)** Control panel locations are as follows for each unit:
   a) East Penetration Fans ⇒ East Penetration Room
   b) West Penetration Fans ⇒ located outside the RB at ground level just under the 'B' MS line
7. **(OBJ R7)** A pressure switch in the ductwork will actuate under low flow conditions and send a start signal to the standby fan. This will illuminate a "Low Flow" light on the local control panel. There is a thirty (30) second time relay that will delay standby fan start to allow initial fan starting.
8. A statalarm in the Control Room will alert the operator of system trouble.
   a) Loss of power to <u>either</u> fan will actuate the statalarm (SA-9/D-4 or E-4), but will not, of itself, start the standby fan.
      1) However if power is lost to the <u>running</u> fan, the air flow pressure switch should pick up as described in #7 above.
   b) The Statalarm will also actuate if a start signal is sent to the fan and the fan fails to start.
9. **(OBJ R8)** If both fans become inoperable, immediately notify Engineering to perform an evaluation on the penetration.
   a) This limit is found in the Alarm Response Procedure for the fan fail statalarms described in #7 above.
   b) The concern is over-temperature considerations of the concrete at the MS line penetration.

REFER to OC-STG-MS-1

C. Main Steam Relief Valves

1. Each main steam line has eight relief valves installed, 16 total and all are required to be operable per TS 3.7.1

Instructor Note: PIP 01-00150, on 1-11-01 two unplanned TS entries were made based on MSRV (1MS-11 and 16) inoperability. During "pop testing" both valves did not meet surveillance requirements. Valves were repaired and Unit startup was continued.

1 POINT

Question 55

Unit 1 initial conditions:
- Reactor power = 100%

Current plant conditions:
- Main Turbine Generator trip
- 1FDW-33 (1A SU FDW Block) FAILS closed

Which ONE of the following are the expected OTSG levels 15 minutes after the trip?

ASSUME NO OPERATOR ACTIONS

A. 1A = 25" SU level 1B = 25" SU level

B. 1A = 0" SU level 1B = 25" XSUR level

C. 1A = 30" XSUR level 1B = 25" SU level

D. 1A = 30" XSUR level 1B = 30" XSUR level

Question 55
T2 /G1 - gcw

059K3.03, Main Feedwater
Knowledge of the effect that a loss or malfunction of the MFW will have on the following: S/GS (3.5/3.7)

K/A MATCH ANALYSIS
Question requires knowledge of the effects that a startup control valve failure will have on the feedwater system and OTSG levels.

ANSWER CHOICE ANALYSIS
As the startup control valve fails closed, level in the 1A SG will decrease until "Dryout Protection" is activated to start BOTH MD EFDWPs. MD EFDW pumps will then maintain both SG level at their setpoint of ~ 30" XSUR even though MFW is still operating.

Answer: D

A. Incorrect - During dry out protection, emergency feedwater level control will maintain both SGs at 30" XSUR even though Main FWP is still operating. Plausible because these are the levels that which would be maintained if feeding through the feedwater startup control valves.

B. Incorrect - Dry out conditions in 1A SG will initiate dry out protection on both SGs. Plausible if you assume that you need dryout conditions on both SGs to start MD EFDW pumps.

C. Incorrect – 1B SG will also maintain at 30" due to EFDW. Plausible because it is logical to assume that since the A SG had the level problem, then only the A SG would be fed by EFW.

D. Correct - Dry out protection will maintain both SG levels at 30" on XSUR, both MDEFWPs will start.

Technical Reference(s): **CF-EF**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **CF-EF R20 R37**

Question Source: **Bank CF023704**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

12. Describe the purpose for the Steam Admission Valve (MS-93), including a description of its operation following a normal start of the TDEFDWP. (R24)

13. Describe how to manually open valve MS-93, following a failure to open after a TDEFDWP pump start signal. (R43)

14. Explain the function of the Auxiliary Oil Pump in relationship with the operation of the Primary Relay and Operating Valve (MS-95) associated with the TDEFDWP. (R13)

15. Explain how to use the Hand-Start lever of the Primary Relay to start the TDEFDWP in the event that the Auxiliary Oil Pump does not start when MS-93 opens. (R44)

16. List the two functions of TDEFDWP Stop Valve (MS-94), including a description of manual operation of the valve. (R14)

17. Describe how to reset the MS-94 and what to look for to verify that it is reset. (R15)

    17.1 Describe how to verify a positive latch on the Reset Mechanism.

18. Explain the purpose for and operation of the Overspeed Governor and Emergency Relay associated with the TDEFDWP. (R16)

19. Describe how control oil and lube oil are supplied to the TDEFDWP during startup and operation. (R17)

20. List the normal and backup cooling medium for the TDEFDWP oil cooler. (R18)

21. Explain how the EFDW Systems can be cross-connected between units. (R19)

22. Describe the MANUAL and AUTOMATIC (including AUTO 1 & AUTO 2) control available for the MDEFDWPs and their purposes. (R20)

23. Describe or make a sketch of the logic/conditions that will AUTO START the MDEFDWPs when the respective control switches are in AUTO, including a description of AMSAC and DRY OUT PROTECTION (R22)

24. Describe the purpose for AMSAC/DSS, including actuating setpoints and functions hey provide following actuation. (R61)

25. Describe the MANUAL control available for the TDEFDWP from the Control Room, including how to prevent an AUTO start. (R23)

26. Describe or make a sketch of the logic/conditions that will AUTO START the TDEFDWP when its control switch is in AUTO, including a description of AMSAC. (R25)

27. Describe the affect an AFIS actuation will have on the EFDW system. (R58)

28. List the EFDW SG Level setpoints for the conditions when RCPs are running and when all RCPs are off. (R37)

29. Describe the SG level indicators used in the EFDW System, including whether or not they are temperature compensated, and how to select the PRIMARY/BACKUP indicators. (R30)

30. List which Level Train is the PRIMARY TRAIN for SG A level control and which is the PRIMARY TRAIN for SG B level control. (R35)

31. Explain why the Primary Level Train for SG A is not the same as the Primary Level Train for SG B. (R36)

32. Discuss the Moore Controller's function during operation of FDW-315 & 316 in automatic and manual, include how to select manual and why manual control may be required after a loss of MFDW. (R34)

33. Discuss the purpose and functions of the Moore Controller by-pass switches. (R68)

34. List the locations of FDW-315 & 316. (R27)

35. Describe the methods for throttling EFDW flow, available to the operator. (R49)

36. Describe how the TDEFDWP meets "AC Independence" criteria including how each component helps provide this independence. (R38)

37. Explain the purposes of the Nitrogen bottles associated with the EFDW System. (R39)

38. List the local indications available for monitoring MDEFDWP operation. (R40)

39. List the local indications available for monitoring TDEFDWP operation. (R41)

40. List the instrumentation available in the Control Room for monitoring the operation of the MDEFDWPs and the TDEFDWP. (R42)

41. Explain why the Jockey Pump is stopped when performing the TDEFDW Pump Backup Cooling Water Supply Test (PT/1,2,3/A/0150/022L). (R62)

42. Describe the emergency feedwater flowpath during performance of the Turbine Driven Emergency Feedwater Pump Test (PT/1,2,3/A/0600/012). (R63)

43. Explain why the TDEFDW Pump is NOT tested on Main Steam if reactor power < 5%. (R64)

44. Given a set of data and a copy of PT/0600/012, Turbine Driven Emergency Feedwater Pump Test, determine if acceptance criteria are being met. (R65)

2. Through normally closed valves FDW-313 and FDW-314 (EFDW X-connects).
3. Open FDW-313 and FDW-314 for the unit supplying and for the unit receiving.

2.7 INSTRUMENTATION AND CONTROLS

A. **(OBJ. R20)** Manual Control - MDEFDWP (Figure OC-CF-EF-13)

1. 4 position - OFF • AUTO 1 • AUTO 2 • RUN
2. No interlocks to prevent Manual start
3. Trip or OFF - prevents Auto start, secures pump after start

B. **(OBJ. R20)** Automatic Control - MDEFDWP (Figure-OC-CF-EF-13 & 21)

1. AUTO 1 position (Dryout Protection)
   a) Purpose: Provide a diverse means of actuating MDEFDWPs as the SGs are approaching dryout conditions.
   b) Upon receiving a two out of two low XSUR level logic signal in either SG (21" for 30 seconds), both MDEFDWPs will start and the EFDW level control will initiate to control at the appropriate XSUR level depending upon operation of the RCPs. (30"/240")
2. AUTO 2 position, MDEFDWPs will start when:

(OBJ. 22)

Both MFDWPs have low hydraulic oil pressure (< 75 psig)

****OR *****

AMSAC/DSS (Diverse Scram System) enabled, AND

Both MFDWPs have low hydraulic oil pressure (< 75 psig)

(This must occur on both AMSAC Channels)

****OR*****

AMSAC/DSS enabled, AND

Both MFDWPs have low discharge pressure (< 770 psig)

(both AMSAC Channels)

CF023704

Unit 1 plant conditions:

INITIAL CONDITIONS:

- Reactor power = 100%

CURRENT CONDITIONS:

- Main Turbine Generator trip
- 1FDW-33 (1A SU FDW Block) FAILS closed

Which ONE of the following are the expected OTSG levels 15 minutes after the trip? (.25)

ASSUME NO operator actions are taken

A. 1A = 25" SU level 1B = 25" SU level

B. 1A = 25" SU level 1B = 30" XSUR level

C. 1A = 30" XSUR level 1B = 25" SU level

D. 1A = 30" XSUR level 1B = 30" XSUR level

D

A. Incorrect - During dry out protection, emergency feedwater level control will maintain both SGs at 30" XSUR even though Main FWP is still operating.
B. Incorrect - Dry out conditions in 1A SG will initiate dry out protection on both SGs.
C. Incorrect - Same as B above.
D. Correct - Dry out protection will maintain both SG levels at 30" on XSUR, both MDEFWPs will start.

1 POINT

Question 56

Unit 1 initial conditions:
- HPI Forced Cooling in progress

Current conditions:
- Tcold = 511ºF
- Preparing for HPI Forced Cooling (HPI F/C) recovery

Based on the above conditions and the guidance in the HPI CD tab, which ONE of the following describes what TBV setpoint (psig) should be used during HPI F/C recovery?

A. 610

B. 625

C. 640

D. 750

Question 56
T2 /G2 - gcw

041K5.02, Steam Dump System and Turbine Bypass Control **Knowledge of the operational implications of the following concepts as they apply to the SDS: Use of steam tables for saturation temperature and pressure (**2.5/2.8)

K/A MATCH ANALYSIS
Use of steam tables is required to determine the setpoint at which the TBVs will control.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct, per the steam table, Psat for 511ºF is 750 psia. Per the EOP 750 psia – 140 = 610 psig (TBV setpoint).**

B. Incorrect, just 125 bias did not convert psia to psig.

C. Incorrect, psia to psig added instead of subtracting.

D. Incorrect, did not use 140.

Technical Reference(s): **EOP HPI CD Tab**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-HPI CD R10**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

1. Describe the use of HPI CD tab of the Emergency Operating Procedure in order to perform the required actions of a Control Room operating crew during an event involving the use of this procedure. (T1)

ENABLING OBJECTIVES

2. Describe the conditions that would require entry into HPI CD. (R23)
3. Discuss the overall mitigation strategy of HPI CD. (R24)
4. State the purpose of this procedure. (R1)
5. Explain the basis for cautions, notes and major steps in HPI CD. (R25)
6. Given the appropriate enclosure from the EOP and present plant conditions, determine whether HPI forced cooling flow is adequate (R2).
7. Explain the use of the RCS high point vents when HPI forced cooling is not fully aligned or effective. (R4)
8. State the two criteria for throttling HPI when in HPI forced cooling mode. (R3)
9. Describe the required actions when a SG approaches overfill level conditions. (R17)
10. Recognize that even during an HPI Cooling Cooldown, if a source of feedwater to the SGs becomes available, attempts will be made to re-establish SG heat transfer. (R7)
11. Concerning HPI Forced Cooling recovery: (R10)
    - 11.1 Recognize that during recovery from HPI forced cooling that the sequence of valve closures, HPI throttling, and FDW initiating guidance is important in obtaining a smooth pressure response.
    - 11.2 Recognize that recovery should be properly timed so as to not be a conflict with actuation of ES channels 1-6.
    - 11.3 Compare the method used to recover from HPI Forced cooling when the RCS is subcooled or saturated.
    - 11.4 Recognize the potential problems associated with recovery of SG heat transfer while in HPI forced cooling with a subcooled RCS.
    - 11.5 Describe how TBVs are used to control SG pressure during HPI Forced Cooling recovery.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
Unit Status • Core SCM > 0°F. • A source of feedwater is available to one or both SGs.	
137.__ Verify CC system in operation.	1. Open the following: __ 1CC-7 __ 1CC-8 2.__ Ensure one CC pump is operating. 3.__ Place the non-operating CC pump in AUTO.
138. Open the following: __ 1HP-1 __ 1HP-2 __ 1HP-3 __ 1HP-4	
139. Close the following: __ 1HP-6 __ 1HP-7	
140.__ Open 1HP-5.	
141.__ Verify any RCP operating.	**NOTE** 1A1 RCP provides the best Pzr spray. __ **IF** any RCP is available, **THEN PERFORM** Encl 5.6 (RCP Restart) to start one RCP (preferably in loop with available SG).
142. Verify all the following: __ T_{cold} > 500°F __ TBVs available	1.__ Manually control SG pressure to match RCS $P_{sat.}$ 2.__ **GO TO** Step 147.
143.__ Verify $T_{cold} \leq 547$°F.	1.__ Ensure THP setpoint at ≈ 885 psig. 2.__ **GO TO** Step 146.
144.__ Determine P_{sat} for existing RCS temperature (RCS P_{sat}).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
145.__ Adjust TBV setpoint to RCS P_{sat} minus 140 psi: Setpoint = ______ - 140 = ______ RCS P_{sat} (psia)	
146.__ Place TBVs in AUTO for available SGs.	1.__ **IF** T_{cold} is ≤ 547°F, **THEN** manually control SG pressure to match RCS $P_{sat.}$ 2.__ **IF** T_{cold} is > 547°F, **THEN** ensure TBVs are closed. 3.__ **GO TO** Step 147.
147.__ Direct Reactor Operators to **PERFORM** Encl 5.40 (Recovery From HPI Forced Cooling).	
148.__ Verify primary to secondary heat transfer exists.	__ **GO TO** Step 162.
149.__ Verify RCS leakage < normal makeup capability.	__ **GO TO** Step 151.
150.__ Energize all available Pzr heaters.	

1 POINT

Question 57

Unit 2 initial conditions:

- Startup in progress
- Main turbine speed = 100 RPM

Current conditions:

- The operator selects 1800 RPM on the Main Turbine EHC control panel.

Based on the above conditions, which ONE of the following is correct?

By______ RPM, the operating speed governor will FULLY CLOSE the____ valves.

A. 1750 / Main Control

B. 1800 / Main Control

C. 1818 / intercept

D. 1836 / intercept

Question 57
T2 /G2 - gcw

045A3.05, Main Turbine Generator **Ability to monitor automatic operation of the MT/G system, including: Electrohydraulic control** (2.6/2.9)

K/A MATCH ANALYSIS

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect - at 1750 RPM the main turbine has not reached its normal operating and no action will occur

B. Incorrect - Normal operating speed of the main turbine and at this point no action will occur

C. Incorrect - This is 101% of the operating speed of the main turbine. At this point the intercept valves will have started to close but will not be fully closed.

D. Correct - this is 102% of Main Turbine speed. Since the main turbine is on speed control and the offset of the Master IV's is 2% the master intercept valves should be fully closed.

Technical Reference(s): **STG-EHC**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **STG-EHC R7**

Question Source: **Bank; STG060701**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

1. Describe the Electrohydraulic Control Systems, including components, startup, normal, and abnormal operation of the system. Explain the operation of the components and controls for turbine operation, including safety feature actuations and setpoints. The explanation of the EHC systems will include the operation of the system during startup, shutdown(s), and testing. (T1)

ENABLING OBJECTIVES

1. Describe the three functions of the Electrohydraulic Control System. (R1)

2. Describe the two portions of the Electrohydraulic Control System. (R2)

3. Describe the basic operation of the Control Pacs associated with the turbine steam valves. (R3)

4. Describe the function of a Servo Valve and identify the turbine steam valves which have Servo Valves associated with them. (R4)

5. Explain the purpose of the Master Trip Solenoid Valve. (R6)

6. Identify the automatic turbine trips including setpoint and type of protection provided. (R10, 23)

7. Describe the purpose and operation of the Operating Speed Governor. (R7)
   - 7.1 Describe EHC system response when the Unit is operating with a degraded grid.

8. Describe the purpose and operation of the Power Load Unbalance Circuit. (R8)

c) Overpressure

d) Mechanical damage

2. Overspeed Protection

a) **(Obj. R7)** Operating Speed Governor:

1) Controls Main Control Valves and Intercept Valves.

2) As speed increases above selected speed the Main Control Valves will ramp closed and will be fully closed by 105% of selected speed.

3) Overspeed regulation of the Master IVs is set at 2% and the point at which they start going closed is dependent on the method of control

(a) When the ICS station for Turbine Header Pressure is in manual with demand at 0% the Main Turbine is in Speed Control. If the operator increases speed from 100 to 1800 RPM the IV's will start closing at 1810 RPM and will be fully closed at 1836 RPM.

(b) If the load demand (from the ICS station) is 20% they will start closing at 101% overspeed and will be fully closed at 103% overspeed. If the load demand is 100% the IV's will start closing at 105% overspeed and will be fully closed at 107%. The controlling speed increases linearly between 20% and 100% ICS demand.

4) Besides the overspeed regulation control, an additional overspeed protection is provided by the Intercept Valves as initiated by any one of the Master IVs. When speed error is increasing at a rate that is causing the Master IVs to close at their fastest rate while trying to maintain overspeed, a signal is generated to energize the Fast Acting Solenoid Valves on all 6 IVs; thereby shutting off steam to the Low Pressure Turbines. Once this condition clears, the Master IVs will return to "normal overspeed control" as dictated by the overspeed regulation circuitry as previously discussed.

b) Mechanical Overspeed Trip Device

1) Unbalanced ring used to trip the mechanical trip valve.

2) Trips turbine at 110% of rated speed - ≈ 1980 RPM.

3) Must allow time for coast down following trip to allow trip ring to move away from trip finger before the overspeed can be reset.

c) **(Obj. R8)** Power/Load Unbalance Circuit

STG060701

Unit 2 plant conditions:

INITIAL CONDITIONS:

- Startup in progress
- Main turbine speed = 100 RPM

CURRENT CONDITIONS:

- The operator selects 1800 RPM on the Main Turbine EHC control panel.

Which ONE of the following is correct? (.25)

By______ RPM, the operating speed governor will have FULLY CLOSED the____ valves.

A) 1750 / Main Control

B) 1800 / Main Control

C) 1818 / intercept

D) 1836 / intercept

D

A. Incorrect - at 1750 RPM the main turbine has not reached its normal operating and no action will occur
B. Incorrect - Normal operating speed of the main turbine and at this point no action will occur
C. Incorrect - This is 101% of the operating speed of the main turbine. At this point the intercept valves will have started to close but will not be fully closed.
D. Correct - this is 102% of Main Turbine speed. Since the main turbine is on speed control and the offset of the Master IV's is 2% the master intercept valves should be fully closed.

1 POINT

Question 58

Unit 1 initial plant conditions:

- Reactor power = 100%
- 1SSH-9 throttled

Current conditions:

- Condenser vacuum = 23.3" Hg slowly decreasing
- Steam Seal Header pressure = 1.1 psig

Based on the above conditions, which ONE of the following describes the status of Statalarm 1SA-03/A-6 (CONDENSER VACUUM LOW) and how should 1SSH-9 be controlled to mitigate this event?

A. actuated / 1SSH-9 should be throttled CLOSED.

B. actuated / SSH-9 should be throttled OPEN.

C. NOT actuated / 1SSH-9 should be throttled CLOSED.

D. NOT actuated / 1SSH-9 should be throttled OPEN.

Question 58
T2 /G2 - gcw

055G2.4.50, Condenser Air Removal **Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.** (3.3/3.3)

K/A MATCH ANALYSIS

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct, Statalarm 1SA-03/A-6 (CONDENSER VACUUM LOW) set point is 25" HG decreasing. The ARG refers you to AP/27 (Loss of Condenser Vacuum). Per AP/27 1SSH-9 should be throttled closed to maintain Steam Seal Header pressure 3 – 5 psig.**

B. Incorrect, first part is correct. Second part is incorrect. Plausible because if the candidate believes that 1SSH-9 is supplying steam to the header opening would be the logical choice.

C. Incorrect, first part is incorrect. Second part is correct.

D. Incorrect, first part is incorrect. Second part is incorrect. Plausible because if the candidate believes that 1SSH-9 is supplying steam to the header opening would be the logical choice.

Technical Reference(s): **AP/27 (Loss of Condenser Vacuum)**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SAE-L126 R3**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

1.0 OBJECTIVES:

1.1 When Loop 'A' RCS Thot transmitter fails low, perform PTR and operate ICS in manual with failed instrumentation/controls per SOMP 1-02. (R1)

1.2 Analyze RCS chemistry results and perform the appropriate actions of AP/1/A/1700/21, High Activity in the RCS. (R2)

1.3 Diagnose a condenser vacuum leak and perform the appropriate actions of AP/1/A/1700/027, Loss of Condenser Vacuum. (R3)

1.4 Utilizing control board indications diagnose a MS Line Rupture of the "1B" MS Line, inside containment and respond to per EP/1/A/1800/01, Emergency Operating Procedure. (R4)

1.5 As the SRO, determine applicability of technical specification for high RCS activity. (R5)

1.6 As the SRO, direct ROs in the performance of tasks per the EOP. (R6)

1.7 As the SRO, determine emergency classification based on current plant conditions. (R7)

2.0 REFERENCES:

2.1 SOMP 1-02, Reactivity Management (Plant Transient Response)

2.2 AP/1/A/1700/028, ICS Instrument Failures

2.3 AP/1/A/1700/021, High Activity in the RCS

2.4 AP/1/A/1700/027, Loss of Condenser Vacuum

2.5 EP/1/A/1800/01, Emergency Operating Procedure

2.6 ONS Technical Specification 3.4.11, RCS Specific Activity

2.7 OMP1-18, Implementations Standard During Abnormal and Emergency Events

2.8 RP/0/B/1000/001 Emergency Classification

3.0 COMMITMENTS AND/OR INDUSTRY EVENTS

3.1 None.

4. Subsequent Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1 __ **IAAT** condenser vacuum is ≤ 22″ Hg, **THEN** trip Rx.	
4.2 Dispatch operators to perform the following: __ Perform Encl. 5.1 (Main Vacuum Pump Alignment). **(PS)** __ Look for vacuum leaks.	
4.3 Ensure <u>all</u> available Main Vacuum Pumps operating: __ A VACUUM PUMP __ B VACUUM PUMP __ C VACUUM PUMP	
4.4 __ Ensure 1V-186 is closed.	
4.5 __ Ensure Stm to Stm Air Eject A, B, C > 255 psig.	
4.6 __ Verify Stm Seal Hdr Press > 1.5 psig.	1. __ **IF** operating with 1SSH-9 throttled, **THEN** throttle 1SSH-9 closed to control Stm Seal Hdr Press 3 - 5 psig. 2. __ **IF** Main Steam is **NOT** available, **THEN GO TO** Step 4.7. 3. __ **IF** 1AS-10 malfunctions **OR** the Aux Stm Hdr is out of service, **THEN** simultaneously perform the following: __ Open 1SSH-1 __ Close 1AS-8 {4}
4.7 __ Ensure <u>all</u> available CCW pumps operating.	

1 POINT

Question 59

Unit 1 plant conditions:

- Reactor power = 100%
- 50 gpd Tube Leak
- An increase in activity is reported in Chemical Treatment Pond (CTP) #3

Which ONE of the following describes an event which would cause this increase and the actions required to mitigate this event?

A. 1RIA-42 (RCW) activity is increasing and this will increase activity levels in CTP #3.
Isolate and repair the faulty cooler

B. 1RIA-31 (LPI Cooler) activity is increasing and this will increase activity levels in CTP #3.
Isolate and repair the faulty cooler

C. 1RIA-54 (TBS) interlock has failed and the Turbine Building Sump is being continually pumped.
Open and White Tag 1A and 1B TBS Pump breakers

D. 1RIA-33 (LW Release) interlock has failed and a Waste Monitor Tank release continues from the Radwaste Building.
Secure the Waste Monitor Tank

Question 59
T2 /G2 - gcw

068A2.04, Liquid Radwaste
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: Failure of automatic isolation (3.3/3.3)

K/A MATCH ANALYSIS
Requires knowledge of a failure of 1RIA-54 (TBS) and the required actions.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect, RCW is a closed system. The RCW cooler is cooled by CCW which goes to the discharge not CTP #3. Isolating the cooler would not stop the release.

B. Incorrect, LPSW goes to the discharge not to #3 CTP. Isolating the cooler would not stop the release.

C. Correct, TBS pump goes to CTP #3. Due to the tube leak, activity could be high in the sump. If the interlock failed it could pump high activity to CTP #3. AP/18 requires that the 1A and 1B TBS pump breakers be opened.

D. Incorrect, the waste monitor tanks discharge to the Keowee tailrace not CTP # 3. Stopping the waste monitor tank release would not stop the release to CTP # 3.

Technical Reference(s): **AP/18 (Abnormal Release of Radioactivity)**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **RAD-RIA R2**

Question Source: **Bank**

Question History: Last NRC Exam: **Oconee 2005 NRC Exam**

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

5. Describe the basic function of each applicable monitor. (R2)
   - 5.1 State the purpose of each monitor.
   - 5.2 State where each monitor is located\
   - 5.3 List the interlocks and automatic actions associated with each applicable monitor.
   - 5.4 When given the monitor title, be able to state which system(s) the monitor checks.
6. List seven (7) functions which can be performed at the RIA Control Room CRT. (R8)
7. Describe the basic procedure to check/set High and Alert alarm setpoints. (R5)
8. Describe the operational relationship between the following components associated with the Sorrento Radiation Monitoring System: (R10)
   - 8.1 RM-80 Microprocessor Unit
   - 8.2 Transient Monitor System Computer
   - 8.3 View Node
9. For the following situations, state whether or not the associated Radiation Monitor is operational and explain why for each case: (R11)
   - 9.1 The RM-80 out of service
   - 9.2 Transient Monitor System Computer out of service
   - 9.3 The View Node out of service
10. Describe a situation which would require the Operator to monitor the status of a Radiation Monitor locally from the skid. (R12)
11. Describe the basic procedure to be used to purge RIAs-37 & 38 and state two (2) reasons why this purge operation is performed. (R3)
12. Other than going to the skid, explain how RIA status can be monitored after the Control Room View Node is lost. (R13)
13. Describe the required actions of the Operator in case of a High Radiation Alarm with the associated Transient Monitor System Computer out of service. (R14)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. __ **IAAT** 1RIA-54 is in High alarm, **THEN GO TO** Step 2.	__ **GO TO** Step 14.

NOTE
The white tags can be created and hung after the TBS pump breakers are opened.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
2. Dispatch an operator to open and white tag the following: __ 1XD-R3C (1A TURB Bldg SUMP PUMP BKR) __ 1XE-R3D (1B TURB BLDG SUMP PUMP BKR)	
3. __ Notify Secondary Chemistry to sample U1&U2 TB Sump.	
4. __ Notify Radwaste to stop all LWRs until sample results ensure station release rates within limits.	
5. __ **WHEN** sample results are received, **THEN** continue.	
6. __ Verify TB Sump activity > 10 EC.	__ **GO TO** Step 11.
7. __ Determine source of radioactive leakage.	
8. __ **PERFORM** OP/0/A/1104/048 (TB Sump Operation) to align TB Sump to TB Sump Monitor Tanks as directed by Secondary Chemistry.	
9. __ Log TB Sump transfers in the Unit Log.	
10. __ **WHEN** conditions permit, **THEN EXIT** this section.	

• • • END • • •

42. 059AK1.01 1

ONS 2005 RO NRC Exam

Unit 1 plant conditions:

- Reactor Power is 100%.
- 50 gpd Tube Leak
- An increase in activity is reported in Chemical Treatment Pond (CTP) #3

Which ONE of the following describes the most probable cause of this increase?

A. 1RIA-42 (RCW) activity is increasing and this will increase activity levels in CTP #3.

B. 1RIA-31 (LPI Cooler) activity is increasing and this will increase activity levels in CTP #3.

C. 1RIA-54 (TBS) interlock has failed and the Turbine Building Sump is being continually pumped.

D. 1RIA-33 (LW Release) interlock has failed and a Waste Monitor Tank release continues from the Radwaste Building.

New question developed from lesson plan OP-OC--RAD-RIA page 25 and objective # 5. (Utility wrote this question to replace original) Still a new question.

A. A. Incorrect, RCW is a closed system. The RCW cooler is cooled by CCW which goes to the discharge not CTP #3.

B. Incorrect, LPSW goes to the discharge not to #3 CTP.

C. C. Correct, TBS pump goes to CTP #3. Due to the tube leak, activity could be high in the sump. If the interlock failed it could pump high activity to CTP #3.

D. Incorrect, The waste monitor tanks discharge to the Keowee tailrace not CTP # 3.

K/A: Knowledge of the operational implications of the following concepts as they apply to accidental liquid radwaste release: Types of radiation their units of intensity and the location of the sources of radiation in a nuclear power plant. (2.7/3.1)

Modified question to ensure a correct answer.

Answer: C

1 POINT

Question 60

Unit 2 plant conditions:

- Reactor power = 100% stable
- IA header pressure = 84 psig and slowly decreasing
- SA header pressure = 101 psig and stable
- All Automatic System Actions have occurred

Which ONE of the following describes an action that would positively assist in regaining IA header pressure?

A. Open SA-143, SA to IA Controller Bypass.

B. Place all Backup air compressors in BASE.

C. Place the Standby Service air compressor to RUN.

D. Place all three Units' Auxiliary IA compressors to RUN.

Question 60
T2 /G2

079A4.01, Station Air
Ability to manually operate and/or monitor in the control room: Cross-tie valves with IAS (2.7/2.7)

K/A MATCH ANALYSIS
Requires knowledge of when the SA to IA cross-tie valve is opened.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct, all diesel compressors should already be operating. Opening SA-143 will allow more are to flow from SA to IA.**

B. Incorrect, Should have auto started by 93#.

C. Incorrect, Should have auto started at 95#.

D. Incorrect, AIA compressors do not supply IA header.

Technical Reference(s): **SSS-IA**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SSS-IA R48**

Question Source: **Bank; SSS044802**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

40. Describe the general NLO responsibilities concerning the Service Air System during normal system operations. (R25)

41. Describe the NLO actions for the "Service Air Pressure Low" alarm. (R26)

42. Explain the purpose and operation of the Standby Diesel Air Compressors used at Oconee. (R27)

43. Describe the basic actions that would have to be performed by NLO(s) following a Loss of Instrument Air. (R28)

44. Given a sequence of events, determine if a manual reactor trip would be required. (R44)

45. Explain why the Main Feedwater Pumps must be tripped if the operator manually trips the plant because of a loss of instrument air. (R45)

46. Explain the precaution that must be exercised when an NLO is dispatched to manually open CC-8 because of an IA failure. (R46)

47. Explain why PZR and LDST levels may be affected if IA pressure is lost, and describe the appropriate actions that may be needed to ensure HPIPs integrity. (R47)

48. For an event involving failures in the Instrument Air System, analyze the situation to determine equipment available for recovering instrument air pressure to vital instrumentation and controls. (R48)

49. Explain the basis for the critical action steps of the following NLO JPMs associated with the IA system: (R51)

    48.1 NLO-007, Start the Diesel Air Compressor and Align to the Service Air Header

    48.1 NLO-016, Restore Load Centers and Verify IA Compressor Operation Following Loss of Power

    48.3 NLO-041, Restart the Primary Instrument A/C Following a Trip

50. Without the use of reference, when AP/22 is required to be utilized by the operator be able to demonstrate the following: (R53)

    50.1 State the Entry Conditions and Immediate Manual Actions in the AP.

    50.2 Explain the basis for limits, cautions, notes and major steps in the AP.

    50.3 Based on plant data received, summarize proper operator actions and strategies required in the AP to mitigate the abnormal plant condition.

    50.4 Utilizing available operator controls and instrumentation both inside and outside the control room interpret the indications and take proper actions per the AP that should mitigate the abnormal condition.

5. **(Obj. R24)** Del Tech Filters
   a) Four filter elements on discharge side of SA Air receiver.
   b) Located in Turbine Building basement just east of the IA compressors
   c) Discharge into IA receiver tanks to connect SA system to IA System as backup IA supply.
   d) Filters treat the oil-entrained Service Air to remove remaining oil and moisture for use as high quality Instrument Air.
   e) Color indication of each filter - filter should be isolated and changed prior to red color reaching top of filter - normal filter color is "off-white".
   f) Filters can be manually bypassed during extreme emergencies on the IA System, but it must be recognized that doing so can damage or clog the components in the IA System with oil and/or moisture.
6. **(Obj. R52)** SA to IA Controller (SA-141)
   a) SA to IA Controller (SA-141) valve senses the IA system pressure and opens when IA system falls below 85 psig to allow service air into the IA system. The normal position of the valve is closed to prevent the flow of SA into the IA until SA is needed.
   b) The fail position of SA-141 is open when IA system pressure goes below 85 psig. The pilot valve on SA-141 senses the IA system.
7. Unit 2's AP/22 Enclosure 5.4 (Emergency Start of the diesel Air Compressor) has the operator open SA-143 (SA to IA Controller Bypass) which will allow the SA header to pressurize the IA header to greater than 85 psig.

C. Service Air System Operation
1. Normal System Operation
   a) Air pressure maintained between 105and 115 PSIG.
   b) One compressor in "MAN" and running; other compressor in "STBY" for standby start when service air header pressure drops to 95 PSIG
   c) Check idle compressor oil level periodically
   d) Alternate compressors to equalize run times
2. 3SA-18/E-7 Service Air Pressure Low Statalarm
   a) Located only in Unit 3 Control Room
   b) Actuates at 100 PSIG decreasing service air pressure
   c) Service air compressor in "STBY" should start before pressure drops to the alarm setpoint.

SSS044802

Unit 2 Plant Conditions:

- Reactor power = 100% and steady
- IA header pressure = 85 psig and slowly decreasing
- SA header pressure = 90 psig and decreasing
- All Automatic System Actions have occurred

Which ONE of the following describes an action that would positively assist in regaining IA header pressure? (.25)

A. Open SA-143, SA to IA Controller Bypass.

B. Place all Backup air compressors in BASE.

C. Place the Standby Service air compressor to RUN.

D. Place all three Units' Auxiliary IA compressors to RUN.

A

A. Correct, A diesel compressor should already be operating. Opening SA-143 will allow more are to flow from SA to IA.
B. Incorrect, Should have auto started by 85#.
C. Incorrect, Should have auto started at 95#.
D. Incorrect, AIA compressors do not supply IA header.

1 POINT

Question 61

Which ONE of the following is a function of HPSW-25, (EWST altitude valve)?

A. Automatically closes when the base HPSW pump stops.

B. Maintain HPSW system pressure when tank level drops.

C. Allows continuous HPSW pump operation without EWST overflow.

D. Allows continuous operation of the jockey pump without EWST overflow.

Question 61
T2 /G2 - gcw
086GG2.1.28, Fire Protection

Knowledge of the purpose and function of major system components and controls. (3.2/3.3)

K/A MATCH ANALYSIS
This question requires knowledge of the “altitude Valve”. This is a major component of the HPSW system which provides water for fire protection.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect- Valve does not close on pump operation. Valve closes on tank level which will establish a DP across the valve.

B. Incorrect- When tank level drops to establish the proper DP across the valve, it will supply gravity flow to the HPSW system. Not maintain pressure.

C. Incorrect-The jockey pump is normally running to supply the system base loads. If the HPSW pump is needed it will start on decreasing tank level.

D. Correct- HPSW-25 allows the jockey pump to supply system loads during normal system operation without overflow of the EWST.

Technical Reference(s): **SSS-HPW page 13 of 36**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SSS-HPW R4**

Question Source: **Bank SSS030406**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

TERMINAL OBJECTIVES

1 Upon completion of this lesson plan the student will have an understanding of the functions and operation of the HPSW System during normal and off normal operations. They will also have an understanding of their assigned responsibilities as NLOs during system operations. (T1)

2 Upon completion of this lesson plan the student will be able to explain the operation of the HPSW System during normal and abnormal operations, their assigned responsibilities as ROs/SROs and apply any ITS/SLC Conditions and Required Actions associated with the system. (T2)

ENABLING OBJECTIVES

State the purpose(s) of the HPSW system. (R1)

1 Given a copy of the Oconee Flow Diagram, trace the basic flowpath(s) of the HPSW system and locate the following major components: (R2)

- HPSW pumps
- the common suction source
- the fire main loop and major isolation valves
- Elevated Water Storage Tank and Altitude Valve

2 Describe the major components of the HPSW System listed below: (R4)

- HPSW pumps
- the common suction source
- the fire main loop and major isolation valves
- Elevated Water Storage Tank and Altitude Valve

3 Describe the control function(s) of the HPSW Auto-Initiation Circuit based on changes in the EWST Level. (R5)

4 Identify (9) nine non-fire related functions performed by the HPSW system. (R6)

5 Describe each of the four- (4) sprinkler systems, including the type of sensor, spray header, and method of actuation. (R7)

6 Discuss the operation and testing of the sprinkler supply valves that supply the sprinkler systems for the Turbine Building Basement and Mezzanine and Auxiliary Building Third Floor: (R17)

- State the purpose of the retarding chamber.

3. HPSW-111 (HPSW pump discharge to "B" Header), Manual valve normally locked open.
4. HPSW-451 (Equipment Rm and Cable RM Fire Protection Hdr Supply) isolates the Equipment and Cable Room header and is a normally locked open valve.
    a) Post Indicator Isolation Valves are located throughout the station to isolate individual sprinkler/spray systems for a specific protected zone without degrading the remaining fire main loop.

E. Elevated Water Storage Tank (EWST)

1. Capacity is 100,000 gallons.
2. The EWST serves as the initial source of water should HPSW system demand exceed the Jockey pump.
3. Altitude Valve (HPSW-25)(OC-SSS-HPW-6)
    a) The function of the Altitude Valve is to OPEN allowing water from the EWST to supply various safety-related loads during certain Design Basis events.
    b) Located at the outlet of the Elevated Water Storage Tank (EWST) inside the EWST base, the Altitude Valve remains CLOSED during normal system operation allowing the HPSW Jockey Pump to run continuously maintaining the HPSW system at proper design pressure without overflowing the EWST.
    c) The Altitude Valve is a pilot operated valve, which operates on the DP across the valve. If the pressure on the system side of the Altitude Valve drops 2 psig below the tank side pressure, the pilot will vent water off the main valve chamber. Tank pressure, due to the column of water, opens the main valve and water will flow out of the EWST and into the common fire main.
    d) The altitude valve is totally hydraulic with no electrical controls.
4. Air Bubbler System
    a) The Air Bubbler System measures the level in the EWST, initiates the Auto Initiation Logic Circuit, and provides input signals to associated alarms.
    b) Air is "bubbled up" through the EWST water. The principle of operation being the higher the tank level the more resistance to the Air Bubbler.
    c) Air is supplied to the bubbler system from the Site Assembly horn compressor. If the compressor is removed from service or problems with the compressor occur, this will degrade the Auto Initiation circuit and cause entry into SLC 16.9.1.

SSS030406

Which ONE of the following is correct concerning the operation of HPSW-25, EWST altitude valve? (.25)

A. Automatically closes when the base HPSW pump stops.

B. Maintain HPSW system pressure when tank level drops.

C. Allows continuous HPSW pump operation without EWST overflow.

D. Allows continuous operation of the jockey pump without EWST overflow.

D.

A. Incorrect- Valve does not close on pump operation. Valve closes on tank level which will establish a DP across the valve.
B. Incorrect- When tank level drops to establish the proper DP across the valve, it will supply gravity flow to the HPSW system. Not maintain pressure.
C. Incorrect-The jockey pump is normally running to supply the system base loads. If the HPSW pump is needed it will start on decreasing tank level.
D. Correct- HPSW-25 allows the jockey pump to supply system loads during normal system operation without overflow of the EWST.

1 POINT

Question 62

Unit 1 initial conditions:

- Reactor power = 76%
- Control Rod Group 7 = 78% withdrawn

Current conditions:

- Reactor power = 84%
- Control Rod Group 7 = 85% withdrawn
- Control Rod Group 7 Rod 6 = 78% withdrawn
- ASYMMETRIC FAULT light lit on the Diamond

Based on the above conditions, which ONE of the following describes a possible cause, an affect on the CRD system and a required action?

A. TMR “B” Slice “A” and “C” FAILED
CRD out inhibit at 55% power is in effect
Manually trip the reactor

B. TMR “B” Slice “A” and “C” FAILED
CRD out inhibit at 60% power is in effect
Verify SDM > 1% $\Delta k/k$ within one hour

C. Control Rod Group 7 Rod 6 PG/M Slice “A” and “C” FAILED
CRD out inhibit at 55% power is in effect
Manually trip the reactor

D. Control Rod Group 7 Rod 6 PG/M Slice “A” and “C” FAILED
CRD out inhibit at 60% power is in effect
Verify SDM > 1% $\Delta k/k$ within one hour

Question 62
T2/G2 - gcw

001A2.16, Control Rod Drive System
Ability to (a) predict the impacts of the following malfunction or operations on the CRDS- and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Possible causes of mismatched control rods (3.0/3.8)

K/A MATCH ANALYSIS
Question requires knowledge of possible failure modes of the control rods and procedure requirements for a misaligned control rod.

ANSWER CHOICE ANALYSIS
There exists (2) sets of these TMR modules, each of which can assume control if the other TMR module fails. Each of these processors is redundant to the remaining 2 slices. A loss of 1 of the processor signals will not affect operation of the individual TMR control processor module output to the CRDM(s). The individual TMR control processor module will output only if 2 or all 3 slices are giving a valid output (3, 2 or no output). PG/Ms also operate with 3 slices, such that failure of one slice will not prevent functioning of the PG/M. See drawing on page72.

Answer: D

A. Incorrect, TMR A will still send a signal to the CR. It will not become misaligned. 55% is incorrect but plausible because the ICS runs the unit back to 55% on a misaligned rod. Tripping the reactor would be correct if two or more rods were misaligned.

B. Incorrect, TMR A will still send a signal to the CR. It will not become misaligned. Parts 2 and 3 are correct.

C. Incorrect, first part is correct. 55% is incorrect but plausible because the ICS runs the unit back to 55% on a misaligned rod. Tripping the reactor would be correct if two or more rods were misaligned.

D. Correct, with 2 slices OOS on the PG/Ms it will NOT send a signal to the CR. CRD out inhibit at 60% power will occur due to the misaligned rod. Verification of SDM > 1% $\Delta k/k$ within one hour is required.

Technical Reference(s): **IC-CRI; Pages 69 - 72**
AP/15, Dropped or Misaligned Control Rods

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **IC-CRI R33**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

A. The System Logic Equipment (SLE) is the primary control component of the system. The signals transmitted to this equipment are processed by its logic to produce output signals that control the rod positions and provide system status information as well to the operator.

B. The Motor Control Equipment (MCE) receives command signals from the SLE to energize the Control Rod Drive Mechanism motors in sequence to provide rotation of the rotor.

C. The Operator Control Panel/OCP (DIAMOND CONTROL PANEL) and the Position Indicator Panel (PI Panel) are components used by the operator to control the positioning of the control rods and receive the system and Control Rod position status information.

1. In addition, the ENGINEERING WORK STATION (EWS) allows monitoring, testing, modification of the application software (including patch programming of the Control Rods) to be used by Maintenance and Engineering.

Finally, the OPC Server is a communication device between the TMR Controller(s) and the OAC. The OPC Server provides the Operator Aid Computer (OAC) any data required by the operator.

2.4 System Logic Equipment (SLE)

The new system incorporates a Triple Modular Redundant (TMR) design that provides redundancy in case of failure of various parts. The SLE uses two Triple Modular Redundant (TMR) Controller sets to implement the Logic and Control functions for the CRDMs. Signals transmitted to this equipment are processed by its logic to produce output signals that control the rod positions and provide system status information.

A. In addition, the Relative Position Indication (RPI), and Absolute Position Indication (API) functions are part of the TMR Controller functions.

B. 2 TMR control processor modules (called "P1" and "P2") are required for the CRD system to function. There exists (2) sets of these TMR modules, each of which can assume control if the other TMR module fails - i.e., there are two "P1"s and two "P2"s, and only one of each is required. Each of the independent TMR Processor modules interface with the controls from the ICS and Diamond Control Panel. But, only one of the TMR control module sets is sending an output signal at any one time and the other TMR module is in a standby mode. Furthermore, each individual module has built in redundancy:

1. 3 individual processors (slices) which process field inputs and determine the control output that is used to operate the (CRDMs). Each of these processors is redundant to the remaining 2 slices. A loss of 1 of the processor signals will not affect operation of the individual TMR control processor module output to the CRDM(s). The individual TMR control processor module will output only if 2 or all 3 slices are giving a valid output (3, 2 or no output).

C. Each TMR control processor module set is connected by an 'Ethernet' connection for communication between the (2) TMR Sets. Each TMR Controller set operates the following parameters:

1. TMR Set "**P1**"
   a) Single rod power supplies (SRPS) - CRD movement
   b) Interface to/from the Diamond
   c) Interface to/from the ICS
   d) Relative Position (RPI) from pulse generators
   e) In Limits
   f) Out limits
   g) Reactor Trip Confirm signal
   h) Source Interrupt Device circuitry
   i) Cabinet Temp alarms
2. TMR Set "**P2**"
   a) Zone reference switches (0, 50, 75 & 100)
   b) API-A and B
   c) PI Panel
   d) Voltage Monitoring

D. The Ethernet connection between P1 and P2 which allows the processors to exchange data. If this communication channel is lost then any data that originated in the other processor would freeze at its last known value. At this point the operator would receive a system fault alarm and an OAC alarm (O3SYS201 - DCRDCS PEER TO PEER COMM STATUS SLAVE/O3SYS202 - DCRDCS PEER TO PEER COMM STATUS MASTER). Everything would continue to work as expected except the following:

   a) API indications will continue to work normally, however you cannot switch the PI panel from API to RPI.
   b) RPI would be correct in P1, however it would be unable to transmit this value to P2.
   c) API would be correct in P2, however it would be unable to transmit this value to P1.
   d) Once the rods began to move you would fairly quickly get the API/RPI mismatch alarm since these values cannot be exchanged, however this would not affect operation in either Auto or Manual.
   e) Once the rods moved to an overlap point between groups 5, 6 or 7 you would receive a sequence fault since the system compares between these values to ensure that overlap is occurring at the correct points. This would automatically place the system in manual.

E. Rod movement commands are produced by the TMR Controller by utilizing

1. MANUAL - IN, OUT signals from the Diamond Control Panel
2. JOG and RUN signals from the Diamond Control Panel
3. AUTO IN, AUTO OUT signals from the ICS
4. The rod movement signals from the TMR Controller controls the pulse generator portion of the Pulse Generator/Monitoring Module, which generates the 6-phase trigger signals. These trigger signals are fed to the Single Rod Power Supplies (SRPS), which actually produce the CRDM phase power.

F. **(Obj. R25)** Pulse Generator/Monitors (PG/Ms)- take the input from the TMR Controller and convert that to a pulse signal to the SRPS(s) to provide rotational signal to SCRs for CRDM movement. There is also a monitoring circuit that receives a signal back from the SRPS that confirms the signal has been executed as sent.

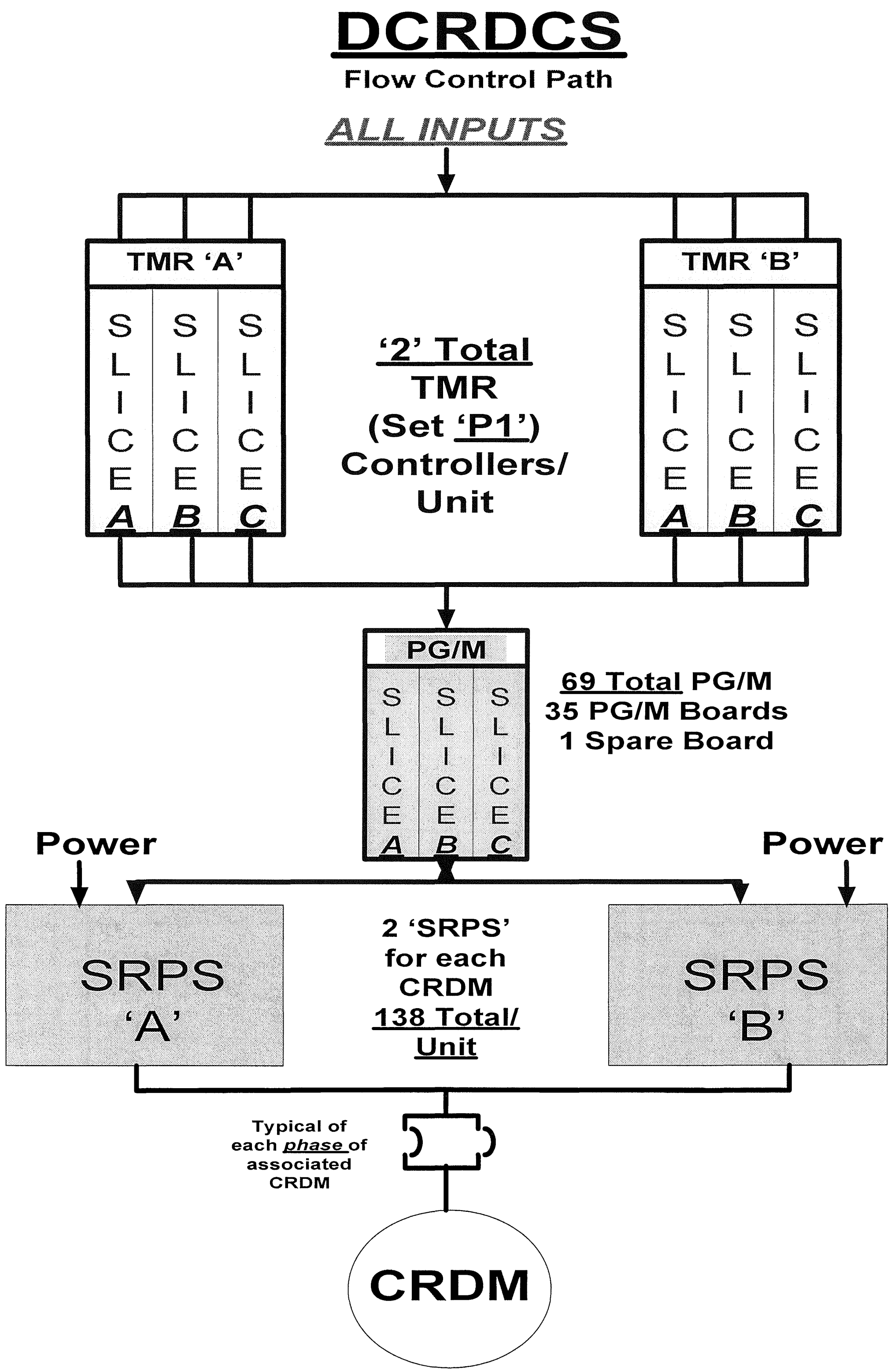
1. PG/Ms also operate with 3 slices, such that failure of one slice will not prevent functioning of the PG/M. The capability exists to swap PG/Ms on-line.
2. Each PG/M generates pulse signals for 2 rods, so that there are a total of 35.

G. It is important that there are never less than two coils of the stator energized at any one time.

1. To cause smooth mechanical rotation, every other time there are three energized coils.
2. If one of these coils or accompanying circuitry were to malfunction, the remaining operating coil would be sufficient to hold the latch arms together against the lead screw and not drop a rod.
   a) If a rod is moving, at least two adjacent coils must be energized to keep the roller nuts engaged or the rod maybe dropped.
3. **(Obj. R5)** If three phases are energized when a control rod stops moving, the rod will step back (INSERT) so that only two phases will be energized to reduce the heat produced in the CRDM.

H. Rod Speed

1. The PG/M - SRPSs can be used to move the rods in or out at JOG (3" per min) or RUN (30" per min) speed.
2. When the Diamond is placed in AUTO it automatically will default to the RUN speed.



2.5 Motor Control Equipment (MCE)

A. **(Obj. R25)** Control Rod Drive Stator Power Supply System

1. The CRD Power System utilizes two (2) separate 600/95 v. 6Φ power supplies to energize the CRD mechanisms

1 POINT

Question 63

Unit 2 initial conditions:

- Time = 0900
- Reactor power = 100%
- 2HP-120 in MANUAL
- PZR level = 220 inches
- Tave = 579.0ºF
- A transient occurs

Current conditions:

- Time = 0905
- Diamond and FDW Master in MANUAL
- Reactor power = 91%
- PZR level = 263 inches
- Tave = 585.2ºF

Based on the above conditions, which ONE of the following describes a required operator action and why?

A. Trip the reactor to prevent exceeding the maximum PZR level of 285 inches.

B. Trip the reactor to prevent operating without a steam bubble in the PZR.

C. Reduce PZR level to prevent exceeding RCS pressure design limits in a subsequent accident.

D. Reduce PZR level to ensure water relief through the PORV does not occur during design accidents.

Question 63
T2 /G2 - gcw

011A1.04, Pressurizer Level Control System **Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PZR Level Control System controls including: Tave** (3.1/3.3)

K/A MATCH ANALYSIS
Requires knowledge how Tave will affect PZR level, level limits and how the Pressurizer Level Control system will be used to prevent exceeding design limits.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect, a reactor trip would be required if PZR level were above 375". 285' is the TS level limit but the reactor would not be tripped until 375".

B. Incorrect, a reactor trip would be required if PZR level were above 375". Tripping the reactor is performed to prevent being solid at power.

C. Correct, an increase in Tave ahs caused PZR level to increase. PZR level must be reduce to less than 260 to preclude exceeding RCS pressure design limits in a subsequent accident.

D. Incorrect, reducing level is correct. The reason is incorrect. Although water relief through the PORV is a concern it is not the reason the PZR level limit.

Technical Reference(s): **TS 3.4.9 and Bases**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **None**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.9 Pressurizer

BASES

BACKGROUND

The pressurizer provides a point in the RCS where liquid and vapor are maintained in equilibrium under saturated conditions for pressure control purposes to prevent bulk boiling in the remainder of the RCS. Key functions include maintaining required primary system pressure during steady state operation and limiting the pressure changes caused by reactor coolant thermal expansion and contraction during normal load transients.

The pressure control components addressed by this LCO include the pressurizer water level, the required heaters, and their controls and emergency power supplies. Pressurizer safety valves are addressed by LCO 3.4.10, "Pressurizer Safety Valves."

The maximum water level limit has been established to ensure that a liquid to vapor interface exists to permit RCS pressure control during normal operation and proper pressure response for anticipated design basis transients. The water level limit thus serves two purposes:

a. Pressure control during normal operation maintains subcooled reactor coolant in the loops and thus is in the preferred state for heat transport; and

b. By restricting the level to a maximum, expected transient reactor coolant volume increases (pressurizer insurge) will not cause excessive level changes that could result in degraded ability for pressure control.

The maximum water level limit permits pressure control equipment to function as designed. The limit preserves the steam space during normal operation, thus both spray and heaters can operate to maintain the design operating pressure. If the level limits were exceeded prior to a transient that creates a large pressurizer insurge volume, the maximum RCS pressure might exceed the design Safety Limit (SL) of 2750 psig.

The pressurizer heaters are used to maintain a pressure in the RCS so reactor coolant in the loops is subcooled and thus in the preferred state for heat transport to the steam generators (SGs). This function must be

BASES

BACKGROUND (continued)

maintained with a loss of offsite power. Consequently, the emphasis of this LCO is to ensure that the essential power supplies and the associated heaters are adequate to maintain pressure for RCS loop subcooling with an extended loss of offsite power.

A minimum required available capacity of 400 kW ensures that the RCS pressure can be maintained. Unless adequate heater capacity is available, reactor coolant subcooling cannot be maintained indefinitely. Inability to control the system pressure and maintain subcooling under conditions of natural circulation flow in the primary system could lead to loss of single phase natural circulation and decreased capability to remove core decay heat.

The 400 kW of heater capacity exceeds the capacity required to be powered by the Standby Shutdown Facility (SSF) per the Technical Specification 3.10.1 BASES. The 400 kW limit is not unit specific and was conservatively established to bound future increases in pressurizer ambient heat loss.

APPLICABLE SAFETY ANALYSES

In MODES 1, 2, and 3 with the RCS temperature > 325°F, the LCO requirement for a steam bubble is reflected implicitly in the accident analyses. No associated safety analyses are performed in lower MODES. All analyses performed from a critical reactor condition assume the existence of a steam bubble and saturated conditions in the pressurizer. In making this assumption, the analyses neglect the small fraction of noncondensible gases normally present.

Safety analyses presented in the UFSAR do not take credit for pressurizer heater operation; however, an implicit initial condition assumption of the safety analyses is that the RCS is operating at normal pressure.

The maximum level limit is of prime interest for the startup accident and Loss of Main Feedwater (LOMFW) event. Conservative safety analyses assumptions for the startup accident indicate that it produces the largest increase of pressurizer level caused by an analyzed event. Thus this event has been selected to establish the pressurizer water level limit. For pressurizer levels > than 285 inches, the LOMFW event may be more limiting.

Evaluations performed for the design basis large break loss of coolant accident (LOCA), which assumed a higher maximum level than assumed for the startup accident, have been made. The higher pressurizer level

BASES

APPLICABLE SAFETY ANALYSES (continued)

assumed for the LOCA is the basis for the volume of reactor coolant released to the containment. The containment analysis performed using the mass and energy release demonstrated that the maximum resulting containment pressure was within design limits.

The requirement for emergency power supplies is based on NUREG-0737 (Ref. 2). The intent is to allow maintaining the reactor coolant in a subcooled condition with natural circulation at hot, high pressure conditions for an undefined, but extended, time period after a loss of offsite power. While loss of offsite power is an initial condition or coincident event assumed in many accident analyses, maintaining hot, high pressure conditions over an extended time period is not evaluated as part of UFSAR accident analyses.

The maximum pressurizer water level limit satisfies Criterion 2 of 10 CFR 50.36 (Ref. 1). Although the heaters are not specifically used in accident analysis, the need to maintain subcooling in the long term during loss of offsite power, as indicated in NUREG-0737 (Ref. 2), is the reason for providing an LCO.

LCO

The LCO requirement for the pressurizer to be OPERABLE with a water level ≤ 285 inches ensures that a steam bubble exists. Limiting the maximum operating water level preserves the steam space for pressure control. The LCO has been established to ensure the capability to establish and maintain pressure control for steady state operation and to minimize the consequences of potential overpressure transients. Requiring the presence of a steam bubble is also consistent with analytical assumptions.

The LCO requires a minimum of 400 kW of pressurizer heaters OPERABLE and capable of being powered from an emergency power supply. As such, the LCO addresses both the heaters and the power supplies. The minimum heater capacity required is sufficient to maintain the system near normal operating pressure when accounting for heat losses through the pressurizer insulation. By maintaining the pressure near the operating conditions, a wide margin to subcooling can be obtained in the loops. The design value of 400 kW will require the use of twenty-nine heaters rated at 14 kW (nominal) each. The amount needed to maintain pressure is dependent on the insulation losses, which can vary due to tightness of fit and condition.

BASES

APPLICABILITY

The need for pressure control is most pertinent when core heat can cause the greatest effect on RCS temperature, resulting in the greatest effect on pressurizer level and RCS pressure control. Thus Applicability has been designated for MODES 1 and 2. The Applicability is also provided for MODE 3 with RCS temperature > 325°F. The purpose is to prevent solid water RCS operation during heatup and cooldown to avoid rapid pressure rises caused by normal operational perturbations, such as reactor coolant pump startup. The temperature of 325°F has been designated as the cutoff for applicability because LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," provides a requirement for pressurizer level ≤ 325°F. The LCO does not apply in MODE 4, 5 or 6 since either pressurizer level is under the control of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," or the RCS is open to the containment atmosphere.

In MODES 1, 2, and 3, there is the need to maintain the availability of pressurizer heaters capable of being powered from an emergency power supply. In the event of a loss of offsite power, the initial conditions of these MODES give the greatest demand for maintaining the RCS in a hot pressurized condition with loop subcooling for an extended period. For MODE 4, 5, or 6, it is not necessary to control pressure (by heaters) to ensure loop subcooling for heat transfer when the Decay Heat Removal loops are in service, and therefore the LCO is not applicable.

ACTIONS

A.1

With pressurizer water level in excess of the maximum limit, action must be taken to restore pressurizer operation to within the bounds assumed in the analysis. This is done by restoring the pressurizer water level to within the limit.

The 1 hour Completion Time is considered to be a reasonable time for draining excess liquid.

B.1 and B.2

If the water level cannot be restored, reducing core power constrains heat input effects that drive pressurizer insurge that could result from an anticipated transient. By shutting down the reactor and reducing reactor coolant temperature to at least MODE 3 with RCS temperature ≤ 325°F, the potential thermal energy of the reactor coolant mass for LOCA mass and energy releases is reduced.

BASES

ACTIONS (continued)

Twelve hours is a reasonable time based upon operating experience to reach MODE 3 from full power without challenging unit systems and operators. Further pressure and temperature reduction to MODE 3 with RCS temperature ≤ 325°F places the unit into a MODE where the LCO is not applicable. The 18 hour Completion Time to reach the nonapplicable MODE is reasonable based upon operating experience.

C.1

If the power supplies to the heaters are not capable of providing 400 kW, or the pressurizer heaters are inoperable, restoration is required in 72 hours. The Completion Time of 72 hours is reasonable considering the anticipation that a demand will not occur in this period.

D.1 and D.2

If pressurizer heater capability cannot be restored within the allowed Completion Time of Required Action C.1, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to MODE 3 within 12 hours and to MODE 3 with RCS temperature ≤ 325°F within the following 6 hours. The Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. Similarly, the Completion Time of 18 hours to be in MODE 3 with RCS temperature ≤ 325°F is reasonable based on operating experience to achieve power reduction from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.4.9.1

This SR requires that during steady state operation, pressurizer water level is maintained below the nominal upper limit to provide a minimum space for a steam bubble. The Surveillance is performed by observing the indicated level. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess the level for any deviation and verify that operation is within safety analyses assumptions. Alarms are also available for early detection of abnormal level indications.

SR 3.4.9.2

The SR verifies the power supplies are capable of producing the minimum power and the associated pressurizer heaters are at their design rating. (This may be done by testing the power supply output and heater current, BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)	or by performing an electrical check on heater element continuity and resistance.) The Frequency of 18 months is considered adequate to detect heater degradation and has been shown by operating experience to be acceptable.
REFERENCES	1. 10 CFR 50.36. 2. NUREG-0737, November 1980.

1 POINT

Question 64

Unit 1 initial conditions:

- Time = 1000
- Reactor power = 100% for several months
- EFPD = 250
- Group 7 CRD position = 93%
- Spare IX placed in service

Current conditions:

- Time = 1030
- Reactor power = 100%
- Group 7 CRD position = 82%

Based on the above conditions, what will axial power imbalance do over the next 6 hours with no operator action and what procedure provides directions on the use of Group 8 rods to control imbalance?

A. Become more negative / AP/3 (Boron Dilution)

B. Become more positive / AP/3 (Boron Dilution)

C. Become more negative / Operation at Power

D. Become more positive / Operation at Power

Question 64
T2 /G2 - kds

015A2.03, Nuclear Instrumentation System **Ability to (a) predict the impacts of the following malfunctions or operations on the NIS; and (b based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Xenon oscillations** (3.2/3.5*)

K/A MATCH ANALYSIS
Question requires knowledge of the effects of Xenon Oscillations on NIs (including imbalance) and how procedures use control rod group 8 to compensate.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: Gp 7 control rods are not used for Xe oscillations at ONS. Plausible because withdrawing Gp 7 control rods would reduce the negative imbalance.

B. Incorrect: For the first ~ 12 hours after the control rod movement, power will be shifting towards the bottom of the core. Plausible because if power imbalance were shifting towards the top, inserting Gp 7 control rods would mitigate the flux shift.

C. Correct: After a control rod insertion following long periods of operation at a constant power, neutron flux (power) will shift towards the bottom of the core causing a negative power imbalance. Over the next 12 hours the higher flux in the bottom of the core will remove Xenon by neutron absorption causing an even more negative power imbalance. As the Xenon transient continues, Xe will build in the bottom of the core while decaying in the top of the core. In the time period of 12-24 hours after the control rod movement, power imbalance will from negative to positive.

D. Incorrect: For the first ~ 12 hours after the control rod movement, power will be shifting towards the bottom of the core. Plausible because if power imbalance were shifting towards the top, this answer would be correct.

Technical Reference(s): **GFES**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **CP-012 R7**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

5. Concerning the power reduction section of the procedure: (R4)

   5.1 State the general purpose of the enclosure.

   5.2 State the reason for placing secured HWPs and CBPs to AUTO.

   5.3 State the correct position of the Unit 1 LOCA Load Shed "DEFEAT" switches after securing CBPs or HWPs.

6. State the basis for applicable instructions given when operating with fewer than four (4) RCP's. (R5)

7. Concerning the section for APSR withdrawal: (R7)

   7.1 Describe the Initial Conditions for using the enclosure

   7.2 Describe the basic procedure steps to withdraw Group 8 and understand the reason for hold periods following a "pull".

8. Describe the use of the ΔTc controller for controlling Reactor Power Tilt. (R12)

9. Given a copy of TS / SLCs and associated Bases, analyze a given set of plant conditions for applicable ITS / SLC LCO's. (R9)

10. Apply all TS / SLC rules to determine applicable Conditions and Required Actions for a given set of plant conditions. (R10)

11. Compute the maximum Completion Time allowed for all applicable Required Actions to ensure compliance with TS / SLCs. (R11)

2.10Operation of Group 8 to Control Rx Power Imbalance

A. Initial Conditions include that Group 8 is at 0-50% withdrawn.

1. Procedure

a) Use any available axial imbalance display to help ensure Group 8 will be moved into the higher neutron flux region.

b) If axial imbalance is positive, withdrawing Group 8 should make imbalance less positive.

c) If axial imbalance is negative, inserting Group 8 should make imbalance less negative.

If Diamond is in AUTO then the group selector switch will enable movement of Group 8 via the joyswitch. Group 7 will move as necessary to maintain temperature.

For all three units, if the Diamond panels are in manual then the controlling group will not respond automatically to temperature changes.

For the Unit 1 CRI system, if the Diamond is in Manual, then APSR movement will require selection of Group 8 on the Group selector switch and the additional selection of Sequence override via the pushbutton.

---

d) Insert or withdraw Group 8 in 5% increments.

e) Observe imbalance for at least 5 minutes after each movement to determine if movement had anticipated effect.

f) Do NOT withdraw Group 8 beyond 50% withdrawn. Further withdrawal will cause axial imbalance to become more positive.

g) **WHEN** axial imbalance has returned to the desired range, return Group 8 to 35% withdrawn.

As Rx power operation continues, it is expected that axial imbalance will continue toward 0% without further Group 8 rod movement

h) Insert or withdraw in 5% increments.

i) Observe imbalance for at least 5 minutes after each movement to determine if movement had anticipated effect.

1 POINT

Question 65

Unit 3 plant conditions:

- Reactor power = 100%
- RC pressure = 2150 psig and steady
- 3KVIB AC Vital Power Panel board supply breaker trips OPEN
- ES Analog Channel "C" WR RCS pressure signal fails LOW

Based on the above conditions, which ONE of the following correctly describes the ES Channels that will actuate?

ANALOG CHANNEL(S)	/	DIGITAL CHANNELS
A. B	/	1 thru 4
B. C	/	1 thru 4
C. B and C	/	2 and 4
D. B and C	/	1 and 3

Question 65
T2 /G2 - gcw

016K3.07, Non-nuclear Instrumentation **Knowledge of the effect that a loss or malfunction of the NNIS will have on the following: ECCS** (3.6*/3.7*)

K/A MATCH ANALYSIS

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect: "B" and "C" ANALOG will trip. Attempt to trip Digital Channels 1 thru 4 on low RCS pressure < 1500/<550 psig. However, Channel 2 and 4 will not trip as KVIB is de-energized. See "D".

B. Incorrect: "C" ANALOG will trip. Digital channels (1-4) will not trip/actuate. EVEN channels 2 and 4 will not actuate. See "D".

C. Incorrect: See "D" EVEN Digital channels will not actuate as KVIB powers the EVEN channels which require power to actuate.

D. **Correct: KVIB feeds "B" ANALOG ES channel which will trip/actuate upon loss of power. KVIB also powers the EVEN (2 and 4) Digital ES channels which require power to trip/actuate. Channels 1-4 receive an actuation signal from low RCS pressure from "C" ANALOG and loss of power to "B" ANALOG. ONLY the ODD (1 and 3) Digital channels will trip/actuate.**

Technical Reference(s): **IC-ES**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **IC-ES R12**

Question Source: **Bank IC031213**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

12. Predict the response of ES analog and digital channels following a loss of power to: (R12)

    12.1 Analog channels

    12.2 Digital channels

    12.3 Analog and Digital channels simultaneously

13. Explain the actions necessary to manually trip and/or reset an analog or digital ESG channel. (R13)

14. Predict the emergency operation of the ESG analog and digital channels in response to a LOCA that results in RCS pressure gradually decreasing to ≈100 psig accompanied by a gradual increase in Reactor Building pressure to ≈15 psig. (R14)

15. Discuss the proper operation of all RZ Module controls and indications located on a unit's vertical control board in the Control Room. (R15)

16. Discuss and properly apply the guidance associated with repositioning ES equipment following an ES actuation. (R16)

17. Describe the actions necessary to properly return HPI pumps, Reactor Building Cooling Units and Keowee Hydro Units to normal operation following ES actuation. (R17)

2) Limit pressurization transient

3) Insure cooling water restored to necessary components - RCPs, CRDMs

4) Limit chemical spray hazard to RB equipment

c) Operator must determine cause and correct problem with ESG system insuring required Tech Specs are met.

d) Possible causes of inadvertent actuation of ESG include:

1) Pressure Instrument failure while testing another Analog channel could result in ES actuation. (Example: while testing Channel 'A' Analog, RCS WR to Channel B fails low.)

2) Loss of power on (or from) vital busses **(OBJ. R12)**

Refer to OC-IC-ES-2

(a) Loss of power to an analog channel results in a trip signal being sent from that channel. (Only the outputs supplied from bistables - HPI, LPI and NR RB pressures; therefore, RBS will not actuate as a result of a vital power failure.)

(b) Digital channels must have power to actuate their associated safeguards action.

(c) KVIA Bkr #2 feeds Analog Ch A & Odd Dig Chnls

KVIB Bkr #2 feeds Analog Ch B & Even Dig Chnls

KVIC Bkr #2 feeds Analog Ch C

(d) Loss of KVIA and KVIC - Analog channels A & C send trip signal to digital channels 1-6. Only even channels 2, 4, and 6 actuate (KVIB powered) channels 7 and 8 do not receive a trip signal on a loss of analog channel power.

(e) Loss of KVIB and KVIC - Analog channels B and C send trip signal to digital channels 1-6. Only odd channels 1, 3, and 5 actuate (KVIA powered).

(f) Loss of KVIA and KVIB - Analog channels A and B send trip signal but no power available for digital channels - no actuation.

3. Manual Trip and Reset of ES Channels **(OBJ. R13)**

a) Analog channels

IC031213

Unit 3 plant conditions:

- Reactor trip from 100% power
- RC pressure = 2150 psig and steady
- 3KVIB AC Vital Power Panel board supply breaker trips OPEN
- ES Analog Channel "C" WR RCS pressure signal fails LOW

Which ONE of the following correctly describes the ES Channels that will actuate? (.25)

ANALOG CHANNELS	/	DIGITAL CHANNELS
A. B	/	1 thru 4
B. C	/	1 thru 4
C. B and C	/	2 and 4
D. B and C	/	1 and 3

D

A. Incorrect: "B" and "C" ANALOG will trip. Attempt to trip Digital Channels 1 thru 4 on low RCS pressure < 1500/<550 psig. However, Channel 2 and 4 will not trip as KVIB is de-energized. See "D".

B. Incorrect: "C" ANALOG will trip. Digital channels (1-4) will not trip/actuate. EVEN channels 2 and 4 will not actuate. See "D".

C. Incorrect: See "D" EVEN Digital channels will not actuate as KVIB powers the EVEN channels which require power to actuate.

D. Correct: KVIB feeds "B" ANALOG ES channel which will trip/actuate upon loss of power. KVIB also powers the EVEN (2 and 4) Digital ES channels which require power to trip/actuate. Channels 1-4 receive an actuation signal from low RCS pressure from "C" ANALOG and loss of power to "B" ANALOG. ONLY the ODD (1 and 3) Digital channels will trip/actuate.

1 POINT

Question 66

Unit 3 initial conditions:

- Reactor Power = 100%

Current conditions:

- Reactor Power = 98% decreasing slowly
- Feedwater flow is decreasing
- Control Rods are inserting
- Turbine Bypass Valves are full open
- Turbine Control Valves are full open

Based on current conditions, which ONE of the following has occurred and what corrective actions should be taken to stabilize the plant?

A. EHC malfunction causing the turbine to pickup electrical load
Take Reactor Diamond, Feedwater Loop Masters, Turbine Master to HAND

B. NI flux input to the ICS has failed high
Take Reactor Diamond, Feedwater Loop Masters to HAND

C. Controlling Turbine Header pressure input to the ICS has failed high
Take Reactor Diamond, Feedwater Loop Masters, Turbine Master to HAND

D. Controlling NR RCS pressure input to the ICS has failed high
Take Reactor Diamond, Feedwater Loop Masters, Turbine Master to HAND

Question 66
T 3 - kds

G2.1.7 **Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.** (3.7/4.4)

K/A MATCH ANALYSIS
Question requires knowledge of plant performance due to instrument malfunction and the appropriate actions to stabilize the plant.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: EHC movement will cause ICS to Track MWe which will cause feedwater and control rods to increase to match MWe. Plausible because actions for this malfunction are correct.

B. Incorrect: NI failing will not cause the Turbine Bypass Valves to Open. Plausible because actions for this malfunction are correct.

C. Correct: When the turbine header pressure instrument fails high, the error signal goes to the Turbine Control valves causing them to open fully, The Turbine Bypass valves which will open fully (setpt + 50 psig), Feedwater summer circuit causing feedwater to reduce and the Reactor summer circuit causing control rods to insert. Actions to stabilize the plant are to take the Reactor Diamond, Feedwater Loop Masters and the Turbine Master to HAND.

D. Incorrect: NR RCS pressure failure will not cause Turbine Bypass Valves to open. Plausible because actions for ICS are correct for this malfunction.

Technical Reference(s): **SAEL033**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **SAEL033 R1**

Question Source: **Bank DB_NRC084**

Question History: Last NRC Exam: **Davis Besse 1984 Exam**

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

1.0 OBJECTIVES:

Terminal:

1.1 Upon successful completion of this exercise, the student will be able to correctly identify and diagnose the Turbine Header Pressure signal failure. Additionally, using proper team skills, communications, and human performance techniques, the student will be able to perform the respective RO/SRO actions to respond to and mitigate the effects of the plant transient associated with the instrument failure in accordance with plant transient & abnormal response procedures. (T1)

Enabling:

1.2 **EXPLAIN** the effect on the plant from the failure of the Turbine Header Pressure (THP) signal to ICS. (R1)

A. Affect on ICS

1. Feedwater demand signals
2. Reactor demand signal

B. Affect on RCS temperature and pressure

1.3 After the ICS instrument/signal failure has occurred, **PERFORM** Plant Transient Response IAW SOMP 1-2, Reactivity Management. (R2)

1.4 **DIAGNOSE** that the Turbine Header Pressure signal to ICS has failed HIGH (1090 psig) from 100% power by: (R3)

A. THP Recorder fails to 1090 psig

B. Turbine Bypass Valves (TBVs) open – OAC alarm

C. ICS to TRACK

1.5 **DIAGNOSE** that the Turbine Header Pressure signal to ICS has failed LOW from 100% power by: (R4)

A. THP Recorder fails to 600 psig.

B. OAC alarm – 1A & 1B TURB HDR PRESS LO-LO 600 psig

C. 'By Reactor' Load Limit light illuminated on the Load Control Panel

1.6 After the unit has been stabilized **PERFORM** required actions of AP/28, ICS Instrument Failure. (R5)

1.7 While acting as the CR SRO, **SUPERVISE** the crew while responding to an ICS instrument failure in accordance with abnormal response procedures by: (R6)

A. Evaluating abnormal system operating parameters

B. Independently verifying proper corrective actions are taken

Instr Note:	***This malfunction emulates an open circuit downstream of the median selected THP signal.***

7.4 After the crew has assumed the shift, **ACTIVATE Timer 01** to insert the following malfunction to cause the HIGH failure of the THP signal:

A. **MCS 001 (Selected MS THP Fails HIGH – 1090 psig)**

7.5 After key parameters have responded, **FREEZE** the simulator, and identify the changes in key indications & affected components for the initial plant response.

Instr Note:	***Depending on the value of MTC and the response of the FDW controls to the negative THP error signal plus the Low Tave error signal, NI power will initially increase and may trip on High NI Flux within ≈ 25 seconds.***

7.6 **Plant Response**

A. *Indication*

1. THP Recorder fails to 1090 psig
2. Turbine Bypass Valves (TBVs) open – OAC alarm
3. Main Turbine Control Valves (MT CVs) open
4. 1SA-2/A12, ICS TRACKING (By Turbine – MT CVs fully open)
5. NI power increases initially then decreases as feedwater decreases
6. Main Generator MWe decrease as actual steam pressure decreases
7. Statalarm 1SA-2/A9, MS PRESSURE HIGH/**LOW**
8. Statalarm 1SA-8/A2, FDW PUMP DISCH PRESS LOW (OAC also)
9. Statalarm 1SA-2/C3, RC PRESSURIZER LEVEL HIGH/**LOW**
10. Statalarm 1SA-2/D3, RC PRESS HIGH/**LOW**
11. Statalarm 1SA-2/B4, RC AVERAGE TEMP HIGH/**LOW**

Instr Note:	***The TBVs open at THP setpoint +50 psig and will not re-close as the Turbine Master remains in AUTO.***

B. *ICS Response*

1. Once THP fails HIGH, all TBVs open and MWe output decreases.

2. All four (4) Main Turbine Control Valves fully open in an attempt to return the failed (1090 psig) THP signal back to 885 psig.

3. Once all four (4) Main Turbine Control Valves fully open, ICS goes to TRACK 'By Turbine' and power begins to decrease as MWe are decreasing due to actual Main Steam header pressure decreasing due to the TBVs being open. ICS tracks generated MWe (MWe becomes front end demand to the reactor, generator, and FDW).

4. With a negative (-) 205 psid THP error signal, the Feedwater & Reactor subsystem demands are further modified down (limited by max error) which further reduces steam pressure.

5. As actual Main Steam header pressure continues to decrease, the following occurs with no operator action:

   a. Main FDWP discharge pressure decreases to maintain Main FDW Control Valve ΔP.

   b. The anticipatory trip circuit (ATWS/AMSAC) trips the main turbine due to low FDWP discharge pressure and starts the MD & TD EFWPs.

   c. From 100% power, a reactor trip will occur in ≈ 1 min 45 sec from the initiation of the failure with no operator action.

   d. TBVs throttle to maintain SG pressure @ 1010 psig after the trip.

Instr Note:	***For more information on the plant response and transient mitigation for the THP failure, refer to Section 9.0 of this Exercise Guide.***

DB_NRC084

The following transient is occurring on Unit Three from 100% power:

- Feedwater flow is decreasing
- Control Rods are inserting
- Turbine control valves are full open
- Turbine Bypass Valves have opened fully but are now closed.
- ICS Tracking statalarm is locked into alarm.

Which ONE of the following failures is the cause of the transient? (.25)

A) OTSG outlet pressure to TBVs has failed high.

B) NI flux input to the ICS has failed high.

C) Turbine Header pressure input to the ICS has failed high.

D) RCS pressure input to the ICS has failed high.

C

1 POINT

Question 67

You are the Unit One OATC and have just been selected to participate in an unannounced drug-screening test. You have been directed to turn over to another RO.

Which ONE of the following is correct per OMP 2-1 (Duties and Responsibilities of On-Shit Operations Personnel)?

If the relief has…

A. NOT previously performed turnover requirements on Unit 1, then he must perform a complete formal shift turnover per OMP 2-16 (Shift Turnover).

B. previously worked on Unit 1 and has been in the control room continuously on Unit 2 since shift turnover, he may relieve the OATC temporarily without any additional actions.

C. previously worked on Unit 1 and is currently signed into the Unit Log as an RO, only an additional entry in the Unit Log documenting the transfer of the RO function is required.

D. NOT previously performed shift turnover requirements on Unit 1, he must, as a MINIMUM walkdown the control room panels with the off-going RO. Discuss evolutions in progress, and notify the CR SRO.

Question 67
T3 - gcw

G2.1.1 **Knowledge of conduct of operations requirements.** (3.7/3.8)

K/A MATCH ANALYSIS
Question requires knowledge of shift turnover requirements.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct, OMP 2-1 allows for an abbreviated turnover only if the RO has received a formal turnover on the unit.**

B. Incorrect, an abbreviated turnover is still required.

C. Incorrect, an abbreviated turnover is required.

D. Incorrect, a complete formal shift turnover per OMP 2-16 (Shift Turnover) is required.

Technical Reference(s): **OMP 2-1 (Duties and Responsibilities of On-Shit Operations Personnel)**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **ADM-OMP R5**

Question Source: **Bank ADM040502**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

1.14 OMP 2-1, Duties and Responsibilities of On-Shift Operations Personnel **(R5)**

A. Explain who is allowed to manipulate facility (reactor) controls.

B. Roles and responsibilities of the OSM

C. Responsibilities of the Control Room SRO

D. Responsibilities of Reactivity Management Control Room SRO (RM CR SRO)

E. Responsibilities of the Plant SRO

F. Responsibilities of the Reactor Operators

G. Responsibilities of non-licensed operators

H. Responsibilities of Refueling SRO and RB SRO

I. Normal lines of communication and shift organization during plant operation

J. Required boundaries within the control room to ensure the controls are adequately monitored by the operator

K. Shift Staffing Requirements

1.15 OMP 2-2, Unit Log **(R24)**

A. Maintain the Unit Log in a manner that documents the shift activities, accomplishments and problems.

B. Discuss priority of log keeping vs controlling and monitoring the plant.

C. State who normally makes entries into the unit logs.

D. Discuss types of information required to be entered into the unit logs.

E. State who has overall responsibility for the unit AUTOLOG.

F. Describe the process for making corrections to AUTOLOG and who can make these corrections.

G. State which unit's AUTOLOG contains the following Sub-logs:

1. Auxiliary boiler Sub-Log
2. Diesel Air Compressor Sub-Log
3. SSF Diesel Generator Sub-Log

H. State how long logs are retained relating to Demineralizers

I. Describe which logs are the official records Operations uses for information reported to DHEC on a monthly basis.

1.16 OMP 2-14, Operations Test Group Use of Blue Tags **(R29)**

1.17 OMP 2-16, Shift Turnover **(R33)**

A. Describe when shift turnover may be delayed and who determines the need for delayed turnover.

B. Describe types of evolutions which need special emphasis during turnover.

6. If OAC points are available, a trend with all affected points shall be used to monitor the progression of all evolutions. The trend shall be updated to reflect the current status (level) of the evolution as well as the final status (level) of the affected parameters. Potential interaction with other systems shall be included on the trend in order to help identify unexpected results. If more than one unit is involved, all affected units shall utilize trends as an aid for ensuring the expected results.{14}

   Example: A BHUT Make up to SFP

   Parameters to trend: A BHUT, B BHUT, CBAST, LDST, BWST, Waste Trend.

7. Report significant plant changes, unsafe trends, or unsafe conditions to the Control Room SRO.
8. As one reactor operator becomes involved in an evolution, the other reactor operator shall maintain a sense of separation to ensure plant monitoring is not compromised.
9. Maintain control of non-licensed personnel performing unit operations as part of a designated formal training program as a licensed operator and completing on-the-job training.
10. An abbreviated turnover between reactor operators who have previously received a formal turnover on the associated unit may occur with permission from the Control Room SRO and should include the following as a minimum:
    - Reactor power level and reactivity changes in progress
    - Control rod positions and expected changes
    - RCS temperature and operating band
    - Reactor pressure and operating band
    - Main generator load (Mwe)
    - Plant evolutions in progress
    - The Control Room SRO is notified once the turnover is complete
11. Conduct a control board walk down frequently to ensure the following:
    - Verify all controls and corresponding indications agree to ensure valve/equipment status matches the demand signals and plant conditions
    - Verify all lights are checked and bulbs replaced as needed
    - Verify readings on all gauges, meters, and chart recorders
    - Verify proper operation of control room equipment (e.g., printers, RIA, chart recorders, etc.)

ADM040502

You are the Unit One OATC and have just been selected to participate in an unannounced drug-screening test. You have been directed to turn over to another RO.

Which ONE of the following is correct per OMP 2-1 (Duties and Responsibilities of On-Shit Operations Personnel)? (.25)

If the relief has...

A) NOT previously performed turnover requirements on Unit 1, then he must perform a complete formal shift turnover per OMP 2-16 (Shift Turnover).

B) previously worked on Unit 1 and has been in the control room continuously on Unit 2 since shift turnover, he may relieve the OATC temporarily without any additional actions.

C) previously worked on Unit 1 and is currently signed into the Unit Log as an RO, only an additional entry in the Unit Log documenting the transfer of the RO function is required.

D) NOT previously performed shift turnover requirements on Unit 1, he must, as a MINIMUM walkdown the control room panels with the off-going RO. Discuss evaluations in progress, and notify the CR SRO.

A
OMP 2-1 allows for an abbreviated turnover only if the RO has received a formal turnover on the unit.

1 POINT

Question 68

Unit 2 plant conditions:

- Reactor power = 97%
- "C" RPS Channel is in manual bypass
- "D" RPS Reactor Building (RB) pressure transmitter fails LOW

Based on the above conditions, which ONE of the following describes the required action(s) per TS and the status of the "D" RPS RB pressure function after the action(s) have been taken?

Trip the "D" RPS channel _____ and the "D" RPS RB pressure function is _____.

A. immediately / operable

B. immediately / inoperable

C. within 1 hour / operable

D. within 1 hour / inoperable

Question 68
T3 - gcw

G2.1.11
Knowledge of less than one hour technical specification action statements for systems. (3.0/3.8)

K/A MATCH ANALYSIS
Requires knowledge of a 1 hour TS action statement.

ANSWER CHOICE ANALYSIS
Answer: D

A. Incorrect, tripping the channel immediately is not required by the TS. Per the TS bases the function with the failed instrument is still inoperable after the channel is tripped.

B. Incorrect, tripping the channel immediately is not required by the TS. Second part is correct.

C. Incorrect, first part is correct. Second part is incorrect.

D. Correct, per TS 3.3.1 if one required channel is inoperable the channel must be tripped in 1 hour. Per the TS bases the function with the failed instrument is still inoperable after the channel is tripped.

Technical Reference(s): **TS 3.3.22**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **ADM-TSS R4**

Question Source: **Bank ADM160409**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

OBJECTIVES

TERMINAL OBJECTIVES

1. Analyze a given set of plant conditions for applicable LCO's and commitments; apply rules to determine applicable Conditions and Required Actions for the given plant conditions and compute the maximum Completion Time allowed for each Required Action to ensure compliance with Tech Spec's and SLC's.

ENABLING OBJECTIVES

1. Analyze plant conditions to determine any applicable TS or SLC Conditions, Actions, and/or Completion Times. (R1)

2. Apply the rules of Section 3.0 of Technical Specification to determine appropriate actions for a given set of plant conditions. (R2)

3. Know Tech Spec and SLC Action Statements with Completion Times $\leq$ 1 hour. (R4)

4. Know the bases in Tech Spec's and SLC's for all Limiting Conditions for Operations and Safety Limits as discussed in this lesson plan. (R5)

5. Given a set of conditions, evaluate system, train, or component operability as defined in Tech Spec's and SLC's. (R6)

ADM160409

Unit 2 plant conditions:

- Reactor power = 97%
- "C" RPS Channel is in manual bypass
- "D" RPS Reactor Building (RB) pressure transmitter fails LOW

Based on the above conditions, which ONE of the following describes the required action(s) per TS and the status of the "D" RPS RB pressure function after the action(s) have been taken? (.25)

Trip the "D" RPS channel _____ and the "D" RPS RB pressure function is _____.

A. immediately / operable

B. immediately / inoperable

C. within 1 hour / operable

D. within 1 hour / inoperable

D

A. Incorrect, tripping the channel immediately is not required by the TS. Per the TS bases the function with the failed instrument is still inoperable after the channel is tripped.

B. Incorrect, tripping the channel immediately is not required by the TS. Second part is correct.

C. Incorrect, first part is correct. Second part is incorrect.

D. Correct, per TS 3.3.1 if one required channel is inoperable the channel must be tripped in 1 hour. Per the TS bases the function with the failed instrument is still inoperable after the channel is tripped.

1 POINT

Question 69

Unit 3 initial conditions:

- Reactor power = 100%
- 3FDW-315 tagged out for maintenance

Current conditions:

- 3FDW-316 mistakenly disassembled

Based on the above conditions, which ONE of the following statements correctly describes the TS required action?

A. Entry LCO 3.0.3 immediately and commence unit shutdown

B. Entry LCO 3.0.3 immediately and commence unit shutdown within 1 hour

C. Restore one EFDW flow path immediately and maintain current power level

D. Restore one EFDW flow path within 1 hour OR commence unit shutdown

Question 69
T3 - kds

G2.2.24
Ability to analyze the affect of maintenance activities on LCO status. (2.6/3.8)

K/A MATCH ANALYSIS
This question requires knowledge of how maintenance on piece of equipment would affect the plant.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: would be correct except for the note.

B. Incorrect: plausible because 1hour is allowed before beginning the LOC 3.0.3 shutdown.

C. Correct: Per the note in TS 3.7.5 (EFW System) Condition E, although LCO 3.0.3 is entered the plant is not shutdown until one EFDW flow path is operable.

D. Incorrect: plausible because 1hour is allowed before beginning the LOC 3.0.3 shutdown.

Technical Reference(s): **TS 3.7.5**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **None**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

3.7 PLANT SYSTEMS

3.7.5 Emergency Feedwater (EFW) System

LCO 3.7.5 The EFW System shall be OPERABLE as follows:

a. Three EFW pumps shall be OPERABLE, and

b. Two EFW flow paths shall be OPERABLE.

-----NOTE-----
Only one motor driven emergency feedwater (MDEFW) pump and one EFW flow path are required to be OPERABLE in MODE 4.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One MDEFW pump inoperable in MODE 1, 2, or 3.	A.1 Restore MDEFW pump to OPERABLE status.	7 days <u>AND</u> 10 days from discovery of failure to meet the LCO
B. Turbine driven EFW pump inoperable in MODE 1, 2, or 3. <u>OR</u> One EFW flow path inoperable in MODE 1, 2, or 3.	B.1 Restore turbine driven EFW pump and EFW flow path to OPERABLE status.	72 hours <u>AND</u> 10 days from discovery of failure to meet the LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two MDEFW pumps inoperable in MODE 1, 2, or 3.	C.1	Restore one MDEFW pump to OPERABLE status.	12 hours
D. Required Action and associated Completion Time of Condition A, B, or C not met. OR Turbine driven EFW pump and one EFW flow path inoperable in MODE 1, 2, or 3.	D.1 AND D.2	Be in MODE 3. Be in MODE 4.	12 hours 24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Three EFW pumps inoperable in MODE 1, 2, or 3. <u>OR</u> Two EFW flow path inoperable in MODE 1, 2, or 3.	E.1 ----------NOTE------------ LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one EFW pump and one EFW flow path are restored to OPERABLE status. ------------------------------- Initiate action to restore one EFW pump and one EFW flow path to OPERABLE status.	 Immediately
F. Required MDEFW pump inoperable in MODE 4. <u>OR</u> Required EFW flow path inoperable in MODE 4.	F.1 Initiate action to restore required MDEFW pump and required EFW flow path to OPERABLE status.	Immediately

1 POINT

Question 70

Unit 1 plant conditions:

- Controlling Procedure for Unit Startup in progress
- Safety Rod Groups 1-4 = 100% withdrawn
- Regulating Rod Group 5 = 87% withdrawn

Based on the above plant conditions, which ONE of the following correctly states the Group 6 control rod position (%) that satisfies “Control Rod Group Overlap” and why group overlap is used?

A. 8 / to ensure “Rod Insertion Limits” are not violated.

B. 8 / to provide a more uniform differential rod worth.

C. 18 / to provide a more uniform differential rod worth.

D. 18 / to ensure “Rod Insertion Limits” are not violated.

Question 70
T3 - kds

G2.2.33 **Knowledge of control rod programming.** (2.5/2.9)

K/A MATCH ANALYSIS
Question requires knowledge of control rod programming (group overlap) data and reasons for it.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect: Bank overlap is not designed to ensure adherence to rod insertion limits. Plausible because 8 % is within 25 $\pm$ 5% of gp 5 and because the rod insertion limit curve has control rod height (in overlap form) as the bottom axis.

B. Correct: Control rod Bank Overlap shall be 25 $\pm$ 5% per OP/1/A/1102/001 (Controlling Procedure for Unit Startup) and TS 3.2.1/COLR. Bank/Group overlap is used for a more uniform differential control rod worth.

C. Incorrect: 18% gp 6 is not within 25 $\pm$ 5% of gp 5. Plausible because of likelihood of calculation error.

D. Incorrect: 18% gp 6 is not within 25 $\pm$ 5% of gp 5. Plausible because of likelihood of calculation error.

Technical Reference(s): **Core Operating Limits Report**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **CP-011 R3**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

Upon completion of this lesson, the student will be able to state the purposes of the startup procedure and the reasons for the limits and precautions. The student will also be able to describe the underlying reasons for specific tasks or evolutions performed during a unit startup as they apply to his or her job.

ENABLING OBJECTIVES

1. State the two (2) general purposes of the startup procedure. (R1)
2. State when limits and precautions should be reviewed in the startup procedure. (R2)
3. State the basis for each limit and precaution in the startup procedure. (R3)
4. State the sequence of performance of the preheatup checklist in relation to the other major enclosures of the startup procedure. (R4)
5. State the general purposes served by the preheatup checklist and its steps. (R5,6,7)
6. State the purpose of the MODE Change Verification PT. (R41)
7. Describe the plant operations in each of the different sections of the Startup Procedure based on MODE changes. (R8, 17, 21, 34)
8. Describe the proper sequence used to establish containment integrity per the Establishing Containment Operability enclosure. (R19)
9. Describe the correct procedure for swapping from LPI to the SGs for decay heat removal. (R20)
10. Describe the problem associated with operating a Unit 1 RCP at low RCS pressures. (R 12)
    - 10.1 Define the term 2/0 RCP operation
11. Explain why it is important to not start a RCP with a significant primary to secondary ΔT established. (R 13)
12. Describe the reason for continuing SG blowdown after minimum SG levels are established. (R 25)
13. State the reason for pulling group 1 control rods to 50% withdrawn. (R 23)
14. Describe how automatic SG pressure control is established at 532° F in RCS. (R 26)

NOTE:
- Reactor startup operations will be performed in accordance with SOMP 01-02 (Reactivity Management). (R.M.)
- If either loop T_{AVE} is < 532°F performance of SR 3.4.2.1 per PT/1/A/0600/001 (Periodic Instrument Surveillance) is required to be logged in unit log, except during PT/0/A/0711/001 (ZPPT). Refer to TS 3.4.2. {6}
- Operating CRD Group overlap shall be 25% ± 5% between groups per COLR, except during PT/0/A/0711/001 (ZPPT). (R.M.)
- Minimum required hold points are as directed per 1/M plots or PT/0/A/0711/001 (ZPPT). {27} (R.M.)
- Criticality typically occurs at approximately 5 to 7 doubles of initial count rate. {59} (R.M.)
- Core reactivity management can be affected due to changes in CRD position. (R.M.)

_____ SRO _____ 2.15 Begin withdrawing Regulating CRDs per OP/1/A/1105/019 (CRD System). (R.M.)

2.16 **WHEN** Group 5 rods are withdrawn off IN LIMIT:

_____ • Ensure MODE 2 selected on OAC.

_____ • Announce on Plant Page "Unit 1 has entered MODE 2".

_____ • Notify Assistant Outage Manager of Unit 1 entry into MODE 2.

_________________________ _____/_____
Person Contacted Date Time

1 POINT

Question 71

Plant conditions:

- 1SA-18/D-6 (RC System Approaching Saturation Conditions) is inoperable

Which ONE of the following describes required actions of OMP 1-02 (Rules of Practice) for removal of a statalarm?

A. Evaluate the removal of the statalarm by completing an evaluation located in OMP 1-02 (Rules of Practice). Control room personal shall review active evaluations once per shift.

B. Evaluate the removal of the statalarm by completing an evaluation located in OMP 1-02 (Rules of Practice). Control room personal shall review active evaluations every 7 days.

C. Evaluate the removal of the statalarm by completing an evaluation located in OP/1102/006 (Removal and Restoration of Station Equipment). Control room personal shall review active evaluations once per shift.

D. Evaluate the removal of the statalarm by completing an evaluation located in OP/1102/006 (Removal and Restoration of Station Equipment). Control room personal shall review active evaluations every 7 days.

Question 71
T3 - gcw

G2.2.11 **Knowledge of the process for controlling temporary changes.** (2.5/3.4*)

K/A MATCH ANALYSIS
Requires knowledge of process for operating with equipment out of service.
ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct, per OMP 1-2, Attachment A (Evaluation for removal of Statalarms/Control Room Indications) shall be performed. When active, the form shall be placed in the unit PT/600/001 Working Copy notebook which is required to be reviewed 1/shift.**

B. Incorrect, Must be reviewed every shift. Plausible because the form is required to be filled out.

C. Incorrect, OMP 1-2, Attachment A (Evaluation for removal of Statalarms/Control Room Indications) shall be performed. Plausible because the form is completed once/shift.

D. Incorrect, OMP 1-2, Attachment A (Evaluation for removal of Statalarms/Control Room Indications) shall be performed. Plausible because OP/1102/006 (Removal and Restoration of Station Equipment) is typically performed to remove equipment from service.

Technical Reference(s) **ADM-OMP, OMP 1-2 (Rules of Practice)**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **ADM-OMP Obj R6/36/37/38/39/40**

Question Source: **NEW**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

5.19.5 Recommended guidance when multiple alarms are received due to electrical disturbance such a lightning strike or voltage spike.

- The associated Control Room should stop all non critical evolutions.
- An RO should be designated to perform a complete and detailed Control Room round, including the electrical boards.
- Re-evaluate all statalarms and OAC alarms, ensuring that alarms previously locked in do not have additional inputs that could now be causing the alarm.
- CR SRO should determine whether or not the condition warrants that the NEOs perform a detailed round in the plant.
- Resolve all discrepancies found during the performance of the Control Room round and alarm review.
- Normal operations may resume after completion of the above actions.

5.19.6 Evaluation For Removal of Statalarms/Control Room Indications {9}

A. When statalarms (Control Room and plant) and Control Room indications must be removed from service for planned/unplanned reasons due to equipment malfunction, or an increase in Operator burden based on current plant conditions, or when a statalarm having multiple inputs is "Locked In" the alarm state, an evaluation shall be performed to determine the impact on plant operations per Attachment A, *Evaluation For Removal of Statalarms/Control Room Indications*.

B. The evaluation shall be performed prior to the planned removal of the statalarm/Control Room indication from service, and as soon as possible if removed for unplanned reasons.

C. The evaluation shall determine the impact on any safety related equipment, and any alternate monitoring required for the affected parameters.

D. The evaluation shall include, but is not limited to, engineering input, applicable Improved Technical Specifications (ITS), Selected Licensee Commitments (SLC), Alarm Response Guide (ARG), Operating Procedures (OP), Abnormal Procedures (AP), Emergency Operating Procedures (EOP) and Ops Guides.

E. A "Locked in" statalarm with multiple inputs should be evaluated immediately for reflash capability. If the alarm does not reflash for additional parameters, monitoring and contingency actions for the parameters having input to the alarm shall be established.

F. The statalarm shall be listed in the "*Out of Normal Alarms*" section of the Unit Turnover Sheet or NLO Turnover Sheet. Any identified alternate monitoring shall be listed in the *"Additional Monitoring"* section of the Unit Turnover Sheet or NLO Turnover Sheet.

G. Appropriate plant status labels shall be placed on the statalarm window and Control Room indication.

H. A work request (WR) shall be issued as necessary for repairs.

I. The Control Room SRO shall review and approve the removal of the statalarm/indication from service.

J. When Attachment A is approved, the active form shall be maintained in the "*Alarm Status*" section of the respective unit "*PT/600/001 Working Copy*" notebook. Control room personnel and NLOs shall review the active evaluations once per shift.

K. When the statalarm/indication is returned to service, remove any plant status labels that were placed on statalarm window and/or Control Room indication and discard evaluation sheet.

5.19.7 Use of the Statalarm Silence Switch shall be limited to abnormal/emergency conditions where numerous statalarms are simultaneously received and detract from the control room work environment.

A. The switch shall be operated by the OATC or BOP and will typically be used immediately following a reactor trip. Use of this switch will temporarily silence the Statalarm horns (two minutes) and provide a better work environment in the control room for performing EOP IMAs and Symptom Check.

B. Successive use of this switch to silence statalarm horns for longer than two minutes is prohibited.

C. A proper review of statalarms shall be conducted as soon as possible, following the use of the Statalarm Silence Switch. This review shall be performed by an SRO or NCO based on available resources.

OBJECTIVES

TERMINAL OBJECTIVES

1. When given a copy of applicable OMPs or sections, be able to demonstrate an understanding of the guidance or rules within the OMP. (T1)
2. Become familiar with and be able to use and follow the requirements and information contained in the Operations Manual. (T2)

ENABLING OBJECTIVES

1. Be able to answer questions specific to the duties and responsibilities of an operator by referencing applicable copies or portions of the Operations Manual for the following OMPs: **(R8)**

1.1 OMP 1-2, Rules of Practice **(R6, R36, R37, R38, R39 R40)**

A. Component Identification

   1. State the individual responsible for initiating a *Label Request Form* per NSD 503, *Station Labeling Standard.* Describe when informal labels can be used.

B. Mispositioned Components

   1. Describe the four conditions when a component (valve, switch, or breaker) that has been inadvertently/accidentally mispositioned may be immediately repositioned in order to return the component or system to a "safe" condition.
   2. State the individual that must be notified following a mispositioning event.

C. Peer Check

   1. Explain who can perform a Peer Check.
   2. Describe when Peer Checks must be used.
   3. Discuss the considerations when determining the necessity for a Peer Check.
   4. Describe the Peer Check process.

D. Self Checking (STAR)

1. Describe the Self Checking (STAR) process.
2. Discuss when STAR must be re-performed.

E. Valve/Breaker Operating Philosophy

1. State when supervision must be involved in verification of valve/breaker position.
2. Describe the process to ensure the valve/breaker is placed in the proper position.
3. Concerning valve/breaker position when is a Peer Check required?
4. State the individual that is authorized to waive the requirement to independently verify valve position.
5. Describe the four conditions that warrant waiving the requirement to independently verify valve position.
6. Describe the conditions when valves must **NOT** be moved to verify their position.
7. State the condition and explain the process for performing a valve lineup for an electrical valve that normally has its breaker open.
8. Explain when a valve may be back-seated.
9. State which valves should be fully opened or closed.
10. Explain when OPS personnel may operate Air Operated Valves manually.
11. State which type of valve is susceptible to internal valve damage if excessive force is used in operating the valve.
    1) Describe the necessary notifications if an Allis-Chalmers butterfly valve is hard to operate while opening or stuck shut.
12. State the required notification prior to manipulating components with special application tags/labels.
    1) Describe 3 examples of valves with Special Application Tags.
13. Explain the prevention technique for 208-volt and 600-volt Breakers being inadvertently opened.
    1) Describe the attachments to the 3” metal ring concerning 208-volt and 600-volt Breakers being inadvertently opened.
    2) State the individual that controls the use of the 3” rings.

F. Valve Wrenches

1. List the valves on which **NO** valve wrench may be used.
2. State when valve wrench extensions are allowed if excessive force is needed to operate the valve.
3. State required notification if excessive force is needed to operate the valve.

G. Motor Operated Valves (MOV)

1. Analyze conditions for manual operation of Motor-Operated Valve.
2. State required action if manual operation, other than approved procedure is required.
3. Describe required actions and notifications if excessive force for MOV is required.
4. State who decides and who performs MOV operations manually from MCC Breaker contactor (i.e. sticking the breaker)
5. State how long MOV throttle valve should be held in closed direction.
6. ES valves
   1) State the preferred position prior to opening breaker for an ES valve for manual operation or maintenance work.
   2) Describe required actions if system conditions require the valve be left in the "Closed" position for maintenance.
7. HP-14
   1) State the preferred position prior to opening breaker for HP-14 valve for manual operation or maintenance work.
   2) Describe required actions if system conditions require the valve be left in the "normal or bleed" position for maintenance.

H. Vents and Drains

1. Explain the reason for red tagging open a vent or drain inside a tagout boundary.
2. State administrative requirements for attaching a hose to a drain or vent valve on an operating system.
3. Recognize the hose does not constitute a temporary modification on an operable system.

I. Pipe Cap control

1. Describe the process for installing and removing pipe caps.

J. Equipment Draining Evolutions

1. Briefly describe equipment draining evolution guidelines.

2. State the two rooms which require an operator's presence during drain evolutions.
3. State notification requirements prior to and completion of draining evolution.
    1) Describe information required in notifications.

1.2 OMP 1-5 Handling Advanced and Proposed TS/SLCs **(R41)**

A. Describe where copies of Advanced and Proposed TS/SLCs are to be kept upon receipt by the OSM.

B. State the documentation and retention requirements for the documentation of Advanced and Proposed TS/SLC

C. Explain who is responsible for issuing the required training package for the Advanced Copy and the documentation and retention requirements for the Training Package.

1.3 OMP 1-7 Operations Emergency Response Organization **(R7, R42, R43, R44)**

A. State who can fill the position of the TSC Operations Superintendent.

B. What two procedures is the TSC Operations Superintendent primarily concerned with?

C. State who can fill the position of the TSC Assistant to TSC Operations Superintendent.

D. State who can fill the position of the on call OSC Operations Liaison.

E. State who can fill the position of the Assistant to the OSC Operations Liaison.

F. State who is the Emergency Coordinator prior to the TSC being manned

G. State who can fill the position of the OSM Liaison.

1.4 OMP 1-9, Administrative Control of Operations Procedures **(R8, R45, R46, R47, R48, R49)**

A. Discuss how "Procedures in the field" are control copy checked.

B. Explain when a "Procedure in the field" is replaced after use.

C. Describe the three categories of procedures which accurately reflect at any given time plant configuration.

D. Describe how often a periodic review of operating procedures is required.

E. Discuss who can perform a qualified review of an operating procedure.

F. Describe the two situations when a procedure on Tech Hold may still be used.

G. Discuss who can place a procedure on Tech Hold.

H. Describe the process for placing a procedure on Tech Hold including the electronic copy in NEDL.

1 POINT

Question 72

While performing the SGTR tab of the Emergency Operating Procedure, which ONE of the following actions are taken to limit the activity released to the atmosphere?

A. The TD EFDW pump is placed in “Pull To Lock” to ensure it does not start and feed the effected SG.

B. The Auxiliary Steam systems for all three units are split to prevent cross contamination.

C. Core SCM is minimized to reduce the primary to secondary leak rate.

D. The steam air ejectors are lined up to the Main Steam system to prevent cross contamination.

Question 72
T3 - kds

G2.3.11
Ability to control radiation releases. (2.7/3.2)

K/A MATCH ANALYSIS
Question requires knowledge of EOP actions used to control release of radioactive contamination to the atmosphere.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: The TD EFDWP is only taken to PTL if both MDs are providing flow to each available SG. The concern is not feeding the SG but for the exhaust steam from the TD EFDWP. Plausible because the TD EFDW pump would be taken to PTL if no MFW is available

B. Incorrect: The AS system at ONS is not split for a SGTR. Plausible because the AS supply is provided from a non-effected unit.

C. Correct: In the SGTR tab of the EOP it states to secure unnecessary release paths such as The TDEFDWP, Main Vacuum Pumps and Emergency Air Ejectors. Based on plant conditions, none of the above are operating. The SGTR tab also states to minimize SCM to minimize the primary to secondary leak rate. There is no guidance to take the TD EFDWP to PTL as a pre-emptive measure.

D. Incorrect: The SJAEs are lined up to the AS system. Plausible because the supply to the SJAEs are switched.

Technical Reference(s): **EP/1/A/1800/001 SGTR, Encl 5.9**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-SGTR R6**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

TRAINING OBJECTIVES

TERMINAL OBJECTIVE

Describe the use of the SGTR tab of the Emergency Operating Procedure in order to perform the required actions during an event involving a primary to secondary leak greater than 25 gpm. Be able to discuss the SGTR procedure steps and their bases in an oral or written format. Discuss in an overview format how SGTR tab mitigates a SGTR event and places the plant into MODE 5 with the affected SG(s) isolated and heat removal via LPI. (T1)

ENABLING OBJECTIVES

1. Using an overview format describe the intent of this procedure including the 4 main strategies of SGTR mitigation. (R1)

2. During a SGTL shutdown explain the importance of maintaining PZR levels ≥ 220, 140 - 180, and 100" at different times during the reactor shutdown and cooldown to 532°F. (R4)

3. Explain the reason for starting the Outside Air Booster Fans for all three units (R18)

4. Given a set of conditions, be able to identify and quantify OTSG tube leakage. (R2)

5. Explain the reason for opening the TB Sump breakers during a SGTR event. (R19)

6. Understand that normal shutdown procedures are not used during a SGTR and the unit shutdown is performed via Enclosure 5.19, Control of Plant Equipment During Shutdown. (R20)

7. Explain the correct method of control for TBVs when the reactor is tripped at 5% power. (R3)

8. Explain why; when HP-24 and 25 are opened per guidance from the SGTR tab the valves should remain open during the unit cooldown. (R22)

9. Describe the three criteria contained in the SGTR tab that allow the operator to procedurally bypass ES actuation. (R23)

10. Explain how and why subcooled margin should be maintained as close as possible to 0°F during the cooldown. (R6)

    10.1 Understand if RCPs are operating SCM may be required to be increased during the depressurization to maintain RCP NPSH.

11. Given a set of conditions determine if the PZR can be sprayed by HPI Auxiliary Spray per Enclosure 5.20, Aux. Spray (R24)

- RCS pressure controllable

THEN bypass ES as necessary.

A. *ES Channels 1 and 2 may be bypassed while depressurizing the RCS < 1750 psig. ES Channels 3and 4 may be bypassed while depressurizing the RCS < 900 psig.*

B. *All three analog channels must be bypassed individually*

Bases:

- *During normal cooldowns, ES is bypassed at the appropriate RCS pressure (<1750) to prevent unnecessary actuation of ES equipment. This same consideration applies during a cooldown with a SGTR except that some ES equipment (HPI) may be operating as a result of the SGTR. ES equipment actuation should not be bypassed if SCM does not exist or RCS pressure is not controlled, since a LOCA may also be in progress.*

NOTE

If normal PZR spray is available, efforts should be made to minimize core SCM ≤ 15ºF. Otherwise, minimize core SCM as low as safely achievable.

2.36 **(OBJ R6)** Minimize core SCM using the following methods:

- De-energizing all Pzr heaters
- Using Pzr spray
- Maintaining Pzr level 140-180 [175-215" acc]

A. *The SRO will direct the crew to maintain a SCM band that is low enough to lower the leak rate but is high enough for the crew to maintain without the threat of saturation and losing RCP operation.*

B. *EXAMPLE: SRO directs the crew to "maintain SCM @ 5 to 15°F".*

C. *Minimizing SCM reduces the ΔP across the SG tubes therefore the leak rate decreases. The ΔP is RCS and SG pressure.*

1. *Decreasing the pressure differential between the RCS and the leaking steam generator can reduce the tube leak flow.*
2. *An isolated steam generator will be at approximately the saturation pressure of the primary temperature as long as the steam generator is not water solid.*
3. *By decreasing the primary subcooled margin by decreasing RCS pressure (making the primary pressure closer to secondary pressure) the primary to secondary pressure differential can be reduced and the tube leak flow will decrease.*
4. *Therefore, the RCS pressure should be controlled as low as possible while maintaining the subcooled margin low and the RCP NPSH (if any RCPs are running). Depressurization methods in the order of preference are:*

a) Turn PZR heaters off

b) Normal PZR Spray

c) Maintaining Pzr level 140-180"

d) If Delta-T < 410° F, Use Aux. PZR Spray

e) Open RC-66 (PORV)

2.37Verify any RCPs operating

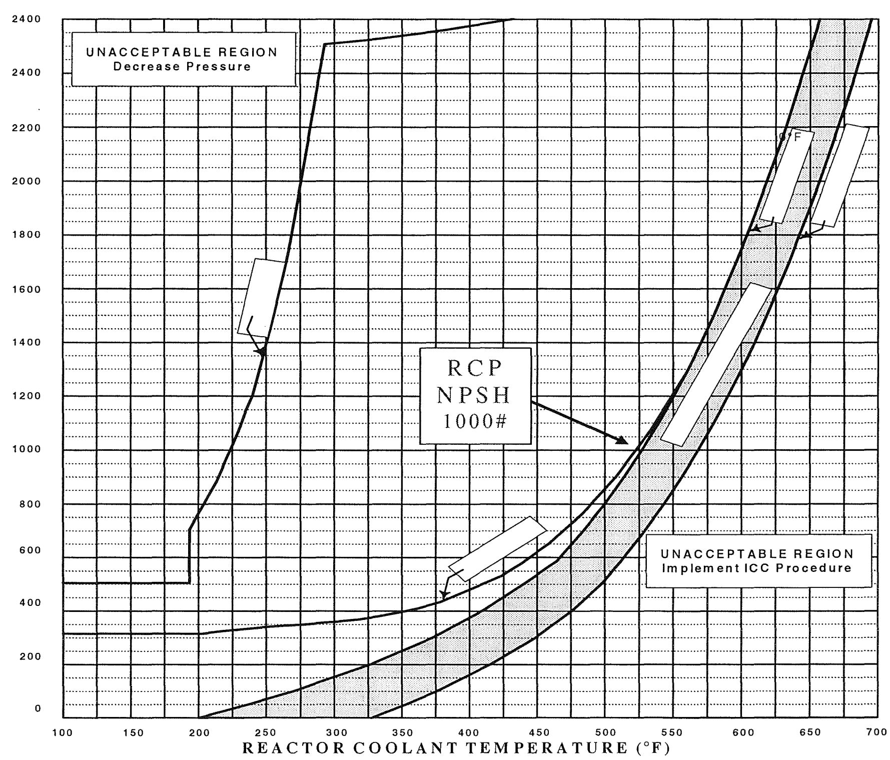
RNO: GO TO Step 39.

2.38 **(OBJ R6)** Maintain RCP NPSH - OAC, Enclosure 5.18, P/T Curves

A. RCP NPSH:

1. The NPSH limit will become a factor during the cooldown at ≈1000 psi. If subcooled margin is being maintained at 5-10°F, the subcooled margin will have to be increased to maintain proper RCP NPSH. (Refer to Enclosure 5.18, P/T Curves)

- *Bases: The purpose of this step is to reduce RCS pressure as much as possible while still maintaining SCM and RCP NPSH.*
- *During the cooldown it is desirable to maintain RCS pressure and temperature close to, but above, the minimum SCM (0°F). This minimizes the differential pressure between the RCS and the affected SG(s), thus minimizing the tube leak flow rate. If normal PZR spray is not available (e.g.,*



RCPs off) to reduce RC pressure, then auxiliary spray from HPI, if available, is used. In the absence of high pressure auxiliary spray, then the PORV is employed to decrease RCS pressure.

INSTRUCTOR NOTE: TIME CRITICAL ACTION
22 minutes, after EFDW is supplied to the unaffected SG, are allowed to start depressurizing the RCS to minimize SCM.

2.39 **IAAT** RCS de-pressurization methods are inadequate to minimize core SCM, **THEN** perform Steps 40 - 42.

RNO:

GO TO Step 43.

2.40 **(OBJ R24)** Verify Pzr spray nozzle $\Delta T \geq 410°F$.

RNO: Initiate Enclosure 5.20, Aux Spray

INSTRUCTOR NOTE: Refer to Enclosure 5.20, Aux Spray

A. *The ΔT is calculated by taking the difference in the HPI suction source temperature (either LDST or BWST) and PZR temperature. At this point in the procedure the suction to the HPIP's should be the BWST. OAC point O1P3367 calculates the ΔT.*

EXAMPLE:
SGTR tab in progress
RCS pressure = 1950 psi
LDST temperature = 110°F
BWST temperature = 82°F
ANSWER: the HPIP suction is aligned to the BWST, PZR temperature from RCS pressure = 632°F so What is the PZR spray nozzle ΔT and can Aux. Spray be used?
632 - 82 = 550°F, No

2.41 Close the following:

- 1LWD-1
- 1LWD-2

2.42 Cycle PORV as necessary.

2.43 Verify at least one of the following open:

1MS-24

1MS-33

A. *These are the MS header A and B to the AS header block valves*

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
27. __ Secure <u>any</u> unnecessary offsite release paths. (Main Vacuum Pumps, TDEFDWP, Emergency Steam Air Ejector, etc.).	
28. __ Verify Main FDW <u>or</u> EFDW controlling properly.	__ Initiate Rule 3 (Loss of Main or Emergency FDW).
29. Open the following: __ 1HP-24 __ 1HP-25	__ **IF** <u>both</u> BWST suction valves (1HP-24 <u>and</u> 1HP-25) are closed, **THEN** perform the following: A. __ Start 1A LPI PUMP. B. __ Start 1B LPI PUMP. C. Open the following: __ 1LP-15 __ 1LP-16 __ 1LP-9 __ 1LP-10 __ 1LP-6 __ 1LP-7 D. __ **IF** two LPI pumps are running <u>only</u> to provide HPI pump suction, **THEN** secure one LPI pump. E. __ Dispatch an operator to open 1HP-363 (LETDOWN LINE TO LPI PUMP SUCTION BLOCK) (A-1-119, U1 LPI Hatch Rm, N end).
30. __ Secure makeup to LDST. {8}	
31. Maintain <u>both</u> SG pressures < 950 psig using <u>either</u> of the following: __ TBVs __ Dispatch <u>two</u> operators to perform Encl 5.24 (Operation of the ADVs) **(PS)**	
32. __ **IAAT** <u>all</u> the following exist: __ <u>All</u> SCMs > 0°F __ ES Bypass Permit satisfied __ RCS pressure controllable **THEN** bypass ES as necessary.	

1 POINT

Question 73

A NEO must perform a high dose job.

RP informs:

- Expected Whole Body Dose Rate for job = 8 R/hr
- Expected Eye Dose Rate for job = 32 R/hr
- NEO has NO dose prior to the job

The job will take 25 minutes to complete.

If allowed, which ONE of the following correctly states all 10CFR20 and/or Duke Power administrative limits that will be exceeded?

A. Duke Administrative TEDE

B. Duke Administrative TEDE / Federal TEDE

C. Duke Administrative TEDE / Federal TEDE / Duke Administrative LDE

D. Duke Administrative TEDE / Duke Administrative LDE / Federal LDE

Question 73
T3 - kds

G2.3.1 **Knowledge of 10 CFR: 20 and related facility radiation control requirements.** (2.6/3.0)

K/A MATCH ANALYSIS
Question requires knowledge of 10CFR20 Occupational Exposure Limits and Duke administrative exposure limits.

ANSWER CHOICE ANALYSIS
Answer: A

A. **Correct: The projected dose from 25 minutes in the stated radiation field would be: TEDE = 8 R/hr x .42 Hr = 3.33 Rem which exceeds Duke Administrative TEDE of 2 Rem but not the Federal Limit of 5R. LDE = 32 R/hr x .42 = 13.3 Rem which is below Duke Administrative LDE and below Federal LDE limits.**

B. Incorrect: Federal TEDE not exceeded. Plausible due to possible calculation errors.

C. Incorrect: Federal TEDE not exceeded. Plausible due to possible calculation errors.

D. Incorrect: LDE not exceeded. Plausible due to possible calculation errors.

Technical Reference(s):

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **RAD-RPP R3**

Question Source: **Modified RAD020301**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

3. Define the following dose terms and discuss how use each can be used to determine if an individual is controlling his dose within applicable limits. (R25)
   - 3.1 Dose Equivalent
   - 3.2 Deep-dose Equivalent
   - 3.3 Shallow-dose Equivalent
   - 3.4 Eye-dose Equivalent
   - 3.5 Committed Dose Equivalent
   - 3.6 Total Effective Dose Equivalent
   - 3.7 Annual Limit on Intake (ALI)
   - 3.8 Derived Air Concentrations (DAC)
4. State the Annual Limit on exposure for Total Effective Dose, Eye Dose Equivalent, Shallow Dose Equivalent, minors, and declared pregnant women, as established by the NRC; state both the basic and maximum administrative limits for each, as established by Duke Power Company. (R3)
5. State the approval requirements for an individual at Duke Power Company to exceed the **basic** permissible exposure limits of 2.0 rem and 4.5 rem. (R4)
6. State the special dose limits established for the general public. (R5)
7. Describe the special dose control measures used to protect the fetus of a "declared" pregnant radiation worker. (R6)
8. Recognize that in "exceptional situations", it is possible to allow an adult radiation worker to receive additional exposure, apart from normal occupational exposure. (R7)
9. Define and describe the specific site area for each of the following terms relating to the control of station areas: (R8)
   - 9.1 Unrestricted Area
   - 9.2 Restricted Area
   - 9.3 Owner Controlled Area
   - 9.4 Radiation Control Area (RCA)
   - 9.5 Radiation Control Zone (RCZ)
   - 9.6 Radiation Area (RA)
   - 9.7 High Radiation Area (HRA)
   - 9.8 Locked High Radiation Area (LHRA)

Extremities, per 10CFR20, are now defined as the hand, elbow, and arm below the elbow, and the foot, knee, and leg below the knee.

Whole body (per 10CFR20) means, for purposes of external exposure, head, trunk (including male gonads), arms above the elbow, or legs above the knee.

Form NRC-4 is the lifetime dose history for an individual.

If a person receives a Whole body dose (DDE), this also counts as a Shallow dose. This is due to the fact that DDE is measured at a depth of 1 cm and SDE at a depth of .007 cm.

B. **(Obj R3)** Duke Power Administrative Controls

		Basic	Maximum
1.	Total Effective Dose Equivalent	**2 rem/yr**	**5 rem/yr**
2.	Eye Dose Equivalent	**15 rem/yr**	
3.	Shallow Dose Equivalent		
	·Skin	**50 rem/yr**	
	·Extremities	**50 rem/yr**	
4.	Minors	**10% of Adult**	
5.	Declared Pregnant Woman	**50 mrem/ month**	**.5 rem/ pregnancy**

NOTE: Current individual exposure limits and dose received can be obtained from EDC or Radiation Dosimetry office. It is every individual's responsibility to know their exposure limits and keep exposure ALARA.

C. **(Obj R5)** Dose Limits for Individual Members of the Public

1. The total effective dose equivalent to any member of the public, due to station operations, cannot exceed 100 mrem/year.
2. The maximum allowable dose **rate** to any unrestricted area from external sources is 2 mrem/hour.

   (Note that the 100 mrem figure is a total dose received limit, while the 2 mrem number is a dose rate limit).
3. The above two limits reflect limits proscribed in Section 20 of 10 CFR; there are, however, even more restrictive limits in other Federal Regulations that take precedence over the 10CFR20 numbers, and 10CFR20 specifically states that these more conservative limits take precedence.
4. One such more conservative limit is defined by the EPA in 40CFR190, and limits the annual dose equivalent to a member of the public to 25 mrem/year, whole body; 75 mrem/year, to the thyroid; and 25 mrem/year, to any other organ.

A NEO must perform a high dose job.

RP informs:

- Expected Whole Body Dose Rate for job = 10 R/hr
- Expected Eye Dose Rate for job = 37 R/hr

The job will take 25 minutes to complete.

Assuming the NEO has NO dose prior to the job, which ONE of the following is correct concerning <u>10CFR20</u> limits? (.25)

A. No limits will be exceeded.

B. TEDE only will be exceeded

C. Eye dose only will be exceeded

D. TEDE and Eye dose will be exceeded.

C

A. Incorrect- Lens dose of 15 rem/yr allowed by 10CFR20 will be exceeded

B. Incorrect- TEDE of 5.0 rem/yr is not exceeded. The operator will receive 4.17R dose for the job.

C. Correct- 15.42 R dose to the eyes will result from job and exceed the legal limit of 15R.

D. Incorrect- The dose to the lens of the eye LDE is not added to the TEDE so the TEDE limits are not exceeded.

1 POINT

Question 74

Unit 1 initial conditions:

- Time = 0500
- Reactor tripped from 100% power with a slow transfer of electrical auxiliaries

Current conditions:

- Time = 0545
- EOP Enclosure “Alignment of Condensate Recirc” initiated

Based on the current conditions, which one of the following describes the concern with starting a Hotwell Pump (HWP) and what requirement must be met to start this pump?

A. Cavitation may occur / HWP may be restarted if EFDW is NOT available and secondary pumps are needed to feed the SGs.

B. Cavitation may occur / HWP may be restarted with Operation Shift Manager permission.

C. A water hammer may occur / HWP may be restarted if EFDW is NOT available and secondary pumps are needed to feed the SGs.

D. A water hammer may occur / HWP may be restarted with Operation Shift Manager permission.

Question 74
T3 - gcw- new

G2.4.20 **Knowledge of the operational implications of EOP warnings, cautions, and notes.** (3.3/4.0)

K/A MATCH ANALYSIS
Requires knowledge of notes in the EOP and enclosures.

ANSWER CHOICE ANALYSIS
Answer: C

A. Incorrect: Cavitation is not the major concern. Plausible because portions of the system are near saturation.

B. Incorrect: Cavitation is not the major concern. Plausible because portions of the system are near saturation.

C. Correct: As stated in Encl 5.23 if the condensate system has been lost, restoring the condensate system within 25 minutes will reduce the possibility of a steam-enduced water hammer when a hotwell pup is started. The pump may be started if EFDW is NOT available and secondary pumps are needed to restore feed to a SG.

D. Incorrect: OSM permission not required. Plausible because water hammer is the major concern.

Technical Reference(s): **EOP Encl 5.9, 5.23**

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-LOHT Obj R43**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: **Memory or Fundamental Knowledge**
Comprehension or Analysis

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. __ Verify <u>any</u> HWP operating.	__ **GO TO** Step 7.
2. __ Verify <u>any</u> CBP operating.	__ **GO TO** Step 25.
3. __ Verify 1C COND BOOSTER PUMP operating.{12}	1. __ Ensure <u>only one</u> CBP is operating. 2. __ **GO TO** Step 5.
4. Stop the following: {12} __ 1A COND BOOSTER PUMP __ 1B COND BOOSTER PUMP	
5. __ Ensure <u>only one</u> HWP is operating.	
6. __ **GO TO** Step 28.	

<u>NOTE</u>

If > 25 minutes has elapsed since a loss of <u>all</u> condensate flow, a steam-induced water hammer may occur when a Hotwell Pump is started. A Hotwell Pump should **NOT** be started unless <u>one</u> of the following is met:

- An engineering evaluation is performed.
- EFDW is **NOT** available and secondary pumps are needed to restore feed to a SG. {17}

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
7. __ Verify <u>all</u> condensate flow has been lost for < 25 minutes.	1. __ **IF** Engineering approves starting a HWP **OR** secondary pumps are needed to immediately restore SG feed, **THEN GO TO** Step 8. 2. __ Notify CR SRO to evaluate starting Main Vacuum Pumps per AP/27 (Loss of Condenser Vacuum). 3. __ **EXIT** this enclosure.
8. __ Place <u>all</u> HWP control switches in OFF.	
9. __ Place <u>all</u> CBP control switches in OFF.	
10. __ Dispatch an operator start <u>all</u> CBP Aux Oil Pumps. (T-1/J-21)	
11. Close the following: __ 1FDW-4 __ 1FDW-9	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. __ **IAAT** all the following exist: __ Rapid cooldown **NOT** in progress __ MD EFDWP operating for each available SG __ EFDW flow in each header < 600 gpm **THEN** place 1 TD EFDW PUMP switch in PULL TO LOCK.	
10. __ Verify 1 TD EFDW PUMP operating.	__ **GO TO** Step 12.
11. __ Start TD EFDWP BEARING OIL COOLING PUMP.	

NOTE

- If the condensate system has been lost, restoring the condensate system within 25 minutes will reduce the possibility of a steam-induced water hammer when a Hotwell Pump is started. It will also aid in maintaining condenser vacuum.
- If the condensate system is operating, establishing FDW recirc will aid in maintaining condenser vacuum.

12. __ Notify CR SRO to set priority based on the NOTE above and EOP activities.	
13. __ Verify any HWP operating.	__ **GO TO** Step 19.
14. __ Verify any CBP operating.	__ **GO TO** Step 37.
15. __ Verify 1C COND BOOSTER PUMP operating.{12}	1.__ Ensure only one CBP is operating. 2.__ **GO TO** Step 17.
16. Stop the following: {12} __ 1A COND BOOSTER PUMP __ 1B COND BOOSTER PUMP	
17. __ Ensure only one HWP is operating.	
18. __ **GO TO** Step 40.	

13. **Explain why the RCS high point vents must be opened if HPI cooling is not effective. (R19)**

    13.1 **Recognize that degraded HPI cooling may require feeding the SGs with lake water from either the SSF-ASWP of the Station ASWP.**

14. **Given plant conditions, determine appropriate actions based on Enclosure 5.8 (Feeding SGs with Station ASW). (R31)**

15. Recognize that if there are NO HPIPs **AND** NO FDW available (from any source) that the PORV must be manually cycled (to conserve RCS inventory), and RCPs secured to have 1 RCP/loop (to reduce RCS heat input). Efforts must continue to restore HPIPs or the ability to feed the SG(s). (R20)

16. Given plant conditions, determine appropriate actions based on Rule 7 (SG Feed Control). (R27)

17. **Given plant conditions, determine appropriate actions based on "Loss of Heat Transfer" tab of the EOP. (R22)**

18. **Explain how a single MDEFDWP is aligned to both SGs. (R42)**

19. Explain why operation of the condensate system is preferred during extended EFDW operation. (R43)

20. **Describe actions taken per enclosure 5.9, Extended EFDW Operation to maintain UST inventory. (R44)**

21. **Explain the actions required to establish suction source to the EFDW pumps from the Hotwell. (R45)**

ATTACHMENT 7

Extended EFDW Operation

(EOP Enclosure 5.9)

1. INTRODUCTION

1.1 This enclosure of the EOP is concerned with continued operation of the EFDW system.

1.2 Efforts are made to ensure an available suction source remains for any operating EFDW pump.

1.3 Additional steps establish a recirc flowpath in the condensate system to provide flow to the CSAEs and SPE to aid in maintaining vacuum as long as possible. This ensures TBV operation.

1.4 Entry into Enclosure 5.9 can be from:

A. Subsequent Actions when Main FDW is not operating

B. Loss of Subcooling Margin section by way of steps in Rule 2

C. Excessive Heat Transfer section when EFDFW is in operation

1.5 It is important to recognize that this enclosure has a time limitation for restarting a HWP due to water hammer concerns.

A. When the EOP directs initiation of Enclosure 5.9, the crew must realize that they have only 25 minutes to start a HWP before the evolution must be delayed while a condensate system evaluation (for severe water hammers) is conducted by engineering.

1 POINT

Question 75

Unit 1 initial conditions:

- Time = 1000
- Reactor power = 100%
- 1B MD EFDWP out of service

Current conditions:

- Time = 1015
- MSLB outside containment
- 1A SG pressure = 0 psig stable
- 1B SG pressure = 1000 psig stable
- RCS pressure = 1520 psig increasing

Based on current plant conditions, which ONE of the following correctly states which procedure each member of the crew should perform at 1016?

ASSUME NO OPERATOR ACTIONS

A. SRO in Excessive Heat transfer tab / OATC performing Encl 5.1 (ES actuation) / BOP performing Rule 5 (Excessive Heat Transfer)

B. SRO in Loss Of Heat Transfer tab / OATC performing Rule 5 (Excessive Heat Transfer) / BOP performing Rule 3 (Loss of Main or Emergency Feedwater)

C. SRO in Excessive Heat transfer tab / OATC performing Rule 5 (Excessive Heat Transfer) / BOP performing Rule 3 (Loss of Main or Emergency Feedwater)

D. SRO in Loss Of Heat Transfer tab / OATC performing Encl 5.1 (ES actuation) / BOP performing Rule 3 (Loss of Main or Emergency Feedwater)

Question 75
T3 - kds

G2.4.13
Knowledge of crew roles and responsibilities during EOP flowchart use. (3.3/3.9)

K/A MATCH ANALYSIS
Question requires knowledge of crew roles for a specific set of conditions.

ANSWER CHOICE ANALYSIS
Answer: B

A. Incorrect: SRO should be in Loss of Heat Transfer Tab. Plausible because an Excessive Heat Transfer event has occurred.

B. Correct: For the stated conditions, a loss of heat transfer and an excessive heat transfer condition exists. Based on procedure Hierarchy, the LOHT tab should be entered and Rule 3 and Rule 5 should also be entered. Encl 5.1 will eventually be performed after Rule 3 or Rule 5 is complete.

C. Incorrect: SRO should be in Loss of Heat Transfer Tab. Plausible because an Excessive Heat Transfer event has occurred.

D. Incorrect: BOP should be performing Rule 5 (higher priority). Plausible because Encl 5.1 will eventually be performed after Rule 3 or Rule 5 is complete.

Technical Reference(s):

Proposed references to be provided to applicants during examination: **None**

Learning Objective: **EAP-EOP R26**

Question Source: **New**

Question History: Last NRC Exam ____________

Question Cognitive Level: Memory or Fundamental Knowledge
Comprehension or Analysis

2. List the specific crew responsibilities/functions for each position in the Control Room during EOP usage. (R20)
   2.1 Operations Shift Manager
   2.2 STA
   2.3 Control Room SRO/Procedure Director
   2.4 Additional licensed SRO personnel
   2.5 Reactor Operator
      A. OATC
      B. BOP
   2.6 NEOs
   2.7 All licensed operators
3. Describe the conditions required for the PD to take action outside of procedural guidance when using the EOP or an AP. (R30)
4. Describe how "Rules", are performed. (R27)
5. Discuss the use of Parallel Actions when making transfers based on symptoms that occur when plant conditions change. (R21)
6. Demonstrate the ability to properly sequence the EOP Sections based on their EOP mitigating hierarchy or priority. (R26)
7. Evaluate a set of plant conditions and determine if an EOP transfer should take place based on the Parallel Actions guidance. (R22)
8. Describe the required actions and options in priority the PD can use if plant conditions significantly change during EOP usage. (R29)
9. Evaluate "IF/THEN" conditional statements and "AND/OR" logic statements and determine which ones are applicable during progression through the EOP. (R8)
10. Describe how "IF AT ANY TIME" conditional statements are performed. (R9)
11. Describe how "WHEN, THEN" hold statements are performed. (R28)
12. Compare the use of a "NOTE" to that of a "CAUTION" statement. (R10)
13. Describe how "Perform", "Initiate", and "GO TO" statement are performed. (R11)

(OBJ R26) EOP HIERARCHY or PRIORITY TRANSFERS (from Subsequent Actions):

CONDITION	ACTIONS	
1. PR NIs ≥ 5% FP OR PR NIs **NOT** decreasing	**GO TO** UNPP tab.	**UNPP**
2. All 4160V SWGR de- energized	**GO TO** Blackout tab.	**BLACKOUT**
3. Core SCM indicate superheat	**GO TO** ICC tab.	**ICC**
4. Any SCM = 0°F	**GO TO** LOSCM tab.	**LOSCM**
5. Both SGs intentionally isolated to stop excessive heat transfer	**GO TO** EHT tab.	**LOHT**
6. Loss of heat transfer (including loss of all Main and Emergency FDW)	**GO TO** LOHT tab.	
7. Heat transfer is or has been excessive	**GO TO** EHT tab.	**EHT**
8. Indications of SGTR ≥ 25 gpm	**GO TO** SGTR tab.	**SGTR**
9. Turbine Building flooding	**GO TO** TBF tab.	**TBF**
10. Inadvertent ES Actuation occurred	Initiate AP/1/A/1700/042 (Inadvertent ES Actuation)	**ES**
11. Valid ES Actuation has occurred OR should have occurred	Initiate Encl 5.1 (ES Actuation).	**ES**
12. Power lost to all 4160V SWGR and any 4160V SWGR re-energized	• Initiate AP/11 (Recovery from Loss of Power). • **IF** Encl 5.1 (ES Actuation) has been initiated, **THEN** reinitiate Encl 5.1.	**ROP**
13. Indication of LOCA or SGTR exist	Notify plant staff that Emergency Dose Limits are in affect using PA system	**EDL**
14. Individual available to make notifications	• Announce plant conditions using PA system. • Notify OSM to reference the Emergency Plan and NSD 202 (Reportability).	**NOTIFY**

c) **(OBJ R22)** Example of transfers using Parallel Actions:

1) While in the Loss of Heat Transfer Tab, due to a loss of all FDW, a SBLOCA occurs. The Procedure Director should make the transfer to the Loss of Subcooling Margin Tab using the Parallel Actions page.